

To: Cathy Wurzer, Jim Bickal, Julie Siple, and Eugene Cha
From: Mark Seeley
Re: Suggestions for MPR's Morning Edition, Friday, Jan 3, 2003

Topic: 130th Anniversary of a famous Minnesota blizzard

Next Tuesday, January 7th marks the 130th anniversary of the most lethal blizzard in Minnesota history. On an seemingly sunny, mild winter day, many Minnesotans were out and about running errands, visiting relatives, stocking up on supplies at town stores when a massive cloud system advancing rapidly out of the northwest in a squall line type fashion overwhelmed the Minnesota landscape with wind and snow. Temperatures dropped over 30 degrees F, with howling winds and blinding snow. Visibilities dropped to just a few feet. Snow piled in enormous drifts, burying cattle and farm homes, especially in southwestern Minnesota and northwestern Iowa. The storm raged on both the 7th and the 8th of January. St Paul reported a daily high of 30 F just before the storm on the 7th, but a high of only 5 degrees F on the 8th, followed by morning lows of -15 F and -16 F. Over 70 people died in Minnesota, many from exposure after being caught outdoors and getting lost. Some bodies were not discovered until the following spring. The telegraph lines used to transmit storm warnings by the relatively new Army Signal Corps Weather Service were all blown down across the region and railroad traffic was stopped for days by huge drifts of snow.

Topic: Benefits of a mild, open winter

Though many are bemoaning the absence of cold and snow, necessary ingredients for winter recreation such as ice fishing, snowmobiling, snow shoeing, cross country skiing and the like, there are many benefits to a mild, and open winter, especially for a state suffering economically as we are.....weather events and episodes tend to always produce "winners" as well as "losers"...a few positive examples include...

reduced commercial and residential heating costs, likely saving tens of millions of dollars

reduced transportation delays in both trucking and commercial airlines

reduced traffic accidents

reduced insurance claims on autos, and on home damages due to fires, wind, snowloads and ice dams

reduced costs for street/highway snow and ice removal

fewer delays and disruptions in building trades, and therefore maintenance of higher employment in this sector of the economy

Higher efficiencies in milk production from dairy herds, as well as greater efficiency in livestock weight gains

Reduced health risks due to exposures in extreme climatic conditions

Topic: a few more records in 2002

Scores of record setting daily temperature and precipitation events occurred around Minnesota this year, the last coming on Sunday, December 29th. The following locations reported new record high temperatures on that date....

Pipestone 51 F Sioux Falls, SD 57 F Winnebago 50 F
Worthington 53 F Fairmont 52 F St James 46 F

About the same time we were setting record high temperatures in Minnesota, Tropical Cyclone Zoe struck the Solomon Islands in the South Pacific with nearly 200 mph winds and 37 ft seas. A rare category 5 storm, it left a swath of destruction across a number of islands popularized by James Michener in his "Tales of the South Pacific." The storm had dissipated at sea by New Years, but Australia was sending relief ships to the Solomon Islands to offer aid and supplies.

MPR listener question: I have heard you say that snow cover greatly modifies temperatures in the winter months. Does it have more effect on maximum temperatures or minimum temperatures?

Answer: I don't have a definitive answer on this question, but examining the Twin Cities climate record suggests perhaps the effect is more pronounced with daytime maximum temperatures. This is logical, since so much of the sun's energy would be reflected by the snow cover. Checking all Twin Cities daily records for the past 54 years shows that the average high and low with the presence of snow cover on January 7th (today's date) is 22 F and 4 F, respectively. Comparatively, the average daily high and low for January 7th without the presence of snow cover is 33 F and 7 F, respectively. So, it would appear the effect of snow cover is more evident with the daytime maximum temperatures which are 9 degrees F different on this particular date, while the minimums are only 3 degrees F different.

Twin Cities Almanac for January 3rd:

The average MSP high temperature for January 3 is 21 degrees F (plus or minus 12 degrees standard deviation), while the average low is 4 degrees F (plus or minus 13 degrees standard deviation).

MSP Local Records for January 3rd:

MSP weather records for January 3rd: highest daily maximum temperature of 43 degrees F in 1908 and 1927; lowest daily maximum temperature of -12 degree F in 1919; lowest daily minimum temperature of -24 degree F in 1911; highest daily minimum temperature of 33 degrees F in 1992; record rainfall of 0.76 inches in 1906; and record snowfall of 9.0 inches in 1906.

Maximum snow depth has been 19 inches in 1969 and 1970; there have been 13 measurable snowfalls since 1948.

