

To: Morning Edition  
From: Mark Seeley  
Re: Topics for MPR's Morning Edition, Friday, January 2, 2004

Topic: A Brief History of Snow Shoveling

Bernard Mergen in his recent book, "Snow in America" recounts the history of the snow shovel. As early as 1870, a patent was granted to William Wentworth of Seneca Falls, NY for a snow shovel with a riveted metal tip for scrapping. In 1889 a Lydia Fairweather applied for a patent on a snow shovel that had both attachable scrapper and scooper. The snow scooper, sometimes called a yooper scooper, is a large bucket shaped shovel with sides. It is a common snow removal device in the Upper Peninsula of Michigan and in Maine, where 100 to 200 inches of snow occurs most winters.

The first plastic snow shovel patent was granted to a Robert Smith of New Jersey in 1939. These are by far the most popular sold today, many with metal tips for scrapping. Often times, shorter handle versions are carried in the trunks of cars for emergency use. In the past three decades, snowblowers and snow throwers have replaced the use of snow shovels for many areas of the country. As a result perhaps the number of heart attacks has been reduced, but on the other hand there are still the occasional serious accidents with these snow removal machines.

Topic: December 2003 climate summary

December will go down as a warm and dry month. Helped along by record setting high temperatures and warm low temperatures on the 27th and 28th the mean monthly temperatures around the state ranged from 5 to 8 degrees F above normal. Extreme temperatures for the month ranged from a high of 55 degrees F on the 1st at Rushford (Fillmore County) to a low of -26 degrees F at Embarrass (St Louis County) on the 12th.

Several places reported between 10 and 20 inches of snowfall for the month. The Twin Cities National Weather Service in Chanhassen reported nearly twice the normal amount of snow with 16.1 inches, while Tower reported 22 inches for the month. Precipitation totals nevertheless were below normal for most places, very few reporting over 1 inch of liquid equivalence in the snow.

MPR listener question: What are the all-time state temperature extremes for the month of January, and how often does the Twin Cities see a January thaw?

Answer: January thaws are far more typical of the Twin Cities climate than many residents think. If we eliminate a single day occurrence of 32 degrees F or greater, and concentrate on two or more days at or above the freezing mark as a working

definition for a January thaw, then all but eight years since 1891 have included such a period. The eight years without a January thaw were: 1912, 1918, 1929, 1940, 1977, 1978, 1979, and 1982.

The all-time extremes of temperature in January for Minnesota are: a high of 69 F at Montevideo on January 24th, 1981; a low of -57 F at Tower and Embarrass on January 21, 1996.

Local Almanac:

Twin Cities Almanac for January 2nd:

The average MSP high temperature for this date is 22 degrees F (plus or minus 12 degrees standard deviation), while the average low is 5 degrees F (plus or minus 12 degrees standard deviation).

MSP Local Records for January 2nd:

MSP weather records for this date include: highest daily maximum temperature of 45 degrees F in 1897 and 1998; lowest daily maximum temperature of -7 degrees F in 1912; lowest daily minimum temperature of -22 degrees F in 1979; highest daily minimum temperature of 31 degrees F in 1992 and 1997; record precipitation of 0.46 inches in 1999; and record snowfall of 6.1 inches also in 1999. There have been 22 measurable snowfalls on this date since 1945. Maximum snow depth on this date was 19 inches in both 1969 and 1970.

Average dew point for January 2nd is 8 degrees F, with a maximum of 34 degrees F in 1907 and a minimum of -31 degrees F in 1979.

All-time state records for January 2nd:

Scanning the state climatic data base: the all-time high for this date is 52 degrees F at Canby (Yellow Medicine County) in 1944; the all-time low is -50 degrees F at Pokegama (Itasca County) in 1904.

Words of the week: sun crust, rain crust, and wind crust

These are words used to describe the crusty condition of a snow cover surface, and specifically refer to the manner in which it was formed. A sun crust is produced by melting from direct sunlight during the day, followed by overnight refreezing into a thin ice layer. A rain crust is produced by light rain or drizzle falling on top of snow cover and freezing into a thin layer. Finally, a wind crust is produced when the force of the wind packs the snow, sometimes into a thick crust. This often happens when brisk northwest winds follow a winter frontal passage in Minnesota. Currently on the Minnesota landscape we probably have all three types of crusts prevalent.

Outlook:

Relatively more cloudy over the weekend, with temperatures falling.  
Chance of some light snow in the north Saturday and Sunday.  
Much colder air moving in next week, perhaps the coldest of winter  
by Tuesday and Wednesday mornings. Chance of snow midweek, then  
bitterly cold toward the end of the week. Temperatures will be  
several degrees below normal.

To: Morning Edition  
From: Mark Seeley  
Re: Topics for MPR's Morning Edition, Friday, January 9, 2004

Topic: Cold weather news and notes.....

The week started out very cold, with -30 F at Baudette, MN, and wind chill values ranging from -30 to -40 F in parts of the state.

On this date in 1977, St Cloud reported their all-time lowest temperature reading of -43 degrees F. They recorded 14 days that month with lows of -15 F or colder.

On Wednesday of this week, Khatanga in north central Russia reported a low temperature of -59 degrees F, while Churchill in Manitoba Canada reported -45 degree F. This is indicative of the cold air positioned at high latitudes in the northern hemisphere this time of year.

Minnesota has reported the coldest temperature in the 48 contiguous states twice so far this month: International Falls with -9 F on New Years Day (the 1st) and Orr, MN on January 8th with -24 F.

Lastly, though no big snowfalls are in sight, cold weather will be a factor for two of the four NFL playoff games this weekend. The Saturday night game in Massachusetts between the New England Patriots and Tennessee Titans will likely be played in single digit temperatures, with 10 to 20 mph northwest winds. This may make it difficult to pass and catch the football. The daytime game late Sunday afternoon at Philadelphia between the Eagles and Packers will likely find temperatures in the 20s F with 10-20 mph northwest winds. This too may be problematic for the passing game. Watching these games on TV here in Minnesota may bring back some football playoff memories from the old Met Stadium days with Bud Grant and the Vikings.

Topic: On atmospheric dispersion, odors, and Frank Pasquill

I attended a meeting in Iowa this week to discuss odor detection and dispersion modeling for livestock facilities. The emission and dispersion of odors from livestock facilities has drawn a good deal of attention in recent years and is largely a function of both the source and the weather conditions. Among the more important weather features to consider is atmospheric stability, that is how vigorously mixed the air is over any given time. Extreme conditions are represented by (1) highly unstable air....the kind that produces thunderstorms....in which both the vertical and lateral transport, dispersion, and dilution of odors is vigorous...and (2) very stable conditions, such as extreme atmospheric inversions, when the air is confined by both an increasing vertical temperature profile and lack of wind speed, such that odor concentrations remain high, and disperse very slowly over the surrounding landscape.

Dr. Frank Pasquill was a British Meteorologist and is the acknowledged

Godfather of atmospheric stability classification. He originally developed his method of characterizing atmospheric stability (there are 7 classes of stability) for military considerations related to the dispersion of chemicals in the air. It since been utilized in wildfire fighting, air pollution studies and assessment of risk from chemical spills, aviation, hot-air balloon navigation, and odor plume analysis. His classification scheme makes use of wind speed, solar radiation, and cloudiness, somewhat weighted by daytime or nighttime conditions. A much greater frequency of stable atmospheric conditions can be found after sunset, as normal inversion conditions begin to take shape and trap odors and other gases near the surface. This time of day is the most common for the reporting of annoyance odors by the public.

Dr. Pasquill's original work was published in 1961 and is still very much used today, over 40 years later. His work is a testament to the durability of good science. We may gain a better understanding of odor dispersion in our Minnesota environment if we develop a climatology (history) associated with atmospheric stability class frequencies over a long historical period in both urban and rural settings.

MPR listener question: Since the weekend snowfalls that preceded Thanksgiving, how have the temperatures been tracking with respect to normal. I know you said the trend in winter was for above normal temperatures, but has it really been that way?

Answer: Yes, indeed. Using the Twin Cities climate record since Thanksgiving Day, the MSP airport has reported 2 days with normal temperatures, 10 days with below normal temperatures, and 31 days with above normal temperatures.

Local Almanac:

Twin Cities Almanac for January 9th:

The average MSP high temperature for this date is 22 degrees F (plus or minus 14 degrees standard deviation), while the average low is 5 degrees F (plus or minus 14 degrees standard deviation).

MSP Local Records for January 9th

MSP weather records for this date include: highest daily maximum temperature of 49 degrees F in 2002; lowest daily maximum temperature of -11 degrees F in 1977; lowest daily minimum temperature of -32 degrees F in 1977; highest daily minimum temperature of 34 degrees F in 2002; record precipitation of 0.31 inches in 1924; and record snowfall of 3.8 inches also in 1924. There have been 11 measurable snowfalls on this date since 1945. Maximum snow depth on this date was 19 inches in 1969.

Average dew point for January 9th is 3 degrees F, with a maximum of 42 degrees F in 1939 and a minimum of -40 degrees F in 1977.

All-time state records for January 9th:

Scanning the state climatic data base: the all-time high for this date is 60 degrees F at Amboy (Blue Earth County) in 2003; the all-time low is -49 degrees F at Warroad (Roseau County) in 1930.

Words of the week: the Nasal Ranger

This is a field oldfactometer developed here in Minnesota by St Croix Sensory. It is designed to measure the strength of an odor in ambient air. The Nasal Ranger also measures a "dilution to threshold" ratio which estimates the number of dilutions needed to make the odorous ambient air non detectable. A person must be free of odor, in healthy condition, and have a good working nose to use one of these instruments. More on this instrument can be found on the following web site....

[www.nasalranger.com](http://www.nasalranger.com)

Outlook:

Temperatures near seasonal normals or above over the weekend and into Monday. There will be some chance for light snow. A sharp cold front will bring another round of arctic air to the state for Tuesday through Thursday next week, with many below zero temperature readings. Some areas of the state may see temperatures remain below zero during the daytime.

To: Morning Edition  
From: Mark Seeley  
Re: Topics for MPR's Morning Edition, Friday, January 16, 2004

Topic: Canadian Ice Sculpture Contest

Today marks the start of the 10th Annual Ice Magic International Ice Sculpture Competition at Lake Louise, Alberta, Canada. There is both team and individual competition. Teams have 33 hours to convert a 300 pound block of ice into a work of art, while individual competitors have 11 hours to do so. Carvers can use chisels or any power tools of their choice, but they must be electric and not gasoline powered. The art works typically remain on display until the warmth of mid-March melts them away.

Topic: Tracking ocean currents with lost cargo....

In the current edition of the AMS Bulletin there is a short article about an oceanographer who tracks lost cargo from container ships. There are some interesting observations about ocean currents. For example, approximately 29,000 bath toys, mostly rubber ducks, turtles, beavers and frogs fell overboard from a container ship in the mid-North Pacific Ocean eleven years ago. They subsequently were tracked along the Alaska coast, across the Bering Strait, and eventually ended up in the North Atlantic, coming ashore along the New England coast. Oceanographer Curtis Ebbesmeyer reports that he continues to track lost cargo from ships and finds plenty of it, as it is estimated that as many as 10,000 containers are lost overboard from ships each year. Among the items he has tracked to study ocean currents are Lego pieces, hockey gloves, and Nike trainers (tennis shoes).

Topic: Minnesota's coldest place in January??

An article in the New York Times travel section last week highlighted the friendly rivalry between International Falls and Embarrass, Minnesota in the quest for bragging rights about having the coldest temperatures in the state and the nation. This prompted me to examine the all-time state low temperature records for each date this month and see which communities are represented in the list for January. By my count, I find that 23 separate Minnesota weather stations hold bragging rights to the coldest place on a January day.

The list below shows the all-time coldest temperature measured in the state for each January date, along with where it was measured. One station, Pokegama Dam (near Grand Rapids) shows up more frequently than any other location, ten times. Tower shows up six times, while International Falls and Embarrass only show up on the list twice each. Of course the Embarrass station has not operated for very many years, so it would naturally not claim a large number of record low temperature readings. Obviously, there are many places in Minnesota that can stake some claim to being the coldest. I guess some just brag more than others.....

January all-time low temperature readings in the state of Minnesota

Date	Temperature	Location
1	-44 F	Pokegama Dam and Tower
2	-50 F	Pokegama Dam
3	-48 F	Pine River Dam and Littlefork
4	-48 F	Leech Lake and Red Lake
5	-43 F	Tower, Pokegama Dam, Detroit Lakes, Agassiz Wildlife Refuge
6	-55 F	International Falls
7	-54 F	International Falls
8	-46 F	Tower
9	-49 F	Warroad
10	-47 F	Littlefork
11	-52 F	Bagley
12	-53 F	Pine River Dam
13	-50 F	Bagley
14	-50 F	Cook and Cotton
15	-53 F	Moose Lake
16	-47 F	Thorhult
17	-52 F	Tower
18	-48 F	Cotton
19	-47 F	Pokegama Dam, Brainerd, Bigfork
20	-43 F	Roseau and Cass Lake
21	-57 F	Tower and Embarrass
22	-51 F	Itasca State Park
23	-55 F	Warroad
24	-57 F	Pokegama Dam
25	-55 F	Pokegama Dam
26	-55 F	Pokegama Dam
27	-47 F	Bagley
28	-50 F	Baudette and Pokegama Dam
29	-54 F	Pokegama Dam
30	-52 F	Duluth, Leech Lake, Pokegama Dam
31	-55 F	Tower and Embarrass

\*Footnote, the some of the record lows at Pokegama Dam may be in question due to thermometer exposures that did not follow the National Weather Service guidelines.

MPR listener question: After the deep frozen soil depths of last winter and consequent problems with frozen septic systems, I am nervous about the lack of snow cover this year. How deeply have the soils frozen so far?

Answer: As of this week, observers are reporting soil freezing depths to range from 8 to 18 inches around the state. Though they increased with numerous below 0 F temperature readings last week, the more seasonal temperatures of this week have caused them to stabilize. Still, more snow cover and the associated insulating effect from arctic cold would be appreciated by most of us. The significant snowfalls early this week in northern counties were a welcome sight. Anywhere from 2 to 6 inches fell in many places on Tuesday night and Wednesday. In fact, International Falls reported a new record snowfall amount for January 14th (Wed)



with 5.5 inches. Finland up along the north shore of Lake Superior reported over 10 inches.

Local Almanac:

Twin Cities Almanac for January 16th:

The average MSP high temperature for this date is 21 degrees F (plus or minus 14 degrees standard deviation), while the average low is 4 degrees F (plus or minus 15 degrees standard deviation).

MSP Local Records for January 16th

MSP weather records for this date include: highest daily maximum temperature of 46 degrees F in 1961; lowest daily maximum temperature of -16 degrees F in 1982; lowest daily minimum temperature of -28 degrees F in 1977; highest daily minimum temperature of 34 degrees F in 1894; record precipitation of 0.63 inches in 1915; and record snowfall of 8.4 inches in 1994. There have been 16 measurable snowfalls on this date since 1945. Maximum snow depth on this date was 18 inches in 1984.

Average dew point for January 16th is 2 degrees F, with a maximum of 37 degrees F in 1913 and a minimum of -38 degrees F in 1977.

All-time state records for January 16th:

Scanning the state climatic data base: the all-time high for this date is 54 degrees F at New Ulm (Brown County) in 1974; the all-time low is -47 degrees F at Thorhult (Beltrami County) in 1977.

Words of the week: Psycho, Dare Devil, Endurance, Bridal Veil

What in the world do these words have in common? Well, there is an interesting article about ice climbing by Jon Kramer in the current issue of the Minnesota Conservation Volunteer magazine. The article is well written and has some great photos. Apparently the northshore area uplands along Lake Superior offer some interesting and challenging ice climbs. Ice climbers tend to name their favorite climbing places which they go back to winter after winter. They give names to these places that infer character. That's what the list of names above is all about. I am not sure that I would want to climb a place called Psycho or Endurance!!

The words listed above are the names of some ice climbs

Outlook:

There will be chances for light snow in eastern sections of the state early this weekend. Temperatures will generally be above normal by a few degrees, but not so as to be a threat to the Ice Palace construction in St Paul. Quiet for the Martin Luther King Holiday, then a chance for snow Tuesday and Wednesday with falling temperatures later in the week.

To: Morning Edition  
From: Mark Seeley  
Re: Topics for MPR's Morning Edition, Friday, January 23, 2004

Topic: Boreas pays a call to Minnesota

This week brought the coldest temperature in Minnesota since New Year's Day 1999. Embarrass reported a low of -43 F on Monday, January 19th (Martin Luther King Day). This was the coldest in the contiguous 48 states on that date and lowest temperature in Minnesota since Tower reported -43 F on January 1, 1999. Minnesota has reported the coldest temperature in the contiguous 48 states six times so far this month.

On Wednesday, January 21st, Boreas made a visit to Minnesota-BIGTIME!!...Cold arctic air combined with northerly winds of greater than 40 mph produced wind chill readings ranging from -40 to -50 F in northwestern Minnesota (actually -53 F at Orr), the coldest of the winter so far, and the coldest wind chill readings since the new system was instituted two years ago. Visibilities were less than 1/4 mile in places and travel on some roads was hazardous due to ground blizzard conditions that persisted over several hours. Duluth reported a record snowfall that day of 3.5 inches.

Topic: Old Versus New Wind Chill Values....

The new Wind Chill Index was put into operation by the National Weather Service in November of 2001. In collaboration with Environment Canada, a new wind chill equation was derived based on wind tunnel studies of heat loss from the human face. The new coefficients are different from the old ones and the wind speed values are no longer taken from a height of 10 meters, but are estimated values for what strikes a human face (say 5-6 ft above ground). The net effect has been to reduce the scaled values....that is to say what formerly may have been a Wind Chill value of -40 F is now probably closer to -25 F.

Under the new system, the National Weather Service releases a wind chill advisory when the expected values are colder than -25 F, and they release a wind chill warning when the expected values are below -35 F.

The new Wind Chill values associated with the arctic air mass that crossed the state on Wednesday and Thursday this week (January 21-22) were the coldest since the new system was implemented over two years ago. The table below for Orr, MN (northern St Louis County) and MSP International Airport shows the temperature and wind speed conditions for early on the morning of Thursday, January 22, along with the associated old and new Wind Chill (WC) values....

Location	Air	Wind	Old WC	New WC
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	Temp (F)	Speed (mph)	Value (F)	Value (F)
Orr	-25 F	17	-69 F	-53 F
MSP Airport	-9 F	25	-57 F	-36 F

If interested, there are two web sites that offer Wind Chill calculations by both the old and new methods. They are...

<http://www.crh.noaa.gov/bis/newwindchill.htm>  
<http://www.mountwashington.org/weather/wind-chill.html>

Also you can read more about the new Wind Chill Index at..

<http://www.nws.noaa.gov/om/windchill/index.shtml>

MPR listener question: Last week you highlighted some of the coldest Minnesota communities, those holding the all-time low temperature records in winter. But what about the warmest places in winter? Which communities in Minnesota hold the majority of the all-time state maximum temperature records for winter?

Answer: The all-time winter high temperature records are most frequently found in western and southern counties. The communities that most frequently appear on this list include places like Marshall (holder of today's all-time temperature record of 59 F in 1981), Canby, Montevideo, Lamberton, Browns Valley, New Ulm, Fairmont, St Peter, and Winona. The highest temperature ever measured in the state during the month of January was 69 degrees F at Montevideo on the 24th of January 1981...almost balmy...

MPR listener question: We live near Lake Phalen and noticed during the fall that the lake level was really low. Recently, they have been cutting ice from the lake to build the Ice Palace for the Winter Carnival. With so little snowfall, what is the outlook for the lake level once winter ends?

Answer: Analyzing the historical lake level data for Lake Phalen is difficult because the lake has been modified so much over the years. Currently the the lake level reading is about 855.8 ft (taken last in November) compared to a historical average of about 857.5 ft, and the inflow from Spoon Creek on the north side of the lake is negligible. The lake is probably at its lowest level since the fall of 1996, but no where near the historical low levels of 1988-89, 1976-77, or record low level of 849.99 ft in April of 1970.

As to the concern about the ice removal for building the Ice Palace and the lake's recovery this spring and summer, I don't believe there is great reason to panic. The total mass of water removed to build the Ice Palace, calculated from an estimate of 27,000 blocks of ice each weighing about 500 lbs, yields a water loss ranging from 1.4 to 1.8 million gallons. This

translates to a depth increment loss across the 198 acre lake that only ranges up to 1/2 inch, so perhaps taking the level reading down to a bit under 855.5 ft. Abundant spring rainfalls could easily raise the lake level from 1 to 3 ft as it did in 1991 or 1993. Even normal amounts of spring precipitation will likely cause a rise of a half foot or more.

Local Almanac:

Twin Cities Almanac for January 23rd:

The average MSP high temperature for this date is 22 degrees F (plus or minus 14 degrees standard deviation), while the average low is 4 degrees F (plus or minus 14 degrees standard deviation).

MSP Local Records for January 23rd

MSP weather records for this date include: highest daily maximum temperature of 53 degrees F in 1942; lowest daily maximum temperature of -16 degrees F in 1936; lowest daily minimum temperature of -31 degrees F in 1935; highest daily minimum temperature of 35 degrees F in 1909; record precipitation of 0.49 inches in 1949; and record snowfall of 5.7 inches in 1949. There have been 14 measurable snowfalls on this date since 1945. Maximum snow depth on this date was 38 inches in 1982.

Average dew point for January 23rd is 6 degrees F, with a maximum of 40 degrees F in 1909 and a minimum of -42 degrees F in 1963.

All-time state records for January 23rd:

Scanning the state climatic data base: the all-time high for this date is 59 degrees F at Marshall (Lyon County) in 1981; the all-time low is -55 degrees F at Warroad (Roseau County) in 1936.

Word of the week: Isallotherm

An old meteorological term rarely used anymore, this word refers to a line drawn on a map to connect points of equal temperature change over a period of time. It was certainly relevant on Wednesday of this week (January 21st) with the passage of an arctic cold front. For most places in the state the highest temperature occurred early in the day, then plummeted throughout the day, changing by as much as 25 to 40 degrees F. In northern Minnesota, communities like Roseau and Thief River Falls saw morning temperatures in the mid 20s F and evening temperatures of -15 F, an isallotherm value of -40 F for the day.

Outlook:

A bit of a frightening forecast for the last week of January. chance of snowfall late Saturday through Monday, with very cold temperatures and gusty winds. Blizzard conditions and dangerous wind chills are likely around the state over this period. Some

places will not rise above zero F for a few days, and depending on the amount of snowfall we get, lows could plummet into the -20s and -30s F.

To: Morning Edition  
From: Mark Seeley  
Re: Topics for MPR's Morning Edition, Friday, January 30, 2004

Topic: Record snowfall this week....

January 25th and 26th brought record snowfalls across Minnesota. Storm totals generally ranged from 6 inches to over 2 feet across much of the state. Record amounts on the 25th included..

Fargo, ND 11.5 inches Moorhead 11.7 inches Ada 8.0 inches  
Grand Forks, ND 9.1 inches Crookston 7 inches Aitkin 6.0 inches  
Brainerd 7.0 inches Beaver Bay 9.0 inches Two Harbors 7.6 inches

Record amounts on January 26th included..

Twin Cities 7.6 inches Duluth 18.2 inches St Cloud 5.6 inches  
Morris 6.4 inches Springfield 6.0 inches Ada 13.0 inches  
Halstad 13.0 inches Ottertail 12.0 inches Campbell 10.0 inches  
Wadena 13.5 inches Staples 18.5 inches Brainerd 10.0 inches  
Pine River Dam 12.0 inches Little Falls 10.5 inches  
Willmar 6.0 inches Aitkin 12.0 inches Redwood Falls 7.0 inches  
Alexandria 10.0 inches Tower 6 inches New London 6.0 inches

Storm total snowfall was substantial for a number of communities, including Duluth (airports) which reported 27.1 inches, their 3rd highest in history. Other storm totals included....

Finland 26.0 inches, Two Harbors 30.5 inches, Beaver Bay 12.5 inches, and Silver Bay 13.3 inches.

Topic: Arctic Cold Blast January 27-30...

The fresh snow cover produced some very cold temperatures, as both Grand Forks and Fargo, ND tied record low temperature values for January 27th with -31 F, and Grand Forks broke the record cold temperature value for January 28th with -35 F. In addition, portions of Minnesota recorded wind chill values ranging from -35 (warning threshold for the National Weather Service) to -60 F. Park Rapids reported a wind chill of -65 F on Friday, January 30th. This is the coldest value reported in the state since the new wind chill formula was instituted by the National Weather Service in November of 2001. More record low temperatures were reported on the 29th and 30th, including a -47 degrees F at Cook on the 29th and -50 F at Fosston on the 30th, both of which were the coldest in the 48 contiguous states, and coldest temperatures in Minnesota since 1996.

Thief River Falls set a new cold maximum temperature record on Thursday, January 29th with a reading of -24 F. Other stations reported record-setting lows on Friday morning (the 30th). These included Grand Forks with an all-time record low of -44 F, Fargo with a record low of -36 F, Park Rapids with a record low of -45 F, Fosston with a record low of -50 F, Crookston with a record low of -35 F, and Thief River Falls a record-tying low of -36 F.

Topic: Preliminary January Climate Summary.....

The January mean temperature ranged from -1 to -4 degrees below normal around the state, and was the coldest January since 1999. The state temperature extremes ranged from 51 degrees F at Canby on the 2nd to -50 degrees F at Fosston on the 30th. Minnesota reported the coldest temperature in the 48 contiguous states on thirteen days in January, preserving our reputation among the American states.

Though many places reported abundant snowfall, the precipitation totals were less than normal for most places. Some above normal snowfall totals included Ada with 26 inches, Baudette with 22 inches, Babbitt with 30 inches, Embarrass with 31 inches, Pine River with 28 inches, Duluth with a whopping 42.1 inches (2nd snowiest January of all time there behind the nearly 47 inches of January 1969).

MPR listener question: Normally when it snows the temperature is in the high 20s or low 30s F. This week's snows fell with temperatures in the teens. How often does this happen? The snow was actually heavier than I expected when it came to shoveling....how come?

Answer: Snowfalls can occur at any temperature below freezing as long as the air becomes saturated. We have had 21 days with measurable snowfall so far in the Twin Cities this winter. The list below shows the distribution of temperature conditions for those 21 cases....

Number of snowfall events	Temperature range (F)
Six	30-33 degrees
Four	25-30 degrees
One	20-25 degrees
Seven	15-20 degrees
One	10-15 degrees
Two	5-10 degrees

As you can see the most common temperature range for snowfall events this winter has been 15-20 degrees F. Historically, some of the heaviest snowfalls have occurred in air temperatures ranging from the high 20s to low 30s F (the Halloween Blizzard is one example). Certainly in these warmer temperatures the snow is more dense and heavier to shovel.

However, there have been some classic historical examples of heavy snowfalls in colder air with temperatures ranging from 15 to 20 degrees F. These include the Armistice Day Blizzard (1940) and the memorable back to back heavy snowfalls of January 1982 (both over 17 inches). Though these were less dense, after settling they were quite heavy to shovel. I suspect this is what happened to the snow this week. Some settling and compaction made it harder to shovel.  
are numerous examples of very hea

Local Almanac:

Twin Cities Almanac for January 30th:

The average MSP high temperature for this date is 21 degrees F (plus or minus 14 degrees standard deviation), while the average low is 2 degrees F (plus or minus 14 degrees standard deviation).

MSP Local Records for January 30th:

MSP weather records for this date include: highest daily maximum temperature of 48 degrees F in 1989; lowest daily maximum temperature of -9 degrees F in 1899; lowest daily minimum temperature of -29 degrees F in 1951; highest daily minimum temperature of 35 degrees F in 1931; record precipitation of 0.37 inches in 1947; and record snowfall of 3.6 inches in 1947. There have been 10 measurable snowfalls on this date since 1945. Maximum snow depth on this date was 24 inches in 1969.

Average dew point for January 30th is 2 degrees F, with a maximum of 34 degrees F in 1923 and a minimum of -34 degrees F in 1951.

All-time state records for January 30th:

Scanning the state climatic data base: the all-time high for this date is 56 degrees F at St Peter (Nicollet County) in 1989; the all-time low is -52 degrees F at Duluth, Leech Lake, and Pokegama in 1899.

Word of the week: Arctic payload....

Saw this term used in the forecast discussion on Wednesday this week. This terminology refers to the arctic high pressure system that migrated from higher latitude into the state, bringing temperatures down to -30 F and colder. An arctic payload is indeed a strong high pressure cell, usually with a central pressure of 1035 millibars (30.56 inches on the barometer) or greater. The strength of the high pressure is an indicator of how long it has resided at high latitude and acquired the characteristic low temperature and absence of moisture.

Outlook:

Continued cold, but some moderation in temperature for Saturday and Sunday with increasing clouds and chances for snowfall. Temperatures should climb more toward zero in the north and perhaps into the single digits and teens F in the south. Then declining temperatures, much below normal for the beginning of next week. A chance of snow storm again by Wednesday and Thursday.



To: Morning Edition  
From: Mark Seeley  
Re: Topics for MPR's Morning Edition, Friday, February 6, 2004

Topic: Snow season totals becoming significant.....

Many observers are now reporting above normal total snowfall for the season so far, and we have the months of February and March ahead of us. Some seasonal totals for communities around the state include.....

Twin Cities (via NWS Chanhassen) 48.2 inches  
Duluth (airport) 82 inches  
International Falls 57 inches  
Moorhead 44 inches  
Red Lake Falls 38 inches  
Babbitt 80 inches  
Embarrass 72 inches  
Tower 79 inches  
Waseca 33 inches  
Worthington 38 inches  
Grand Meadow 35 inches

The Minnesota State Climatology Office data files suggest that on average an additional 15 to 30 inches of snowfall comes in February and March. If that occurs, this could become the snowiest winter for some since that of 1996-1997.

Topic: A unusual dose of arctic air....

Following a significant snowfall across the state on January 26-27, an arctic high pressure system settled in bringing the coldest temperatures to many parts of the state since 1997. The -50 degrees F reading at Fosston in East Polk County on Friday, January 30th was the coldest statewide since Tower and Embarrass reported -52 F and -50 F, respectively on the 26th of January 1997.

What was even more striking was the persistence of the arctic cold, with several consecutive days of temperatures that ranged from 15 to 25 degrees colder than normal. The list below shows the average air temperature reported by various communities for the week (7 full days) from January 27th to February 2nd.....

Moorhead -18.8 F   Warroad -16.7 F   Itasca State Park -13 F  
Thief River Falls -12.7   Fosston -13.4   International Falls -9 F  
Fergus Falls -11.8 F   Morris -11.2 F   Olivia -6.4 F  
St Cloud -4.9 F   Willmar -6.6 F   MSP 0 F   Rochester 0.3 F

The arctic high pressure system which brought this cold spell was indeed a formidable air mass, registering a central pressure while still in Canada of 1055 millibars or 31.15 inches on the barometer.

In contrast, much of Europe had near record-setting warm temperatures this week, including the following....

Vienna 63 F London 61 F Dusseldorf 62 F  
Paris 62 F Antwerp 64 F Stuttgart 63 F

MPR listener question: I heard Cathy Wurzer say on Monday that it had been snowing for over 30 hours in the Twin Cities. How many hours of snowfall were recorded in the Twin Cities from the storm earlier this week and how unusual was this for duration?

Answer: The State Climatology Office reports that from Saturday night, January 31st to Monday evening, February 2nd, it snowed in the Twin Cities for 45 of 47 hours. That is a very persistent stretch and highly unusual. The most recent snow storm of the same approximate duration occurred on January 1-3, 1999 when it snowed for 42 hours. Previous to that, other memorably persistent snowfalls included the Halloween Blizzard, October 31 to November 3, 1991 when it snowed for 66 hours and the famous January 20-23 snows of 1982 when it snowed for 70 of 75 hours, leaving a snow depth of 38 inches!

But the record for longevity of snowfall in the Twin Cities belongs to December of 1969. From the 5th to the 9th, over a period of 111 hours, it snowed for 108 hours, but very lightly, totaling only 14.2 inches. Nevertheless, it must have been quite aggravating to snowplow drivers.

Local Almanac:

Twin Cities Almanac for February 6th:

The average MSP high temperature for this date is 23 degrees F (plus or minus 12 degrees standard deviation), while the average low is 6 degrees F (plus or minus 14 degrees standard deviation).

MSP Local Records for February 6th:

MSP weather records for this date include: highest daily maximum temperature of 51 degrees F in 1925; lowest daily maximum temperature of -13 degrees F in 1936; lowest daily minimum temperature of -24 degrees F in 1936; highest daily minimum temperature of 34 degrees F in 1925; record precipitation of 0.26 inches in 1895; and record snowfall of 5.4 inches in 1946. There have been only 7 measurable snowfalls on this date since 1945. Maximum snow depth on this date was 22 inches in 1967 and 1979.

Average dew point for February 6th is 5 degrees F, with a maximum of 38 degrees F in 1965 and a minimum of -32 degrees F in 1962.

All-time state records for February 6th:

Scanning the state climatic data base: the all-time high for this date is 59 degrees F at Madison (Lac Qui Parle County) in 1963; the all-time low is -47 degrees F at Baudette (Lake of the Woods County)

in 1967.

Word of the week: Q-Code

In many parts of the world this refers to a letter code used in passing information, some meteorological to aircraft. The Q stands for query, which means the message is in the form of a query or response to a query. Examples include: QFE refers to [what is/here is] the station level atmospheric pressure, QBT refers to [what is/or here is] the runway visual range, QAM refers to [what is/here is] the latest surface weather report, etc.

Outlook:

Drier air across the state over the weekend, with moderate temperatures, though perhaps still a few degrees cooler than normal. Chance for light snow again Monday, then again later next week.

To: Morning Edition  
From: Mark Seeley  
Re: Topics for MPR's Morning Edition, Friday, February 13, 2004

Will we make 32 degrees F on Friday in the Twin Cities? Is so, we'll break the string of 26 consecutive days with temperatures remaining below the freezing mark...

Topic: February snow piling up....

The Twin Cities report over 17 inches of snowfall so far this month making this already the 6th snowiest February (since 1884). Measurable snowfall occurred on ten of the first eleven days of the month.

Other locations have recorded significant snowfall totals as well. Duluth has reported over 16 inches for the month, as has Forest Lake, St James, and Grand Meadow. Eau Claire, WI has reported nearly 20 inches for the month, while Rochester has reported over 15 inches.

Topic: The Ice Dams Cometh....

The frequent and abundant snow has placed a good deal of weight on shallow sloped roofs around Minnesota. Some roof areas of 1000 square feet or bigger may have as much as 12 inches of snow resting on them, perhaps containing up to 1 inch of water....this translates to 5.2 lbs per square foot of roof area.....over 5000 lbs on a 1000 square foot roof. That's a lot of weight, but also a lot of water. Melting of the snow on the roof and then refreezing along the roof edge or gutter area can produce ice dams that hold back the melting water, sometimes producing some roof damage. A conspicuous feature of ice dams with the type of temperatures we have seen this week, are the enormous icicles, some as long as 8 ft, that hang off the edges of roofs. Hopefully the longer days and higher sun angles will produce more absorption of solar radiation on the roof, and a more rapid melt that erodes the ice dams.

Topic: Climate for Valentine's Day....

Certainly noted for being an indoor day for romantics, the weather on Valentine's Day is seldom suitable for outside activity.. perhaps some skiing, skating, or ice fishing.. none of which sounds too romantic. It rains or snows on Valentine's Day about 25-30 percent of the time...snow has been recorded about once for every four Valentine's Days. It's been in the 40s F fourteen times in the past 114 years on this date in the Twin Cities. On the other hand temperatures have only been in the single digits or colder thirteen times in the past 114 years..brrr....most recently 1986 brought a high of just 10 F and a low of -6 F. The coldest Valentine's Day in the Twin Cities occurred in 1920, with a high of -5 F and a low of -16 F.

MPR listener question: I heard Cathy remark last week that the Twin Cities area is well ahead of normal on snowfall for the season, and that the snowiest month of March is still ahead of us.....but isn't January the snowiest month?

Answer: Indeed, you are right. The MSP climate normals (averages) show that January is the snowiest month in the Twin Cities based on 1971-2000 averages (inches)

OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	ANN
0.6	10.0	10.1	13.7	8.2	10.5	3.1	0.1	56.3

However, some years ago, March was indeed the snowiest month in the Twin Cities.....for example for the period from 1951 to 1980 average March snowfall was greater than that of any month. There are still some communities in Minnesota that can claim March as their snowiest month. Among these are Canby and Redwood Falls in southwestern Minnesota. But for the balance of the state, January is usually the snowiest.

A complete 120 year distribution of annual snowfall in the Twin Cities shows how often each month represents the snowiest of the season.....

Frequency of greatest monthly snowfall amounts reported in the Twin Cities climate record (winter of 1883-1884 through winter of 2003-2004)...120 years...

Nov	Dec	Jan	Feb	Mar	Apr
13yrs	24yrs	35yrs	16yrs	28yrs	3yrs

In the winter of 1922-1923, January and March tied as the snowiest month with 11.8 inches each.

MPR listener question: I have been a winter camping enthusiast for over 20 years. I made a trip to the BWCA, and camped at Sawbill Lake in Cook County from December 18 to 20 of 1983. It was extremely cold...and now over 20 years later I realize we were probably camping in some record-setting cold weather. Can you tell me if that was true?

Answer: You are certainly correct. The statewide low temperature records for December 17-20 all date from 1983. They are.....

December 17th, -44 F at Mora

December 18th, -52 F at Mora

December 19th, -52 F at Tower and Mora

December 20th, -49 F at Tower

Though there is no weather station at Sawbill Lake, I would guess you were camping in air temperatures of -40 to -50 degrees F. Even the daytime high temperatures during this period ranged from -5 to -15 F. Estimates of the wind chill conditions (new formula) during that time suggest values ranging from -60 to -70 F.

Local Almanac:

Twin Cities Almanac for February 13th:

The average MSP high temperature for this date is 27 degrees F (plus or minus 12 degrees standard deviation), while the average low is 10 degrees F (plus or minus 14 degrees standard deviation).

MSP Local Records for February 13th:

MSP weather records for this date include: highest daily maximum temperature of 50 degrees F in 1921; lowest daily maximum temperature of 0 degrees F in 1905 and 1909; lowest daily minimum temperature of -23 degrees F in 1905; highest daily minimum temperature of 34 degrees F in 1911; record precipitation of 0.60 inches in 1915; and record snowfall of 5.5 inches in 1909. There have been 13 measurable snowfalls on this date since 1945. Maximum snow depth on this date was 22 inches in 1979.

Average dew point for February 13th is 12 degrees F, with a maximum of 36 degrees F in 1915 and a minimum of -23 degrees F in 1971.

All-time state records for February 13th:

Scanning the state climatic data base: the all-time high for this date is 63 degrees F at Mankato (Blue Earth County) in 1990; the all-time low is -46 degrees F at Detroit Lakes (Becker County) in 1916.

Word of the week: Wind scoop

This term refers to the saucer-shaped depression in snow cover near the base of trees, buildings, or other barriers that obstruct or disrupt the wind flow. The depression is caused by the eddy action (deflection) of the wind as it is deflected around the object. Though this feature is evident in the pattern of snow deposition in Minnesota's climate, in desert climates these saucer-shaped depressions can be the result of wind blown sand and soil.

Outlook:

Colder than normal weekend with a chance of snow later on Sunday and into Monday. Cooler than normal temperatures will give way to a warming trend next week, perhaps bringing temperatures as high as 40 F by the end of the week.

To: Morning Edition  
From: Mark Seeley  
Re: Topics for MPR's Morning Edition, Friday, February 20, 2004

Topic: New Monthly and Seasonal Outlooks....

The Climate Prediction Center released the new monthly and seasonal outlooks on Thursday of this week, covering the period from March through May. There appears to be equal chances for above or below normal precipitation in Minnesota over this time period. With respect to temperature, some of the models favor slightly cooler than normal temperatures in western Minnesota over the coming three month period. In the near term, at least through early March, it appears that above normal temperatures will be more likely.

Topic: Streak of days below freezing ends....

With a high of 42 degrees F on Wednesday this week, the Twin Cities ended a string of 31 consecutive days below freezing, the longest such streak since the winter of 1985-1986. In fact the 42 degrees F was the highest temperature reached since December 27th.

Duluth reached 45 degrees F on Wednesday, the warmest temperature there since 50 F on November 20th. Duluth will likely soon pass 100 inches of snowfall for the season as well.

Topic: Freezing rain....

With freezing rain in the forecast for parts of Minnesota this week, I looked up the distribution of such events for the Twin Cities area. Freezing rain is most common in the month of December, having been reported on 40 separate days over a period of 56 years. The second highest frequency of occurrence can be found in January (30 days), followed by February and March (each with 27 days) over the same 56 year period. Freezing rain events have also been reported in the months of April and November, though not in very great numbers. One of the most memorable freezing rain events occurred in the month of December 1972, when over the period from the 29th to the 31st widespread areas of central Minnesota were coated in ice, felling power lines and poles and causing numerous traffic accidents.

Topic: A Cowrific Heroine Indeed....

New Zealand's North Island was hit with a severe summer storm this week, bringing as much as 8 inches of rainfall to places north of Wellington. Near the rural community of Woodville farmsteads were washed away by flood waters. According to an AP and USA Today report, farmer Kim Riley was swept off her feet by the flowing waters when she was trying desperately to herd some of her cows to the safety of higher ground. Struggling to keep afloat in the roaring current of water, she threw her arms around the neck of one of her cows, called cow number 569. This cow eventually struggled to reach an embankment, saving itself and its owner from drowning in the flash

flood. Farmer Riley says she lost 15 of her 350 cows to the flood, but cow number 569, though old and ugly, will get a bit of special attention.....perhaps she'll even give her a name!

MPR listener question: The day after Valentine's Day, Sunday, the 15th of February, I saw that International Falls, MN reported a new low temperature record with -32 degrees F. Since that time, milder temperatures have taken hold over the state. Do you think that was the last gasp of cold, arctic air for the winter?

Answer: Indeed, last Sunday was a cold one. For the 3rd time this month Minnesota reported the coldest temperature in the 48 contiguous states. International Falls was not the only place to report a new low temperature record. The following communities also reported new record lows.....

Embarrass -44 F (lowest in the nation that day)  
Theilman -19 F (tied their record low in Wabasha County)  
Hibbing -29 F  
Blackduck -30 F  
Littlefork -33 F

Was this the last gasp of arctic air?.....could be. All of the forecast models show above normal temperatures dominating Minnesota from now through early March. Intrusions of high latitude air masses by that time will likely only bring temperatures in the single digits. It is interesting to note that on the day they began to demolish the St Paul Winter Carnival Ice Palace, Mother Nature began to serve up spring-like weather.....just a coincidence???

Local Almanac:

Twin Cities Almanac for February 20th:

The average MSP high temperature for this date is 28 degrees F (plus or minus 12 degrees standard deviation), while the average low is 11 degrees F (plus or minus 13 degrees standard deviation).

MSP Local Records for February 20th:

MSP weather records for this date include: highest daily maximum temperature of 57 degrees F in 1981; lowest daily maximum temperature of -4 degrees F in 1918; lowest daily minimum temperature of -18 degrees F in 1918; highest daily minimum temperature of 35 degrees F in 1899; record precipitation of 0.43 inches in 1891; and record snowfall of 4.2 inches in 1979. There have been 14 measurable snowfalls on this date since 1945. Maximum snow depth on this date was 29 inches in 1967.

Average dew point for February 20th is 12 degrees F, with a maximum of 43 degrees F in 1930 and a minimum of -26 degrees F in 1966.

All-time state records for February 20th:



Scanning the state climatic data base: the all-time high for this date is 65 degrees F at Tracy (Lyon County) in 1930 and at Luverne (Rock County) and Canby (Yellow Medicine County) in 1981; the all-time low is -50 degrees F at Baudette (Lake of the Woods County) in 1966.

Word of the week: "Frost" and "Snow" working together....

The National Weather Service has announced the acquisition of a new parallel supercomputer system from IBM. This system will be used to run sophisticated weather and climate forecast models. It is capable of 450 billion calculations per second (a good desktop computer runs about 2 billion per second). The operational forecasting side of the computer is called "Frost", while the model development and research side of the computer is called "Snow." I don't know why these names were given, but they represent the second largest supercomputer system in the world and a \$224 million investment for the National Weather Service.

Outlook:

Chance of lingering snow showers in southeastern Minnesota on Saturday, otherwise cloudy with above normal temperatures over the weekend. A chance for light snow Monday, then again later in the week. Temperatures will average above normal for this time of year.

To: Morning Edition  
From: Mark Seeley  
Re: Topics for MPR's Morning Edition, Friday, February 27, 2004

Topic: Mother Nature pulls a fast one...

It was interesting to note this week that the states of Alabama, Florida, Arkansas, and Georgia were scheduled for severe weather practice sessions on Wednesday, including tornado safety drills with the public. Actual severe weather in those states caused cancellation of the drills as the National Weather Service Forecast Offices were extremely busy. Tornadoes and straight line wind damages were reported in both Florida and Georgia later on Wednesday. Guess they will have to practice severe weather drills on another future date.....

Topic: Preliminary climate summary for February....

As we close the books on February in Minnesota, most are grateful for the precipitation it brought. All communities, with the exception of some far north-central locations, reported above normal precipitation values in terms of both snowfall and the water equivalence. February was the first month since last June that the state averaged precipitation amounts are above normal. With 19.7 inches of snowfall, the Twin Cities reports the 5th snowiest February in history. In fact, many communities around the state reported between 10 and 20 inches of snowfall, making a number of skiers and snowmobilers quite happy.

Temperatures in February were up and down, with state extremes of 53 degrees F at Winona on the 29th, to -44 degrees F at Embarrass on the 15th. Overall, locations with abundant snow cover reported average monthly temperatures that were slightly cooler than normal, while many other places reported values slightly warmer than normal.

MPR listener question: What are the climate statistics for February 29th in the Twin Cities? Because it comes around only once in every four years, are the climate statistics for that date unusual?

Answer: The average high and low temperature for February 29th are 35 degrees F and 14 degrees F, respectively. These values are about the same as those for the nearby dates of February 28th (33 and 17 F) and March 1st (34 and 17 F), so the smaller climatic sample available for February 29th seems to have little effect on the average temperatures. With respect to precipitation, February 29th is climatically drier than neighboring dates on the calendar, with precipitation recorded only about 18 percent of the time. Both February 28th and March 1st show precipitation about 25 to 30 percent of the time.

MPR listener question: What fraction of our March precipitation in the Twin Cities falls in the form of snow and what fraction falls as rain?

Answer: This would take considerable study to answer precisely. Normal March precipitation totals 1.85 inches in the Twin Cities. Examining the climate records since 1950 shows that about 64 percent of the time, the precipitation comes in the form of snow, and the remainder (36 percent) comes exclusively as rain. Of course we sometimes have mixed precipitation (snow, sleet, freezing rain, or rain all in one storm).

March is certainly a month of extremes when it comes to weather. In 1951, 1952, 1977, and 1998 over half the days (16 to be exact) brought some form of precipitation. In 1951 there were 15 days with snowfall, totaling 40 inches for the month, while in 1965 (the wettest ever March with 4.75 inches) there were 12 days with snowfall totaling over 37 inches. Both years produced spring flooding on the Mississippi River. Conversely, both 1910 and 1928 saw only two days with precipitation, one snowfall event and one rainfall event. In 1910 only 0.09 inches of precipitation fell, the driest March ever. The extreme temperatures for the month in the Twin Cities range from 83 degrees F in 1968 and 1986 to -32 degrees F in 1962.

Local Almanac:

Twin Cities Almanac for February 27th:

The average MSP high temperature for this date is 30 degrees F (plus or minus 11 degrees standard deviation), while the average low is 14 degrees F (plus or minus 13 degrees standard deviation).

MSP Local Records for February 27th:

MSP weather records for this date include: highest daily maximum temperature of 54 degrees F in 1896; lowest daily maximum temperature of -1 degrees F in 1962; lowest daily minimum temperature of -14 degrees F in 1897; highest daily minimum temperature of 37 degrees F in 1895 and 1983; record precipitation of 1.01 inches in 1981; and record snowfall of 5.5 inches in 1893. There have been 14 measurable snowfalls on this date since 1945. Maximum snow depth on this date was 24 inches in 1962 and 1967.

Average dew point for February 27th is 15 degrees F, with a maximum of 42 degrees F in 1958 and a minimum of -21 degrees F in 1962.

All-time state records for February 27th:

Scanning the state climatic data base: the all-time high for this date is 66 degrees F at Pleasant Mound (Blue Earth County) in 1896: the all-time low is -40 degrees F at Warroad (Roseau County) in 1913.

Word of the week: Dirty High

Typically the presence of high pressure indicates relatively

cloud-free skies as the sinking air causes compressional heating and the evaporation of any cloud formations. However, skies across Minnesota late last week (Feb 19) remained overcast even though a high pressure system drifted eastward over the state. Sometimes this situation is called a "dirty high". In this case, the sinking motion produced a temperature inversion (where the temperature increases with altitude) at approximately 5000 feet, which effectively trapped the residual moisture and aerosol particulates below. The air in the near-surface layer was nearly saturated as it remained chilled from below by the snow cover across the region. It also remained filled with pollution, serving as condensation nuclei for fog droplet formation. Fog, indeed, was reported at some locations. In addition, winds were relatively light, which inhibited mixing of dry air downward. Fortunately Minnesota does not suffer from this type of situation too often.

#### Outlook:

Continued above normal temperatures into the weekend, but under mostly cloudy skies. There is an increasing chance for precipitation in the form of both rain and snow for Sunday and Monday, even into early Tuesday. Some areas will get significant amounts and see a good deal of wind as well. A bit cooler next week with another chance for rain showers and snow in the second half of the week. So, looks like March will begin wet....

To: Morning Edition  
From: Mark Seeley  
Re: Topics for MPR's Morning Edition, Friday, March 5, 2004

For a Minnesota climatologist today's date (March 5th) is a significant one for two reasons...firstly, this is the earliest date in the year when a temperature of 70 F or higher has been recorded in Twin Cities history (72 F back in 2000)... hard to believe!!

The second memorable weather event that ended on this date was the famous 1966 blizzard. From the 2nd through the 5th of March that year a powerful blizzard gripped central and northern Minnesota counties with howling winds and heavy snowfall, some up to 32 inches at Park Rapids and 29 inches at Wadena. Drifts up to 20 feet high blocked roads for up to 4 days. Snowmobiles were the only form of useful transportation for some. Up to 3 inches of ice coated powerlines and brought them down in many areas, especially around Duluth. The heavy snowfall helped to set up April flooding on the Red River of the North and the upper reaches of the Mississippi River.

Topic: Follow-up to climatic statistics for Leap Day..

As we discussed last week, the climate statistics for Leap Day (which only comes around every 4 years) are obviously taken from a smaller record period and at least for most locations are skewed in favor of dryness. Keeping this in mind, the Twin Cities recorded a new daily record precipitation amount last Sunday, Leap Day, with a paltry 0.09 inches recorded at the MSP International Airport. This broke the old record of 0.05 inches recorded on February 29, 1940. As daily precipitation records go this amount is exceptionally small. For any other day of the year, the daily record precipitation amounts are 0.27 inches or greater.

Another Leap Day record was set in Minnesota last Sunday at International Falls where they recorded a high temperature of 45 degrees F, breaking the record of 44 F set in 2000.

MPR listener question: I heard that Wisconsin reported a tornado on March 1st (Monday) of this week. Isn't that unusual?

Answer: Indeed, March 1st brought a variety of weather to the region including, fog, rain, sleet, hail, thunder, snow, drizzle, and some strong winds. Most of this occurred in southeastern Minnesota and southern Wisconsin. Reedsburg, WI, northwest of Madison reported a tornado sighting which is still being investigated by the National Weather Service. This would indeed be highly unusual, as Wisconsin has recorded less than 10 tornadoes in the month of March going all the

way back to 1880.

Local Almanac:

Twin Cities Almanac for March 5th:

The average MSP high temperature for this date is 33 degrees F (plus or minus 11 degrees standard deviation), while the average low is 16 degrees F (plus or minus 13 degrees standard deviation).

MSP Local Records for March 5th:

MSP weather records for this date include: highest daily maximum temperature of 72 degrees F in 2000; lowest daily maximum temperature of 8 degrees F in 1901; lowest daily minimum temperature of -14 degrees F in 1960; highest daily minimum temperature of 46 degrees F in 1983; record precipitation of 0.70 inches in 1961; and record snowfall of 11.2 inches in 1915. There have been 16 measurable snowfalls on this date since 1945. Maximum snow depth on this date was 26 inches in 1962.

Average dew point for March 5th is 14 degrees F, with a maximum of 49 degrees F in 1983 and a minimum of -23 degrees F in 1960.

All-time state records for March 5th:

Scanning the state climatic data base: the all-time high for this date is 79 degrees F at Milan (Chippewa County) in 2000: the all-time low is -40 degrees F at Warroad (Roseau County) in 1943.

Word of the week: Upbank or Upslope Thaw

A thaw, or marked rise in temperature at positions higher than the surrounding landscape. This happens before the thaw takes place in the lower landscape positions, such as a valley, which may take more hours to show some signs of thaw. The inversion layer often keeps temperatures in lower landscape positions below the freezing mark well into the morning hours.

Another feature of the recent thaw period around Minnesota, was the rapid loss of snow cover on south or southwestern facing slopes. As the sun's elevation angle gets higher and days grow longer, now by about 17-19 minutes each week, the sun's thawing effect is greatly magnified.

Outlook:

Lingering light snow in the eastern and northern sections of the state over the weekend. Generally a cloudy period for next week, but temperatures will remain above normal for this time of year. Chance for rain or snow later in the week.

To: Morning Edition  
From: Mark Seeley  
Re: Topics for MPR's Morning Edition, Friday, March 12, 2004

Topic: In recent years the deployment of modern technology in meteorology has provided many more ocean and land surface automated weather stations which telemetry their measurements to various data centers around the world. Recently it was announced that the Tibetan Weather Bureau in Lhasa will deploy the world's highest automated weather station later this year on Mt Everest. This station will make routine weather measurements at an altitude of nearly 17,500 ft. Hopefully it will lead to better forecasts for those who make attempts to climb this mountain. Previously, meteorologists had to forecast conditions on the mountain based on satellite imagery and weather observation from as far as 55 miles away. Up to 20 expeditions each year make attempts to climb Mt Everest relying on weather forecasts to guide them on the suitability of conditions they may encounter.

Topic: Anniversary for Minnesota Weather Service....

Coming up on Monday is the 63rd anniversary of a famous Minnesota blizzard that caused a significant change in Weather Service Operations for Minnesota. On March 15-16, 1941 a severe blizzard raged across northern and central Minnesota. At about 9:30 on Saturday night southerly winds of 10-12 mph shifted to the northwest and increased to 40-50 mph, accompanied by blowing snow. Gusts as high as 85 mph were recorded at Grand Forks, 74 mph at Fargo-Moorhead, and 75 mph at Duluth. Overnight temperatures dropped by 35-40 degrees F, visibility fell to zero, and over 32 people perished in the storm by Sunday afternoon. Outside the Duluth harbor seven men and one woman were stranded on an ice floe in Lake Superior for over 23 hours before being rescued.

This storm occurred only four months after the terrible Armistice Day blizzard of the preceding fall. That was the last straw for Governor Harold Stassen and the Minnesota Congressional Delegation, as they appealed to the federal government that the Chicago Office of the National Weather Service should no longer have forecast jurisdiction over Minnesota (up to that time weather service personnel in Minnesota only had observational responsibilities and simply passed on the forecasts issued from the Chicago Office, a rather ludicrous situation). The Minnesota Congressional Delegation made their point, and the National Weather Service granted forecast jurisdiction to the Twin Cities Office to do their own Minnesota forecasts.

MPR listener question: What do you think has been the top weather story of the past year?

Answer: That's a tough one because there are so many....record number of tornadoes in May.....record drought and wildfire season

in the western U.S., lethal cold wave in India and Asia...record flooding in China....

I guess based on the severity of impacts, I would agree with the writers of Weatherwise magazine, that the most significant was the European Heat Wave of last August. It was the worst seen in our lifetime and contributed to between 10,000 and 20,000 deaths. This puts it in the same rank as the weather story of 1998, which was Hurricane Mitch, a category 5 storm that struck Honduras and caused between 9,000 and 10,000 deaths.

Local Almanac:

Twin Cities Almanac for March 12th:

The average MSP high temperature for this date is 37 degrees F (plus or minus 12 degrees standard deviation), while the average low is 22 degrees F (plus or minus 12 degrees standard deviation).

MSP Local Records for March 12th:

MSP weather records for this date include: highest daily maximum temperature of 69 degrees F in 1990; lowest daily maximum temperature of 11 degrees F in 1956; lowest daily minimum temperature of -10 degrees F in 1856; highest daily minimum temperature of 50 degrees F in 1990; record precipitation of 1.10 inches in 1899; and record snowfall of 11.0 inches also in 1899. There have been 17 measurable snowfalls on this date since 1948. Maximum snow depth on this date was 26 inches in 1962.

Average dew point for March 12th is 21 degrees F, with a maximum of 55 degrees F in 1995 and a minimum of -17 degrees F in 1984.

All-time state records for March 12th:

Scanning the state climatic data base: the all-time high for this date is 70 degrees F at Canby (Yellow Medicine County) in 1933, at Beardsley (Big Stone County) in 1934, at St Paul, Stillwater, and St James in 1990; the all-time low is -34 degrees F at Ada (Norman County) in 1896.

Words of the week: snow burst

Twin Cities residents experienced this feature of nature on Monday morning this week, when a weather system moving from Brainerd to the southeast corner of the state, intensified as it reached the Metro area and produced snowfall rates of between 2 and 3 inches per hour. Between about 10:00 am and 12:30 pm over 150 traffic accidents were reported around the Metro area. An influx of low level moisture, combined with sub-freezing temperatures contributed to this intense snow squall that produced very large flakes, and very low visibilities. On occasion such snow bursts are also accompanied by thunder. Snow bursts produce snowfall rates of 1 to 3 inches per hour, but they are often relatively



short-lived, as this one was.

#### Outlook:

Generally cloudy skies over the weekend with chances for rain or snow, perhaps 1 to 3 inches in the north. Rather windy as well. Cooler on Sunday, then moderating temperatures next week with some 40s and perhaps 50s F around the state. Chance for precipitation again Tuesday through Thursday, as March continues to be wetter than normal most places.

To: Morning Edition  
From: Mark Seeley  
Re: Topics for MPR's Morning Edition, Friday, March 19, 2004

Topic: New Seasonal Climate Outlooks....

The NOAA Climate Prediction Center released the new seasonal climate outlook on Thursday this week. There will be equal chances for above or below normal values of precipitation over the April through June period across all of Minnesota. With respect to temperature, there are mixed indications. The near term 15-30 days out suggest warmer than normal conditions will prevail in eastern Minnesota, while the longer term outlook, 30-90 days out suggest cooler than normal temperatures are likely in the western half of the state. Most Minnesotans would be happy with warmer temperatures, but the state's farmers would all like to see more than usual spring rainfall.

Topic: Iowa Snow Storm....

Monday, March 15th brought a snow storm of historical note to the state of Iowa. A slow moving weather system passed across central Iowa with heavy rates of snowfall, and even some thundersnow. New daily snowfall records were set at many locations, including Des Moines, Sioux City, Carroll, and Grinnell among others. These record amounts generally ranged from 11 to 16 inches. The 15.6 inches of snowfall measured in Des Moines was their 3rd greatest 24-hour snowfall in history (back to 1878), and greatest ever in March.

Had this weather struck the east coast it would have paralyzed several cities and made national headlines.

While Iowa was experiencing record snowfall on Monday, Tower, MN reported the lowest temperature in the 48 contiguous states with -11 degrees F, no where near their record low for March 15th of -35 F back in 1897.

Topic: At what temperature do you relish a cold drink???

A recent study by the United Kingdom Meteorological Office showed that the British consumption of cold drinks skyrockets when temperatures get above 64 degrees F in the spring. This made me wonder about Minnesota. I'll bet our consumption of cold drinks starts to climb at a lower temperature threshold. My reasoning goes like this: the Brits rarely experience temperatures below 30 degrees F during their winters, while Minnesotans acclimate to persistent temperatures below freezing, as well as many days with lows in the single digits or below zero. As we approach spring in Minnesota, 50 degrees F brings out the short sleeves, even shorts and tennis shoes in some cases. I'll bet a

thirst for a cold drink dramatically increases at this temperature as well. Heck, there's probably an increased craving for ice cream!! Looks like 50s F are coming next week, so beverage and ice cream vendors better gear up!!

MPR listener question: Is there an efficient way I can search for places on Earth that have a climate similar to San Diego, which is the best weather I have experienced? (Unfortunately it is very expensive there).

Answer: I can understand taking a liking to the San Diego climate, especially during a Minnesota winter. The climate of San Diego is technically classified Temperature/Mediterranean, according to the Koeppen system (one of the most widely used). This means generally mild winters that bring most of the annual precipitation, with warm and dry summers. Obviously the climate is greatly modified by proximity to the ocean. Using any book or web site that details the Koeppen classification system will provide more insight. Finding a match for the San Diego climate is difficult. In the northern hemisphere, there are areas of the Mediterranean Sea that are similar. In the southern hemisphere, areas along the southern coast of Chile, and areas along the southern coast of South and Western Australia present somewhat similar climates.

Another scheme used to rate the suitability of climates is called the Camelot Climate Index (something Cathy Wurzer and I have talked about before). This index is based on temperature, precipitation and sunshine. A Camelot Index is available for most major American cities, and guess what, San Diego comes in with the highest rating (88 out of 100) among 158 cities. The Twin Cities comes in with a rating of 63 and a ranking of 118th. The Camelot Index has a web site at.....

<http://ggweather.com/camelot.htm>

Sometimes climate is illustrated graphically with a figure called a climograph.....this too is available on the web at..

<http://www.drought.unl.edu/whatis/climographs.htm>

Local Almanac:

Twin Cities Almanac for March 19th:

The average MSP high temperature for this date is 40 degrees F (plus or minus 11 degrees standard deviation), while the average low is 24 degrees F (plus or minus 11 degrees standard deviation).

MSP Local Records for March 19th:

MSP weather records for this date include: highest daily maximum temperature of 72 degrees F in 1910; lowest daily maximum temperature of 14 degrees F in 1965; lowest daily minimum

temperature of -7 degrees F in 1923; highest daily minimum temperature of 48 degrees F in 1910; record precipitation of 1.09 inches in 1897; and record snowfall of 8.8 inches in 1943. There have been 11 measurable snowfalls on this date since 1948. Maximum snow depth on this date was 26 inches in 1951.

Average dew point for March 19th is 23 degrees F, with a maximum of 52 degrees F in 1976 and a minimum of -11 degrees F in 1965.

All-time state records for March 19th:

Scanning the state climatic data base: the all-time high for this date is 76 degrees F at Albert Lea (Freeborn County) in 1910; the all-time low is -40 degrees F at Meadowlands (St Louis County) in 1923 (following a blizzard two days earlier).

Words of the week: Bluffart and Blunk

These are both Scottish words used to describe unfriendly weather like we had last Sunday around the Twin Cities area. Bluffart refers to a squall or sudden wind, accompanied by snowfall or mixed precipitation...sleet, hail..etc. This is often only short lived. Blunk refers to tempestuous weather that suddenly makes it quite inhospitable outside, with wind squalls and sometimes light precipitation in the form of snow, mist or rain. Blunk spells of weather may last longer, up to half a day.

Outlook:

Near normal temperatures on Saturday, but windy with a chance for snow showers in the north. Chance for rain showers again Tuesday and Wednesday with temperatures climbing into the 50s F. Balance of the month looks to be warmer and wetter than normal.

To: Morning Edition  
From: Mark Seeley  
Re: Topics for MPR's Morning Edition, Friday, April 9, 2004

Topic: Recent warm spell....

Seven of the first eight days of April registered above normal temperatures with a general absence of significant precipitation. Consequently, except for some far northeastern counties, most of the soil frost is now gone. Lake ice-out dates are a week to week and a half earlier than normal, but many northern lakes are still at least partially ice covered. Numerous wildfires have been reported this week as vegetation is dry and yet to green up. Most areas of the Minnesota landscape are in need of a good rain.

Warm weather in Europe has apparently fooled an exotic African bird into migrating to the wrong place. The BBC reported that the colorful African Hoopoe a bird which makes a spring migration to Spain or Greece in the Mediterranean area has ended up in north Wales this week, supposedly fooled by the recent warm weather over the eastern Atlantic Ocean. Its appearance has promoted a surge in spring bird watching across Wales and England.

Topic: Trends in evaporation data

According to a study by the National Climatic Data Center (Asheville, NC) time trends in evaporation data from the United States and the former Soviet Union show a negative trend. An examination of 45 years worth of daily pan evaporation measurements during the northern hemisphere growing season showed a decreasing trend in most areas. This fits well with the trends of increased cloudiness, frequency of precipitation and reduced diurnal temperature range in the northern hemisphere found by other researchers. These features of the climate would tend to reduce evaporation rates since they suggest limited solar radiation and smaller water vapor deficits, both of which help drive the evaporation process.

Granted this study only documents trends in evaporation from the land, rather than the oceans. Nevertheless, the downward trend fits well with other Northern Hemisphere summer observations of higher dew points, more rainfall, higher minimum temperatures, reduced daily temperature range, and increased cloudiness, all of which relate to the amount of water vapor in the atmosphere.

MPR listener question: With a chance for rain or snow forecast for the weekend, it made me wonder how often it has snowed on Easter Sunday in the Twin Cities? And what are some of the climate extremes?

Answer: This is rather difficult since the date of Easter is

associated with the first Sunday following the full moon that occurs next after the Vernal Equinox (usually March 20 or 21). Thus, historically the Date of Easter has ranged from as early as March 23 in 1913 to as late as April 25 in 1943. Nevertheless lining up the historical dates of Easter with the Twin Cities climate records back to 1891, we can derive some climate statistics for this significant Christian celebration.

In the 113 years since 1891, precipitation has fallen on Easter Sunday 33 years, the most being 0.49 inches in 1941. Snow has fallen on Easter Sunday in nine years, the most coming in 1929 when 2.5 inches fell. The last time snow fell on Easter Sunday was March 29, 1970 when 0.4 inches was measured. The two coldest Easter Sundays were: March 25, 1894 with a high of 15 and a low of -2 degrees F; and March 30, 1975 with a high of 18 and a low of 4 degrees F. The two warmest were: April 10, 1977 with a high of 88 and a low of 55 degrees F; and April 19, 1987 with a high of 84 and a low of 58 degrees F. Usually the daytime temperature falls somewhere in the 40s and 50s F.

Local Almanac:

Twin Cities Almanac for April 9th:

The average MSP high temperature for this date is 51 degrees F (plus or minus 11 degrees standard deviation), while the average low is 32 degrees F (plus or minus 7 degrees standard deviation).

MSP Local Records for April 9th:

MSP weather records for this date include: highest daily maximum temperature of 81 degrees F in 1930; lowest daily maximum temperature of 29 degrees F in 1973; lowest daily minimum temperature of 15 degrees F in 1997; highest daily minimum temperature of 53 degrees F in 1945; record precipitation of 0.75 inches in 1919; and record snowfall of 5.5 inches in 1894. There have been nine measurable snowfalls on this date since 1948. Maximum snow depth on this date was 4 inches in 1980.

Average dew point for April 9th is 27 degrees F, with a maximum of 58 degrees F in 1945 and a minimum of 3 degrees F in 1995.

All-time state records for April 9th:

Scanning the state climatic data base: the all-time high for this date is 91 degrees F at Redwood Falls in 1977; the all-time low is -5 degrees F at Tower (St Louis County) in 1997.

Words of the week: Woolpack or Cauliflower Cloud

These terms are old ones used to refer to some types of cloud formations, namely cirrocumulus (high cumulus) and altocumulus (mid level cumulus). These types of clouds seen in abundance may have a fleecy appearance and look like an airborne flock

of sheep or lambs. Seen in isolation, one of these clouds may have the appearance of a head of cauliflower. These terms were first used by 19th century British meteorologists Abercromby and Scott who contributed to the first International Cloud Atlas published in 1896. These cloud forms are more frequent during the spring months in Minnesota when it is fun to observe the wide variety of cloud formations like we have been having so far this month.