Average dew point for January 3rd is 6 degrees F, with a maximum of 33 degrees F in 1927 and a minimum of -42 degrees F in 1919.

All-time state records for January 3rd:

Scanning the state climatic data base: the all-time high for this date is 53 degrees F at Canby (Yellow Medicine County) in 1998; the all-time low is -48 degrees F at Pine River Dame (Crow Wing County) and Little Fork (Koochiching County) in 1911.

Word of the Week: Z-R relationships

This is a term used in radar meteorology and refers to the empirical relationship between the power of the reflected signal from a radar (Z), in units of dBZ, and rainfall rate at the ground (R); many relationships exist, depending on the degree of convection, presence of ice and assumed rain drop distribution. Basically this is how meteorologists can in the absence of rain gage reports, estimate rainfall amounts from accumulated radar returns.

Outlook:

Mostly cloudy over the weekend with a chance of snow in the north, possibly 1-3 inches, and light flurries in the south. Temperatures will generally stay warmer than normal, then trail off cooler by mid week. There will be an increasing chance for snow later in the week.

To: Cathy Wurzer, Jim Bickal, Julie Siple, and Eugene Cha
From: Mark Seeley
Re: Suggestions for MPR's Morning Edition, Friday, Jan 10, 2003

BEST WISHES TO GARY MCDEVITT, LONG-TIME HYDROLOGIST FOR OUR LOCAL NATIONAL WEATHER SERVICE. HE IS RETIRING AFTER OVER 30 YEARS OF FEDERAL SERVICE AND SEEING US THROUGH MANY DROUGHTS AND FLOODS..

Topic: Warm Temperatures in January....

Many January temperature records fell on Tuesday and Wednesday this week....it was probably the warmest January 7th and 8th in history on a statewide basis since record setting values occurred from border to border. A new state record high was reported on the 7th (Tuesday) when Fairmont recorded 60 degrees F. This was also the earliest January temperature of 60 F ever recorded in the state.

Though no new state record was reported on Wednesday (the 8th), scores of cities reported new record high temperatures, including Madison, Montevideo, Maple Lake, Marshall and Fairmont all with 57 degrees F. Locally, for the Twin Cities, the 52 F on Tuesday and 54 F on Wednesday represent only the 11th and 12th occurrence of 50 F or greater temperatures in the Metropolitan area since 1891, and the first occurrence of back to back 50 F plus temperatures in January since 1981.

Recall too that last January we set new Twin Cities high temperature records on January 9th with a high of 49 F and a very warm low of 34 F and Amboy set a new state record for January 8th last year as well with 60 F.....other recent Januarys have produced new temperature records as well...on January 2nd of 1998 the Twin Cities record high was tied with 45 F (tying 1897) and on January 2nd of 1997 a record tying warm low temperature of 31 F was recorded (tying 1992).... In fact, 4 of the last 5 Januarys on a statewide basis have shown mean temperatures significantly above normal. So this month, so far, is certainly following that trend.

Some record high temperatures in January include...

Highest temperature ever measured in January, 69 F at Montevideo (1/24/1981)

Highest ever January temperature in the Twin Cities, 58 F (1/25/1944)

State Record high for January 8th, 60 F at Amboy (Blue Earth County County) in 2002

More on January warmth can be found on the Minnesota Climate Group web site...<http://www.134.84.160.120> under the Climate Journal section.....

Topic: Cold in Europe and Asia....

Though our winter has been somewhat mild, cold winter weather has dominated Europe and Asia lately. Snow and ice in southern France created many traffic accidents, 2 inches of snow in London this week was the most in 12 years, roads were closed due to snow storms in Spain, cities in Germany, Norway, and Finland reported daytime high temperatures below zero, and in Russia Moscow reported a low of -24 F, while portions of Siberia (Jakutsk) recorded lows as cold as -65 F! This dome of cold air at high latitudes will soon be circulating over portions of North America and bring us the coldest temperatures of the winter so far. It may also produce some long-awaited snow cover.

MPR listener question: How many daily weather records were set last year in the Twin Cities and what is a typical number of weather records set in any given year or a human lifetime?

Answer: Mercy, what a question! According to Ross Carlyon of the National Weather Service Forecast Office in Chanhassen, there were 18 daily records (temp, rainfall, or snowfall) set in the Twin Cities during the year 2002. This compares to 24 record setting daily values in the year 2001 and 32 such values in the year 2000. So the number of daily weather records set each year in the Twin Cities appears to be highly variable. With a 112 year old instrumental record in our area it is relatively hard to reach record-setting daily values.