Those readers wishing to learn more about clouds can consult two educational web sites which catalog the different cloud types:

[http://ww2010.atmos.uiuc.edu/\(Gh\)/guides/mtr/cld/home.rxml](http://ww2010.atmos.uiuc.edu/(Gh)/guides/mtr/cld/home.rxml)  
(University of Illinois Atmospheric Sciences Dept project 2010)

<http://vortex.plymouth.edu/clouds.html>  
(Plymouth State College Cloud Boutique page)

#### Outlook:

Chance for snow showers or rain showers around the state over the weekend, with below normal temperatures. Most chances for snow are in the northern counties. Generally dry then until later next week, temperatures will climb back to normal by Wednesday and Thursday with an increasing chance for rainfall by Thursday and Friday.

To: Morning Edition  
From: Mark Seeley  
Re: Topics for MPR's Morning Edition, Friday, April 16, 2004

Topic: Anniversary week for Minnesota's most lethal tornado..

One hundred eighteen years ago this week (April 14, 1886) an F4 tornado (winds over 200 mph) traveled 25 miles across central Minnesota, killing 74 people, injuring 213, and destroying over 200 homes. Described by witnesses as alternately a massive 1/2 mile wide funnel and also as a "double spiral" the tornado swept up the water as it crossed the Mississippi River near Sauk Rapids, leaving the river bottom dry for a brief period. Sauk Rapids and St Cloud were devastated, while near Rice eleven members of a wedding party, including the bride and groom were swept away to their death. Though more destructive tornadoes have occurred since this time in Minnesota, none have caused more deaths than this one.

MPR listeners are encourage to listen to NOAA Weather Radio next week for Severe Weather Awareness and Education announcements.

Topic: Evidence for how dry the Minnesota landscape is on April 15th...

Fire weather statements have been issued by the National Weather Service Offices in Sioux Falls, La Crosse, Duluth, and Chanhassen, some stipulating a critical fire danger especially on Thursday in southeastern Minnesota. Though no real major fires have occurred, fires have been abundant around the state so far this month. An extremely dry air mass over the state brought relative humidity values of only 12 to 19 percent on Wednesday of this week. Such dry air manifests itself in the static electricity shocks you have been getting around the house and office this week!

Stream flow data show many major watersheds are running at or below the 25th percentile historically for this time of year. This includes several points along the Mississippi River. The Root River at Houston, MN is showing an all-time low flow value for mid-April with just 256 cfs measured, while the Cedar River at Austin is running at just 81 cfs, the 2nd lowest historically for mid-April.

Though precipitation deficits for 2004 so far are ranging from only 1 to 2 inches short of normal for many locations, the carryover moisture deficits since last July are quite substantial. Lamberton, Olivia, and even the Twin Cities report the driest ever July through mid-April period, falling short of normal precipitation by 9 to 11 inches. Alexandria and Browns Valley report the 2nd driest ever



July through April precipitation, while Rochester reports the 3rd driest ever.

Soil moisture deficits estimated for the top five feet of the soil profile range from 2.5 to 4.5 inches for many places. These values are some of the lowest since 1989. This shortage implies that 2004 crop production in Minnesota will rely much more than normal on the amount of within season rainfall, a risky situation to be in.

Topic: New seasonal climate outlooks....

The Climate Prediction Center on Thursday of this week released the new climate outlooks for the months of May, June, and July. The outlook for May is for cooler than normal temperatures in our region, with equal chances for above or below normal rainfall. The longer term outlook through July favors near normal temperature and rainfall.

Unfortunately to recharge soil moisture and the state's hydrologic systems (lake levels, streamflows, and shallow aquifers, we will need above normal rainfall this summer. So we can always hope that the CPC is wrong on this part of the outlook!

MPR listener question: A listener from Winona asked why during this time of year, early morning temperatures from northern locations like Bemidji and Brainerd are even warmer than Winona?

Answer: These differences may be caused by the greater heat absorption of the evergreen forests around Bemidji and Brainerd. These forests act as a better heat sink under the higher sun and longer days of spring. Conversely, Winona may be influenced by cool air drainage into the Mississippi River Valley and by the cooler river water temperatures this time of year. There may be a variety of other circumstances contributing to this as well.

Local Almanac:

Twin Cities Almanac for April 16th:

The average MSP high temperature for this date is 57 degrees F (plus or minus 12 degrees standard deviation), while the average low is 37 degrees F (plus or minus 8 degrees standard deviation).

MSP Local Records for April 16th:

MSP weather records for this date include: highest daily maximum temperature of 88 degrees F in 1964; lowest daily maximum temperature of 32 degrees F in 1910 and 1953; lowest daily minimum temperature of 20 degrees F in 1907; highest daily minimum temperature of 65 degrees F in 1976; record precipitation of 1.04 inches in 2003; and record snowfall of 5 inches in 1961.

There have been five measurable snowfalls on this date since 1948. Maximum snow depth on this date was 7 inches in 1983.

Average dew point for April 16th is 32 degrees F, with a maximum of 59 degrees F in 1976 and a minimum of 8 degrees F in 1953.

All-time state records for April 16th:

Scanning the state climatic data base: the all-time high for this date is 89 degrees F in southwestern Minnesota at Canby, Windom, and Luverne in 1964; the all-time low is 0 degrees F at Gunflint Lake (Cook County) in 1983 (with 17 inches of snow on the ground).

Words of the week: Albedo

This term refers to the ratio of reflected radiation (light) to the amount received on a given surface or body. This time of year, a satellite view of Minnesota may show areas of relatively higher albedo (0.50 or more) where snow cover is still persistent (Arrowhead region). In agricultural areas of the state, a satellite view this time of year will be dominated by the albedo of the soil, often in the 0.20 to 0.30 range (indicating that 20 to 30 percent of the sun's radiation is reflected back. Our drier soils right now are probably reflecting an even larger amount of the sun's energy.

Outlook:

Increasing chance for showers and thunderstorms over the weekend and going into early next week. Temperatures will cool off a bit next week and average below normal by midweek. But chances for rainfall will return on or about the 22nd.

To: Morning Edition  
From: Mark Seeley  
Re: Topics for MPR's Morning Edition, Friday, April 23, 2004

Topic: What is the real information conveyed by our weather detection technology and how much should we depend on it?

This question came to my mind last Sunday night (April 18th) during the severe weather outbreak across southern Minnesota (coincidentally on the 184th anniversary of the first observed tornado in the state which took part of the barracks roof off old Ft Snelling).

Though we have deployed millions of dollars worth of weather detection technology over the past decade, often it does not give us as definitive a picture of the weather as some would like to think. In fact, in some ways it dilutes the essential information that should be conveyed to the public. Radar resolutions and software have improved, but we still cannot be sure of a tornado or the size of hail until verified by ground observation. We are only just learning about the time and space variation of wind shear, hail, and funnels that remain imbedded inside thunderstorm cells. Characteristics observed in individual radar image displays occur aloft and they often do not translate to what happens on the ground. It is important not to exaggerate the ability and certainty of this technology. Deployment of multiple radars, with satellite images, automated surface observations, and spotter networks represents the mosaic or composite approach to detection that the National Weather Service continues to rely on. This system remains our best defense. Verified observations of tornadoes, straight line winds, and hail stones are real and should be given priority over the reporting of "possible or probable features" that are detected by radar.

Topic: Blessed Rain.....

The efficiency of rainfall is important for recharging soil moisture reserves. The closer the rainfall rate matches with the infiltration rate of the soil, the higher the storage efficiency of the rainfall. The two rainfalls this week (Sunday night and Tuesday night) were very welcome indeed, but the latter event was much more efficient at recharging our soils. The Sunday night storms produced some intense rainfall. We received nearly 0.90 inches in 15 minutes on the St Paul Campus. Many places reported from 1 to 2 inches for a storm total, but some of this was lost to runoff as it came down so fast. Conversely, the Tuesday night rainfall was of less intensity, ranging from 0.05 to 0.25 inches per hour, a closer match to the infiltration rate of the soil. Consequently most of this rainfall soaked into the soil.

Some of the larger rainfall totals for this week include....

Alexandra 1.82 inches, Chaska 2.56 inches, Albert Lea 1.77 inches, New Hope 2.36 inches, Wadena 1.51 inches, and Brainerd 1.50 inches.

Topic: Remarkable swing in temperatures on this date in 1980

One of the most remarkable drops in temperature occurred on this date in 1980. Hawley, in Clay County east of the Fargo-Moorhead area, had recorded an all-time high April temperature of 101 degrees F on April 22nd. However, winds shifted around to the north and brought in a cold Canadian air mass dropping the temperature to 30 degrees F on the morning of April 23rd. This 71 degree F change in temperature over a 24 hour period is one of the largest in the Minnesota historical records. The month of April that year saw the onset of a spring drought in the Red River Valley.

MPR listener question: Did the rainfall this week erase the threat of drought for this coming growing season?

Answer: Certainly not. Though abundant in some areas, the rainfall was generally not enough to erase the cumulative precipitation deficit since last summer. It was however, highly beneficial in providing many agricultural areas with enough moisture to germinate a crop and establish a stand of seedlings. I am sure most farmers would welcome even more rain.

Local Almanac:

Twin Cities Almanac for April 23rd:

The average MSP high temperature for this date is 61 degrees F (plus or minus 11 degrees standard deviation), while the average low is 40 degrees F (plus or minus 8 degrees standard deviation).

MSP Local Records for April 23rd:

MSP weather records for this date include: highest daily maximum temperature of 86 degrees F in 1990; lowest daily maximum temperature of 35 degrees F in 1910; lowest daily minimum temperature of 19 degrees F in 1910; highest daily minimum temperature of 65 degrees F in 1925; record precipitation of 0.87 inches in 1948 and 1968; and record snowfall of 1.6 inches in 1988. There have been three measurable snowfalls on this date since 1948. Maximum snow depth on this date was 2 inches in 1963.

Average dew point for April 23rd is 34 degrees F, with a maximum of 66 degrees F in 1908 and a minimum of 11 degrees F in 1930.

All-time state records for April 23rd:

Scanning the state climatic data base: the all-time high for this date is 93 degrees F at Winona in 1980; the all-time low is -1 degrees F at Grand Rapids in 1918.

## Word of the week: Transmissivity

From the root words trans meaning over or across and mittere meaning to send (both Latin). In meteorology as well as in physics this word is used to describe the fraction of radiation which passes through the Earth's atmosphere and reaches the surface. For example at the top of the Earth's atmosphere radiant energy striking a surface placed normal (perpendicular) to the sun will receive approximately 1360 Watts per square meter. That radiation is reduced as it passes through the Earth's atmosphere by absorption and reflection primarily from water vapor, atmospheric aerosols and particularly clouds. The fraction of radiation which reaches the Earth's surface then is a measure of the transmissivity of our atmosphere (the ability of our atmosphere to transmit radiation). It varies both geographically and over time. For example now during the spring in Minnesota, typical clear day transmissivity is about .72 to .76 (72 to 76 percent). This will decline as we move toward summer to about .67 to .70 (67 to 70 percent), then begin to rise again in the fall. Highest clear day transmissivities are generally in the winter. In the absence of inversions, the air tends to be cleaner in the winter.

### Outlook:

Chance of showers and thunderstorms later on Saturday and into early Sunday. Temperatures will remain near normal, then warm significantly by mid week. There will be another chance for showers next Thursday and Friday, including perhaps some thunderstorms.

To: Morning Edition  
From: Mark Seeley  
Re: Topics for MPR's Morning Edition, Friday, April 30, 2004

Topic: Arbor Day

Happy National Arbor Day today. Minnesota also celebrates Arbor Month during May. We certainly missed the refreshing shade of deciduous trees on Wednesday of this week, when high temperature records were broken all around the state. Many of these trees were not yet leafed out, so they could not provide the welcome shade on our patios, decks, and gardens.

Arbor Day is a day for planting trees, and in many places a ceremonial act of spring that dates back to 1872 in Nebraska. In Minnesota today and during the month of May (Arbor Month) there will be a good deal of tree planting and educational activities about the value of trees.

It is worth noting the many advantages trees bring to the local environment. In recent years with the research on global climate change we have learned that trees take up large quantities of carbon dioxide on a global scale. When used in the home landscape they can also provide a buffer from nearby sources of dusts, odours, aerosols and noises. They are planted in the rural landscape to provide wind protection, to reduce soil erosion potential, to capture blowing and drifting snow, preventing it from clogging roadways, and to provide wildlife habitat.

In the residential landscape trees provide selective shading in the summer, somewhat reducing air conditioning needs, particularly when placed on south or west facing exposures to protect roofs, windows and air conditioning units from direct sunlight. In winter, trees (especially evergreens) can provide protection from northerly and westerly winds which may tend to carry off heat from buildings more rapidly. They also tend to alter the local radiation balance, as they have lower albedo (reflectivity) and help reduce long wave radiation loss to the atmosphere at night, keeping minimum temperatures higher.

Topic: Hottest April 28th in Minnesota History.....

One could say it was the hottest April 28th in state history this past Wednesday, as many communities reported new record high temperatures, breaking records from 1910, 1934, and 1952. Even the all-time state record high for the date of 94 degrees F at Argyle in 1952 was broken when Benson, MN reported 95 degrees F at 4 pm that afternoon. The following communities reported new record high temperatures on Wednesday....

MSP airport 91 F	St Cloud airport 92 F	Fargo airport 91 F
Detroit Lakes 90 F	Fergus Falls 93 F	Madison 91 F
Glenwood 93 F	Redwood Falls 93 F	Wheaton 91 F

Orr 90 F Willmar 93 F Litchfield 91 F Hutchinson 93 F  
New Ulm 91 F Faribault 90 F Waseca 91 F Albert Lea 90 F  
Alexandria 91 F Olivia 93 F Morris 90 F St James 90 F  
Red Wing 88 F Brainerd 87 F Little Falls 88 F Austin 88 F  
Preston 90 F Cambridge 93 F Lamberton 93 F Chaska 92 F

Rochester and Fairmont tied record highs with 87 degrees F and 90 degrees F, respectively. La Crosse too tied a record high with 89 degrees F.

In addition, new record low humidity values (greatly inflating the fire danger) were reported on Wednesday afternoon, many lower than what Tucson, Arizona reported for the same date (13 percent)!!!!

New record low relative humidity values for April 28th included...

Detroit Lakes 12% Fergus Falls 6% Glenwood 9%  
Litchfield 10% Waseca 12% New Ulm 5% Redwood Falls 9%  
Olivia 5% Pipestone 2% St James 9% Fosston 9%  
Cambridge 12% Madison 8% Willmar 12% Windom 10%  
Marshall 10% Montevideo 11% Ortonville 10%

Some of these are about as low as we ever see in Minnesota. Locally, the Twin Cities relative humidity dropped as low as 20 percent, but did not reach the 11 percent value recorded on April 28, 1934.

Topic: Climate Summary for April

The average temperature for April was warmer than normal most places around the state, except in the far north-central and northeastern sections where it was slightly cooler than normal. Extremes ranged from 95 degrees F at Benson on the 28th to just 7 degrees F at Embarrass on the 2nd.

Though there were some welcome rains during the month, total precipitation was generally less than normal, except for portions of east-central and northeastern Minnesota where some communities saw 2.5 to 3 inches fall. Snowfall was generally absent during the month. Only Babbitt, Tower, and Isabella in northeastern Minnesota reported more than 1 inch of snowfall. The month was generally cloudy and windy as well.

MPR listener question: Was that an exceptionally strong cold front on Wednesday night? I see that Olivia's temperature dropped from 93 degrees F to 36 degrees F over a 12 hour period (5 pm Wed to 5 am Thu), a 57 degrees F plummet.

Answer: Indeed, most meteorologists would agree that a temperature drop of 40 degrees F or greater indicates a very strong cold front passage. Such was the case Wednesday and Thursday this week. This time of year the temperatures of different air masses that cross Minnesota can be substantially different and bring huge temperature changes. For example April 2, 1982 brought a near record high temperature of 78 degrees F to Lamberton, MN, but a very strong cold

front swept in later in the day and took the low down to just 7 degrees F, a drop of 71 degrees F!

Local Almanac:

Twin Cities Almanac for April 30th:

The average MSP high temperature for this date is 62 degrees F (plus or minus 13 degrees standard deviation), while the average low is 43 degrees F (plus or minus 9 degrees standard deviation).

MSP Local Records for April 30th:

MSP weather records for this date include: highest daily maximum temperature of 91 degrees F in 1934 and 1952; lowest daily maximum temperature of 31 degrees F in 1909; lowest daily minimum temperature of 24 degrees F in 1903; highest daily minimum temperature of 66 degrees F in 1934; record precipitation of 1.53 inches in 1954; and record snowfall of 3.1 inches in 1984. There has only been one measurable snowfalls on this date since 1948. Maximum snow depth on this date was 4 inches in 1984.

Average dew point for April 30th is 37 degrees F, with a maximum of 63 degrees F in 1942 and a minimum of 8 degrees F in 1918.

All-time state records for April 30th:

Scanning the state climatic data base: the all-time high for this date is 96 degrees F at Maple Plain (Hennepin County) in 1934 and at Winona in 1952; the all-time low is 8 degrees F at Cook (St Louis County) in 1966.

Words of the week: Ironwood, Kentucky coffeetree, Shagbark hickory, Big-Toothed Aspen

These are undoubtedly familiar names to arborists who might be planting trees today. They are all deciduous trees adapted to Minnesota's climate, though some are recommended only for certain parts of the state. From the DNR web site I found over 40 recommended deciduous tree species for Minnesota and ten coniferous trees suitable for planting. So go out, pick a favorite from your local nursery, and give it a try.

Outlook:

Cooler than normal for this time of year, with chances for showers and perhaps snow flurries over the weekend and into early Monday. A warming trend will start on Tuesday and carry temperatures back into the 60s and 70s F. Another chance for showers by late Tuesday and into Wednesday.



To: Morning Edition  
From: Mark Seeley  
Re: Topics for MPR's Morning Edition, Friday, May 7, 2004

MAY 8, 1910....94 YEARS AGO....GOVERNOR ADOLF EBERHART  
DECLARED MINNESOTA'S FIRST MOTHER'S DAY...HAPPY MOTHER'S  
DAY TO EVERYONE....LOOKS LIKE MANY PLACES MAY SEE SOME  
RAINFALL THIS MOTHER'S DAY....A LITTLE PRESENT FROM MOTHER  
NATURE.....

International Falls set a new record low temperature  
record on Friday, May 7th with a reading of just  
19 degrees F at 6 am....followed by a change in wind  
that warmed the air to 36 degrees F by 9 am....

Topic: 2004 is a low water mark in Minnesota....

The cumulative precipitation deficit since last July,  
now amounting to 7 to 12 inches below normal in many  
places is certainly evident in many Minnesota rivers  
and streams.

According to the DNR, over 40 percent of Minnesota  
watersheds currently report flow values that are in the  
lowest 25 percent historically for this time of year.  
A few are even close to record low flows. This  
condition will likely persist, as we enter summer, when  
nearly all of the rainfall goes into the soil and is  
consumed by crops and other plants. Snags, sand bars  
and formerly submerged features of the river beds are  
going to be seen throughout most of the summer. I would  
suppose for those citizens who care a great deal about  
the health of Minnesota's watersheds this affords an  
ideal opportunity to clean up on the watershed's  
shoreline and river bed.

Topic: Retired Hurricane Names.....

As a sign of respect for the loss of life and property  
inflicted by three hurricanes last year, the World  
Meteorological Organization has retired the names of  
Juan, Isabel, and Fabian. They will no longer appear  
on the rotating list of hurricane names.

In early September, 2003 Hurricane Fabian devastated  
the island of Bermuda with over 120 mph winds, high seas,  
and heavy rain. It was reported to be the strongest  
hurricane to hit that island in 40 years.

In mid September Hurricane Isabel struck the east coast,  
causing extensive damage in North Carolina and Virginia.  
Some areas received over 7 inches of rain and saw wind  
speeds peak over 100 mph.

Finally, at the end of September, Hurricane Juan passed over Nova Scotia and Prince Edward Island, with 85 mph winds. The winds produced waves over 30 feet in height which caused a great deal of harbor damage at Halifax.

MPR listener question: How often has the Twin Cities seen snow in May, even flurries?

Answer: This is difficult to answer because of the way records are kept. Sometimes flurries are noted as a trace of snow, and sometimes I suspect they have been ignored. If we take the National Weather Service data for the Twin Cities and combine it with the old Ft Snelling data we find an interesting discrepancy. From the establishment of Ft Snelling in 1820 to the mid 20th Century (1950), snow was observed during the month of May in the Twin Cities about 35 to 40 percent of all years, a pretty high frequency. However, since 1950, observations of snow in May have occurred in only 10 years, a frequency of less than 19 percent of the time. On May 2, 1976, the Minnesota Twins game had to be cancelled as a result of a 1 inch snowfall, the latest snow-out in the team's history.

Local Almanac:

Twin Cities Almanac for May 7th:

The average MSP high temperature for this date is 65 degrees F (plus or minus 12 degrees standard deviation), while the average low is 45 degrees F (plus or minus 8 degrees standard deviation).

MSP Local Records for May 7th:

MSP weather records for this date include: highest daily maximum temperature of 92 degrees F in 1963; lowest daily maximum temperature of 38 degrees F in 1907; lowest daily minimum temperature of 31 degrees F in 1906, 1907, and 1931; highest daily minimum temperature of 68 degrees F in 1896; record precipitation of 1.31 inches in 1933; and record snowfall of just a trace in 1907, 1938, and 1946.

Average dew point for May 7th is 37 degrees F, with a maximum of 70 degrees F in 1916 and a minimum of 15 degrees F in 1945.

All-time state records for May 7th:

Scanning the state climatic data base: the all-time high for this date is 94 degrees F at Canby (Yellow Medicine County) in 1916; the all-time low is 13 degrees F at Hallock (Kittson County) in 1907.

Word of the week: HITPR

Another acronym, this time it describes an instrument. Hardened In-Situ Tornado Pressure Recorder (HITPR) designed by Applied Research Associates in Colorado is the first instrument designed to withstand a tornado and capture measurements of temperature, dew point and pressure. It is a conical shaped instrument, about 20 inches in diameter and 6 inches tall at the center, made of 6 millimeter thick steel. It has already been placed in the path of several tornadoes and measured the drop in atmospheric pressure, some as much as 100 mb or nearly 3 inches of mercury.

#### Outlook:

Near normal temperatures, but more humid and windy over the weekend. There will be a chance for showers and thundestorms, mainly Saturday night and Sunday. Cooler on Monday, then another chance for showers and thunderstorms for Tuesday through Thursday. Some of these storms may bring heavy rain and wind.

To: Morning Edition  
From: Mark Seeley  
Re: Topics for MPR's Morning Edition, Friday, May 14, 2004

Topic: Wild Weather Week....

Wind damage across the state on Sunday night (Mother's Day), May 9th was due mostly to severe thunderstorm winds, although four preliminary tornado reports were filed, from Yellow Medicine, Wright, Meeker, and Hennepin Counties. There were dozens of hail reports and some heavy rains as well.

After a lull on Monday, Tuesday and Wednesday also brought a variety of hazardous weather reports from around the region. New record high temperatures were set on Tuesday (May 11) at Sisseton, SD and Redwood Falls, MN, both reporting 89 degrees F, while to the north on the opposite side of a cold front straddling Minnesota, the high temperature barely reached 40 degrees F at Thief River Falls and Baudette. This contrast in air mass helped produce some significant differences in weather. Sleet and snow were reported in parts of North Dakota, Northwestern Minnesota, and southern Manitoba. Up to 10 inches of snow fell across southern Manitoba with thundersnow reported in places. This weather caused power outages, snarled traffic, closed schools, and led to cancelled flights at the Winnipeg Airport.

Thunderstorms, with high winds and hail ravaged parts of Kittson, Roseau, Marshall, Lake of the Woods, and Pennington Counties in northwestern Minnesota as well. Rainfall amounts ranged from 2 to 4 inches in many places, and a number of sites in Roseau County, including Wannaska reported over 5 inches (up to 5.30 inches). This caused a flood crest forecast for the Roseau River to be issued by the National Weather Service. A crest of 20.5 ft was reported on Thursday night, the 3rd highest crest ever reported on the river, but below the levee height (22 ft) that protects the city. The two higher flood crests in Roseau were 23.3 ft caused by thunderstorms in June of 2002 and the 21.1 ft crest caused by spring snowmelt in April of 1996. Thunderstorm induced flood crests are more difficult to anticipate and prepare for than those from spring snowmelt. In addition to Roseau, the Red Lake River near Crookston and Two Rivers at Hallock were expected to approach or exceed flood stage briefly. There was also brief tornado touchdown Tuesday near Barnesville in northern Minnesota.

Wednesday brought record snowfall for the date (May 12) to Bismarck, ND (0.2 inches) and Minot, ND (7.1 inches), along with more rains, hail and wind across parts of Minnesota. For the most part amounts varied from 0.25 to 0.75 inches and were welcome in most of the drier western counties.

Very cold air settled over the state on Thursday morning, with

lows in the 20s F reported at Hallock, Tower, and Embarrass, and record lows reported from North Dakota. In turn, Friday morning produced more cold, with record lows reported from Morris (28 F tied record from 1888), Madison (28 F), Appleton (28 F) and Jackson (30 F).

MPR listener question: Why are Winona and La Crosse usually so much warmer than the rest of Minnesota and Wisconsin from about April to October?

Answer: The feature you speak of has been studied in the past, notably by Professor Don Baker and former State Climatologist Earl Kuehnast, both once colleagues of mine. The answer to your question can be found in the topography and the size of the Mississippi River associated with that region. Air moving across the landscape there will be warmed as it compresses and descends into the river valley from the bluffs on either side. According to the adiabatic rules of meteorology this can amount to 5.5 degrees F per 1000 feet. So in that area of the country a change of a few hundred feet in elevation can still have an effect. A second important topographic characteristic is the open exposure of the Mississippi River Valley to the southern sky. This allows the landscape to have a long exposure time to the sun during the longer days and higher sun associated with the summer season. The capture of solar radiation and conversion to sensible heat is more efficient in this type of landscape. Finally, the Mississippi River itself provides a constant source of local water vapor which tends to have a greenhouse effect in trapping the longer radiation wavelengths and not letting the surrounding landscape cool off so much at night. In combination, all of these characteristics lead to a warmer climate.

Local Almanac:

Twin Cities Almanac for May 14th:

The average MSP high temperature for this date is 67 degrees F (plus or minus 11 degrees standard deviation), while the average low is 47 degrees F (plus or minus 8 degrees standard deviation).

MSP Local Records for May 14th:

MSP weather records for this date include: highest daily maximum temperature of 95 degrees F in 1932; lowest daily maximum temperature of 38 degrees F in 1907; lowest daily minimum temperature of 32 degrees F in 1907; highest daily minimum temperature of 66 degrees F in 1894; record precipitation of 1.28 inches in 1916; and traces of snowfall in 1907 and 1927.

Average dew point for May 14th is 44 degrees F, with a maximum of 68 degrees F in 1911 and a minimum of 16 degrees F in 1934.

All-time state records for May 14th:

Scanning the state climatic data base: the all-time high for this date is 99 degrees F at Milan (Chippewa County) and Redwood Falls (Redwood County) in 1932; the all-time low is 18 degrees F at Virginia (St Louis County) in 1945.

Words of the week: plough winds and black blizzards.....

In the Canadian Prairie Provinces and the Midwest, downburst winds from thunderstorms can have dual effects. On the one hand they can be destructive, sweeping through farmsteads or communities, knocking down trees in one direction (like the blade of a plough being dragged by a tractor) or on the other hand acting like a broom and dislodging so much soil that the air is darkened almost like nighttime (a black blizzard), so that visibility becomes a problem. These types of winds are most common in the Spring and have been in evidence around the region so far this April and May.

Outlook:

Generally cooler than normal over the Fishing Opener weekend, with a chance for showers later on Saturday and into Sunday. Some lingering showers may be possible on Monday, with a better chance for showers and thunderstorms by Wednesday and Thursday. Temperatures will continue to trend cooler than normal with a good deal of cloudiness through the period.

To: Morning Edition  
From: Mark Seeley  
Re: Topics for MPR's Morning Edition, Friday, May 21, 2004

Topic: A wet start to the week was very welcome.....

Though nearly a third of the state's soybean crop remains to be planted, most farmers around the state were glad to see the rainfall on Sunday (5/16) and early Monday (5/17) of this week. Some locations set new daily records for rainfall, including the following....

Olivia with 1.58 inches, Willmar with 1.74 inches, Pipestone with 1.60 inches, Madison with 1.91 inches, Dawson with 1.25 inches, Mora with 1.62 inches, and Rosemount with 1.08 inches. The rainfall came at a rate conducive to recharging the soil.

Topic: Cold here, but early spring heat in Asia....

Cold weather has certainly dominated northern Minnesota so far this month. International Falls is reporting an average temperature for the month of only 42.2 degrees F which is below the record coldest May (43.1 degrees F) in 1924. They have reported 3 days with traces of snowfall and 14 days with morning frosts so far this month. Similarly, Crookston has reported a monthly average temperature of only 47 degrees F. Only 1907 and 1924 had colder May temperatures. In addition it has been quite wet, with nine consecutive days of measurable rainfall in that area of the Red River Valley

While much of Minnesota has been recording below normal temperatures during May, portions of Siberia in Russian were experiencing record levels of heat this week, as the cities of Omsk and Petropavlosk reported new all-time high May temperatures of 96 F and 97 F, respectively. These cities are located at 53 and 54 degrees north latitude, roughly equivalent to the southern edges of Hudson Bay in North America.

Further south in New Delhi, India at 28 degrees north latitude, the temperature on Monday was 112 degrees F, followed later in the week by a 124 degrees F reading at Jacobabad. The early heat wave is expected to persist for several more days, with increasing humidity from the onset of the monsoon season.

Topic: New Climate Outlook.....

The new seasonal outlook for June through August was issued by the Climate Prediction Center this week. The outlook suggests equal chances for above or below

normal temperature and rainfall during the period in Minnesota.

On the brighter side, the CPC drought outlook covering the same period suggests rainfall will be frequent enough and sufficient to alleviate the drought areas in Minnesota and the eastern Dakotas. We have already seen signs of this happening during May, as the rest of the month is forecast to be wetter than normal, with more frequent showers and thunderstorms.

MPR listener question: We've had four mornings with frost in the outlying metro area of the Twin Cities so far this month. Isn't this unusual? What's the most number of frosty mornings ever during the month of May?

Answer: Indeed it is unusual to have so many in May. In recent years, the the Twin Cities last frost has more often occurred in April (median date being April 29 since 1971). The all-time record for number of frosts in May is 14 which occurred in 1907, the coldest May in history with an average of only 46.8 F compared to a normal of 59.3 F. There were also 5 days with snow in the Twin Cities that May, totaling 1.6 inches. May of 1907 was also the coldest in history on a statewide basis, with a frost reported somewhere in the state on every day of the month. Many communities reported over 6 inches of snowfall for the month. corn and wheat crops had to be replanted due to frost damage.

Local Almanac:

Twin Cities Almanac for May 21st:

The average MSP high temperature for this date is 71 degrees F (plus or minus 10 degrees standard deviation), while the average low is 50 degrees F (plus or minus 8 degrees standard deviation).

MSP Local Records for May 21st:

MSP weather records for this date include: highest daily maximum temperature of 92 degrees F in 1964; lowest daily maximum temperature of 46 degrees F in 1915; lowest daily minimum temperature of 33 degrees F in 1997; highest daily minimum temperature of 71 degrees F in 1921; record precipitation of 3.16 inches in 1906; and a trace of snowfall in 1931.

Average dew point for May 21st is 47 degrees F, with a maximum of 69 degrees F in 1927 and a minimum of 17 degrees F in 1924.

All-time state records for May 21st:

Scanning the state climatic data base: the all-time high for this date is 100 degrees F at Thief River Falls (Pennington County) in 1964; the all-time low is 19 degrees F at Baudette (Lake of the



Woods County) in 1924 and at Tower (St Louis County) in 1997.

Words of the week: Tanqueray skies...

Not commonly used in America, this term has been used by the BBC meteorologists in England to describe those rare spring and summer days when the sky is perfectly clear, as clear as the London dry gin they drink. Such was the weather in Minnesota on Tuesday of this week, with some of the clearest skies so far this spring. The National Weather Service in Chanhassen reported nearly 900 minutes (15 hours) of sunshine on Tuesday, virtually 100 percent possible sunshine for the date.

Outlook:

Generally cloudy over the weekend with a chance for showers and thunderstorms, especially in the south Saturday night and Sunday. With the cloudiness, temperatures will likely be somewhat cooler than normal. Showers and thunderstorms will be likely but scattered in nature over the Monday through Wednesday period as well.

To: Morning Edition  
From: Mark Seeley  
Re: Topics for MPR's Morning Edition, Friday, May 28, 2004

Topic: Preliminary Climate Summary for May 2004

Though a few days away from the end of the month, a few significant climate features are evident. It was cooler and wetter than normal for just about every community in the state of Minnesota. Most places report average temperatures that are 1 to 8 degrees cooler than normal, with the greatest departures in northern counties. Southern Minnesota reported 2-3 frosts in May, while some northern communities recorded 15-16 frosty nights. The temperature extremes for the month were 93 degrees F at Redwood Falls and Lamberton on May 10th, and just 10 degrees F at Embarrass on May 2nd.

Precipitation was abundant just about everywhere in the state, greatly alleviating the drought conditions in many places. Some northern communities also recorded traces of snowfall, while Little Fork in northern Koochiching County actually measured 0.2 inches of snow. The rainfall was excessive in the north on May 12th when Karlstad, Roseau, and Warroad reported 4 inches or more, and Wannaska reported over 5 inches. Excessive rainfall occurred in southern counties from the 21st to the 23rd when Harmony and Wabasha reported over 3 inches. As a result of these very heavy rains, some smaller watersheds went from a trickle to briefly exceeding flood stage. The Roseau River reached its 3rd highest ever flood stage for a brief time.