A break-down of the types of daily records set in the last three years is listed below....

Year	warm temp record	cold temp record	precip record	snowfall record	total
2002	8	3	7	0	18
2001	16	2	6	0	24
2000	19	6	4	3	32
Total	43	11	17	3	74

Clearly warm temperature records are the dominant feature of record-setting values in recent years, primarily skewed to the months of November, December, January, February and March....they represent 43 of the 74 daily records set in the past three years.

If we assume an average of 25 new daily weather records

are set each year, then a person with a life expectancy of 75 to 80 years would experience record-setting weather nearly 2000 times in their life!! At least in Minnesota...

Twin Cities Almanac for January 10th:

The average MSP high temperature for January 10 is 22 degrees F (plus or minus 13 degrees standard deviation), while the average low is 5 degrees F (plus or minus 14 degrees standard deviation).

MSP Local Records for January 10th:

MSP weather records for January 10th include: highest daily maximum temperature of 49 degrees F in 1990; lowest daily maximum temperature of -14 degree F in 1912; lowest daily minimum temperature of -27 degree F in 1977; highest daily minimum temperature of 33 degrees F in 1928; record rainfall of 1.13 inches in 1975; and record snowfall of 4.0 inches in 1975 and 1976. Maximum snow depth has been 18 inches in 1969; there have been 16 measurable snowfalls since 1948.

Average dew point for January 10th is 3 degrees, with a maximum of 39 degrees F in 1980 and a minimum of -39 degrees F in 1982.

All-time state records for January 10th:

Scanning the state climatic data base: the all-time high for January 10th is 58 degrees F at Madison (Lac Qui Parle County) in 1990; the all-time low is -47 degrees F at Little Fork (Koochiching County) in 1912.

Word of the Week: SOOP

Another scientific acronym...this time referring to the Ship of Opportunity Program associated with the World Meteorological Organization and the Intergovernmental Oceanographic Commission. This program has proven to be highly valuable in providing the scientific community with data from the oceans, including water temperature, ocean current trajectories, and salinity measurements. SOOP takes advantage of merchant ships which routinely travel in the major shipping lanes of the world's oceans. The crews make daily measurements by lowering sensors into the water. They then transmit these data over the WMO Global Telecommunications System so that government agencies and universities can better assess the variations and trends in ocean temperature, currents, and salinity. This has improved our understanding of oceans and their role in affecting the climate.

Outlook:

Colder than normal temperatures dominate the outlook for the weekend and next week, with several nights of below zero F readings. There is a chance for light snow, particularly in the north each day, and some lake-effect snow is likely

in the northeast. Better chance for snow statewide on Monday and Wednesday of next week.

Thursday, but primarily in the northern counties.

To: Cathy Wurzer, Jim Bickal, Julie Siple, and Eugene Cha
From: Mark Seeley
Re: Suggestions for MPR's Morning Edition, Friday, Jan 17, 2003

Who's got snow????

Most of our region has seen little snow this winter so far, but some communities in South Dakota saw some sizable amounts on Wednesday this week. Many places in the central part of that state reported 5-7 inches of snow, while Pierre reported a record-setting 10 inches of snow. More frequent chances for snow are in the forecast for this coming week....

Topic: Typical dry, winter air.....

The polar air that has descended upon us in recent days is very dry, with dew points well below zero. The drying effect of this air is greatly amplified when it is drawn inside buildings and then heated up to 68 degrees F, a typical indoor thermostat setting. For example, if you compute the partial pressure of water vapor (essentially the number of water vapor molecules) in outside air with a dew point temperature of -10 degrees F (like we had in the Twin Cities on Wednesday of this week), then assume with no additions or subtractions of water vapor molecules, you draw that air inside your home (via opening a door) and heat it up to 68 degrees F. At this temperature, the air can hold a decidedly larger number of water vapor molecules than the cold air outside, therefore the relative humidity declines rapidly to only 4 percent. That alone leads to dry mouth, lips, skin, rasping voice, nose bleeds, itchy and static hair, etc. Indoor plants, humidifiers, or vapor discharge from showers, washers, and clothes driers really help to improve the indoor relative humidity, but they rarely raise it above 45-50 percent in the winter time.

Topic: Using your vehicle as shelter from the wind.....