Total rainfall for the month was well above normal, with many areas reporting from 5 to 7 inches. Some reported record or near record total rainfall. In northern Minnesota, Warroad set a new May record with 6.20 inches of rainfall. In southeastern Minnesota, Wabasha reported a new May record rainfall of 9.76 inches. Other southeastern communities reported the second wettest May historically including La Crescent (8.51 inches), Zumbrota (7.82 inches), and Harmony (7.23 inches). With more storms forecasted for the Memorial weekend, these rainfall totals may grow even greater.

MPR listener question: I moved to Minnesota from Florida five years ago and was told the winters were quite harsh and that spring came very late. I have observed the contrary, at least here in the Twin Cities. What's going on?

Answer: One of the strongest climate trends in Minnesota is that of warmer than normal winters. Five of the last seven have been significantly warmer than normal, especially noteworthy by examining the total heating degree days (cumulative temperature below 65 degrees F). Despite a cool May and having to run our

furnaces a bit, the overall heating season this year has also shown warmer than normal temperatures (fewer than normal Heating Degree Days) for most places. In fact of the 20 most recent winters in Minnesota, only four have been significantly colder than normal.

MPR listener question: I hear that the Memorial Weekend is likely to be stormy. How often does it rain in the Twi Cities area over the Memorial weekend holiday?

Answer: Probably more than you think. Historically it rains on at least one day of the three-day holiday weekend 67 percent of the time. Usually one or more days turn out to be fine for outdoor activity. It has only rained on all three days of the holiday weekend 9 times in the past 113 years.

Local Almanac:

Twin Cities Almanac for May 28th:

The average MSP high temperature for this date is 73 degrees F (plus or minus 10 degrees standard deviation), while the average low is 53 degrees F (plus or minus 8 degrees standard deviation).

MSP Local Records for May 28th:

MSP weather records for this date include: highest daily maximum temperature of 98 degrees F in 1934; lowest daily maximum temperature of 46 degrees F in 1947; lowest daily minimum temperature of 36 degrees F in 1965; highest daily minimum temperature of 70 degrees F in 1969; record precipitation of 2.08 inches in 1899; and a trace of snowfall in 1965.

Average dew point for May 28th is 50 degrees F, with a maximum of 70 degrees F in 1941 and a minimum of 22 degrees F in 1947.

All-time state records for May 25th:

Scanning the state climatic data base: the all-time high for this date is 106 degrees F at Beardsley (Big Stone County) in 1934; the all-time low is 18 degrees F at Hallock (Kittson County) in 1947.

Word of the week: AWPAG (awe-pag)

This is a new National Weather Service acronym that refers to a recently deployed automatic rain gage. It stands for All Weather Precipitation Accumulation Gage, a sophisticated automated gage manufactured by Ott Hydrometrie of Germany. This gage has a windshield to protect against the wind carrying microscopic droplets or snow crystals past the orifice. It also has a heat regulated rim to prevent ice and snow build up during very cold weather. Precipitation amount is measured by weight using an electronic strain gage, adjusted for a fixed amount of

environmentally friendly antifreeze which keeps the precipitation in liquid form. Internal software provides corrections for wind induced vibration and internal evaporation, both of which can produce false readings.

This is perhaps the world's most expensive rain gage and intended for use with the National Weather Service Automated Surface Observing Systems installed at many airports. Its cost ranges from \$10,000 to \$13,000, including installation.

#### Outlook:

A bit warmer over the weekend, but with a chance for showers and thunderstorms late Saturday through Monday. Better chances for heavy thunderstorms in southeastern sections. Continued chance for showers into early next week, with some cooler temperatures, then a warm up toward the end of the week.

To: Morning Edition  
From: Mark Seeley  
Re: Topics for MPR's Morning Edition, Friday, June 4, 2004

Topic: Wrap Up on a Wet May.....

Much has been made of the wet May. The abundant precipitation helped to end the drought in Minnesota that had persisted since late last summer.

Preliminary analysis by the State Climatology Office shows that about 75 percent of the state's landscape received surplus rainfall in May. Only some north central counties received less than normal amounts, particularly Crow Wing County. The statewide average rainfall was nearly 5.80 inches representing the 5th wettest May in history. The rains caused many rivers to rise close to or just above flood stage.

Locally in the Twin Cities area the 12 consecutive days with rain in May represented an exceptionally long streak. The longest streak of rainy days for the Twin Cities is 15, occurring twice, once in March and April of 1974 (ending on April 4th) and in June of 1975 (ending on the 22nd). Another striking feature was the persistent cloudiness. On average we record 61 percent possible sunshine for the month of May in the metro area, but this past month it was only 44 percent, including four consecutive days with zero hours of sunshine.

Many communities reported new record rainfall totals for the month of May, including....

La Crosse, WI with 9.73 inches  
Austin with 8.46 inches  
Warroad with 8.23 inches  
Forest Lake with 7.79 inches  
Zumbrota with 8.78 inches  
Redwood Falls with 9.62 inches  
Caledonia with 11.61 inches  
Wasbasha with 11.25 inches

Hydrologically for Minnesota watersheds this spring has been similar to that of 1854, the year of the original Grand Excursion riverboat trip on the Mississippi River from Rock Island, IL to St Paul, MN over the 5th to the 8th of June. In both cases, river flows were very low throughout the fall, winter and early spring, then significantly increased by late May heavy rainfalls. This made the Mississippi River navigation channel deeper for the riverboats in 1854 and coincidentally if the rain keeps up in June, there will be the same effect for the 150th Anniversary reenactment of the Grand Excursion later this month.....June 25 to July 4.

Topic: May was a stormy month nationwide....

During May of 2004 the Storm Prediction Center of the National Weather Service received 539 reports of tornadoes across the nation, second only to the record number of 543 reported for May of 2003. Most of the tornadoes occurred in the southern plains states and the Gulf states.

MPR listener question: I've been wondering, with all this rain and news of continuing drought and fires out west, what is the status of the blowdown area in the BWCA of northern Minnesota? When the event occurred there was much talk of the potential for huge fires.

Answer: The great blowdown you referred to (Derecho caused) was in July of 1999. Though it left a massive load of wood fuel laying on the ground in the BWCA, the Forest Service has done a remarkable job in alleviating the fire danger by removing debris and conducting prescribed burns to eliminate some of the fuel load. I am sure the weather has played a role as well in rotting much of the remaining wood. The Superior National Forest lifted the fire restrictions for the first time in the BWCA in the fall of 2002. Now 5 years later and following a very wet May, there are no fire restrictions posted for the BWCA. If you want to learn more about what has happened there and what present conditions are like, I would encourage you to go to the storm recovery section of the Superior National Forest web site...

<http://www.superiornationalforest.org/>

Local Almanac:

Twin Cities Almanac for June 4th:

The average MSP high temperature for this date is 76 degrees F (plus or minus 8 degrees standard deviation), while the average low is 56 degrees F (plus or minus 7 degrees standard deviation).

MSP Local Records for June 4th:

MSP weather records for this date include: highest daily maximum temperature of 96 degrees F in 1968; lowest daily maximum temperature of 56 degrees F in 1935; lowest daily minimum temperature of 38 degrees F in 1990 and 1998; highest daily minimum temperature of 70 degrees F in 1934; record precipitation of 1.80 inches in 1984.

Average dew point for today's date is 51 degrees F, with a maximum of 76 degrees F in 1925 and a minimum of 29 degrees F in 1912.

All-time state records for June 4th:

Scanning the state climatic data base: the all-time high for this date is 100 degrees F at Lamberton (Redwood County) in 1968; the all-time low is 21 degrees F at Bigfork (Itasca County) in

1964 and at Remer (Cass County) in 1985.

Words of the week: POP and QPF

In precipitation forecasting, two type of guidance are used:  
The probability of precipitation (POP) and quantified  
precipitation forecasts (QPF).

There are two dimensions to POP: Some weather services used to use POP to express the areal coverage of precipitation expected from a given storm, in other words the percentage of the forecasted area that was expected to receive precipitation. But today, nearly all weather services (including America, Canada, and Australia) use POP to express the chance of receiving precipitation at any point within the boundaries of a forecast zone over a specified period of time. The POP is based on the historical occurrence of similar storms or weather systems and how often they deposited precipitation within the forecast zone. POPs are usually issued on a county basis and for a 24 hour period of time.

QPF is designed to indicate the likely amount of precipitation expected. QPF guidance is provided to forecasters every 12 hours and refers to the amount of precipitation expected to occur for at least one point in the forecast area over a specified period of time. Typically this might range from 0.1 to 0.5 inches, though occasionally QPF guidance may indicate rainfall values from 1 to 2 inches or more.

Outlook:

Rather cloudy with scattered showers and thunderstorms on Saturday, some lingering into early Sunday in the far southeastern sections. Partly cloudy elsewhere for Sunday and Monday with warmer temperatures. A warming trend will really start by Tuesday, but also bring higher dew points with a chance for thunderstorms through Thursday.

To: Morning Edition  
From: Mark Seeley  
Re: Topics for MPR's Morning Edition, Friday, June 11, 2004

Topic: A hot June 7th....

Strong southern winds and bright sunshine pushed the temperature to record setting values on Monday afternoon this week. New high temperature records were set at....St Cloud with 96 F, Waseca with 96 F, Windom with 95 F, the Twin Cities with 95 F, Redwood Falls with 97 F, and Benson with 95 F (tied record).

With the heat came high humidity as well. The first dew points to exceed 70 degrees F this year occurred at a number of locations, topped by a 77 degrees F dew point at Willmar. The combination of temperature and humidity pushed the heat index to the 100 F mark for the first time this year.

Topic: Flash Floods....

Flash floods are caused by heavy rainfalls, usually 3 inches or more, over a large enough area that drainage capacities of most watersheds and storm water runoff systems are exceeded, thereby producing some level of flooding within a 24 hour period.

Tuesday and early Wednesday brought slow moving thunderstorms to southern Minnesota producing very heavy rainfall, enough to cause flooding on a number of watersheds including the Minnesota River, Blue Earth River, Upper Iowa River, and Root River. Highway 169 between Mankato and St Peter was closed due to mudslides.

Record rainfalls on June 9th included.....

Mankato 6.24 inches, Rochester 4.06 inches, St Peter 2.50 inches, Morris 2.23 inches, Dodge Center 4.73 inches, Waseca 2.46 inches, Belle Plaine 5.40 inches, New Ulm 2.15 inches, La Crescent 2.11 inches, Preston 4.17 inches, La Crosse (WI) 2.41 inches, North Mankato 7.00 inches, and Spring Grove 3.00 inches.

The climatology of Minnesota flash floods compiled by former State Climatologist Earl Kuehnast shows that 4-6 days per year produce flash flooding somewhere in the state. Nearly 60 percent of all flash floods occur in the months of June and July. An additional 35 percent occur in the months of August and September. Better than half of all flash floods occur between the hours of 6 pm and 11 pm, while the fewest occur in the early hours of the day from 4 am to 10 am. Storm systems that produce flash floods tend to be oriented west to east or northwest to southeast. Flash floods vary in size from as small as 25 square miles to as large as 6000 square miles.

Topic: Hail too....



More reports of hail this week on Tuesday from Meeker, Stearns, Sherburne, and Kandiyohi Counties, among others. Most crops are small and can recover from hail damage at this time.

In Minnesota the hail season runs primarily from March through November, peaking in July in terms of the frequency of events. A typical year produces 11 to 13 days with hail across the state. The areas of the state with the highest average annual frequency are counties in west-central, southwestern and parts of southeastern Minnesota, which record from 2 to 4 days with hail, primarily during the growing season. Hail losses filed with insurance companies typically exceed 100 claims per year.

The most common time of occurrence for hailstorms is between 3 pm and 8 pm, in correspondence with the peak times of day for thunderstorms and tornadoes. Hailstorms are often associated with stationary fronts over northern Iowa or southern Minnesota.

The Skywarn spotter training program of the National Weather Service uses food, sports, and money analogies to define the size of hailstones. Spotters may report actual measured diameters of hailstones or make estimates using the analogies in the table below....

Hail Diameter Size	Description
1/4 in.	Pea size
1/2 in.	Marble size
3/4 in. (severe criteria)	Dime size
7/8 in.	Nickel size
1 in.	Quarter size
1 1/4 in.	Half Dollar size
1 1/2 in.	Walnut or Ping Pong Ball size
1 3/4 in.	Golf Ball size
2 in.	Hen egg size
2 1/2 in.	Tennis ball size
2 3/4 in.	Baseball size
3 in.	Teacup size
4 in.	Grapefruit size
4 1/2 in.	Softball size

MPR listener question: There were numerous reports of hail around the state this week. What is the largest hailstone to ever fall in Minnesota?

Answer: The largest hailstone reported in the state climate records is one with a 12 inch circumference recorded near Detroit Lakes (Becker County) on July 4, 1966. There may have been even larger ones that have gone unreported. Incidentally, hailstones of 3/4 inch diameter or larger are one of the criteria used by the National Weather Service to issue a severe thunderstorm warning.

Local Almanac:

Twin Cities Almanac for June 11th:

The average MSP high temperature for this date is 76 degrees F (plus or minus 9 degrees standard deviation), while the average low is 57 degrees F (plus or minus 7 degrees standard deviation).

MSP Local Records for June 11th:

MSP weather records for this date include: highest daily maximum temperature of 96 degrees F in 1956; lowest daily maximum temperature of 57 degrees F in 1903; lowest daily minimum temperature of 40 degrees F in 1903; highest daily minimum temperature of 74 degrees F in 1956; record precipitation of 2.58 inches in 1975.

Average dew point for today's date is 54 degrees F, with a maximum of 71 degrees F in 1918 and a minimum of 31 degrees F in 1962.

All-time state records for June 11th:

Scanning the state climatic data base: the all-time high for this date is 102 degrees F at Fairmont (Martin County) in 1933; the all-time low is 25 degrees F at Pokegam Dama (Itasca County) in 1903.

Words of the week: Hail pads

A hail pad is sometimes used to measure the distribution of sizes and shapes regarding hailstones. This is composed of a piece of styrofoam board, covered with a secured sheet of aluminum foil and placed in an exposed area when thunderstorms are predicted. The falling hailstones leave a measurable impression in the tin foil so that size and shape can be determined after the storm without having to go out and collect the stones.

Outlook:

Generally cloudy over the weekend with a chance for showers and thunderstorms mostly in the south on Sunday, becoming more numerous and widespread Monday through Wednesday. Some storms may be severe. Then drier by the end of next week. Temperatures will remain close to seasonal normals.

To: Morning Edition  
From: Mark Seeley  
Re: Topics for MPR's Morning Edition, Friday, June 18, 2004

Topic: New seasonal climate outlooks....

On Thursday of this week, the Climate Prediction Center released the seasonal outlooks for July, August, and September. For our region, the outlooks all favor cooler than normal temperatures as a result of recent abundant wetness and persistent cloud cover. The outlooks suggest rainfall will have equal chances of being above or below normal for the balance of the summer season in Minnesota.

Many central and southern Minnesota counties have already reported 3 to 6 inches of rainfall during the first half of June, continuing the trend of above normal rainfall started in May. A tapering off of rainfall frequency and intensity would be welcome by most.

Topic: More reasons to own a weather radio....

The Department of Homeland Security announced this week that it has entered a cooperative agreement with the National Weather Service to expand the types of warnings and alerts issued over NOAA Weather Radio broadcasts. Some of the new alerts and warnings will include chemical spills, nuclear power plant accidents, terrorist attacks and Amber alerts for reports of missing children.

With over 900 transmitters around America NOAA Weather Radio provides 24/7 broadcasts of weather conditions, including watches and warnings. The radio alarm system can be set to trigger only when warnings pertinent to your area are issued. Over 80 percent of the Minnesota landscape is covered by NOAA Weather Radio. Current portable models range in price from \$35 to \$80.

MPR listener question: I heard you describe the coldest June (1969 at 57.5 F) and warmest June (1933 at 72 F) in the historical records statewide on a recent MPR program. What has been the wettest and driest month of June statewide and what were the rainfall totals?

Answer: The average rainfall statewide in June of 1910 was only 1.5 inches, the driest ever. Grand Meadow in southeastern Minnesota reported just two days with measurable rainfall and a monthly total of 0.05 inches, while Rochester reported only a trace of rainfall for the entire month. Four years later, June rainfall averaged over 8 inches statewide, making 1914 the wettest. Grand Meadow and Winona in southeastern Minnesota received over 14 inches of rainfall during June of that year.

## Twin Cities Almanac for June 18th:

The average MSP high temperature for this date is 78 degrees F (plus or minus 9 degrees standard deviation), while the average low is 59 degrees F (plus or minus 6 degrees standard deviation).

## MSP Local Records for June 18th:

MSP weather records for this date include: highest daily maximum temperature of 98 degrees F in 1953; lowest daily maximum temperature of 56 degrees F in 1935; lowest daily minimum temperature of 46 degrees F in 1950; highest daily minimum temperature of 74 degrees F in 1931; and record rainfall of 1.14 inches in 1956.

Average dew point for June 18th is 55 degrees F, with a maximum of 76 degrees F in 1953 and a minimum of 39 degrees F in 1981.

## All-time state records for June 18th:

Scanning the state climatic data base: the all-time high for this date is 106 degrees F at Beardsley (Big Stone County) in 1933; the all-time low is 27 degrees F at Angus (Polk County) in 1912.

## Words of the week: Precipitable water

Precipitable water is a measure used often by meteorologists. More specifically it is the liquid equivalent of water vapor in a vertical column of air. Thus it represents the depth of liquid that would result if all of the water vapor were wrung out of the atmosphere by condensation at a particular point in space and time.

Atmospheric profiles are taken twice daily by instrumented balloons (radiosondes) to characterize the vertical patterns in temperature, humidity, pressure and wind away from the Earth's surface. Calculations of precipitable water are made from these measurements and used in guidance for providing quantified precipitation forecasts

Incidentally, precipitable water was in great abundance over both Minnesota and Wisconsin this week. In Wisconsin, 2 to 5 inch rains fell in the Sparta, Portage, and Stevens Point areas, while in southwestern Minnesota similar intense rains produced severe erosion and brief flooding in Murray and Pipestone Counties

Bear in mind that of the total planetary water supply, only less than 0.1 percent is found in the atmosphere, where the average residence time for water vapor is about 10 days, but may vary from hours to weeks before it condenses out again as liquid in the form of precipitation.

## Outlook:

Partly cloudy over the weekend with a chance for showers in the north, south, and eastern sections. Generally cooler than normal temperatures

with possibly some record setting lows on Saturday morning. A better chance for showers Monday through Wednesday. Temperatures are expected to remain at or below average for this time of year through much of next week.

To: Morning Edition  
From: Mark Seeley  
Re: Topics for MPR's Morning Edition, Friday, June 25, 2004

Topic: Traffic accidents on wet roads...

A recent study from the University of California, Berkeley suggests that the risk for auto accidents due to wet roads is greater following a prolonged dry spell. Examination of accident records and weather data showed that there were relatively more accidents on wet roads following dry spells of several days or longer than during periods of several days when the weather was continuously wet. Interpretations varied as to cause and effect. Speculation was that the build up of dry deposition of debris on roads during dry spells makes them more slippery when it does rain. Another speculation was that drivers become less accustomed to the hazards of wet pavement when they drive in dry conditions for several days or weeks.

Topic: Cold Summer Temperatures.....

Weather news this week includes over 9 inches of Monsoon rains in India, rainouts at Wimbledon (putting them 109 matches behind schedule), record streak of hot days in Juneau, Alaska (six consecutive days over 80 F), all-time record June warmth in Canada's Northwest Territories (90 F at Inuvik), a strengthening typhoon near Manila, Philippines, and multiple tornadoes in Wisconsin. But our major Minnesota weather story has been the cold temperatures, including multiple frosts in the northern counties.

Since Saturday, June 19th and continuing through Thursday, June 24th several low temperature records have fallen by the wayside. Two of the most significant occurred on the 19th and 22nd. On the 19th, Embarrass reported a new state record low of 24 degrees F, while on the 22nd Tower reported a new state record low of 26 degrees F. It is unusual for two state records to fall over such a short period of time.

Among the other new low temperature records set this week... For June 19th....new record lows of 40 F at Eau Claire, WI, 24 F at Embarrass, and 34 F at International Falls.

For June 22nd....new record lows of 33 F at Hibbing, 35 F at International Falls, 28 F at Embarrass, and 26 F at Tower.

For June 23rd....new record lows of 36 F at Ely, 34 F at Baudette, 34 F at Hallock, 33 F at Hibbing, and 29 F at International Falls.

For June 24th....new record lows of 38 F at Grand Forks, ND, 39 F at Fargo, ND, 32 F at Hibbing, 34 F at Moose Lake (tied

record low), 37 F at Park Rapids, 37 F at Wadena, and 39 F at Crookston (tied record low).

MPR listener question: If my memory is right, summer of 1992 was a cool one in the Twin Cities. Is that true and how did it rank historically? How does this spring compare with that of 1992?

Answer: Indeed the summer of 1992, June through August was the 2nd coldest in Twin Cities history (coldest was 1915), heavily influenced by the coldest July ever, and 3rd coldest ever August. However the combined months of May and June in 1992 though cold (ranking 33rd coldest in Twin Cities history) were no where near record setting. This year as of today's date (June 25th) the Twin Cities shows the 13th coldest every May June combination, averaging about 60.5 degrees F over the period. So it has been colder than the similar period in 1992.

In some of Minnesota's northern counties the colder than normal conditions of May and June are even more evident. International Falls recorded its 3rd coldest May in history. Through June 24th 47 of the 55 days have produced colder than normal temperatures at International Falls. Over the same 55 day period, we have recorded 32 days with colder than normal temperatures.

Twin Cities Almanac for June 25th:

The average MSP high temperature for this date is 81 degrees F (plus or minus 8 degrees standard deviation), while the average low is 61 degrees F (plus or minus 6 degrees standard deviation).

MSP Local Records for June 25th:

MSP weather records for this date include: highest daily maximum temperature of 98 degrees F in 1934; lowest daily maximum temperature of 63 degrees F in 1968; lowest daily minimum temperature of 46 degrees F in 1957; highest daily minimum temperature of 75 degrees F in 1901; and record rainfall of 2.88 inches in 1978.

Average dew point for June 25th is 57 degrees F, with a maximum of 76 degrees F in 1943 and a minimum of 38 degrees F in 1926.

All-time state records for June 25th:

Scanning the state climatic data base: the all-time high for this date is 109 degrees F at Beardsley (Big Stone County) in 1933; the all-time low is 27 degrees F at Wannaska (Roseau County) in 1982.

Words of the week: Emanciprecipitation.....

This past year the American Meteorological Society conducted a contest to come up with new weather jargon. Among the questions

posed was "what do you call a heavy rain or snow storm that causes schools to close?" Among many clever suggestions (including "snowverwhelmed), the winning entry came from a gentlemen who truly understood how school aged children feel about such things....."emanciprecipitation" or precipitation that leads to freedom (at least from school).

#### Outlook:

Continued cooler than normal into the weekend, but generally dry. A warming trend will start next week, bringing temperatures to near normal levels by July 1st. There will be an increasing chance for rainfall by Thursday and Friday.



To: Morning Edition  
From: Mark Seeley  
Re: Topics for MPR's Morning Edition, Friday, July 2, 2004

Topic: Preliminary June Climate Summary..

Cool and dry are the words that describe June weather across most of Minnesota. As always there are some exceptions to this. Overall June temperatures averaged about 3 to 5 degrees F cooler than normal around the state. Extremes ranged from 97 degrees F at Redwood Falls on June 8th to just 22 degrees F at Cook (St Louis County) on June 4th. Following the 3rd coldest May of all-time, International Falls reported the 4th coldest June of all-time, averaging just 56 degrees F for the month. They even started the month of July by tying a record low of 37 degrees F as well.

Four state record lows were broken or tied during the month.

-A low of 24 degrees F at Embarrass on June 19th set a new state record for the date.

-A low of 26 degrees F at Tower on June 22nd set a new state record

-A low of 27 degrees F at Embarrass on June 24 tied a state record

-A low of 29 degrees F at Embarrass on June 27th set a new state record.

Rainfall for June was generally 1 to 3 inches below normal, except in portions of south-central and southeastern Minnesota. Most of the rainfall came in the first half of the month.

Two of the driest spots were Leech Lake with just 0.67 inches, their 3rd driest June month in history, and Grand Rapids with just 0.88 inches, their 5th driest June in history.

Conversely, short term flooding occurred on many southern Minnesota watersheds as a result of heavy thunderstorms in the first part of June. Rochester (8.53"), Mankato (7.94"), and La Crescent (8.40") reported one of their wettest Junes in history, while Preston (11.68") and Dodge Center (7.17") reported the 2nd wettest June in history. A particularly heavy thunderstorm deposited 4.17 inches of rain at Preston on June 9th setting a record for the date, while 4.09 inches fell at Rochester, also setting a record.

Of the 268 tornadoes reported across the nation during June, eight reports came from Minnesota (June 11) and seven came from Wisconsin (June 23).

Topic: Twin Cities weather trivia.....

What does the number 58 have to do with Twin Cities weather in the months of January and July?

According to Jim Zandlo, our Minnesota State Climatologist, 58 degrees F is the only value that has been a high temperature in the months of January and July in the Twin Cities climate history. The all-time highest January daytime temperature was 58 degrees F on January 25, 1944, while the all-time coldest July daytime temperature was 58 degrees F on July 4, 1967.....that's a heck of a cold July 4th holiday.

MPR listener question: I'm from Iowa, and I am planning to spend this weekend in St Paul to welcome the Grand Excursion flotilla on Saturday afternoon and stay over for the 4th of July on Sunday. Historically, how often does it rain in St Paul on July 3rd and 4th?

Answer: The climate data since 1891 show that it rains on July 3rd 36 percent of the time and on July 4th 42 percent of the time. It has rained on both days just 22 times since 1891, about 19 percent frequency. Interestingly enough, the forecast for this weekend in St Paul gives a better chance for showers and thunderstorms on Saturday and less of a chance on Sunday.

Twin Cities Almanac for July 2nd:

The average MSP high temperature for this date is 81 degrees F (plus or minus 7 degrees standard deviation), while the average low is 62 degrees F (plus or minus 6 degrees standard deviation).

MSP Local Records for July 2nd:

MSP weather records for this date include: highest daily maximum temperature of 96 degrees F in 1911; lowest daily maximum temperature of 60 degrees F in 1892; lowest daily minimum temperature of 49 degrees F in 1924; highest daily minimum temperature of 77 degrees F in 2002; and record rainfall of 2.18 inches in 1992.

Average dew point for July 2nd is 59 degrees F, with a maximum of 75 degrees F in 1949 and a minimum of 38 degrees F in 1917.

All-time state records for July 2nd:

Scanning the state climatic data base: the all-time high for this date is 105 degrees F at Winona in 1911; the all-time low is 28 degrees F at Tower (St Louis County) in 1980.

Word of the week: Sukhoveis

This is a Russian word (pronounced sue-koo-vay) for the hot, dry winds that sometimes blow during their growing season. In the absence of sufficient soil moisture, these winds can rapidly lead to drought conditions and drastically reduce crop yields, up to 30 to 40 percent. Like the Corn Belt in America, the most

critical time for poor weather to occur in Russia is in the month of July when most crops are blooming or heading out. The sukoveis brings temperatures of 80 and 90 degrees F, humidities less than 20 percent and winds from 10 to 20 mph, all of which last for several days. This causes rapid dessication of most plants. The agriculturally productive area of the Caspian plains is sometimes buffered from the effects of the sukoveis by the water available from the Volga River flood plain.

#### Outlook:

Partly cloudy with a chance for showers and thunderstorms on Saturday, especially in eastern sections. But, generally drier on the 4th of July, except for the far northeast. Another chance for showers Monday and Tuesday, but with cooler temperatures. Then remaining somewhat cooler than normal for the balance of next week.

To: Morning Edition  
From: Mark Seeley  
Re: Topics for MPR's Morning Edition, Friday, July 9, 2004

Topic: Running the furnace in July....it happens in MN!

Starting on Sunday, July 4th a cool, cloudy air mass began to dominate portions of Minnesota and persisted for four days, setting numerous records for cold daytime temperatures.

It was a cold July 4th in Grand Forks, ND with a new record cold daytime temperature of only 63 degrees F. Thief River Falls, MN tied the record cold daytime high that same day, with just 64 degrees F.

The cool, cloudy air took a stronger grip on the state on Monday, July 5th, as record temperatures were more numerous. The following were record cold daytime high temperatures reported for Monday, July 5th....

Warroad 56 F Hibbing 56 F Two Harbors 55 F (tied)  
Cook 59 F Eveleth 59 F Bigfork 57 F Aitkin 57 F  
Grand Rapids 57 F Moose Lake 55 F Floodwood 57 F  
Embarrass 57 F Alexandria 63 F Redwood Falls 59 F  
Glenwood 64 F Little Falls 64 F Staples 59 F  
Milaca 64 F St Cloud 67 F (tied) Grand Forks, ND 60 F  
Fargo, ND 61 F Baudette 64 F Park Rapids 60 F  
Bemidji 57 F Thief River Falls 57 F Hallock 59 F  
Fergus Falls 63 F Detroit Lakes 61 F Crookston 59 F  
Fosston 61 F Moorhead 61 F Waskish 57 F Wadena 57 F  
Wheaton 64 F

By Tuesday, July 6th, the cool air mass and rainfall had covered the majority of the state producing for some cities the coldest ever daytime temperatures for the month of July (noted by \* in the listing below)....record cold daytime temperatures included...

Alexandra 54 F\* St Cloud 58 F Redwood Falls 60 F  
Appleton 57 F Hutchinson 61 F Litchfield 59 F  
Little Falls 57 F\* Madison 61 F Montevideo 61 F  
Mora 59 F Morris 54 F\* Olivia 59 F Willmar 59 F  
Milaca 57 F\* Jackson 61 F Marshall 61 F Aitkin 55 F\*  
Pipestone 63 F International Falls 61 F Hibbing 61 F  
Brainerd 55 F\* Bigfork 57 F Moose Lake 59 F  
Cloquet 57 F Wheaton 55 F\* Park Rapids 53 F\*  
Grand Forks, ND 62 F Fargo, ND 57 F Baudette 60 F  
Bemidji 52 F\* Thief River Falls 57 F Detroit Lakes 52 F  
Fergus Falls 55 F\* Crookston 57 F\* Fosston 55 F  
Waskish 54 F Moorhead 57 F Wadena 50 F\*

And finally, on Wednesday, July 7th as the cold pool of air finally moved off to the east, some communities recorded

more record cold daytime temperatures, including...

Eau Claire 66 F   Fairmont 64 F   Mankato 64 F  
Olivia 64 F   Willmar 66 F   Madison 66 F

These temperatures range from 20 to 25 degrees F colder than average for this time of year. The coldest daytime high measured in the state dates from July 2, 1992 when Two Harbors reported just 47 degree F.

Anytime daytime highs fall below the 65 degrees F mark, significant Heating Degree Days accumulate, causing buildings to cool down. Normally, few significant Heating Degree Days (accumulated daily mean temperature below a base of 65 degrees F) occur in July, typically ranging from 20 to 40 around the state for the entire month. However, over the four day period from July 4-7, as many as 20 to 30 HDD accumulated, prompting many to turn on their furnaces for warmth!

Such spells of cool weather in July are not unprecedented, but they are fairly rare. Historically, significant Heating Degree Days accumulated in July during the summers of 1992, 1978, 1956, 1945, 1927, and 1915.

Topic: Wet too.....

The persistent cloudiness and rainfall brought record setting amounts to some Minnesota communities this week. The following were reports of new rainfall records for July 6th....

Moorhead 1.49 inches, Worthington 2.38 inches, Albert Lea 3.70 inches, Fairmont 2.27 inches, Winnebago 2.26 inches, and Harmony 2.90 inches (tied record). In fact, Albert Lea reported 32 hours of rain over a 48 hour period this week.

MPR listener question: After seeing back to back days this week with daytime temperatures only in the 60s F here in the Twin Cities, I wondered how often this happens in the month of July. Is it exceptionally unusual?

Answer: Not really....about half of all Julys since 1891 have yielded at least one day with a high temperature in the 60s F. In fact, July of 1915 produced seven such days. As recently as 1997, the Twin Cities recorded five days in July with daytime highs in the 60s F. Nearly all occurrences of such temperature conditions in July are associated with a high degree of cloud cover, and most frequently with rain showers. On occasion, about once every 5 to 6 years a persistent July fog will hold the temperatures to such a low range.

Twin Cities Almanac for July 9th:

The average MSP high temperature for this date is 83 degrees F (plus or minus 7 degrees standard deviation), while the average

low is 63 degrees F (plus or minus 6 degrees standard deviation).

MSP Local Records for July 9th:

MSP weather records for this date include: highest daily maximum temperature of 99 degrees F in 1976; lowest daily maximum temperature of 68 degrees F in 1945; lowest daily minimum temperature of 48 degrees F in 1895; highest daily minimum temperature of 82 degrees F in 1936; and record rainfall of 2.55 inches in 2000.

Average dew point for July 9th is 60 degrees F, with a maximum of 75 degrees F in 1946 and a minimum of 42 degrees F in 1931.

All-time state records for July 9th:

Scanning the state climatic data base: the all-time high for this date is 110 degrees F at Beardsley (Big Stone County) in 1936; the all-time low is 32 degrees F at Tower (St Louis County) in 1977.

Word of the week: EMMA

I must admit I have a soft spot for this name (my daughter's), but in this meteorological context it is an acronym.....European Multi-Service Meteorological Awareness. It is a joint effort of the Meteorological Services of the United Kingdom, France, Germany, and the Netherlands. EMMA is an Internet based communications system patterned somewhat after our own National Weather Service's Emergency Managers Weather Information Network (EMWIN) and the National Storm Prediction Center. It is designed to provide the European community with up to date information and forecasts concerning the risks of severe weather events and episodes. It is currently being tested in various European countries, but it is not inconceivable that in the near future European airports will be populated with terminals or kiosks that show the current risk of severe weather for various destinations around the continent.

Outlook:

Warm and more humid weather is in store for this weekend across the state, with a chance for showers and thunderstorms, especially later on Saturday and into Sunday. Continuing warm, with another chance for showers on Tuesday and Wednesday, followed by slightly cooler weather toward the end of the week.

To: MPR's Morning Edition  
From: Mark Seeley  
Re: Topics for MPR's Morning Edition, Friday, July 16, 2004

Topic: Thunderstorm climatology.....

The average number of days with thunderstorms each year varies across Minnesota, from about 30 days in northern counties to over 40 days for those counties along the Iowa border. This is considerably more than west coast states and the northeastern states, but less than most southern states. The state with the largest number of annual thunderstorm days is Florida, where some central counties record 100 days with thunderstorms each year. This feature of Florida's weather is the result of convergence of the sea breezes coming off both the east and west coasts, which induces lift in the warm, humid air and development of thunder clouds. The second highest frequency of thunderstorm days is found in the Rocky Mountain Front Range through portions of Wyoming, Colorado, and New Mexico. In this region, topography plays an important role and helps produce 60-70 days with thunderstorms each year.

Incidentally, so far in 2004, we have recorded 27 thunderstorm days in the Twin Cities, the most coming in May with thirteen.

Topic: Hudson Bay Climate.....

Much ice cover is still present in the satellite images of Hudson Bay this week. They too have had somewhat cooler than normal temperatures this month, often times with highs in the 40s and 50s F. They did rise to highs in the 70s F earlier this week at Churchill, Manitoba along the southwestern shores of Hudson Bay.

During the peak summer months, 60 and 70 degree F temperatures are often recorded in far northern Manitoba along the Churchill River to the shores of western Hudson Bay. Dewpoints rarely get very high, but even values in the 40s and 50s (low by Minnesota standards for summer) F are sufficient to bring fog to the area. The major cause of this is the cold water of Hudson Bay which keeps temperatures over the water in the 30s and 40s F. This causes rapid condensation of the water vapor given up by the land surface as evaporation or plant transpiration during the daytime. Fog is often evident in summer satellite images of Hudson Bay, and appears as a darker layer of stratoform clouds. In addition, as I mentioned above, satellite images often show ice floes scattered about western and northern sections of the bay, even in July. The unfrozen or thawed period for the waters of Hudson Bay is a short season indeed, usually occurring only during the month of August.

MPR listener question: Last week, I heard you say that for the Twin Cities almost all cool daytime July temperatures

(less than 70 F) are associated with persistent cloudiness, long lasting rain showers, or fog. But isn't an all day July fog quite unusual in this area?

Answer: Indeed, though I mentioned that fog is fairly common in July (about once every 5-6 years), all day fog is quite rare. In the past half century I can find only two occasions when an all day fog held the temperature to a very narrow range in the Twin Cities....these were July 4, 1962 which produced a daytime high of 71 F and a low of 65 F, and July 23, 1993 which shows a high of 71 F and a low of 66 F

Twin Cities Almanac for July 16th:

The average MSP high temperature for this date is 84 degrees F (plus or minus 7 degrees standard deviation), while the average low is 64 degrees F (plus or minus 6 degrees standard deviation).

MSP Local Records for July 16th:

MSP weather records for this date include: highest daily maximum temperature of 102 degrees F in 1926; lowest daily maximum temperature of 66 degrees F in 1900; lowest daily minimum temperature of 51 degrees F in 1911 and 1958; highest daily minimum temperature of 80 degrees F in 1931; and record rainfall of 1.28 inches in 1908.

Average dew point for July 16th is 61 degrees F, with a maximum of 76 degrees F in 1986 and a minimum of 42 degrees F in 1976.

All-time state records for July 16th:

Scanning the state climatic data base: the all-time high for this date is 109 degrees F at Beardsley (Big Stone County) in 1931; the all-time low is 33 degrees F at Tower (St Louis County) in 1979.

Word of the week: CONUS

This is a term often used in satellite meteorology to refer to a field of view that encompasses the Continental United States (CONUS). The various Geostationary Operational Environmental Satellites deployed by the National Ocean and Atmospheric Administration offer such view. A CONUS satellite image is a good perspective to evaluate large scale weather systems (hurricanes, winter storms, large mesoscale convective systems), and the trajectory of atmospheric moisture. The Space Science and Engineering Center at the University of Wisconsin offers several CONUS satellite images on their web site....

<http://www.ssec.wisc.edu/data/index.html#rtsat>

Outlook:



Generally a dry weekend with seasonal temperatures, followed by an unsettled period beginning late Monday through Wednesday, when there will be a chance for showers and thunderstorms again. Somewhat warmer next week as well with highs reaching the 90s F in places.

To: Morning Edition  
From: Mark Seeley  
Re: Topics for MPR's Morning Edition, Friday, July 23, 2004

Topic: Remembering July 23, 1987

Most long-time residents of the Twin Cities area can recall this date because it marked the worst flashflood of the 20th Century in this area of the state. Between 8 pm and midnight, MSP airport recorded a total of 9.15 inches of rainfall (another 0.85 inches fell after 12 am making a storm total of 10 inches). Quite obviously that amount of rainfall in less than 6 hours produced flooding on a grand scale, closing many sections of the Interstate system, flooding thousands of basements, and even blowing off manhole covers on major streets with storm sewer drainage underneath them.

The magnitude of this rainfall challenged all the statistical records kept by Minnesota climatologists: a new daily rainfall record for the month of July by nearly 3 inches; a new daily rainfall record for any day of the year by nearly 2 inches; three consecutive hours of rainfall rates that were equivalent to the 100 year return period calculation; a storm total rainfall that exceeded the 100 year maximum expected 10 day total; and a new monthly rainfall total (17.9 inches) which exceeded the previous record for any month of the year by 6 inches. Among all single day weather events recorded in Minnesota during the 20th century, this one would have to rank among the most unusual.

Topic: High Dew Points.....

This week brought a strong influx of warm, humid air to the state. Dew points reached into the 70s F, with Owatonna reporting a value of 82 degrees F on both Tuesday and Wednesday. These values are remarkably high for our Minnesota climate, though they have occurred in 5 of the past 6 summers. The high dewpoints inflate the Heat Index to values over 100 degrees F. This can cause health related problems for those who work in the outside environment.

Fortunately, dew points of 74 degrees F or higher occur less than one percent of the time during the typical Minnesota summer, so we can always look forward to some relief after such spells.

MPR listener question: With Heat Index values this week ranging from 95 to 111 degrees F around Minnesota, I wondered what the highest Heat Index Value measured in the state has been? Also, what about the highest dew point?

Answer: Dew point and Heat Index data have not been recorded as long as temperature data. The record period for such data is about 60 years. The highest Heat Index measured in Minnesota was 125 degrees F at Red Wing on July 30, 1999. Also on that date

Red Wing and Faribault reported a dew point of 84 degrees F, the highest ever measured in the state.

Twin Cities Almanac for July 23rd:

The average MSP high temperature for this date is 84 degrees F (plus or minus 7 degrees standard deviation), while the average low is 64 degrees F (plus or minus 6 degrees standard deviation).

MSP Local Records for July 23rd:

MSP weather records for this date include: highest daily maximum temperature of 105 degrees F in 1934; lowest daily maximum temperature of 67 degrees F in 1962; lowest daily minimum temperature of 50 degrees F in 1978; highest daily minimum temperature of 80 degrees F in 1934; and record rainfall of 9.15 inches in 1987.

Average dew point for July 23rd is 60 degrees F, with a maximum of 79 degrees F in 1965 and a minimum of 43 degrees F in 1931.

All-time state records for July 23rd:

Scanning the state climatic data base: the all-time high for this date is 108 degrees F at Milan (Chippewa County) in 1934; the all-time low is 32 degrees F at Pine River Dam (Crow Wing County) in 1925.

Word of the week: Ac

Most people who see or hear these letters spoken in the summer immediately think of air conditioning. However, meteorologists (who think differently from normal people) readily associate these letters with the international observation code for altocumulus clouds. These are common summertime clouds which form in the middle layers of the atmosphere. They are puffy, rounded masses, some with considerable vertical development. They typically form between 6500 ft and 25,000 ft. They indicate moderate instability and turbulence in the middle layers of the atmosphere, but they are not associated with severe weather.

Outlook:

It appears a cooler and drier period is setting up for the weekend and much of next week. This may persist into the first week of August as well.

To: Morning Edition  
From: Mark Seeley  
Re: Topics for MPR's Morning Edition, Friday, Aug 6, 2004

Topic: Windy Tuesday.....

A large mesoscale convective system moved over SD, MN, and WI on Tuesday of this week, bringing heavy rain, hail, and damaging winds. There were over a dozen reports of wind damage from the southernmost tier of counties in Minnesota, including Rock, Nobles, Jackson, Martin, and Mower Counties among others. Wind gusts ranging from 50 to 80 mph knocked down trees and farm silos, tipped over semi truck-trailers, caused power outages, and flattened some corn fields. Hopefully, the corn crop will recover and straighten out, but if it remains flat it will present harvest problems and may have to be used for silage rather than grain.

Estimating the force of these wind gusts is difficult. One general method used is to square the wind speed (taken in mph) and multiple by 0.004. This gives an estimate of the wind force in pounds per square foot. For example a 70 mph wind gust produces a force equivalent to about 20 lbs/square foot. Such a wind hitting a farm silo or a semi-truck trailer with a surface area of 100 square feet, generates nearly 2000 pounds of force.....no wonder damages result.

Topic: Heavy rains as well.....

The damaging thunderstorms which started on Monday night and lasted through Tuesday also brought heavy rains. Sioux Falls, SD reported a new daily rainfall amount for August 2nd with 1.89 inches. Record setting rain for Tuesday, August 3rd was reported at Worthington with 2.60 inches, Jackson with 1.46 inches, and Hokah with 2.25 inches.

Topic: Cool Thursday.....

A cool, Canadian high pressure system settled over the state following the storms of Monday and Tuesday. On Thursday morning, August 5th several record low temperatures were reported around the state, including the following.....

Hibbing with 36 F, Cook with 36 F, Eveleth with 37 F, Babbitt with 34 F, Floodwood with 37 F (tied record low), Bigfork with 36 F (tied record low), Embarrass with 28 F, and Tower with 26 F. The reading at Tower set a new all-time state record low for August 5th and was also the coldest temperature reported in the nation on that date.

MPR listener question: The Olympic Games begin next week in Greece. Any thoughts on about what kind of weather to expect?

Answer: Indeed, there has been much anticipation about the weather since Greece is known for both heat and humidity in the month of August. Temperature forecasts for next week suggest that daytime highs will range from the upper 80s to lower 90s F at most of the Olympic venues. Nighttime temperatures will remain high as well, from the upper 60s to low 70s F. Unsettled weather on Wednesday and Thursday (the 11th and 12th) may lead to some showers and thunderstorms, then high pressure should bring predominately fair skies for a few days. The Hadley Center which forecasts for most of Europe shows an outlook for the balance of the Olympic Games that favors above normal temperatures and average rainfall. This suggests that on some days the temperatures may impose additional stress on the competitors in certain sports.

Some athletes from the USA team will be using a garment known as the Arctic Heat Cooling Vest. This vest is filled with a chilled gel-like material and worn by an athlete just before engaging in a competitive sport. The vest pre-cools the body so that once competitive exertion starts, it takes longer to cause sweat and elevated heart rate in the athlete. Some athletes use these vests for training as well. With the expected higher temperatures in Greece perhaps such a garment will give a competitive advantage. We may hear more about this from the media.....

Some web sites for following the weather conditions during the Olympics are.....

<http://www.noa.gr/Issues/Weatheren.html> (National Observatory at Athens, Greece)

<http://www.usatoday.com/weather/forecast/international/europe-temps-index.htm> (USA Today Weather Page for Europe)

<http://uk.weather.com/> (the Weather Channel)

Twin Cities Almanac for August 6th:

The average MSP high temperature for this date is 83 degrees F (plus or minus 7 degrees standard deviation), while the average low is 62 degrees F (plus or minus 5 degrees standard deviation).

MSP Local Records for August 6th:

MSP weather records for this date include: highest daily maximum temperature of 99 degrees F in 2001; lowest daily maximum temperature of 66 degrees F in 1903 and 1991; lowest daily minimum temperature of 48 degrees F in 1977; highest daily minimum temperature of 80 degrees F in 2001; and record rainfall of 1.67 inches in 1995.

Average dew point for August 6th is 61 degrees F, with a maximum of 78 degrees F in 1996 and a minimum of 41 degrees F in 1989.

All-time state records for August 6th:

Scanning the state climatic data base: the all-time high for this date is 106 degrees F at Canby (Yellow Medicine County) in 1937; the all-time low is 28 degrees F at Tower (St Louis County) in 1976.

Word of the week: Sundowning

This is a term used to describe the reaction of some people (usually the elderly who suffer from forms of dementia) to the loss of sunlight in the late afternoon or evening. In some cases the loss of light triggers an agitated or confused state, or sometimes anxious and restless behaviors. There are a variety of explanations being offered for this but I am not aware of any consensus opinion. Like those who suffer from Seasonal Affective Disorder, some who suffer from sundowning are helped by photo therapy and being in rooms with bright lights.

Outlook:

Generally seasonal temperatures over the weekend with a chance for widely scattered showers and thunderstorms, especially later on Saturday and Sunday. Cooler than normal temperatures next week, with chances for showers on Monday and Tuesday.

To: Morning Edition  
From: Mark Seeley  
Re: Topics for MPR's Morning Edition, Friday, Aug 13, 2004

Topic: Exceptionally cool August so far.....

August temperatures are following the trend set by May, June, and July, but even more dramatically, averaging from 5 to 10 degrees cooler than normal so far. Tower, MN has reported the nation's lowest temperature on four dates so far this month, 26 F on the 5th, 28 F on the 6th, 28 F on the 12th, and 27 F on the 13th.....the first three of these readings either tied or set new state record lows for the date.

A strong cold front pushed through the state on Sunday, August 8th and ushered in very cool, Canadian air from high latitude. This was in evidence on Monday, August 9th when several communities reported new record cold daytime temperatures, including the following....

61 F at both Fargo and Grand Forks, ND, 59 F at Thief River Falls, 61 F at Hallock, 61 F at Crookston, 59 F at Wadena, 64 F at Olivia, 57 F at Madison, and 64 F at Pipestone. This was only a precursor to an even colder day on Tuesday, August 10th, one of the coldest August days of all-time around Minnesota. Persistent cloud cover and northerly winds kept daytime high temperatures at record cold levels for the date, including the following records.....

Twin Cities 59 F	St Cloud 57 F	Duluth 53 F,
Grand Forks, ND 59 F	Fargo, ND 59 F	Park Rapids 53 F
Detroit Lakes 54 F	Hallock 59 F	Crookston 57 F
Alexandria 54 F	Albert Lea 61 F	Fairmont 61 F
Faribault 59 F	Little Falls 57 F	Mankato 59 F
New Ulm 63 F	Olivia 61 F	Ely 48 F
Two Harbors 55 F	Orr 54 F	Hibbing 53 F

In addition the following communities reported the coldest ever daytime temperature measured in the month of August...

Brainerd 53 F	Crane Lake 52 F	Cook 48 F
Eveleth 54 F	Bigfork 50 F	Grand Rapids 52 F
Aitkin 54 F	Cloquet 52 F	Grand Marais 48 F
Hutchinson 57 F	Litchfield 55 F	Mora 55 F
Baudette 51 F	Bemidji 48 F	Fergus Falls 55 F
Thief River Falls 54 F	Roseau 50 F	Warroad 48 F
Wadena 50 F	Waskish 50 F	Intl Falls 49 F

Though it remained mostly cloudy during the overnight hours, Wednesday morning's temperatures also set some new record lows for August 11th, including...

Twin Cities 47 F	Redwood Falls 46 F	Hutchinson 44 F
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Olivia 39 F      Willmar 39 F

The cool high pressure system brought further cold temperature records to the state on Wednesday and Thursday as well.

New record cold daytime highs were reported on Wednesday, August 11th at the following locations...

Twin Cities 65 F (tied record), Rochester 58 F, Wheaton 66 F, Eau Claire, WI 56 F, La Crosse, WI 61 F, Wadena 61 F, Warroad 63 F, Baudette 63 F, Albert Lea 61 F, Fairmont 61 F, Hutchinson 61 F, Mankato 59 F, Mora 59 F, and 59 F at Moose Lake.

On Thursday morning, August 12th new record low temperatures were reported at the following locations....

Embarrass 29 F, Tower 28 F, Crane Lake 39 F, Cook 37 F, Hibbing 36 F, Pine River 39 F, Aitkin 37 F, Brainerd 39 F, Little Falls 39 F, Olivia 41 F, Park Rapids 36 F, and Wadena with 36 F.

And finally on Friday morning, August 12th a few more record low temperature values were tied or broken....record lows were reported at Ely and Eveleth with 36 F, at Tower and Embarrass with 27 F, and at Hibbing with 32 F.

Topic: Minnesota Tornadoes on August 8th....

Despite the trend of cooler temperatures this month, a line of strong thunderstorms brought tornadoes to portions of northern and central Minnesota on Sunday, August 8th. Eight reports of tornado touchdowns were filed with the National Weather Service, all occurring in the evening hours. Reports were filed from Kitton, Marshall and Beltrami Counties in the northwest and from Sherburne County in central Minnesota. Fortunately there was little damage associated with any of these.

Topic: Severe weather and lost luggage in England.....

Severe thunderstorms were widespread in England this past weekend as well. London's Heathrow Airport was closed for a time and a number of flights were delayed or cancelled. In addition baggage conveyors in two terminals broke down. The combined effects caused a backlog of lost luggage totaling over 7,000 pieces for British Airways. At the height of the European vacation season, there were thousands of irate travelers wondering where their luggage was. British Airways deployed a special aircraft to carry nothing but luggage in an effort to clear the backlog.

MPR listener question: With the cool summer we are having, how far behind are the major crops in their development cycle?

Answer: From a climatic perspective we assess crop development using Growing Degree Days (GDD), the accumulation of daily



temperature values above some base that is preferred for growth by a given crop. For corn we use a temperature base of 50 degrees F. This summer GDD are running about 10 to 15 percent less than normal for most areas since May 1st. This marks the coldest summer growing season in Minnesota since those of 1996, 1993, and 1992. The corn crop is ten days to two weeks behind in development, so that most producers are hoping for a frost-free September that allows the crop to reach full maturation. If this is not the case yields will certainly be diminished. The soybean crop is behind as well, and although reaching maturation is not a major concern, shorter plant height and cool weather retardation of the pod filling stage may prevent outstanding yields.

MPR listener question: I have heard you say that northern counties have historically seen frost occur in every summer month. What about snowfall? Has it snowed in every summer month?

Answer: The only month with no historical record of snowfall is July. It has snowed in June a few times historically, the greatest amount being 1.5 inches on June 4, 1935 in Koochiching County (Mizpah). It has snowed once in August, reported as a trace at Duluth on August 31, 1949.

Twin Cities Almanac for August 13th:

The average MSP high temperature for this date is 81 degrees F (plus or minus 7 degrees standard deviation), while the average low is 61 degrees F (plus or minus 5 degrees standard deviation).

MSP Local Records for August 13th:

MSP weather records for this date include: highest daily maximum temperature of 95 degrees F in 1965 and 1978; lowest daily maximum temperature of 63 degrees F in 1951; lowest daily minimum temperature of 48 degrees F in 1924 and 1997; highest daily minimum temperature of 70 degrees F in 2000 and numerous earlier years; and record rainfall of 2.03 inches in 1957.

Average dew point for August 13th is 60 degrees F, with a maximum of 78 degrees F in 1995 and a minimum of 37 degrees F in 1933.

All-time state records for August 13th:

Scanning the state climatic data base: the all-time high for this date is 108 degrees F at Beardsley (Big Stone County) in 1965; the all-time low is 26 degrees F at Bigfork (Itasca County) in 1964 and at Embarrass (St Louis County) in 1997.

Word of the week: Meltemi

As the Olympics get underway this week there has been much talk about the weather of Greece and how it might affect the competition. In sports such as sailing, kayaking, rowing, and canoeing the wind

can have tremendous effects, so the Hellenic (Greek) National Meteorological Service is paying particular attention to the meltemi, the name given to the summer's northeastern winds that blow down from the mountains of the Balkans during July and August. These winds can arise suddenly, often in the afternoon, and they can be very strong, blowing from 30 to 40 mph. Such winds can cause large swells in the seas, and may at times cause postponements of various events. Olympic organizers have planned for this and will start many of the events in the early hours of the morning before the meltemi get started. Rumor has it that many athletes have been training in windy conditions in order to be better adapted for the environment of the Olympic venues.

#### Outlook:

Warming trend throughout the weekend, reaching the 70s and 80s F most places. Increasing chance for showers and thunderstorms across the north and central on Sunday, then continuing chances statewide for Monday through Wednesday next week. This will be followed by another period of cooler than normal temperatures.

To: Morning Edition  
From: Mark Seeley  
Re: Topics for MPR's Morning Edition, Friday, Aug 20, 2004

Topic: The 2004 Annual State Fair Weather Quiz.....

Do you know your Minnesota weather? How about answers to these questions.....

What weather record was set at the State Fair on August 24th (Sunday) last year?

- a. new rainfall record of 2.40 inches
- b. new low temperature record of 38 degrees F
- c. tied the all-time high temperature record of 97 degrees F

Which of the following Minnesota communities has reported the nation's coldest temperature most frequently during 2004?

- a. International Falls
- b. Tower
- c. Embarrass

(Answers below).....

We will broadcast the 8th Annual Minnesota Weather Quiz on MPR's Midday Program next Thursday, August 26th at 11:00 am, live from the Minnesota State Fair. If you are at the fair, please come by, if not I encourage you to listen on MPR, or even take the quiz yourself by going to the MPR web site....[www.mpr.org](http://www.mpr.org)

(ANSWERS TO THE ABOVE QUESTIONS: Both are c)

Topic: Fall Climate Outlook.....

The Climate Prediction Center released the outlook for fall (Sep-Nov) on Thursday of this week. September is expected to be cooler and wetter than normal across most of the state. Then the balance of autumn (October-November) is assigned equal chances for positive or negative departures with respect to temperature and precipitation. This agrees with the Hadley Center (European) outlook for our region of North America that suggests a near normal fall climate.

Topic: Indicators of a cold growing season in MN.....

Last week as an indicator of how cold it has been, I remarked about some new state record low temperatures and the lack of Growing Degree Days (GDD) for normal crop development this summer. However there are other significant indicators of how cold it has been too.....

This week the National Weather Service office in Chanhassen

reported that Alexandria, MN is thus far recording what may be its coldest all-time August, while St Cloud is so far recording its 2nd coldest August.

At present Duluth is recording one of the top five coldest growing seasons, measured as the mean temperature for May through August. To date (Aug 18), Grand Rapids has recorded the third coldest ever May through August period, while International Falls has recorded its coldest ever such period, dating all the way back to 1898.

In addition, the frequent outbreaks of Canadian high pressure systems have brought remarkably cold low temperatures to the state each month of the year. Excluding Alaska, Minnesota has reported the coldest temperature in the nation over 70 times this year, including 10 days in May, 10 days in June, 3 days in July, and 6 days so far in August. For the 5th consecutive year Tower and Embarrass have reported frost in every summer month.

New record lows were again set on August 19th this week (Thu) at the following locations.....

International Falls 36 F, Duluth 37 F, Little Falls 35 F, Tower 25 F, Orr 37 F, Embarrass 27 F, La Crosse, WI 46 F, Olivia 37 F, Sioux Falls, SD 39 F, Willmar 39 F, Fargo, ND 39 F, Pine River 37 F (tied), Madison 36 F, Wadena 36 F, Crookston 37 F, Park Rapids 36 F, Thief River Falls 37 F, and Waseca 40 F

Topic: Early Frost: How common historically and did it end the growing season for some?

Friday morning, August 20th brought frost to many sections of northern Minnesota. Numerous new record lows were set all around the state. Those locations reporting freezing temperatures or nearby ground frost conditions included the following:

International Falls 33 F    Cook 30 F    Hibbing 35 F  
Pine River 34 F    Aitkin 32 F    Bemidji 35 F  
Floodwood 31 F    Littlefork 32 F    Babbitt 32 F  
Kabetogama 33 F    Isabella 32 F    Tower 23 F    Embarrass 23 F  
Grand Forks, ND 32 F    Fargo, ND 34 F    Crookston 32 F  
Wadena 34 F    Hallock 30 F    Thief River Falls 30 F  
Park Rapids 32 F    Baudette 35 F    Brandon, Manitoba 32 F

Yes, we have had frequent intrusions of high latitude arctic air masses this summer thanks to the persistent position and strength of a continental polar vortex. This makes us all nervous about early frost probabilities for a very slow developing crop. Though the historical frequencies argue against it, this morning already brought one dose of arctic air that is expected to persist through Saturday morning (Aug 21st). Thus, frost on August 21st may be even more widespread around the state. Find below a chronology of August frosts reported south to north along the Red River Valley...

Ada, MN (3 years) 8/31/1895, 8/21/1920, and 8/30/1931  
Crookston, MN (3 years) 8/28/1893, 8/13/1964, and 8/28/1965  
Thief River Falls (3 years) 8/26/1915, 8/30/1930, and 8/27/1982  
Argyle, MN (six years) 8/25/1934, 8/31/1935, 8/13/1964, 8/28/1965,  
8/27/1982, and 8/27/1986  
Hallock, MN (8 years) 8/29/1915, 8/21/1920, 8/24/1923, 8/23/1927,  
8/28/1934, 8/31/1935, 8/18/1942, and 8/27/1982

So at least for northern counties there is certainly precedent for such temperatures in August, though they are unusual. In southern counties it is exceptionally rare to see freezing temperatures in August, though not entirely unseen in the climate record. Witness Pipestone had frost on August 11, 1902 and again on August 23, 1987.

Though the microclimate effect weighs heavily on the occurrence of frost, notice some common years for all.....the summers (May through August) of 1895, 1915, 1923, 1942, 1965, and 1982 were all in the colder end of the distribution historically, just as the summer of 2004 has been.....we are expected to average colder than normal from now through September according to the Climate Prediction Center.

Crop damage from frost varies depending the stage of crop development, and on the magnitude of the temperature (how far below freezing it drops) and the duration below the freezing mark (typically minutes to hours). Fortunately, the radiational frosts of last night and that expected for Saturday morning (Aug 21) will only be of short duration, likely minutes in duration for many areas. Soybeans may be affected in particular, but it will take time to assess. Consequent damages may be evident in smaller pod or seed size.

MPR listener question: Has any place in the state recorded a 100 degrees F temperature this year? How often do such temperatures occur in Minnesota?

Answer: The highest temperature I can find in the state this year is 97 degrees F at Redwood Falls back on June 8th. So, the answer to your first question is NO!

Historically, 100 F temperatures occur somewhere in the state with great regularity. According to Greg Spoden in the State Climatology Office of the past 113 years only 12 (about 11 percent) have shown the absence of a 100 F temperature anywhere in the state. Those years were 1903, 1904, 1907, 1909, 1915 (coldest ever summer), 1924, 1951, 1986, 1992, 1993, 1994, 1997.

Twin Cities Almanac for August 20th:

The average MSP high temperature for this date is 80 degrees F (plus or minus 7 degrees standard deviation), while the average low is 61 degrees F (plus or minus 5 degrees standard deviation).

MSP Local Records for August 20th:

MSP weather records for this date include: highest daily maximum temperature of 97 degrees F in 1972; lowest daily maximum temperature of 62 degrees F in 1966; lowest daily minimum temperature of 40 degrees F in 1950; highest daily minimum temperature of 74 degrees F in 1959 and numerous earlier years; and record rainfall of 2.23 inches in 1891.

Average dew point for August 20th is 58 degrees F, with a maximum of 78 degrees F in 1959 and a minimum of 33 degrees F in 1950.

All-time state records for August 20th:

Scanning the state climatic data base: the all-time high for this date is 105 degrees F at Campbell (Wilkin County) in 1976; the all-time low is 25 degrees F at Alborn (St Louis County) in 1934.

Words of the week: Rain Foot

This term is used to describe the horizontal bulging near the surface that is sometimes seen at the bottom of a rain shaft, usually observed from a distance. A wet microburst or downburst forces the spreading out of the rain shaft into a foot-shaped prominence, that brings precipitation to a larger landscape area. They are usually of brief duration. I noticed this on Monday morning of this week while biking to work. I observed a rain shaft descending from a cloud base upwind from me, but I was getting wet even though I was considerably east of the clouds themselves because I was biking through the rain foot!

Outlook:

Cooler than normal on Saturday with some scattered frosts, then a warming trend beginning on Sunday and running through next week. The weekend will be mostly dry, with an increasing chance for showers late on Sunday in the north. Then a chance for showers and thunderstorms around the state on Monday through Wednesday with near normal temperatures.

To: Morning Edition  
From: Mark Seeley  
Re: Topics for MPR's Morning Edition, Friday, Aug 27, 2004

Topic: What temperature variation can do.....

The frost around the state last Thursday, Friday, and Saturday mornings (August 19-21) certainly did its share of crop damage, much of which is yet to be assessed in terms of yield reduction. Various field inspections made by agronomists and others highlighted how far behind the major crops (corn, soybeans) are this growing season. Many are just now in growth stages that should have occurred back in the first or second week of August. Much of this is attributed to the fact that the 2004 growing season has been about 20 percent cooler than average.

Let's examine two situations in which seasonal temperatures that are 20 percent cooler than average can have profound economic consequences for the state.....

#### EXAMPLE 1: AGRICULTURE

Growing Degree Days (GDD) above a base temperature value of 50 degrees F are used to gauge the rate of corn development. Since temperatures this summer have been averaging consistently cooler than normal, the seasonally accumulated GDD values are roughly only 80 percent of normal for this time of year. This means that much of the corn will likely not reach physiological maturity before the next killing frost. That translates to a loss in yield potential. For example a corn crop that is frosted at the milk stage will only yield about 80 percent of potential. If the expected average yield of a fully mature crop was to be 160 bushels per acre, that means that the actual yield is likely to be closer to 128 bu/a, a reduction of 32 bu/a. In economic terms at a corn price of \$2.25/bu on the Chicago Board of Trade, that is a loss of \$72/a. Such a sum can easily be the difference between a positive or negative cash flow on the farm. And that does not account for the extra cost of drying a high moisture crop before placing it in storage. If such an impact can be extrapolated over the state's nearly 7 million acres of field corn, the economic consequence easily exceeds half a billion dollars! And that's just for consideration of the corn crop. Granted not all of the corn crop is simultaneously going through the same growth stage, but even as a ballpark figure this is staggering!

#### EXAMPLE 2: ENERGY USE

Taking another example of the economic consequence of temperature variation let's examine heating degree days (HDD) which is the accumulation of daily temperature below a base value of 65 F. This number is used as an index to estimate residential and commercial energy use, primarily for heating. In the Twin Cities area the average number of HDD for the four month period from December through March is 5350. Most of our residential and

commercial gas usage is measured in ccf or therms. For my home heating in St Paul, I use one therm for every 5.2 HDD at a cost of about \$.68 per therm. This would equate to a gas bill under average December through March temperature conditions (5350 HDD) of about \$700. A negative temperature departure (cold winter) for the four month period which produced an increase of 20 percent in total HDD (making it 6420) would likely increase my heating costs by nearly 140 dollars. This does not factor in the volatility in the price of natural gas. If my home heating costs however are representative of the general Minnesota population and you then multiple the effect of a cold winter times one million households, you reach a number approaches \$150 million dollars and that does not include commercial energy use.

Thus, although we live with wild swings in weather conditions and take pride in our adaptation and tolerance to them, the daily, weekly, monthly, and seasonal variations in temperaure alone have pretty sizable economic implications for our state.

MPR listener question: What type of weather do you expect for the 12 day State Fair run this year in St Paul?

Answer: Well, it already started humid and showery for the opening day on August 26th.....however the opening weekend should be cooler than normal and mostly dry. This pattern will give way to warmer conditions next week with increasing chances for showers and thunderstorms.

MPR listener question: All of my tomatoes are still green. Will the weather ever allow them to vine ripen?

Answer: After a cool August, it appears more ideal temperature conditons for ripening of tomatoes will prevail for the next ten days or so. Ripening should accelerate as temperatures remain in the near ideal range of 55 to 75 F for much of the period. I still think most of the tomatoes will have ripened before the next chance of frost comes in September.

Twin Cities Almanac for August 27th:

The average MSP high temperature for this date is 79 degrees F (plus or minus 9 degrees standard deviation), while the average low is 60 degrees F (plus or minus 7 degrees standard deviation).

MSP Local Records for August 27th:

MSP weather records for this date include: highest daily maximum temperature of 99 degrees F in 1926; lowest daily maximum temperature of 60 degrees F in 1914; lowest daily minimum temperature of 44 degrees F in 1967, 1971, and 1986; highest daily minimum temperature of 76 degrees F in 1973 and record rainfall of 2.80 inches in 1978.

Average dew point for August 27th is 60 degrees F, with a maximum



of 77 degrees F in 1990 and a minimum of 33 degrees F in 1935.

All-time state records for August 27th:

Scanning the state climatic data base: the all-time high for this date is 103 degrees F at Tracy (Lyon County) in 1973; the all-time low is 22 degrees F at Tower (St Louis County) in 1986.

Word of the week: Therm

A term used for the measurement of heat energy, this can be found often on your natural gas bill. A therm is equal to 100,000 British Thermal Units, also formerly defined as a unit equal to 1000 cubic feet of natural gas at standard temperature (32 F) and pressure (29.92 in.). The number of therms used in residential and commercial heating is quite closely related to Heating Degree Days (HDD) the accumulation of daily mean temperature below a base of 65 degrees F.

Outlook:

Cooler weather will prevail again this weekend, with a chance for showers by Sunday in the north and west. Temperatures will warm next week and feel more summerlike. There will be an increasing chance for showers toward the end of the week and Labor Day weekend.

To: Morning Edition  
From: Mark Seeley  
Re: Topics for MPR's Morning Edition, Friday, Sep 3, 2004

Topic: Last word on a cold August.....

Average temperature for August around Minnesota was typically 4 to 8 degrees cooler than normal. This was sufficient to make it one of the coldest Augusts in state history in sharp contrast to August of last year which was one of the warmest in state history. A number of communities including St Cloud, International Falls, Eau Claire, WI and Alexandria, recorded their coldest August ever. Many individual daily records of low temperature and cold daytime maximum temperature were broken. Excluding Alaska, Minnesota reported the coldest temperature in the nation on 8 dates during the month. Extremes of temperature around the state ranged from 91 degrees F at Canby on the 2nd to 20 degrees F at Embarrass on the 21st.

August was the 4th consecutive month with average temperatures below normal. Though this pattern was good for some early season crops like oats and grass seed, it has been quite detrimental for most of Minnesota's major crops which will undoubtedly show negative departures from recent yield trends.

The month was generally drier than normal, but some locations reported surplus rainfall. In northwestern Minnesota, Karlstad, Crookston and Warroad all reported between 4.5 and 5.0 inches of rain for the month, as did Waseca, Winnebago, Winona, Marshall, and Grand Meadow in the south. In western sections, Montevideo reported over 5.5 inches, while in the southwestern part of the state Lamberton reported nearly 5 inches and Lakefield over 7 inches.

Topic: Another cold growing season from Pioneer Days....

Though many are comparing this cold growing season (May-Aug) in Minnesota with some from the early 20th Century (1907, 1915, 1924, and 1927), St Paul weather historian Charles Fisk wrote me to point out that nothing compares with the growing season of 1863 in terms of crop damaging frosts. From the old pioneer era climate records it is evident that Minnesota weather during that growing season would have made most farmers want to give up. May and June saw the onset of drought across the state. The Mississippi River flow was so low that boat traffic was restricted in May. St Paul reported no measurable rainfall in June and rivers were reported at record low levels. A number of prairie fires were reported in June and July as well. Nevertheless stored soil moisture seemed to be seeing the crop through until frosts came in July. Yes, July! The nights of the 11th through the 14th brought various frosts, killing or damaging many corn fields within 25 miles of St Paul. Near Rochester nearly all crops were reported damaged or killed except for small grains

which were being harvested. In those days when home grown produce was much more important to the family food stores, farmers reportedly lost potatoes, pumpkins, squash, cucumbers, melons, corn, and tomatoes. It was reported that only the cabbage crop escaped serious damage. Additional July frosts were reported near Winona and Mankato but they inflicted little damage.

August brought more frosts on the 25th and the 29th, killing most of the remaining crops. This disastrous growing season was a precursor to another most unusual weather event, snow in September. Snow squalls were reported during the daytime hours in St Paul on September 18th. Some other years when snow was reported in the Twin Cities during the month of September also happened to be those with very cold growing seasons as well.... years like 1915 (snow on Sept 15th), 1927 (snow on Sept 19-20), 1985 (snow on Sept 23), 1945 (snow on Sept 26 and 28), 1908 (snow on Sept 28-29) and 1951 (snow on Sept 28).

Topic: An icy road indeed.....

It was reported in the recent addition of the Bulletin of the American Meteorological Society that the National Science Foundation is helping to fund a \$20 million highway of ice in Antarctica. The goal is to build an ice road as a supply route to the Amundsen-Scott research station at the South Pole. It is hoped that tractor pulled sleds will be able to haul supplies from the coast to the research station across this 1000 mile long highway of ice. The second year of construction work ended recently with completion of the first 425 miles of road. Working conditions must present a formidable challenge to say the least!

MPR listener question: What are the all-time state temperature extremes for the month of September?

Answer: This may surprise you. The all-time low temperature record in Minnesota during September is 10 degrees F and it has occurred as early as the 22nd at Thorhult (Beltrami County) in 1974. Big Falls, MN (Koochiching County) also reported just 10 degrees F on the 30th of September in 1930.

The all-time state high temperature record for September is 111 degrees F at Beardsley (Big Stone County) on the 11th in 1931. By the way, the latest that a 100 degrees F reading has occurred in the state is 101 degrees F at Ada (Clay County) on September 22, 1936. Note all of these temperature records for September occurred in dry years.

Twin Cities Almanac for September 3rd:

The average MSP high temperature for this date is 77 degrees F (plus or minus 9 degrees standard deviation), while the average low is 57 degrees F (plus or minus 7 degrees standard deviation).

## MSP Local Records for September 3rd:

MSP weather records for this date include: highest daily maximum temperature of 97 degrees F in 1925; lowest daily maximum temperature of 58 degrees F in 1934; lowest daily minimum temperature of 32 degrees F in 1974; highest daily minimum temperature of 73 degrees F in 1960; and record rainfall of 0.84 inches in 1986.

Average dew point for September 3rd is 55 degrees F, with a maximum of 74 degrees F in 1960 and a minimum of 31 degrees F in 1930.

## All-time state records for September 3rd:

Scanning the state climatic data base: the all-time high for this date is 103 degrees F at New Ulm (Brown County) in 1925; the all-time low is 20 degrees F at Tower (St Louis County) in 1997.

## Words of the week: Fly in the Ointment

This is an expression used by meteorologists to refer to some feature that causes the forecast to be uncertain. For example, the intensity and track of hurricane Frances this weekend will have something to say about the long wave pattern established over North America next week and how much high latitude cold air may spell down into the midwest as a result. This presents a "fly in the ointment" when trying to forecast the daily temperatures across our region for next week.

## Outlook:

Cooling trend over the weekend with a chance for showers and thunderstorms each day. Some areas may get heavy rains and very active weather on Sunday. Temperatures will remain in the 60s and 70s during the day much of next week.....

To: Morning Edition  
From: Mark Seeley  
Re: Topics for MPR's Morning Edition, Friday, Sep 10, 2004

Topic: Sometimes being wrong is a good thing!!

Back in mid August the NOAA Climate Prediction Center presented a climate outlook for the month of September that favored colder than normal temperatures and above normal rainfall for Minnesota and much of the upper midwest. For some areas of the state the first eight days of the month have produced wetter than normal conditions (over 2 inches in parts of Clay, Ottertail, Wadena, Traverse, Wilkin, Becker, and Dakota Counties), a blessing for late developing crops and replenishment of soil moisture where crops (small grains) have already been harvested. However, the same eight days have also seen temperatures average from 2 to 6 degrees "above normal", a climate trend that is entirely opposite of that predicted. Though the past 2-3 days have averaged cooler than normal again, the forecast is for above normal temperatures to return through the third week of the month.

Most Minnesotans, and particularly farmers, are thankful that the Climate Prediction Center was wrong. In a growing season most notable for its absence of summerlike conditions, the warmth is welcome. Residents of some central Minnesota communities have already seen as many 80 degrees F days in September as they saw in the entire month of August. These conditions will allow slow developing crops to make more progress toward maturity before the threat of frost comes later in the month.

Topic: Some simple forecasting "rules of thumb"

I often get asked about simple forecasting rules that might be used to anticipate weather conditions when radio and television information sources are not available. Each forecaster probably has his or her own rules of thumb, but some of the more common ones are....

Clear skies, low humidity and nearly calm winds an hour or two after sunset produce very low overnight minimum temperatures and by late September or early October often lead to frosts.

Towering cumulus clouds by mid morning can be an indicator of a stormy afternoon.

The dissipation of an overnight fog by mid morning usually ushers in a fair weather afternoon.

The dewpoint shortly after sunset is an indicator of the potential overnight minimum temperature.

When outdoors in Minnesota, stand with your back to the wind. Low pressure will be on your right and high pressure on your left. Remember that pressure systems (lows and highs) often migrate from west to east in Minnesota.

MPR listener question: It seems I have been reading all week about damaging weather along the east coast as a result of the remnants of Hurricane Frances. How many tornadoes have been spawned by this weather system?

Answer: Since Hurricane Frances made landfall last weekend and slowly migrated up the east coast as a tropical storm, and then a tropical depression, the NOAA Storm Prediction Center shows a total of 91 tornado reports associated with this system as of Thursday this week.

The Storm Prediction Center noted that a record number of tornadoes were reported across the nation during August with a total of 173. Thanks to Frances, a record number of tornadoes may be reported in September as well, particularly with Hurricane Ivan expected to have some impact on the southeastern states next week.

Twin Cities Almanac for September 10th:

The average MSP high temperature for this date is 74 degrees F (plus or minus 10 degrees standard deviation), while the average low is 54 degrees F (plus or minus 8 degrees standard deviation).

MSP Local Records for September 10th:

MSP weather records for this date include: highest daily maximum temperature of 104 degrees F in 1931; lowest daily maximum temperature of 49 degrees F in 1918; lowest daily minimum temperature of 37 degrees F in 1917; highest daily minimum temperature of 75 degrees F in 1931; and record rainfall of 2.08 inches in 1913.

Average dew point for September 10th is 53 degrees F, with a maximum of 73 degrees F in 1961 and a minimum of 25 degrees F in 1955.

All-time state records for September 10th:

Scanning the state climatic data base: the all-time high for this date is 108 degrees F at Milan (Chippewa County) in 1931; the all-time low is 17 degrees F at Roseau in 1917.

Words of the week: Dumbbell or Dumbbelling

Some MPR listeners think that this refers to the long pause (or dead airwaves) so evident when I am stumped by a question from Cathy Wurzer. However, these terms are occasionally used by forecasters as verbs when describing the behavior of a low

pressure system. Sometimes a low pressure system splits into two smaller circulating lobes that are close to each other. They behave in the large scale weather pattern as a single system, but they actually appear on satellite imagery as two distinct rotating cloud masses. Dumbbelling then refers to the shape of the pressure pattern (like a weight room dumbbell) that appears on a weather map, rather than implying something about the character of the weather forecaster.

#### Outlook:

A pretty good fall-like period of weather coming up with temperatures averaging a few degrees warmer than normal. Chance for showers in eastern sections on Saturday and then on a more statewide basis again next Tuesday through Thursday.

To: Morning Edition  
From: Mark Seeley  
Re: Topics for MPR's Morning Edition, Friday, Sep 17, 2004

## CORRECTION TO LAST WEEK'S FORECASTING RULES OF THUMB....

Several readers pointed out an error in WeatherTalk last week and I want to offer a correction. In the forecasting rules of thumb I paraphrased the classical Buys-Ballot law relating the horizontal wind field to the atmospheric pressure gradient and Coriolus Force. I stated the rule for the Southern Hemisphere, rather than the Northern Hemisphere!

The rule in the Northern Hemisphere is that you turn your back to the wind and low pressure is on your left, while high pressure is on your right. This law is over 100 years old and I still got it wrong! It is named for famous Dutch meteorologist Christoph H.D. Buys-Ballot.

Topic: Heavy rains in southern and southeastern Minnesota....

As if the weather had not been enough trouble this growing season, heavy thunderstorms brought flooding to many areas of southern and southeastern Minnesota on September 14-15 this week. New record 24-hour rainfall amounts occurred at a number of locations, and storm total amounts exceeded 10 inches in many areas. A more complete assessment is available from the Minnesota State Climatology Office on our web site....

<http://www.134.84.160.120/doc/whatsnew.htm>

Some record rainfall amounts for September 14th included Rochester with 4.04 inches, La Crosse, WI with 2.46 inches, Dodge Center with 4.69 inches, Austin with 2.87 inches, Preston with 2.48 inches, Winnebago with 4.86 inches, Zumbrota with 3.92 inches, Waseca with 3.54 inches, Amboy with 3.37 inches, Fairmont with 6.20 inches (heaviest rain ever at that community), Albert Lea with 7.22 inches (most ever for that community), and 9.20 inches at Bricelyn (heaviest ever and close to the all-time state record for 24-hr rainfall of 10.84 inches at Fort Ripley on July 22, 1972.

The slow moving and at times stalled frontal system brought record setting rains on the 15th as well. Those reporting new record rainfall amounts included Worthington with 2.94 inches, Pipestone with 2.15 inches, Winona with 2.73 inches, Preston with 1.91 inches, and Eau Claire, WI with 1.60 inches. Even some northern Minnesota locations reported record setting rainfall on the 15th, including International Falls with 1.50 inches and Grand Rapids with 1.78 inches.

The heavy rains caused most watersheds to exceed flood stage, closing roads, eroding banks, and flooding basements in



several communities, especially in Faribault, Freeborn, Mower, and Dodge Counties. The Minnesota State Climatology Office called the storm one of "the most significant flash floods in Minnesota climate history." This was because the area receiving six or more inches of rainfall (equivalent to a 100 year storm in terms of frequency) encompassed over 4000 square miles.

Topic: A reversal of fortune for southeastern Minnesota.....

Coming into the year 2004 much of southeastern Minnesota was designated by the Drought Mitigation Center as being in a severe to extreme drought situation. As it turns out 2004 has brought a complete reversal of trend in this area of the state, producing one of the wettest January through September periods on record for many communities. Find below a listing of southeastern communities, their total precipitation for 2004 through September 15th, and the historical ranking of this amount for the period.....

Location	Total Precipitation Jan 1 to Sep 15, 2004	Historical Ranking for the period
Albert Lea	38.81 in.	2nd (1993, 47.69 in)
La Crescent	42.57 in.	1st
Preston	39.90 in.	1st
Harmony	38.76 in.	3rd
Rochester	34.95 in.	5th
Waseca	37.92 in.	3rd
Zumbrota	34.91 in.	7th

MPR listener question: With the very cold 2004 growing season, and a record cold August in many northern Minnesota communities, I was wondering if there has ever been a year in the climate record when the average temperature for September was actually greater than the average temperature for August.

Answer: Great question.....and the answer is yes! International Falls, MN which just reported their coldest August in history with a mean daily temperature of only 56 degrees F is averaging nearly 61 degrees F so far in September. This happened only one other time in their climate history. The year was 1897 when September turned out to be about 0.5 degrees F warmer than August. Checking the records across the state, 1897 was the only year when the statewide September average temperature was warmer than the August average. The year 1897 produced the same result in the Twin Cities climate record as well, though this record also shows that August and September mean temperatures were essentially equal in 1851. These are very rare climate anomalies, as the August mean temperature is normally 10 degrees F greater than that of September.

A similarity between 1897 and 2004 is the dominance of cool Canadian air and abundant cloudiness during August, and the widespread occurrence of frost during the month.

MPR listener question: Is it true that ocean surface temperatures need to be at least 80 degrees F to support the formation and sustainability of a tropical storm or hurricane?

Answer: As a result of the pioneering research of Finnish meteorologist Erik Palmen (1948) and M.I.T. researcher Kerry Emanuel (1988) most forecasters use the 80 degrees F threshold in ocean temperature as one of the predictors for tropical storm development. It is important to remember that a deep layer of warm water is also needed to sustain a tropical storm or hurricane. Ocean temperatures are monitored by instrumented buoys as well as by satellites. Part of the reason Hurricane Ivan sustained its strength for so long in the past week is because it was passing over warm water that ranged from 83 to 87 degrees F. At such temperatures large volumes of water vapor are released into the atmosphere and feed the deep convection that powers the storm. Buoy observations can be found on the Internet at the National Buoy Data Center web site....

<http://www.ndbc.noaa.gov/rmd.shtml>

Twin Cities Almanac for September 17th:

The average MSP high temperature for this date is 72 degrees F (plus or minus 10 degrees standard deviation), while the average low is 52 degrees F (plus or minus 8 degrees standard deviation).

MSP Local Records for September 17th:

MSP weather records for this date include: highest daily maximum temperature of 96 degrees F in 1895; lowest daily maximum temperature of 47 degrees F in 1918; lowest daily minimum temperature of 34 degrees F in 1943; highest daily minimum temperature of 75 degrees F in 1948; and record rainfall of 1.70 inches in 1942.

Average dew point for September 17th is 51 degrees F, with a maximum of 71 degrees F in 1963 and a minimum of 26 degrees F in 1929.

All-time state records for September 17th:

Scanning the state climatic data base: the all-time high for this date is 105 degrees F at Milan and Granite Falls in 1895; the all-time low is 14 degrees F at Mahanomen in 1929.

Word of the week: MEOW

Probably your cat's greeting when you come home from work, but in the meteorological community, especially hurricane forecasting this acronym has two meanings: (1) maximum envelope of water, or; (2) maximum envelope of wind. The forecasting models used to predict landfall hurricanes will provide the meteorologist with a geographic envelope depicting the area where storm surge inundation is expected

to occur across the coastal landscape. This is defined as the maximum envelope of water. Similarly, the models will also provide a depiction of the geographic area that is expected to experience tropical storm force winds (39-74 mph) or hurricane winds (greater than 74 mph). This is called the maximum envelope of wind. MEOW was a term frequently used this week in anticipating the landfall of Hurricane Ivan.

#### Outlook:

A return of above normal temperatures this weekend with highs ranging in the 70s and low 80s F most places. Chance of showers later on Sunday into Monday in the north. Tuesday through Thursday looks to be a more showery period with cooler, fall-like temperatures.

To: Morning Edition  
From: Mark Seeley  
Re: Topics for MPR's Morning Edition, Friday, Sep 24, 2004

Topic: Active tropical weather a boon for the Weather Channel..

The summer of 2004 has produced 13 named tropical storms and hurricanes in the North Atlantic Basin. Eight formed during the month of August, setting a new record number for that month. Many of these storms struck portions of the southeastern coastal states, including Alex, Bonnie, Gaston, Charley, Frances, and Ivan.

Currently there are four named storms appearing on satellite imagery.....Ivan (Jr), Jeanne, Karl, and Lisa. Ivan Jr is actually a continuation of the storm that already ravaged Alabama, Florida, and several eastern states. Remnants of its center actually drifted out over the Atlantic, dipped south to cross the Florida peninsula and then strengthened over the warm waters of the Gulf of Mexico to tropical storm status again, then renamed Ivan Jr by several forecasters. Now it appears to be poised to bring heavy rains to eastern Texas and Louisiana. This is the first documented evidence of a recycled tropical storm over U.S. waters.

The headline grabbing tropical storm and hurricane season has been a boon to the Weather Channel. Viewership is way up for their television broadcasts, while a recent Nielsen/NetRatings poll showed their weather.com web site has never been busier reaching over 26.7 million people during the month of August. I suspect that as Hurricane Jeanne approaches the Florida coast this weekend, the Weather Channel will have another surge in viewership and web site usage.

Topic: Fall colors.....get out and enjoy them....

We are in the midst of fall color changes in Minnesota. These are primarily triggered by changes in daylength. With shorter days, chlorophyll breaks down faster than it is produced and allows the yellow, red and purple pigments in plant leaves to become more visible. We are now losing 2-3 minutes of daylight each day, which certainly adds up and is perceptible on a weekly basis.

The pace at which this color change occurs can be modified by the temperature pattern of late summer and early fall. For example, the cool temperatures experienced in August helped to trigger some early color change in places. However, that has been somewhat slowed by the warm temperature pattern of September so far. The expected cool down this coming week will likely accelerate the rate of color change we have already seen in northern counties

Former State Climatologist Earl Kuehnast found a relationship

between overnight minimum temperatures in the 30s F and the rate of leaf color change. Three nights with temperatures in the 30s F were associated with the onset of leaf color change, and peak fall color was associated with 7 to 10 nights in the 30s. Since the unusual frosts that came on August 20-21, several northern climate stations have reported from 5 to 10 nights with minimum temperatures in the 30s F, including Silver Bay, Orr, Hibbing, and Ely. Most central and southern Minnesota areas have just had one or two such nights.

With far northern counties near color peak a couple of travel routes that might be recommended include: Highway 61 along the north shore of Lake Superior; and County Roads 23 and 116 near Orr and Ely.

MPR listener question: With 12 days of 80 degrees F or greater so far this month in the Twin Cities, September trails only July in producing this level of summer warmth, surpassing the months of May, June, and August. Has this pattern ever occurred in the past?

Answer: Yes, but only twice. In 1897 the Twin Cities recorded 24 days of 80 degrees F or greater temperatures in July and 16 such days in September, while in 1908 there were 20 days in July with 80 degrees F or higher followed by 18 such days in September. This year's corresponding numbers so far are 24 days in July and 12 days in September.

One of the most unusual summers in the Twin Cities climate record was 1891. That year brought 15 days with 80 degrees F and greater in August, followed by 12 such days in September. The combined warmth of these two months exceeded that of all other months, marking a very late starting but slow ending summer indeed!

Twin Cities Almanac for September 24th:

The average MSP high temperature for this date is 67 degrees F (plus or minus 9 degrees standard deviation), while the average low is 47 degrees F (plus or minus 8 degrees standard deviation).

MSP Local Records for September 24th:

MSP weather records for this date include: highest daily maximum temperature of 89 degrees F in 1935; lowest daily maximum temperature of 42 degrees F in 1942; lowest daily minimum temperature of 30 degrees F in 1942; highest daily minimum temperature of 71 degrees F in 1892; and record rainfall of 1.06 inches in 1934.

Average dew point for September 24th is 45 degrees F, with a maximum of 73 degrees F in 1958 and a minimum of 22 degrees F in 1928.

All-time state records for September 24th:

Scanning the state climatic data base: the all-time high for this date is 94 degrees F at New Ulm and Beardsley in 1935; the all-time low is 15 degrees F at Red Lake in 2000.

Word of the week: Fujiwhara Effect

This term named for Japanese meteorologist Dr. Sakuhei Fujiwhara describes the behavior of two or more tropical storms, hurricanes, or typhoons as their pressure patterns interact and they rotate around each other. In order for this to occur the storms typically have to be within 900 miles of each other. Storms that are close to equal strength may rotate around each other, depicting a pattern on satellite imagery that some term the "Fujiwhara dance." More often than not, when such storms come close together, the stronger one will absorb the other. For a time in August it looked like tropical storms Gaston and Hermine might embarked in a Fujiwhara dance, but in the end Gaston swallowed up the smaller circulation of Hermine.

Outlook:

A more fall-like period is in store beginning this weekend. A drier pattern should prevail for several days along with temperatures close to seasonal averages. Mostly sunny skies too. Chance of rainfall later in the week.

To: Morning Edition  
From: Mark Seeley  
Re: Topics for MPR's Morning Edition, Friday, Oct 1, 2004

Topic: Probably setting a new annual tornado record....

All of the tropical storms and hurricanes making landfall in the United States over the past two months have greatly increased the number of tornadoes reported by the NOAA Storm Prediction Center. A new record was set for number of tornado reports in August with 173, and it appears a new record number will be reported in September, as the count currently stands at 243, nearly five times the historical average for the month. The total reported in the United States for the year is currently at 1512 a number that already surpasses the record year of 1998 (1472).

Topic: September is one for the record books...

After four consecutive months with cooler than normal temperatures, September was a complete reversal. Average temperatures for the month ranged from 3 to 7 degrees F above normal. September produced more days with 80 degrees F or higher than any month but July... a very rare weather pattern for Minnesota summer. The warm month literally rescued much of the corn and soybean crop. Extremes for the month ranged from 93 degrees F at Browns Valley on the 2nd to just 19 degrees F at Embarrass on the 28th.

The month was very wet for most places, many reporting over twice the average rainfall. A flash flood event hit parts of Jackson, Martin, Blue Earth, Faribault, Waseca, Freeborn, Steele, Mower, Dodge, Olmsted, Fillmore, Winona, and Houston Counties on the 14th and 15th. Some locations that reported one of the wettest Septembers ever included the Marcell Forestry Station and Bricelyn, both reporting over 10 inches; Fairmont, Albert Lea, and Fergus Falls, all reporting 9 to 9.5 inches; Itasca State Park, Leech Lake, Lakefield, and Worthington, all with approximately 8.5 inches; and Winnebago which reported over 8 inches.

The final days of the month brought frost to many communities and Embarrass reported the coldest temperatures in the nation (outside Alaska) on the 28th (19 degrees F) and the 29th (20 degrees F).

By the end of the month, most of the Minnesota landscape had shed the excess moisture and crops were at or near maturity with some areas ready to harvest. Yield potential of both corn and soybeans looks to be much better having benefitted from the late summer warm spell.

Topic: Special program at the Bell Museum next week....

The Bell Museum at the University of Minnesota has initiated a

program called Science and Popular Culture. Activities include Cafe Scientifique, casual discussions with university scientists about current research and Science on Screen, the viewing of motion pictures along with a discussion of the science portrayed in them.

Next Wednesday, October 6th in the Bell Museum's auditorium will be the first installment of the Science on Screen series with a showing of climate change disaster film "The Day After Tomorrow" at 7:00 pm. There will be discussion about the science portrayed in the film, including comments by Dr. Mark Seeley of the university's Department of Soil, Water, and Climate. There will also be comments about the film's artistic merits by Jamie Hook, artistic director at Minnesota Film Arts. More information can be found at....

<http://www.bellmuseum.org/>

MPR listener question: How often do we see measurable snowfall during the month of October in the Twin Cities area?

Answer: The Twin Cities climate record back to 1884 shows that measurable snowfall occurs in October about 35 percent of the time (42 years). Most of the time this is due to a singular snowfall event during the month, such as the famous Halloween Blizzard of 1991 that deposited 8.2 inches of snowfall on the 31st. On occasion, Octobers can be quite winter like. For example in 1917, the 2nd coldest October in the Twin Cities record, there were four measurable snowfalls, ten days with a trace of snowfall, and eleven days when the temperature never got out of the 30s F. The most winter like October was in 1925, the coldest on record, when six measurable snowfalls occurred, five more days brought a trace of snow, nine days remained in the 30s F, and three days remained in the 20s F.....brrrr.

Twin Cities Almanac for October 1st:

The average MSP high temperature for this date is 67 degrees F (plus or minus 10 degrees standard deviation), while the average low is 46 degrees F (plus or minus 7 degrees standard deviation).

MSP Local Records for October 1st:

MSP weather records for this date include: highest daily maximum temperature of 87 degrees F in 1897; lowest daily maximum temperature of 45 degrees F in 1974 and 1999; lowest daily minimum temperature of 24 degrees F in 1974; highest daily minimum temperature of 61 degrees F in 1971; and record rainfall of 0.63 inches in 1907

Average dew point for October 1st is 43 degrees F, with a maximum of 66 degrees F in 1951 and a minimum of 19 degrees F in 1936.

All-time state records for October 1st:



Scanning the state climatic data base: the all-time high for this date is 93 degrees F at Madison (Lac Qui Parle County) in 1963 and at Browns Valley (Traverse County) in 1976; the all-time low is 10 degrees F at Moorhead in 1886.

Word of the week: Schneeflocke

The German word for snowflake will begin to appear later this fall in the German meteorological service forecasts and information statements.

Outlook:

Following some showers Friday and Saturday, a cool down starts that will bring another chance for frost to many areas. A few snow flurries may even occur in northern counties this weekend. Sunday morning will see a cool start to the Twin Cities Marathon with temperatures likely in the upper 30s to low 40s F, warming into the 50s F during the race. A cool and dry weather pattern will give way to some moderating temperatures and a chance for showers towards the end of next week.

To: Morning Edition  
From: Mark Seeley  
Re: Topics for MPR's Morning Edition, Friday, Oct 8, 2004

Topic: 12th Annual Kuehnast Lecture.....

The 12th Annual Kuehnast Lecture will be held at the University of Minnesota St Paul Campus on Tuesday, October 12th, from 3:30 to 5:00 pm in Rm 335 Borlaug Hall....the public is invited. The speaker this year is Dr. Wally Broecker one of the leading experts on the role of ocean circulation in climate change. His topic will be "The Role of Sea Ice in Global Climate." More information on this lecture series can be found at our web site....

[http://www.134.84.160.120/doc/journal/kuehnast\\_lecture/kuehnast.htm](http://www.134.84.160.120/doc/journal/kuehnast_lecture/kuehnast.htm)

Topic: Comment on the Twins-Yankees playoff and the weather....

The Twins won game one of the playoff series with defense and pitching. Shannon Stewart and Torii Hunter both made leaping catches against the outfield wall, robbing Yankee batters of extra base hits. The first night game in Yankee Stadium was played with temperatures in the low 50s F, so in the denser atmosphere fly balls to the outfield did not travel as far as they would have in the 70 degrees F of the Metrodome. According to some researchers all other things being equal, a baseball will travel about 4 feet farther for every 10 degrees F increase in temperature. The second night game played at Yankee stadium on Wednesday saw temperatures that were about 10 degrees F warmer, and indeed the ball did seem to travel farther...especially for the Yankees hitters as they won the game in extra innings. In the Metrodome this weekend, those fly balls will likely travel even further in the 70 degrees F temperature, unless of course the pitching dominates.

Speaking of which, Twins pitcher Johan Santana remarked that the cool temperatures in NY affected his ability to throw his deceptive changeup pitch, which he uses more effectively in warm temperatures. Thus, although the Metrodome may provide a better temperature environment for hitting homeruns, in Santana's case it may make him an even better pitcher in game four of the series.

Topic: Weather for the Lewis and Clark Expedition 1804-1806

Two recent papers in the Bulletin of the American Meteorological Society represent studies of the weather experienced on this most famous expedition, but set in the context of climatology. A paper by Solomon and Daniel shows that the careful observations and measurements of Lewis and Clark adequately captured the character of weather on the High Plains of America. Their data and interpretations still fit well with the documented

weather behavior in today's environment, except that winters have grown to be milder. Their observations of very desert-like dry air, large daily temperature ranges, and mountain range effects on wind patterns were quite valid.

The second paper by Paul Knapp presents an argument that Lewis and Clark were lucky when it comes to the weather. Their expedition took place between two extreme historical droughts across the High Plains, one in 1800 and the other in 1808-09. Thus they benefitted from adequate water flow in the Missouri River so they could navigate their boats relatively unencumbered by low flows and sand bars. A second and perhaps more important stroke of luck was that the precipitation pattern had favored abundant growth of vegetation and plentiful wild game. So for the most part, they were able to harvest food along the way.

Topic: New cloud stamps from the Post Office

Earlier this month (by the way it is National Stamp Collecting Month), the U.S. Postal Service issued the new "cloudscapes" postage stamps. They are beautiful. There are fifteen different cloud forms depicted in splendid colors. My favorites are Cumulonimbus mammatus, Altocumulus stratiformis, and Altocumulus lenticularis. Luke Howard who over 200 years ago invented the cloud classification scheme still used around the world is surely smiling down from heaven at this government salute to the majesty of clouds. The stamps are now available at the post office.

Back in 2001 the Royal Mail in England issued a series of weather stamps with heat-sensitive ink printed images of clouds, instruments, and outdoor scenes. The scenes on the stamps changed as they were exposed to different temperatures. This was supposed to exemplify the changeability of weather in that country.

MPR listener question: Does the probability for thunderstorms dramatically fall in Minnesota when we get to the month of October?

Answer: Not sure if I would call it dramatic, but it does tail off quite a bit. In the Twin Cities area we average about 40 days with thunder each year, but only two in October, or about 5 percent. We may hear some long about Tuesday next week.

Twin Cities Almanac for October 8th:

The average MSP high temperature for this date is 61 degrees F (plus or minus 10 degrees standard deviation), while the average low is 42 degrees F (plus or minus 8 degrees standard deviation).

MSP Local Records for October 8th:

MSP weather records for this date include: highest daily maximum temperature of 84 degrees F in 1966; lowest daily maximum temperature of 42 degrees F in 1925 and 1977; lowest daily minimum temperature of 27 degrees F in 1989; highest daily minimum temperature of 69 degrees F in 1997; record rainfall of 1.43 inches in 1970; and record snowfall of 0.3 inches in 1959.

Average dew point for October 8th is 41 degrees F, with a maximum of 68 degrees F in 1949 and a minimum of 17 degrees F in 1932.

All-time state records for October 8th:

Scanning the state climatic data base: the all-time high for this date is 90 degrees F at Long Prairie (Todd County) in 1905 and at Montevideo (Chippewa County) in 1980; the all-time low is 11 degrees F at Angus (Polk County), Roseau (Roseau County), and Hallock (Kittson County) in 1917.

Word of the week: Meteorological philately

Some who like watching the weather also like collecting stamps. Many nations over the years have issued special stamps that depict sky conditions, storms, winds, lightning, weather instruments, snowflakes, weather researchers, and the like. Meteorological philately is simply a specialized field of stamp collecting.

Outlook:

Fall like weekend with temperatures somewhat near normal and plenty of sunshine. A chance for showers next Tuesday and Wednesday followed by much cooler temperatures and more frosts.

To: Morning Edition  
From: Mark Seeley  
Re: Topics for MPR's Morning Edition, Friday, Oct 15, 2004

#### HEADLINES:

- Record cold in the north
- Anniversary of a historical blizzard
- Blizzard climatology
- Snow and freezing rain question
- Proteus monitoring of high clouds
- Outlook

Topic: Record cold this week....

International Falls tied their record low temperature on Thursday, October 14th with a reading of 21 degrees F. On the same date, Embarrass, MN reported just 18 degrees F, the coldest reading in the contiguous 48 states.

Topic: Anniversary of the worst ever October blizzard...

One hundred and twenty-five years ago today, the most severe October blizzard struck southwestern Minnesota counties. It was even worse in eastern SD and northwestern IA. The storm started out as rain on Friday the 15th, changing over to snow during the night and into the 16th. Wind gusts up to 70 mph accompanied the storm and helped produce snowdrifts from 10 to 20 ft high across southwestern counties, and wind chill readings approaching 0 degrees F. A barometric pressure of just 28.65 inches was recorded in the Twin Cities area. Wind whipped waves caused extensive damage to ships on the Great Lakes.

The wind driven, compacted snow blocked railroads for several days, brought down telegraph lines, and collapsed the roofs of many buildings. The snow never completely melted, marking one of the longest winters ever with continuous snow cover along the Minnesota river valley, and set up one of the coldest Novembers in state history. Consequently, there was widespread flooding during the snowmelt period in the spring of 1881.

Topic: Blizzard climatology

For a storm to be classified as a blizzard, there must be winds of 35 mph or greater, falling snow or blowing and drifting snow that reduces visibility to 1/4 mile or less, and persistence of such conditions for a period of at least 3 hours. Often such storms also produce dangerous wind chill conditions and large drifts of snow.

Climatologists have studied the historical frequencies of

such storms and found that North Dakota and South Dakota lead the nation, averaging 2-3 blizzards per year. I guess this should not be surprising given the very open and exposed landscapes and the fact that South Dakota used to call itself "the Blizzard State" (not exactly a smart marketing ploy). Next in historical frequency are Nebraska, Iowa and Minnesota, averaging 1-2 blizzards per year.

Most blizzards originate out of the intensification of Alberta low pressure systems or Colorado low pressure systems, both of which track over the high plains states. The highest frequency of blizzards in recent years was the winter of 1996-1997 when the National Weather Service issued 14 separate blizzard warnings for the state of Minnesota. Maximum snow deposition rates during a blizzard can approach 3 inches per hour. Fortunately, this type of storm usually lasts a few hours, but on occasion can last for 1 or 2 days.

MPR listener question: I recently moved to Minnesota from Alaska and by this time of year up there we would usually have recorded some freezing rain and/or snow. When does this usually occur in Minnesota?

Answer: First snows occur about 50 percent of the time over the last few days of October in far northern counties like Koochiching, St Louis, Lake and Cook. Elsewhere they are later in the fall. For example at Winona in southeastern Minnesota the first snow occurs by the third week of November about 50 percent of the time.

Freezing drizzle and freezing rain season starts in October around Minnesota, but these events are rare. Historically, less than 0.1 percent of freezing rain events have occurred in the month of October. Peak months for the occurrence of freezing rain or freezing drizzle in Minnesota are November, December, and March. But the historical frequencies are relatively low, averaging from 30 hours per year of freezing rain conditions in southwestern Minnesota to about 50 hours per year in the northeastern counties. Unfortunately, studies of the historical frequencies, show that peak occurrence times are 5:00 am to 8:00, right during the morning commute hours.

Our National Weather Service issues a freezing rain or drizzle advisory when they expect total ice accumulations to be less than 1/4 inch. If ice accumulation is expected to exceed that amount, they issue an ice storm warning.

Twin Cities Almanac for October 15th:

The average MSP high temperature for this date is 62 degrees F (plus or minus 11 degrees standard deviation), while the average low is 42 degrees F (plus or minus 8 degrees standard deviation).

MSP Local Records for October 15th:

MSP weather records for this date include: highest daily maximum temperature of 85 degrees F in 1947 and 1968; lowest daily maximum temperature of 40 degrees F in 1943; lowest daily minimum temperature of 26 degrees F in 1974; highest daily minimum temperature of 66 degrees F in 1968; record rainfall of 1.24 inches in 1966; and record snowfall of 0.3 inches in 1992.

Average dew point for October 15th is 41 degrees F, with a maximum of 69 degrees F in 1962 and a minimum of 13 degrees F in 1952.

All-time state records for October 15th:

Scanning the state climatic data base: the all-time high for this date is 93 degrees F at Madison (Lac Qui Parle County) in 1958; the all-time low is just 8 degrees F at Alborn (St Louis County) in 1937.

Word of the week: Proteus

Best known in Greek mythology as the sea god who could change his appearance, this name is given to the new heavily instrumented, high altitude aircraft used to learn more about the role of clouds in the Earth climate system. It was designed by Burt Rutan, who also designed the SpaceShipOne rocket plane the first privately financed spacecraft to leave Earth's atmosphere (earlier this month) and win a \$10 million prize.

The Proteus is an airplane made from a light, but strong composite material and is capable of cruising at altitudes as high as 63,000 ft. It will make measurements of the character of high clouds, including their radiative properties. In global climate research it is important to know the climate feedbacks induced by changes in cloud cover. It is thought that high clouds will have a significant positive feedback, reinforcing the warming due to greenhouse gases, but the magnitude of this effect is somewhat uncertain. Researchers funded through the Department of Energy hope to gain new insights about the role of high clouds when they analyze all of the data collected from the flights of Proteus.

Outlook:

Strong northerly flow is expected to dominate the period ahead, bringing us colder than normal temperatures. There will be a chance for rain showers and/or snow showers over the weekend, with some gusty winds. Continued cold temperatures are expected next week, though some moderation should set in for Tuesday through Thursday when increased cloudiness will bring a chance for rain.

To: Morning Edition  
From: Mark Seeley  
Re: Topics for MPR's Morning Edition, Friday, Oct 22, 2004

HEADLINES:

- New Seasonal Climate Outlook
- 2004 Tornado Numbers
- Fall chores
- Wettest places in Minnesota
- Scottish forecast terminology
- Weather Outlook

Topic: New Seasonal Climate Outlook from CPC

The new seasonal climate outlook for November, December, and January was released by the Climate Prediction Center (CPC) on Thursday this week.....

Our area of the western Great Lakes has equal chances of warmer or colder than normal temperatures for the period. The month of November is expected to be drier than normal, but the outlook for early winter through January shows equal chances for wetter or drier than normal conditions in our region.

Topic: 2004 Tornado Numbers....

The National Weather Service reports 57 tornadoes in Minnesota so far this year, 39 of which were classified as F0 (winds less than 73 mph). There have been just two F3 (winds from 158-206 mph) tornadoes, one on May 19 in the NW corner of Kittson County near Humboldt and the other on June 11 in Mower County near LeRoy.

The 57 tornadoes are the second highest annual number reported in the state since the new radars (Doppler WSR88D) were installed in the 1990s. The record number was 74 in 2001.

Nationally, the 2004 tornado count now exceeds 1525 which is a new record number for the United States.

Topic: Weather driven fall chore list.....

As opposed to the pattern seen in September, temperatures so far this month are averaging somewhat colder than normal.

Now that mean daily soil temperature has declined into the 40s F (at the 4 inch depth) some farmers may be considering the application of fall nitrogen (primarily in the form of anhydrous ammonia). Though there may yet be some warm spells ahead of us, none appear to be too extreme, so soil temperatures are likely to stabilize if wetted down by precipitation, or decline as they



dry out. Similarly, home gardeners who plant bulbs or mulch their gardens should be doing so very soon.

In fact there are a number of fall chores that gain a sense of urgency when the temperature declines rapidly in the fall, including,

- Outdoor painting which typically requires 50 degrees F
- Taking in the dock and winterizing the cabin at the lake
- Putting up the storm windows
- Cut, split, and stack firewood, clean the fire place
- Covering the air conditioner, checking the furnace
- Caulking around doors and windows
- Stocking up on deicer, salt, or grit for sidewalks and driveways
- Checking the car's coolant system and flushing it if necessary
- Considering new winter wiper blades
- Cleaning the leaves out of gutters
- Raking the leaves from the yard
- Cleaning grain storage areas
- Checking heating systems in livestock buildings
- Putting the winter survival kit back in the car
- Testing the snow thrower
- Inventory your winter wardrobe

MPR listener question: What are the ten wettest places in MN?

Answer: Not sure of the context of this question...this year?  
or historically (climatologically)?

This year the ten wettest places (through October 20th) are..

Winona 44.09"	La Cresecent 43.18"	Albert Lea 41.81"
Harmony 40.74"	Waseca 40.31"	Preston 38.79"
Mankato 37.26"	Byron 37.26"	Caledonia 37.11"
Rochester 36.34"		

These amounts make 2004 one of the top ten wettest years for most of these communities.

Historically, using average values from the 1971-2000 period, the wettest places in Minnesota are not terribly different from what is occurring this year, mostly showing southeastern communities.....the top ten based on climatology are...

Caledonia 34.99"	Grand Meadow 34.65"	Lanesboro 34.58"
Preston 34.29"	Winona 34.20"	La Crescent 34.15"
Rushford 33.99"	Harmony 33.47"	Wabasha 33.45"
Hokah 33.26"		

Twin Cities Almanac for October 22nd:

The average MSP high temperature for this date is 56 degrees F (plus or minus 12 degrees F standard deviation), while the average low is 39 degrees F (plus or minus 9 degrees F standard deviation).

MSP Local Records for October 22nd:

MSP weather records for this date include: highest daily maximum temperature of 81 degrees F in 1992; lowest daily maximum temperature of 31 degrees F in 1936; lowest daily minimum temperature of 20 degrees F in 1936; highest daily minimum temperature of 60 degrees F in 1914; record rainfall of 0.69 inches in 1957; and record snowfall of 1.6 inches in 1925. The worst wind chill conditions on this date were -4 degrees F in 1917.

Average dew point for October 22nd is 38 degrees F, with a maximum of 60 degrees F in 1914 and a minimum of 12 degrees F in 1936.

All-time state records for October 22nd:

Scanning the state climatic data base: the all-time high for this date is 87 degrees F at St Peter (Nicollet County) in 1947; the all-time low is just 0 degrees F at Meadowlands (St Louis County) in 1937.

Words of the week: snell and shoosh

These words sometimes appear in Scottish weather forecast narratives. Instead of calling a cold wind sharp, biting, piercing, or penetrating, they may simply refer to it as a snell wind, particularly if it is coming off the North Sea. Similarly, as we call the absence of wind a calm condition, they refer to it as a shoosh condition, meaning no measurable wind speed.

Outlook:

Good chance for showers on Saturday, some lingering into early Sunday. Then, mostly dry with seasonal temperatures until Wednesday. Mid week brings another chance for showers, followed by cooler temperatures toward the end of next week.

To: Morning Edition  
From: Mark Seeley  
Re: Topics for MPR's Morning Edition, Friday, Oct 29, 2004

HEADLINES:

- Preliminary Climate Summary for October
- Goodbye to Daylight Savings Time
- Election Day Weather
- Halloween Weather
- Bombogenesis
- Weather Outlook

Topic: Preliminary Climate Summary for October

October was cloudy with less than average sunshine. Monthly temperature averages reported around the state were close to normal. Extremes ranged from 15 degrees F at Litchfield on the 17th to 81 degrees F at Moorhead, Grand Rapids, and Milan on the 6th. Minnesota reported the lowest temperature in the 48 contiguous states on the 15th and 17th.

Precipitation in October has been mostly less than normal, but it appears the end of the month will bring more. On Thursday October 28 many counties in central MN were receiving rainfall amounts ranging from 2 to 4 inches.

Some locations in St Louis, Cook, and Lake Counties reported snow earlier in the month. Soil moisture reserves in the top 5 ft of soil are estimated to range from 5 to 8 inches of water, with the higher values in the southern third of the state.

Topic: Daylight Saving Time

Daylight Saving Time comes to an end this Sunday. Set your clock back one hour before going to bed Saturday night. Advancing the clock by one hour for the April through October period has been shown to improve our use of the evening hours for outdoor activity and also to reduce our home energy use (because of more daylight in the after dinner hours and before bedtime) during the Daylight Saving Time months.

Standard time zones in the United States were first proposed by the railroads in 1883 in order to help standardize their schedules. The International Prime Meridian Conference in Washington during 1884 helped establish the standard time zones (based on the 0 degree meridian of longitude at Greenwich, England) throughout the world. In 1918 Congress officially adopted the standard time zones proposed by the railroads, along with the summer usage of Daylight Saving Time to conserve energy resources. Daylight Saving Time was unpopular that year (people got up earlier and went to bed earlier than today), and it was repealed in 1919. Daylight Saving Time was again adopted

by many states during World War II to save energy. The Uniform Time Act of 1966 established the use of Daylight Saving Time based on the last Sunday of April and last Sunday of October. It was amended in 1986 to start on the first Sunday of April.

Today, over 70 countries observe some form of Daylight Saving Time. Most equatorial countries do not, because the length of day varies so little throughout the year. Some MPR listeners have asked if the time change causes a problem among government weather services in reporting their data. Not really. The World Meteorological Organization mandates that all government weather services remain on international standard time (Universal Time) throughout the year. They do adjust some hourly reporting to accommodate the media, but their official data and reports are geared on a midnight to midnight calendar date using standard time.

More on Daylight Saving Time can be found at the following web site...

[www.webexhibits.com/daylightsaving](http://www.webexhibits.com/daylightsaving)

Topic: Weather during November election week in Minnesota

How many times have we heard the weather take the blame for an undesirable outcome....."housing starts were down this quarter due to bad weather in the east"....."food prices will be higher due to poor growing season weather"... "the space shuttle landing was postponed due to foul weather" ...."construction costs were higher because of weather delays." But the one I can't stand is "voter turnout was low due to poor weather conditions." This is the case more often in other states rather than in Minnesota, where the relative voter turnout nearly always looks pretty good in national statistics.

With the possible exception of parenting our children, what's more important than using our right to vote? Albeit if weather conditions are dangerous, such as a blizzard, then voters may be justified in staying home, but I can't buy uncomfortable or inclement weather as an excuse.

Historically, election day has varied from the 2nd of November to the 8th of November. In Minnesota, high temperatures are typically in the 40s with lows in the 20s and 30s (MSP averages are 48 F and 33 F, respectively). There is frequently little or no precipitation, but there have been some notable exceptions of rather harsh weather in terms of both precipitation and temperature. Both 1892 and 1936 were quite cold with temperatures in the single digits to teens F, while 1901, 1910, 1911, 1933, 1951, 1959, and 1991 were all notable for being quite cold, windy, and snowy during election week. The major national election in 1936 was perhaps the most dramatic case of voters facing difficult weather conditions in Minnesota. The days preceding election day had been cold, snowy, and icy. Heavy snows and glaze occurred in northern, western, and central counties during the first three days of November and near record setting cold temperatures accompanied the storms. Election morning lows (Nov 3) were in the single digits to teens. The streets and sidewalks were

pretty icy from recent snows and the wind chill index was well below zero all day and in the dangerous category (colder than -25) in some places. Yet, the voter turnout was over 1.1 million in Minnesota, probably over 70 percent of those eligible. Way to go Minnesota!

MPR listener question: What are the averages and extremes of weather for Halloween in the Twin Cities?

Answer: The average max/min temperatures on Halloween are 51 and 35 degrees F, respectively. Precipitation occurs about one third of the time (35 of the past 108 years). A trace or more of snow has fallen on seven Halloweens since 1891, the largest being 8.2 inches during the onset of the Halloween Blizzard of 1991. The past six Halloweens have been dry. The warmest Halloween was in 1950 when the afternoon temperature hit 83 degrees F. The coldest Halloweens were 1951 (with a hi/lo of 30 and 18 degrees F) and 1996 (with a hi/lo of 32 and 16 degrees F). However the coldest feeling Halloween was probably in 1905 when the combination of temperature (25 F) and wind (25 mph) produced a windchill value of only 9 degrees F...of course trick or treating was not so big back then.

Twin Cities Almanac for October 29th:

The average MSP high temperature for this date is 53 degrees F (plus or minus 11 degrees F standard deviation), while the average low is 35 degrees F (plus or minus 9 degrees F standard deviation).

MSP Local Records for October 29th:

MSP weather records for this date include: highest daily maximum temperature of 78 degrees F in 1922; lowest daily maximum temperature of 25 degrees F in 1925; lowest daily minimum temperature of 15 degrees F in 1925; highest daily minimum temperature of 56 degrees F in 1974; record rainfall of 1.01 inches in 1896; and record snowfall of 5.5 inches in 1905.

Average dew point for October 29th is 35 degrees F, with a maximum of 64 degrees F in 1946 and a minimum of 6 degrees F in 1988.

All-time state records for October 29th:

Scanning the state climatic data base: the all-time high for this date is 85 degrees F at Marshall (Lyon County) in 1937; the all-time low is just -3 degrees F at Campbell (Wilkin County) and at Pipestone (Pipestone County) in 1925.

Word of the week: Bombogenesis

This term is used by meteorologists to describe an extreme case of cyclogenesis, the deepening or intensification of a mid-latitude cyclone (low pressure system). When this happens, typically in the October to March time frame, weather can change rapidly for the worse. Often times this happens along the boundary between cold, polar air and subtropical air. One criteria used to define bombogenesis is the

rapid drop in atmospheric pressure, equivalent to 24 mb (about 0.7 inches on a home barometer) over a 24 hour period. This naturally intensifies the wind field around the low producing wind driven rain or snow.

#### Outlook:

Cooling down over the weekend with some scattered showers around the state. Halloween Sunday should be dry most places with temperatures in the 40s to low 50s F. Chance for more showers on Monday, and perhaps some rain and/or snow flurries on Tuesday (Election Day). More widespread precipitation (rain or snow) toward the middle and end of next week with cooler temperatures.

To: Morning Edition  
From: Mark Seeley  
Re: Topics for MPR's Morning Edition, Friday, Nov 5, 2004

HEADLINES:

- wet in the west and northwest counties
- snow season starting in places
- remembering the storm of November 7, 1986
- November 5th Almanac
- question on the pitch of thunder
- arkllatex
- Weather Outlook

Topic: Wet in the Red River Valley

Thanks to some very heavy rainfalls at the end of October much of West Central Minnesota and the Red River Valley area in the northwest finds itself in an extreme moisture surplus going into the winter. Total rainfall for the months of September and October set new historical records at the following climate stations.....

Itasca State Park 13.82 inches	Artichoke Lake 9.24 inches
Fergus Falls 12.88 inches	Wheaton 10.90 inches
Montevideo 11.41 inches	Browns Valley 11.04 inches

In addition, gages along the Red River report flow values near record highs for this time of year and stored soil moisture values in the top 5 ft are estimated as high as 7-8 inches. This surplus of moisture going into winter will enhance the risk of spring flooding if this region receives a great deal of snowfall during the winter.

Topic: Snow falling in places already....

Tuesday, November 2nd (Election Day), brought up to 10 inches of snow to the Texas Panhandle area, the first snow of the season. It dropped the temperatures into the 20s F overnight. Wet snow was moving across northern Ontario Canada on Wednesday and across northern sections of Russia northwest of Lake Baikal where several inches had accumulated.

The mean date for the start of the snow accumulation season in northern Minnesota counties ranges from October 27th along the Canadian border to November 4th around the Headwaters Lakes of the Mississippi River in Itasca County. Snow looks like a possibility in these areas next week.

Topic: Remembering the snow, ice, and blizzard of November 7, 1986

Eighteen years ago this Sunday as the deer hunting season opened in Minnesota a strong storm system brought blizzard conditions to northwestern counties and, in southern counties produced thunder,

rain, ice, and damaging winds. The blizzard primarily affected the northern Red River Valley area where it dropped up to 11 inches of snowfall after coating power lines with thick ice. There were numerous power outages and road closures between Thief River Falls and Alexandria. In central and southern Minnesota high winds did considerable damage. The Twin Cities and Rochester recorded winds over 65 mph. Roofs were blown off buildings, barns collapsed, trees were downed, and cars and trucks blown off highways. The storm was well forecasted and there were no fatalities associated with it. It was a memorable deer hunting opener for those who braved these conditions out in their deer stands.

MPR listener question: I recently moved from the Twin Cities to Finland to participate in a year-long research project. We experienced a fine thunderstorm here but the pitch of the thunder was higher than I have ever heard, somewhat like comparing a viola to a low throated cello. Anyway, is the different pitch of thunder an effect of latitude?

Answer: There is no single factor that determines the pitch of thunder. Several characteristics come into play, including the orientation and width of the lightning stroke, the distance from you, and the doppler effect, among others. If the lightning stroke is powerful it cuts a wider channel through the atmosphere producing a low-pitched shock wave, while a narrow channeled lightning stroke produces a higher pitch. The sound wave from thunder is modified by atmospheric characteristics (pressure and wind mostly) that cause scattering, refraction, reflection, and attenuation. Generally, the closer the lightning is to you the higher the pitch in the sound you hear. Lastly, the doppler effect changes the pitch as well. If the lightning that produced thunder is moving towards you, the pitch is generally higher. When its motion is away from you it lowers the pitch.

If there is a latitude effect on the sound of thunder in Finland compared to that of Minnesota it may have to do with differences in atmospheric density, water vapor, and wind between the two locations, all of which might lead to variation in attenuation, reflection, refraction, and scattering of the sound. However, it might also have to do with the size and shape of the lightning, or your position relative to it.

Twin Cities Almanac for November 5th:

The average MSP high temperature for this date is 47 degrees F (plus or minus 10 degrees F standard deviation), while the average low is 30 degrees F (plus or minus 8 degrees F standard deviation).

MSP Local Records for November 5th:

MSP weather records for this date include: highest daily maximum temperature of 71 degrees F in 2001; lowest daily maximum temperature of 26 degrees F in 1935; lowest daily minimum temperature of 3 degrees F in 1951; highest daily minimum temperature of 48



degrees F in 1918; record rainfall of 0.93 inches in 1948; and record snowfall of 4.2 inches in 1959. There have been twelve measurable snowfalls on this date.

Average dew point for November 5th is 29 degrees F, with a maximum of 55 degrees F in 1956 and a minimum of 0 degrees F in 1951.

All-time state records for November 5th:

Scanning the state climatic data base: the all-time high for this date is 78 degrees F at Madison (Lac Qui Parle County) in 1975; the all-time low is -16 degrees F at Detroit Lakes (Becker County) in 1951.

Word of the week: Arklatex

This is obviously an acronym used by meteorologists, but what does it mean? It refers to a specific area of the country where Arkansas, Louisiana, and Texas, share a common border. Quite often mesoscale convective system (MCS) composed of numerous thunderstorms may cluster over this area. On occasion low pressure systems will track over this area picking up ample Gulf moisture to carry into the southeastern states and produce prolific rainfalls.

Outlook:

Generally a pleasant fall day on Saturday, with mild temperatures. A bit cooler on Sunday under partly cloudy skies, still dry most places through Tuesday with near seasonal temperatures. Increasing cloudiness on Wednesday with a better chance for rain showers or snow showers, then turning much colder later in the week.

To: Morning Edition  
From: Mark Seeley  
Re: Topics for MPR's Morning Edition, Friday, Nov 12, 2004

HEADLINES:

- A warm, record-setting November day
- A Warm Winter Climate Trend
- Winter Hazard Awareness Week
- Q/A The wettest day in November
- Almanac for November 12
- Attery
- Weather Outlook

Topic: A very pleasant November 6th indeed!

Last Saturday (November 6) was magnificent for wrapping up fall outdoor chores around here in Minnesota.....Mankato set a new high with 74 F, Red Wing a new record high with 70 F, and Sioux Falls a new record with 73 F. Also the following communities tied their record highs for the date....A number of Minnesotans ignored their fall chores and went out to play golf!

Redwood Falls 72 F (tied 1934)  
Faribault 70 F (tied 1934 and 2001)  
Waseca 72 F (tied 1916)  
Winnebago 73 F (tied 1916 and 1934)....

Topic: Warm Winter Climate Trend....

The exceptionally fine day last Saturday (November 6) reminded me that we have had eight consecutive Novembers in the Twin Cities area that have been conducive to golf on at least one day (also gaged by a number of Metro area courses that remain open). This trend has been mostly unprecedented historically (granted that long ago Minnesota golfers may not have been so fanatical about golfing in the late fall season). Since 1997 58 percent of all November days in the Twin Cities area have seen daily temperatures that are warmer than normal, on occasion 25 to 30 degrees F above normal. These statistics are somewhat dominated by the fact that 2001 and 1999 mark the two warmest Novembers in Twin Cities climate history. An examination of more statistics reveals that this trend for above normal temperatures is even more pronounced in some of the other winter months.

Since the El Nino winter of 1997-1998 when the December through February period brought the warmest winter temperatures statewide in over 100 years, the trend for above normal temperatures in these months has been remarkable. Sixty-nine percent of all days in the months of December and February (nearly 7 out of every 10 days) have seen above normal temperatures. The seven year run of January temperatures shows that 63 percent were above normal.

These percentages are higher than those of any other months during this time period (1997-2003). This high frequency of above normal temperatures during the winter months can be attributed to both high daytime temperatures, especially in the absence of snow cover, and also to high overnight minimum temperatures, most often with the presence of cloud cover.

This trend has translated into a significantly reduced number of Heating Degree Days (accumulation of daily mean temperature below 65 F), an index often used to estimate home and commercial heating needs. The table below summarizes the Heating Degree Days (HDD) for the Twin Cities during the December through February (peak) period each winter from 1997-1998 to 2003-2004. The percentage of normal HDD figure is based on the 1971-2000 average....

Winter Period (DEC-FEB)	Total HDD	Percentage of Normal for the Period
1997-1998	3504	81%
1998-1999	3908	90%
1999-2000	3799	88%
2000-2001	4640	107%
2001-2002	3416	79%
2002-2003	4101	95%
2003-2004	4144	96%

Average HDD over this period equates to 91 percent of normal, with only one year showing above normal values.

The warm season months of July, August, and September show a modest trend for above normal temperatures, ranging from 54 to 57 percent of all days with positive temperature departure over the seven year period (1997-2003). However, when these statistics are dissected further, it is clear that positive departures in minimum temperature are contributing more to this trend than those of maximum daily temperature. This suggests that in the summer months higher water vapor content of the atmosphere, more overnight cloud cover, or perhaps increased heat storage of the Metro Area landscape may be amplifying the trend in overnight minimum temperature.

Topic: Winter Hazard Awareness Week

As we enter the winter storm season in Minnesota, the National Weather Service has been providing background information on safety and precaution measures for dealing with winter weather. Their web site provides a wealth of information concerning home care, preparing your vehicle for winter, advice on driving, and outdoor safety tips. This information can be found at...

<http://www.crh.noaa.gov/mpx/whaw.html>

MPR listener question: What is the greatest amount of daily precipitation from a single storm in the month of November?

Answer: During this week a number of people marked the anniversary of the Edmund Fitzgerald storm (November 10, 1975) and the Armistice Day Blizzard (November 11, 1940), both of which were truly historical events in our weather history. The total precipitation from each of these storms was substantial, 2.80 inches at Minnesota City in Winona County from the Edmund Fitzgerald Storm and 2.52 inches from the Armistice Day Blizzard recorded in the Twin Cities. Another likely candidate for the wettest day in the month is November 1, 1991, the middle of the famous Halloween Blizzard. In the town of Winona that storm deposited 3.28 inches of precipitation.

However none of these storms fit the answer to the question. We have to look deeper into Minnesota weather history, at Thanksgiving Day (November 26) of 1896. On that date in southern Minnesota a freakish convective storm developed, producing thunder, lightning, sleet, ice, and rain. And it rained cats and dogs, 2.55 inches at New Ulm, 3.12 inches at Pleasant Mound in Blue Earth County, and an incredible 4.80 inches at Worthington in Nobles County, a statewide daily record for November. The temperature started out in the 30s F but fell throughout the day and when the precipitation turned to ice it left up to a 1 inch ice coating in Worthington. This remains the only documentation of a 4 inch daily rainfall in the state during the month of November, truly a climatic singularity.

Twin Cities Almanac for November 12th:

The average MSP high temperature for this date is 41 degrees F (plus or minus 11 degrees F standard deviation), while the average low is 27 degrees F (plus or minus 10 degrees F standard deviation).

MSP Local Records for November 12th:

MSP weather records for this date include: highest daily maximum temperature of 65 degrees F in 2001; lowest daily maximum temperature of 11 degrees F in 1911 and 1940; lowest daily minimum temperature of -4 degrees F in 1966; highest daily minimum temperature of 44 degrees F in 1964; record rainfall of 0.90 inches in 1965; and record snowfall of 8.5 inches in 1940. There have been 12 measurable snowfalls on this date since 1891, the most recent being 0.6 inches last year. Greatest snow depth on this date was 16 inches in 1940. Worst wind chill conditions occurred in 1911 with a value of -23 F.

Average dew point for November 12th is 26 degrees F, with a maximum of 51 degrees F in 1951 and a minimum of -9 degrees F in 1986.

All-time state records for November 12th:

Scanning the state climatic data base: the all-time high for this date is 74 degrees F at Faribault (Rice County) in 1923; the all-time low is -26 degrees F at Tower (St Louis County) in 1995.

Word of the week: Attery

This is taken from the old Anglo Saxon word 'atter' meaning poison or inflammation. The Scottish Meteorological Office will still occasionally use this term to describe a spell of stormy weather, implying that it is like a poisonous, or inflamed condition of the atmosphere. Usually November brings some form of "attery" weather to Minnesota, but there has been a conspicuous absence of it so far this month.

#### Outlook:

Mostly dry, sunny, and warmer than normal around the state over the weekend and into the middle of next week. The other shoe may drop toward the end of the week with increasing cloudiness and a chance for rain and snow.

To: Morning Edition  
From: Mark Seeley  
Re: Topics for MPR's Morning Edition, Friday, Nov 19, 2004

HEADLINES:

- New seasonal climate outlook
- Wine makers help climate research
- The blizzard of 1948
- Thanksgiving weather
- Q/A The frequency of November fog
- Almanac for November 19
- Haar
- Weather Outlook

Topic: New winter outlook

The NOAA Climate Prediction Center released a new winter outlook on Thursday (November 18) this week. For Minnesota they suggest a colder than normal December followed by equal chances for colder or warmer than normal January and February. The precipitation outlook also shows equal chances for wetter or drier than normal conditions through February. Bottom line is that uncertainty still reigns in making a winter season outlook.

Topic: Wine makers lend a hand in climate research

It was reported from France this week that researchers have evaluated historical records of the Pinot Noir grape harvest in the Burgundy Region for the period from 1370 to 2003. Many of these records had been preserved on vineyards, in churches and in village halls. The dates of the grape harvest are associated with summer warmth, earlier in hot summers, later in cold summers. These records revealed great historical variability, showing that very warm summers like the 1990s occurred in 1380s, 1420s, 1520s, and over much of the mid 17th Century. These proxy records for summer temperature matched up with tree ring data that goes back just as far.

Topic: Remembering the blizzard and heavy snow of 1948

On this date in 1948 southwestern Minnesota was in the grip of a very strong winter storm. Heavy snow was falling and winds were blowing from 20-35 mph. Dawson reported a snowfall of 19 inches on the 19th of November, a statewide record for the date. Total snowfall from this storm was near record amounts for three communities: Canby with 18.2 inches; Dawson with 21.0 inches, and Marshall with 24.0 inches.

Topic: Thanksgiving weather

Last week I noted the very heavy rainfall in southern Minnesota counties over Thanksgiving in 1896, one of the wettest holiday periods in Minnesota history. What are other climate features of the Thanksgiving holiday?

Average conditions based on climate history suggest daytime highs in the 30s and 40s F, with lows in the teens and 20s F. It is usually a dry day, though there is snow cover about 35-40 percent of the time.

Wednesday and Sunday either side of the holiday have evolved to become two of the heaviest travel days of the year. 37 percent of the Wednesdays preceding Thanksgiving have recorded measurable precipitation of some form, suggesting better than a 1 in 3 chance of encountering some form of storminess. 27 percent of these Wednesdays also show a measurable snowfall, the greatest being 11.4 inches in 1983. On the other hand, 26 percent of the Sundays following Thanksgiving show measurable precipitation of some form. 21 percent of the Sundays had measurable snowfall, with the greatest being 8.4 inches in 1985. In 1939, it wasn't snowfall which created travel problems, but very dense fog that lasted much of the day on the Sunday after the holiday and created numerous traffic accidents. Despite this incident, statistics suggest a higher probability of having reasonable travel weather on the Sunday after Thanksgiving than on the Wednesday before.

Regarding the Thursdays when Thanksgiving is observed, some rather extreme conditions have occurred. For example the afternoon high was only 4 degrees F in 1930 with a windchill factor ranging between -10 and -23 degrees, while in 1914 the afternoon high reached 62 degrees F under sunny skies.

The most snowfall on Thanksgiving was 4.6 inches in 1940 (the year of the Armistice Day Blizzard). One of the more pleasant Thanksgivings was 1988 when the mercury hit 52 degrees F and several families enjoyed a bit of the outdoors playing and picnicing in city parks.

The Friday and Saturday after the holiday have become two of the busiest shopping days of the year. Based on history, there is less than a 1 in 4 chance of having snowfall on Friday, and less than a 1 in 5 chance of having snowfall on Saturday following the holiday. So in relative terms, Mother Nature has been kind to shoppers. Friday, November 29, 1991 was not a pleasant shopping day, with 12.6 inches of snow falling. Neither was Friday, November 29, 1929 which produced a high temperature of only 4 degrees F with daytime windchills of -25 to -30 degrees, blowing snow reducing visibility and cars trying to negotiate icy streets. But then 1929 was probably before shopping became such a popular activity following the holiday.

Taken as a whole (Wed.-Sun.), the holiday period covering Thanksgiving shows a 57 percent occurrence of snowfall on at least one day and a 50 percent occurrence of snow covering the ground. From 1944 to 1958 there was measurable snowfall over every Thanksgiving holiday period, while from 1963 to 1974, no significant snowfalls were measured over the holiday period. Talk about streaky weather! In recent years snow cover at Thanksgiving has been lacking around the Twin Cities.

MPR listener question: I have a 31 mile commute into the Twin Cities each weekday morning and it seems this month I have had to drive in fog, sometimes heavy, several mornings. Has the frequency of fog been greater than normal this month?

Answer: Indeed, nearly everywhere in the state the frequency of fog this month has been greater than average. Granted November has a reputation for being cloudy, but it does not bring as much fog as December, February, and March. The average number of foggy days for November ranges from 1 to 4 around the state. Listed below are the number of days with fog reported from various locations through November 17, 2004..

St Cloud 9 days, Rochester 8 days, International Falls 8 days, La Crosse, WI 8 days, Austin 8 days, Dodge Center 8 days, Winona 7 days, Duluth 7 days, Twin Cities 7 days, Fargo-Moorhead 6 days, and Sioux Falls, SD 4 days. I am sure there will be a few more such days as well.

Twin Cities Almanac for November 19th:

The average MSP high temperature for this date is 40 degrees F (plus or minus 11 degrees F standard deviation), while the average low is 25 degrees F (plus or minus 11 degrees F standard deviation).

MSP Local Records for November 19th:

MSP weather records for this date include: highest daily maximum temperature of 65 degrees F in 1930; lowest daily maximum temperature of 13 degrees F in 1894; lowest daily minimum temperature of -5 degrees F in 1932; highest daily minimum temperature of 48 degrees F in 1930; record rainfall of 1.0 inches in 1983; and record snowfall of 6.2 inches in 1981. There have been 16 measurable snowfalls on this date since 1891. Greatest snow depth on this date was 10 inches in 1957. Worst wind chill conditions occurred in 1914 with a value of -24 F.

Average dew point for November 19th is 25 degrees F, with a maximum of 55 degrees F in 1930 and a minimum of -4 degrees F in 1921.

All-time state records for November 19th:

Scanning the state climatic data base: the all-time high for this



date is 74 degrees F at Montevideo (Chippewa County) in 1897; the all-time low is -29 degrees F at Roseau (Roseau County) in 1896.

Word of the week: Haar

Originally a Scottish term this one is for listeners who play scrabble. The term refers to a cold, fine drizzle or cooling sea fog which blows in from the North Sea in northeast England or eastern Scotland. It occurs most frequently in the summer but can occur in other seasons as well. It is somewhat analogous to the fog or mist that sometimes blows in to NE Minnesota off Lake Superior. The fog we had around the Twin Cities this week was a very wet one, often times turning into a mist.

Outlook:

Cooler over the weekend, but generally dry with some peeks of sunshine. Increasing clouds by Tuesday and Wednesday with a chance for precipitation in southern areas. Generally dry for Thanksgiving, then a chance for precipitation again by next weekend.

To: Morning Edition  
From: Mark Seeley  
Re: Topics for MPR's Morning Edition, Friday, Nov 26, 2004

HEADLINES:

- Preliminary November climate summary
- Soils on the verge of freezing
- Q/A on November tornadoes
- Almanac for November 26
- "Snaw" words
- Outlook

Topic: Preliminary Climate Summary for November...

Climate statistics for the month so far show most stations are averaging from 3 to 6 degrees F warmer than normal for the month. This continues a trend of above normal temperatures that started in September. The fall season has generally been significantly warmer than normal, following a cooler than normal summer. The last time such a yo-yo swing in seasonal temperatures occurred was in 1958.

Extreme temperatures for November so far have been 74 degrees F at Mankato on the 7th and 1 degrees F at Embarrass on the 24th.

Virtually all locations in the state report a drier than normal November so far. In fact some are approaching record setting dryness for the month. The following stations show very low values of total monthly precipitation, approaching or breaking records for the driest November.....

Location	Current Month Total Precip..	Lowest Ever November Precip..(yr)
Crookston	Tr	Tr (1901)
Fargo	Tr	0.04 (1967)
Moorhead	.05	Tr (1901)
Hibbing	.03	.15 (1954, 1972)
Red Lake Falls	.02	.04 (1916)
Warroad	.06	Tr (1976)

Though it has been drier than normal, with precipitation reported on only a few days for most, some locations have reported snowfalls. International Falls reports 1.0 inches, Babbitt reports 0.3 inches, and Littlefork 0.4 inches.

Topic: Soils on the verge of freezing up....

Recent downward trends in soil temperature suggest that the soil may be freezing up for the winter soon. Though deeper soil temperatures remain in the upper 30s to low 40s F, the top 2 inches of soil will be freezing over the next week, especially in the absence of any protective mulch or cover. Similarly

shallow lakes in central and northern Minnesota counties will begin to see more surface ice formations. Anybody with bulbs left to plant had better hurry up.....

MPR listener question: The Weather Channel reports that there have been nearly 1650 tornadoes in the United States this year, a new annual record. I understand Minnesota has reported 58 of these. Have we ever had tornadoes in November?

Answer: Yes, we have, but only three occurrences historically all the way back to 1880. The most recent instance was November 1, 2000 about 5:25 pm when a small F1 tornado (winds 73-112 mph) struck near Prinsburg in Kandiyohi County. It partially damaged a farm there. An F2 tornado (winds 113-157 mph) traveled along a path from Nashwauk in Itasca County to near Virginia in St Louis County between 3:00 and 4:00 pm on November 2, 1938. This tornado downed thousands of trees and moved a cabin 50 feet. Finally, the latest ever fall season tornado occurred on November 16, 1932 at Maple Plain in Hennepin County. This F2 tornado struck about 9:30 pm and destroyed a farm.

All three of these November tornadoes occurred on days with record or near record high temperatures in the 60s and dew points in the high 50s to 60s F.

The only three months of the year when tornadoes have never been reported in Minnesota are December, January and February.

Twin Cities Almanac for November 26th:

The average MSP high temperature for this date is 34 degrees F (plus or minus 10 degrees F standard deviation), while the average low is 20 degrees F (plus or minus 10 degrees F standard deviation).

MSP Local Records for November 26th:

MSP weather records for this date include: highest daily maximum temperature of 62 degrees F in 1914; lowest daily maximum temperature of 10 degrees F in 1898; lowest daily minimum temperature of -16 degrees F in 1977; highest daily minimum temperature of 39 degrees F in 1909; record rainfall of 1.76 inches in 1896; and record snowfall of 5.9 inches in 2001. There have been 34 measurable snowfalls on this date since 1891. Greatest snow depth on this date was 9 inches in 1983 and 1996. Worst wind chill conditions occurred in 1930 with a value of -30 F.

Average dew point for November 26th is 20 degrees F, with a maximum of 52 degrees F in 1909 and a minimum of -22 degrees F in 1977.

All-time state records for November 26th:

Scanning the state climatic data base: the all-time high for this date is 68 degrees F at Fairmont (Martin County) in 1914; the all-time low is -37 degrees F at Pokegam Dam (Itasca County) in 1903. The heaviest snowfall statewide on this date occurred just 3 years

ago (2001) When Granite Falls reported 19.5 inches.

Word of the week: Snawwreath and Snawbroo

These are terms Scottish meteorologists use in the winter season. Snaw is Scottish for snow. A snawwreath is the term for snowdrift, a feature we have yet to see this month. Broo is a Scottish term used to refer to water for cooking. Thus, snawbroo is melting snow, sometimes harvested in the old days for cooking, especially when the pump handle was frozen.

Outlook:

Mixture of precipitation in the eastern sections on Saturday, perhaps lingering flurries into Saturday night. Then generally dry for Sunday and much of next week with cooler temperatures, some lows into the single digits and teens.

To: Morning Edition  
From: Mark Seeley  
Re: Topics for MPR's Morning Edition, Friday, Dec 3, 2004

#### HEADLINES:

- The Significance of the Tower, MN Climate Station
- Books for the Holidays
- Snowy Decembers
- Q/A on Twin Cities Inversions
- Almanac for December 3
- Intortus
- Outlook

Topic: Tower, MN one of our signature climate stations....

Earlier this week the Associated Press ran a story about Tower's weather observer who is quitting and moving away after over 30 years of taking daily readings there. There was concern expressed about keeping up the record of observations from this remote climate station. Why the fuss?

Located just SW of Lake Vermillion in northern St Louis County, Tower's daily climate observations were begun by the state's Forest Service staff in January of 1895. Since that time there have been significant gaps in the data, but nevertheless Tower has acquired the reputation as one of the coldest places in Minnesota....indeed one of the coldest places in North America. Minnesota's national reputation for cold is heavily grounded in the Tower historical data, which contain 47 separate state low temperature records, including the state's all-time coldest reading of -60 degrees F on February 2, 1996. Tower also claims two of the state's record snowfall amounts, a remarkable 27 inches on April 17, 1961, and 16 inches on November 24, 1983.

During this year Minnesota has reported the coldest temperature in the contiguous 48 states on 42 dates, twelve of which are attributable to the readings at Tower. It is important for the National Weather Service to keep this unique climate station operating into the future. Hopefully, they will find an observer to carry on there.

Topic: Weather Books for the Holidays

Among weather enthusiasts, I know that the new book by Paul Douglas, "Restless Skies", has been sought by those holiday shoppers who were out last weekend. I imagine it is a popular selection for those interested in the weather. Another new book is out that might be escaping the holiday shoppers radar, "The Children's Blizzard" by David Laskin (Harper Colins Pub). This book combines weather and history in a retelling of the story of the January 12, 1888 blizzard that struck Iowa, Nebraska, South Dakota, and Minnesota and left scores of dead young people on the prairie. Horror, hardship, and

heroism are depicted in the story of this storm told from the accounts of five families. It too would make a good holiday gift.

Topic: Snowy Decembers

As recently as 2000 December brought over 30 inches of snowfall to the Twin Cities. But this was quite unusual. The average snowfall for December in the Twin Cities is just slightly over 10 inches. Including the Pioneer Era back to 1820, snowfall in December has only exceeded 30 inches three times: 1856, 1969, and 2000. In two of these years, 1856 and 2000, the abundant snowfall went hand in hand with very cold temperatures, producing average monthly values (7.6 F in 2000 and 8.7 F in 1856) that rank among the all-time coldest Decembers. In 1969, the record year for December snowfall with 33.2 inches, the mean monthly temperature was actually quite warm, averaging 20.3 degrees F.

Officially the outlook for this December appears to favor colder than normal temperatures, with equal chances for above or below normal snowfall, however the second week of the month is looking warm and wet, so perhaps we'll see some significant snowfalls soon. Of the most recent 20 Decembers, 13 have produced less than average monthly total snowfall.

MPR listener question: I live in St Paul and cross the High Bridge nearly every weekday morning, noticing the plume on the power plant stack near the river. It appears to be affected by temperature inversions quite often, where it rises briefly and then fans out, or sometimes descends back downward some distance from the stack. How often do inversions occur in the Twin Cities and how long do they typically last?

Answer: A study of Twin Cities inversions by my colleague at the university, Dr. Don Baker (now retired) showed that overnight low level inversions (increase of temperature with height) are common in the Twin Cities occurring about 45 percent of the time on an annual basis. In December they occur about 30 percent of the time. The average duration varies from 6 to 8 hours, typically starting at midnight or shortly after and ending an hour or two after sunrise. When inversions occur during these hours, emissions from smoke stacks may linger at lower levels, and smells or odors (such as those from coffee houses or bakeries) may be more pronounced.

Twin Cities Almanac for December 3rd:

The average MSP high temperature for this date is 32 degrees F (plus or minus 11 degrees F standard deviation), while the average low is 18 degrees F (plus or minus 13 degrees F standard deviation).

MSP Local Records for December 3rd:

MSP weather records for this date include: highest daily maximum temperature of 62 degrees F in 1962; lowest daily maximum temperature of 6 degrees F in 1972; lowest daily minimum

temperature of -19 degrees F in 1940; highest daily minimum temperature of 43 degrees F in 1962; record rainfall of 1.05 inches in 1953; and record snowfall of 5.9 inches in 1934. There have been 27 measurable snowfalls on this date since 1891. Greatest snow depth on this date was 17 inches in 1985 and 1991. Worst wind chill conditions occurred in 1985 with a value of -32 F.

Average dew point for December 3rd is 18 degrees F, with a maximum of 52 degrees F in 1951 and a minimum of -22 degrees F in 1940.

All-time state records for December 3rd:

Scanning the state climatic data base: the all-time high for this date is 72 degrees F at Canby (Yellow Medicine County) in 1941; the all-time low is -38 degrees F at Itasca State Park in 1927.

The heaviest snowfall statewide on this date occurred back in 1934 when Duluth reported 16.8 inches.

Word of the week: Intortus

This is a form of high cirrus cloud. The filaments are irregularly curved and form a zig-zag pattern that often becomes entangled, leaving an impression like that of an unsteady artist making long white strokes across the sky with the paint brush. Some of this cloud form was in evidence under the moonlight on Tuesday night this week.

Outlook:

Chance of light snow in the north over the weekend, spreading into southern counties Sunday and Monday. Temperatures will be above normal for this time of year until midweek, then much colder air will invade Minnesota from the north by Wednesday and Thursday next week. Snow possibilities will be more frequent, but mostly on the light side.

To: Morning Edition  
From: Mark Seeley  
Re: Topics for MPR's Morning Edition, Friday, Dec 10, 2004

HEADLINES:

- Persistent warmth
- Freezing fog and drizzle this week
- How late is the arrival of snow in SW Minnesota?
- Almanac for December 10th
- What is an AWPAG?
- Outlook

Topic: Continuing warm weather....

For everyday of December so far we have logged above normal temperatures. In fact over the 51 days since October 20th, 47 days have seen above normal temperatures in the Twin Cities Metro Area. Now that's called climatic persistence! December temperatures are so far the exact opposite from those predicted by the Climate Prediction Center, which called for a colder than normal month in our area of the country! Perhaps the other shoe will drop soon.

Topic: Freezing drizzle and fog this week a rarity

The Duluth area reported freezing fog on Tuesday morning this week as the temperature and dew point both hovered around 32 degrees F from midnight until about 11:00 am. This presented rather risky driving conditions. Freezing fog, though very unusual in Minnesota, tends to occur in the months of November, December, and March.

Then on Wednesday of this week portions of Koochiching, Itasca, St Louis, and Carlton counties reported freezing drizzle during the morning hours. This too presented some risky driving conditions. Freezing rain and freezing drizzle occur with a frequency of 3-5 days per year around the state, again more commonly in November and December, but the historical range in dates has been anywhere from October to May. The temperature profile of the atmosphere on Wednesday morning favored this condition as surface temperatures in northern counties were in the teens to twenties F (below freezing), while the temperature aloft at 3000 to 4000 ft was in the 30s F (at or above freezing). Pete Boulay of our Minnesota State Climatology Office reports that he found documented freezing drizzle events in the Twin Cities with surface temperatures as cold as 14 degree F.

In terms of both freezing fog and freezing drizzle events, the most common time of occurrence is early morning between 0300 and 1000 am, unfortunately overlapping with commuter time in Minnesota. The average duration of such events is from 1 to



4 hours. For Minnesota, the largest number of freezing rain and drizzle events can be found in the northeast along the Lake Superior shoreline, while the fewest number can be found in the far northwest corner of the state in Kittson and Marshall Counties.

MPR listener question: The National Weather Service at Sioux Falls, SD sent out a news release this week that they have never gone this late into the fall season without measurable snowfall (their record date for latest snowfall was December 7, 1963). Is this also true for those of use who live in southwestern Minnesota? We live near Pipestone and have yet to see snow.

Answer: The climate records at Pipestone go all the way back to 1898. For the fall season, these records show that the five latest measurable snowfalls occurred on the following dates..

December 9, 1973  
December 9, 1946  
December 19, 1939  
December 22, 1911  
December 30, 1923

In order to set a new record at Pipestone, you would have to go all the way to the end of this month without measurable snowfall. I would say that is highly unlikely.

Twin Cities Almanac for December 10th:

The average MSP high temperature for this date is 27 degrees F (plus or minus 12 degrees F standard deviation), while the average low is 12 degrees F (plus or minus 14 degrees F standard deviation).

MSP Local Records for December 10th:

MSP weather records for this date include: highest daily maximum temperature of 54 degrees F in 1979; lowest daily maximum temperature of -3 degrees F in 1977; lowest daily minimum temperature of -18 degrees F in 1977; highest daily minimum temperature of 34 degrees F in 1896, 1921, and 1930; record rainfall of 0.61 inches in 1911; and record snowfall of 9.0 inches in 2003. There have been 18 measurable snowfalls on this date since 1891. Greatest snow depth on this date was 15 inches in 1950 and 1991. Worst wind chill conditions occurred in 1917 with a value of -38 F.

Average dew point for December 10th is 10 degrees F, with a maximum of 37 degrees F in 1918 and a minimum of -27 degrees F in 1977.

All-time state records for December 10th:

Scanning the state climatic data base: the all-time high for this date is 60 degrees F at Grand Meadow (Mower County) in 1939; the all-time low is -41 degrees F at Thorhult (Beltrami County) in 1977. The heaviest snowfall statewide on this date occurred just last year when Lake Wilson in Murray County reported 10 inches. It rained

2.42 inches in New Richland (southern Waseca County) on this date in 1911, causing some local flooding.

Word of the week: AWPAG

Obviously a Weather Service acronym, this term stands for All Weather Precipitation Accumulation Gage. It is a new instrument that replaces the older heated tipping bucket rain gages at both the Twin Cities International Airport (MSP) and the St Cloud Airport. The older gages were prone to erroneous readings when small quantities of frozen precipitation fell (not all of it melted, some evaporated, or there were problems with the mechanical tipping mechanism). The new gage is based on a heated weighing bucket containing an antifreeze mixture. In field tests it has performed rather well. The timing is good as the new gages have been measuring light mixtures of frozen and liquid precipitation (0.05 inches or less) on three days already this month.

Outlook:

The weather will be a bit unsettled over the weekend with a mixture of precipitation, some snow flurries, mostly in northern counties, windy on Sunday, and cooler temperatures. Next week starts out dry, then warming at mid-week with a chance for snow by Wednesday through Friday. Temperatures will be above or close to seasonal averages, but a stronger surge of cold air may come toward next weekend.

To: Morning Edition  
From: Mark Seeley  
Re: Topics for MPR's Morning Edition, Friday, Dec 17, 2004

HEADLINES:

- Santa Forecast
- New Climate Outlook for Winter
- Arctic blast with high winds
- Cold at high latitude
- Are there Southern Hemisphere counterparts to Minnesota?
- Almanac for December 17th
- value of GPS dropwindsondes
- Outlook

Topic: The Santa Forecast program on Midday...

Next Friday (Christmas Eve) Gary Eichten and I will be trying to make sense of the Santa Forecast this year from 11:00 am to noon on Minnesota Public Radio's Midday program. Could be a snowy one, but we'll see.....

Topic: New climate outlook for January through March

The NOAA Climate Prediction Center released the new climate outlook on Thursday of this week. The period from January to March is expected to be warmer than normal across the area, with equal chances for above or below normal precipitation. It certainly looks like the balance of December will bring mostly colder than normal temperatures.

Topic: Arctic blast on Sunday and Monday this week...

A strong low pressure system tracked across the region on Sunday, bringing gale force winds to the state. Over 45 communities in Minnesota reported wind gusts of 50 mph or greater. Welch in Goodhue County reported a gust of 71 mph. MSP International airport reported a wind of 52 mph and the St Paul Airport (Holman Field) reported a 55 mph wind gust. These values exceed the average annual highest wind speed for the Twin Cities which is 48 mph and usually associated with a summer thunderstorm. The fall temperatures when combined with the wind produced wind chill readings around the state ranging from -15 to -25 degrees F.

The polar air mass ushered in by this system produced the coldest temperatures around the state since last March. In fact, Minnesota reported the coldest temperatures in the contiguous 48 states on three consecutive days this week with: December 13 a low of -6 F at Flag Island, Roseau, and Warroad; December 14 a low of -15 F at Crane Lake, Cook, and Big Fork; and December 15 a low of -25 F at Embarrass.

Topic: Cold at high latitude

Compared to higher latitudes in the northern hemisphere, Minnesota was rather balmy this week. On Thursday (Dec 16) week Eureka, Nunavut, Canada (80 degrees N. latitude) reported a maximum temperature of -43 degrees F, while on the same date, Jakutsk, Russia in Siberia (at 62 degrees N. latitude) reported a maximum temperature of -54 degrees F.

MPR listener question: I know that Minnesota's climate behavior has been described as similar to that of central Russia, but what about analogies to places in the Southern Hemisphere? Are there any that behave just like ours, only with the summer and winter months reversed?

Answer: The simple answer is no. There are no continental landscapes in the Southern Hemisphere between 43 and 49 degrees south latitude that have similar soils, topography, inland water bodies, and climate to ours. Parts of New Zealand, Argentina and Chile are located in the exact opposite positions from us in the Southern Hemisphere and therefore see the same daylength and sun angle variations throughout the year, but their seasonal characteristics of temperature, moisture, and wind are vastly different, undoubtedly influenced by the southern oceans, topography, soils, and vegetation.

Twin Cities Almanac for December 17th:

The average MSP high temperature for this date is 24 degrees F (plus or minus 14 degrees F standard deviation), while the average low is 10 degrees F (plus or minus 13 degrees F standard deviation).

MSP Local Records for December 17th:

MSP weather records for this date include: highest daily maximum temperature of 53 degrees F in 1939; lowest daily maximum temperature of -5 degrees F in 1945; lowest daily minimum temperature of -17 degrees F in 1983 and 1985; highest daily minimum temperature of 35 degrees F in 1977; record precipitation of 0.81 inches in 1908; and record snowfall of 10.8 inches in 1908.

There have been 26 measurable snowfalls on this date since 1891. Greatest snow depth on this date was 19 inches in 1983. The worst wind chill conditions occurred in 1964 with a value of -35 F.

Average dew point for December 17th is 7 degrees F, with a maximum of 40 degrees F in 1977 and a minimum of -24 degrees F in 1964.

All-time state records for December 17th:

Scanning the state climatic data base: the all-time high for this date is 63 degrees F at Farmington (Dakota County) in 1939; the all-time low is -44 degrees F at Mora (Kanabec County) in 1983. The heaviest snowfall statewide on this date occurred from two separate storms. On this date in 1863 Beaver Bay reported 15 inches of snowfall produced by northeast winds off Lake Superior. Again, on this date in 1908, Lynd out in Lyon County reported a snowfall

of 15 inches, with drifts of several feet.

Word of the week: GPS dropwindsonde

These instruments have been deployed since 1997 for research study and forecasting of hurricanes. Recent papers have lauded the use of these measurements in forecasting for the 2004 Atlantic hurricane season, one of the most active in recent memory. GPS dropwindsondes are deployed from aircraft flying within the hurricane. They drift down through the atmosphere on a parachute making measurements of temperature, pressure, humidity, and wind as they fall. The onboard global positioning system allows for more accurate definition of the level of maximum wind and other features of the hurricane. Usually several GPS dropwindsondes are deployed in one flight through the storm, which is a flight path called a "figure 4" the pattern left by the aircraft if viewed from above the storm.

Outlook:

Moderate temperatures for the start of the weekend will give way to a rollercoaster type pattern through Tuesday, with generally colder temperatures, some of the coldest of the year. Chance for light snow Saturday into early Sunday, then a better chance for snow by Tuesday and Wednesday. Depending on the amount of snow that falls next week, the balance of December could generally bring colder than normal temperatures.

To: Morning Edition  
From: Mark Seeley  
Re: Topics for MPR's Morning Edition, Friday, Dec 24, 2004

HEADLINES:

- snow in some places
- a cold Christmas week
- historical Christmas Eve wind chills
- rapid soil freezing
- weather-related fatality statistics
- Almanac for December 24th
- Degomble
- Outlook

Topic: Some places getting snowfall....

Long awaited significant snowfalls occurred earlier this week in north-central, northeastern and southeastern counties. North-central and northeastern counties have had measurable snowfalls occur more frequently, between 11 and 13 days so far this month, and with an additional 3 to 6 inches on the 20th finally have snow depths ranging from 9 to 17 inches, good enough for cross country skiing and snowmobiling. Monday's weather also produced some significant snowfalls in southeastern counties, with Rochester reporting a record 3.0 inches and La Crosse, WI reporting a record 6.5 inches.

The same system brought a wedge of warm air aloft over central Minnesota, including the Twin Cities. The air aloft was above freezing and as it reached saturation it produced liquid droplets which fell, then froze when they contacted the frozen ground or pavement. It was slippery indeed, with well over 300 accidents reported in the morning hours. Freezing rain events, though rare (3-5 times per year in Minnesota), do tend to occur when warm air overruns a very cold surface layer.

Finally, a storm system crossing the southern USA late in the week will likely give parts of Arkansas a white Christmas for only the 9th time in the past 120 years.

Topic: A cold Christmas week.....

On Thursday morning, December 23rd, Embarrass reported a low of -42 degrees F, coldest in the nation. Crane Lake, Tower, and International Falls reported lows of -31 F that same day (a new record low for the Falls), while many other Minnesota communities reported lows of -20 F or colder. Minnesota has reported the coldest temperatures in the contiguous 48 states on 7 days so far this month.....

Topic: Topic: Christmas Eve Windchill Conditions

With wind chill readings this week ranging from -15 to -40 F around the state, I thought it might be interesting to look at other Christmas weeks in Minnesota history that were quite cold.

There have been 13 Christmas Eves since 1900 in the Twin Cities when windchill conditions met the advisory criteria for the National Weather Service (-20 F or colder as revised by the new formula in November of 2001). Those years were...

Year	Christmas Eve Windchill Conditions (F)
1902*	-33 (T=-4 F, WS=34 mph)
1910	-24 (T=-6 F, WS=11 mph)
1914	-27 (T=-5 F, WS=17 mph)
1917	-32 (T=-9 F, WS=16 mph)
1921	-39 (T=-12 F, WS=23 mph)
1924	-23 (T= 1 F, WS=26 mph)
1926	-20 (T= 3 F, WS=24 mph)
1933	-27 (T=-1 F, WS=28 mph)
1935	-24 (T=-1 F, WS=22 mph)
1980	-25 (T=-4 F, WS=16 mph)
1983	-61 (T=-25 F, WS=32 mph)
1985	-32 (T=-6 F, WS=25 mph)
2000	-40 (T=-10 F, WS=32 mph)

\*On Christmas Eve of 1902 the Duluth Weather Service Office reported -8 degrees F with wind gusts to 60 mph, equating to a wind chill of -45 F, and of course zero visibility with over a foot of snow on the ground. In December of 1902 they recorded 24 days with snowfall.

#### Topic: Rapid soil freezing

It was not surprising to see soil freezing depths increase this week with the onset of an arctic cold air mass over the region. Many soils had recently frozen to a depth of 4 inches by December 17th, but since that time the depth of freezing has more than tripled to 13 to 16 inches. The shallow snow cover in many places is not sufficient to protect the soils from freezing even deeper with continued outbreaks of arctic air. For stabilizing the depth of soil freezing additional snowfalls would help. Studies have shown that six inches of snow depth helps to stabilize soil temperature and prevent deeper frost penetration. The lessons learned from last winter are hopefully being applied, with gardeners using more mulch this fall, and homeowners with septic fields applying layers of straw to protect against deep penetration of frost.

For ice fishermen the arctic air mass this week has certainly improved ice conditions, particularly in the northern third of the state where lows have been in the -20s and -30s F.

MPR listener question: I have heard you say that NOAA national statistics suggest that most weather related human fatalities

now are associated with heat waves rather than tornadoes, floods or hurricanes. But how about in Minnesota?

Answer: Recent statistics for the 1993-2004 period as reported by the National Weather Service Forecast Office in Chanhassen show that heat waves have produced the most fatalities over that period, second on the list is extreme cold and winter storms, followed by tornadoes, lightning, and floods. Aside from fatalities, the statistics show that the greatest number of weather related injuries is associated with tornadoes.

Twin Cities Almanac for December 24th:

The average MSP high temperature for this date is 25 degrees F (plus or minus 11 degrees F standard deviation), while the average low is 9 degrees F (plus or minus 13 degrees F standard deviation).

MSP Local Records for December 24th:

MSP weather records for this date include: highest daily maximum temperature of 47 degrees F in 1881; lowest daily maximum temperature of -10 degrees F in 1983; lowest daily minimum temperature of -38 degrees F in 1872; highest daily minimum temperature of 35 degrees F in 1982; record precipitation of 1.26 inches in 1982; and record snowfall of 2.8 inches in 1916.

There have been 34 measurable snowfalls on this date since 1891. Greatest snow depth on this date was 20 inches in 1983. The worst wind chill conditions occurred in 1983 with a value of -61 F.

Average dew point for December 24th is 10 degrees F, with a maximum of 38 degrees F in 1936 and a minimum of -38 degrees F in 1983.

All-time state records for December 24th:

Scanning the state climatic data base: the all-time high for this date is 56 degrees F at Winnebago (Faribault County) in 1899; the all-time low is -43 degrees F at St Vincent (Kittson County) in 1884. The heaviest snowfall statewide on this date occurred in 1959 when Isabella (Lake County) reported 15.5 inches. On this date in 1893 Worthington, New Ulm, and Medford all reported over 2 inches of precipitation, extremely heavy amounts for the month of December.

Word of the week: Degomble

This term is used more by scientists who do research in arctic climates.

When you are out in a snow storm or out in extreme wind chill conditions, ice and snow accumulate on your hat, face mask, gloves and boots, as well as in the nooks and crannies of your clothing. Prior to coming inside, you have to degomble, that is remove all the frozen stuff that's attached to you so you don't make a mess when you thaw out!



## Outlook:

Chance for light snow on Christmas Day, possibly some freezing drizzle in the southwest, with highs in the teens to lower 20s F (warm relative to earlier this week). A warming trend continues Sunday through Wednesday, with highs reaching the 20s and 30s F. Chance for light snow Monday through Thursday.

To: MPR's Morning Edition  
From: Mark Seeley  
Re: Topics for MPR's Morning Edition, Friday, Dec 31, 2004

HAPPY NEW YEAR TO EVERYONE!!

HEADLINES:

- 2004 Minnesota weather review...
- 2004 National weather review...
- 2004 International weather review...
- Maximum range in daily temperatures...
- Almanac for December 31st
- Manky weather
- Outlook

Topic: 2004 Minnesota weather stories and headlines....

A warmer than normal year, with excess precipitation in many places. The beginning and ending of the year were bookmarked by -45 degrees F at Park Rapids in January (the 30th) and at Embarrass in December (Christmas Eve). Highest temperature in the state was 97 F at several locations both in June and July.

Precipitation was abundant in many places, with La Crescent reporting over 48 inches for the year, Winona 47 inches, and Albert Lea 45 inches. Bricelyn reported 9.22 inches of rain in one day (September 15), while Alden, west of Albert Lea reported 13 inches from one storm (Sept 15-16).

Discounting the polar regions of Alaska, Minnesota reported the coldest temperature in the nation on at least 55 days in 2004.

Cold temperatures in late January and February drove frost deep into the ground, beyond 60 inches in places. Many septic systems were frozen and homeowners had to bear the expense of thawing them out.

A snow burst on the morning of March 8th produced 2-3 inches of snow in an hour, snarled traffic and caused numerous accidents in the Metro area.

Over 25 Minnesota communities reported temperatures of 90 F or higher on April 28th with Benson tying the state record for the date at 95 F.

A terrific wind storm in the Twin Cities on Mother's Day (May 9th) brought down many trees, especially in Como Park.

A very cold growing season in Minnesota caused crops to develop very slowly. There was widespread frost in central and northern counties on August 20-21. But, the crop season was rescued by one of the warmest Septembers in history and most crops reached maturity.

For many communities there were more days with 90 F or greater temperatures in September than any other month of the year, a highly unusual pattern.

One of the largest and most intense flash floods in Minnesota history occurred on September 15-16 in parts of Martin, Faribault, Freeborn, and Steele Counties, dumping up to 10 to 13 inches and flooding every watershed in the area.

Finally, a freezing rain and drizzle on December 20th across central Minnesota produced nearly 350 traffic accidents, the most for any single day of the year.

Topic: 2004 National Weather Stories and Headlines....

Alaska recorded its warmest ever summer with 90 F plus readings in the months of June, July, and August. There were also more than the usual number of thunderstorms.

The National Weather Service Storm Prediction Center reports that 2004 was a record year for number of tornadoes in the United States. The preliminary count is over 1700 breaking the record of 1424 set in 1998. There were new record monthly totals reported in August (173), and September (247). Despite this high frequency in tornadoes there were only 35 deaths nationally due to such storms, a testimonial to the improved storm warning system of the National Weather Service.

The Atlantic hurricane season was an active one with 15 named tropical storms, nine of which affected the United States. Four hurricanes visited Florida (Charley, Frances, Ivan, and Jeanne). This produced the most costly hurricane season with estimates running as high as \$42 billion. A downstream consequence to American agriculture as a result of Hurricane Ivan will be the introduction of Asian soybean rust as a major crop disease.

Lingering drought in the western states did not abate in many areas and aggravated another very active wildfire season.

Christmas week snows blanketed Ohio, Indiana, and Kentucky. The same system even brought Arkansas and the New Orleans area an exceptionally rare White Christmas.

Topic: 2004 International Weather Stories and Headlines...

A January cold wave in South Asia, primarily India and Bangladesh, was blamed for over 600 deaths as much of the homeless population was exposed to temperatures in the 30s F.

Australia suffered through one of the worst February heat waves ever, with temperatures soaring to 113 degrees F.

A very rare hurricane formed in the South Atlantic off the coast of Brazil in March. By the end of the month it struck the coastal

region near Santa Catarina, as a tropical storm named Catarina.

Peru, Chile, and Argentina suffered through a cold, snowy winter (June and July) reporting over 50 deaths due to the snow and cold.

A rare August 20th hard freeze caused nearly \$1 billion in crop losses to farmers in Saskatchewan and Manitoba, Canada.

Japan suffered through its worst ever tropical storm season, sustaining ten storm landfalls. In October Typhoon Ma-on with winds of 109 mph struck near the Tokyo area, the strongest storm there in 10 years.

(P.S. I recognize that the significance of the above pales in comparison to the recent tsunami disaster in Indonesia and the coastal regions of the Indian Ocean, but that disaster is distinctly geologic in nature and not atmospheric)

MPR listener question: I heard you mention during the Christmas Eve Midday program that the all-time state temperature records for Christmas Day are 62 degrees F at Faribault in 1923 and -50 F at Big Falls in 1933, a range of 112 degrees for a single day. What is the largest range in daily temperature records for the state?

Answer: The largest range in statewide daily temperature records can be found in the months of February and March which for both warmth and cold can be greatly modified by the presence or absence of snow cover on the Minnesota landscape. The largest range in temperature I can find is for March 18th. In 1921 Canby (Yellow Medicine County) registered a temperature of 84 degrees F on that date, while in 1939, Sawbill Camp (Cook County) reported a low of -48 degrees F on the same date. This is a range of 132 degrees F on the same date!

Twin Cities Almanac for December 31st:

The average MSP high temperature for this date is 24 degrees F (plus or minus 13 degrees F standard deviation), while the average low is 8 degrees F (plus or minus 14 degrees F standard deviation).

MSP Local Records for December 31st:

MSP weather records for this date include: highest daily maximum temperature of 50 degrees F in 1904; lowest daily maximum temperature of -12 degrees F in 1968; lowest daily minimum temperature of -24 degrees F in 1973; highest daily minimum temperature of 34 degrees F in 1904; record precipitation of 0.48 inches in 1911; and record snowfall of 7.2 inches in 1977.

There have been 30 measurable snowfalls on this date since 1891. Greatest snow depth on this date was 18 inches in 1969 and 1996. The worst wind chill conditions occurred in 1968 with a reading of -47 F.

Average dew point for December 31st is 9 degrees F, with a maximum of 43 degrees F in 1965 and a minimum of -34 degrees F in 1967.

All-time state records for December 31st:

Scanning the state climatic data base: the all-time high for this date is 58 degrees F at St Peter (Nicollet County) in 1921 and at Winona in 1965; the all-time low is -57 degrees F at Pokegama Dam (Itasca County) in 1898. The heaviest snowfall statewide on this date occurred in 1996 when Two Harbors reported 18.4 inches, concluding a month in which they had over 48 inches of snow. On this date in 1887 Grand Meadow reported 11 inches of snow, that melted down to 1.50 inches of precipitation, a state record for the date.

Words of the week: Manky weather.....

This is a British expression for the type of weather that brings persistent, low overcast skies, high humidity, sometimes fog, and generally murky conditions. We have certainly had our share of this type of weather during December. Manky is sometimes used as a adjective to indicate something is dirty or unpleasant.

Outlook:

Cloudy with a chance for snow in western sections on Saturday, perhaps light snow and freezing drizzle elsewhere. Snow likely on Saturday night, lingering in the eastern sections early Sunday. Then cooler temperatures will settle over the area for much of next week. There will be another chance for snow Monday night through Wednesday. It looks like the first full week of January may bring some accumulating snowfalls.