A current article in the Bulletin of Meteorology describes a study focused on the question how safe are motor vehicles as shelters from strong wind storms or tornadoes. This study uses the results of damage surveys made following tornadoes, as well as wind tunnel experiments with motor vehicle models. The article concludes that stationary motor vehicles are generally safer places to take shelter than mobile homes. The study purports that depending on size, weight, general geometry, and orientation with respect to the wind, a motor vehicle affords a seatbelted passenger a relatively safe shelter for wind speeds ranging up to well over 100 mph. This contrasts with earlier studies that show severe damage and destruction to mobile homes at

wind speeds of 70 to 100 mph. Interestingly, minivans show greater stability in high winds than mid-size sedans, at least in wind tunnel tests. The authors are careful not to advocate taking shelter in motor vehicles when other places such as basements or secure structures are available.

MPR listener question: With the onset of cold January temperatures, how deeply is the soil frozen now?

Answer: After remarkable warmth early in the month, recent very cold temperatures have extended the depth of freezing in the soil each of the last seven days. The depth of freezing in bare soil now ranges from 12 to 24 inches. Continued cold temperatures through the end of this month will likely cause the freezing depth to gradually get deeper. The maximum depth of frozen soil in Minnesota typically does not occur until late February or early March.

Twin Cities Almanac for January 17th:

The average MSP high temperature for January 17 is 22 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 17th:

MSP weather records for January 17th include: highest daily maximum temperature of 44 degrees F in 1894; lowest daily maximum temperature of -12 degree F in 1962; lowest daily minimum temperature of -26 degree F in 1967; highest daily minimum temperature of 33 degrees F in 1894; record rainfall of 0.90 inches in 1996; and record snowfall of 5.1 inches in 1932. Maximum snow depth has been 20 inches in 1970; there have been 18 measurable snowfalls since 1948.

Average dew point for January 17th is 5 degrees F, with a maximum of 39 degrees F in 1973 and a minimum of -37 degrees F in 1962.

All-time state records for January 17th:

Scanning the state climatic data base: the all-time high for January 17th is 54 degrees F at Minnesota City (Winona County) in 1894; the all-time low is -52 degrees F at Tower (St Louis County) in 1982.

Words of the Week: Aura, Parasol, Calipso, Aqua, and Cloudsat

These are all names of satellites to be launched in a new NASA study of the Earth's clouds. They will function in concert as a constellation of satellites, each equipped with a variety of sensors, including radars, lidars, radiometers, spectrometers, and microwave sounders. In this manner they will be able to provide climate researchers and meteorologists will measurements of cloud properties, including physical dimensions, moisture distribution and density, particle size distributions, aerosols and trace gas content, and radiation properties. The

resolution of measurements will be sufficient to estimate the precipitation falling from clouds over areas where rain gages are insufficient to quantify how much is reaching the Earth's surface.

Outlook:

Continued cold this weekend, but chances for snow statewide off and on during the next several days look pretty good, albeit generally small amounts with fast moving Alberta Clippers passing through. There are better chances for snow in the northern counties. Temperatures will continue generally below normal.

To: Cathy Wurzer, Jim Bickal, Julie Siple, and Eugene Cha
From: Mark Seeley
Re: Suggestions for MPR's Morning Edition, Friday, Jan 24, 2003

Talk about cold.....windchill readings around Minnesota reached the -35 to -45 F mark on Thursday morning, the coldest readings since the new formula was initiated by the National Weather Service in November of 2001.

But these pale in comparison to the values reported from the Mt. Washington Observatory (elevation 6288 ft) in New Hampshire on Wednesday this week.....they reported a 6 am (EST) temperature of -34 F with winds of 117 mph and gusts to 142 mph, giving a windchill of -93 degrees F.....not only far colder than us...but colder than any report from the South Pole as well!!!

Topic: The negatives and positives of cold soils....

Many locations reported overnight temperatures well below zero F this week, and some daytime highs that did not reach the zero F mark as well. Coldest locations were Embarrass with -35 F and Tower with -31 F.

These cold temperatures, combined with dry soils, short days, and the lack of snow cover produced significant increases in the depth of frozen soil. Most locations now report frozen soil to a depth of 2 to 3 feet. In addition, the shallower depths of the rootzone have shown extremely cold temperatures that can be harmful to the roots and crowns of herbaceous plants. Some temperatures as low as 2 degrees F have been recorded at 4 inches under bare soil.

Gardeners and farmers will not be able to assess the extent of plant or crop injury until the spring, when soils thaw and plants break dormancy to start to grow again. But similar conditions occurred in the winters of 1987 and 1989, and subsequently produced quite a bit of winter injury, especially to alfalfa.

On the positive side, the very cold soil temperatures also kill many overwintering pathogens and insects. In this regard perhaps we'll see less of a threat from certain plant diseases or damaging insects this coming growing season.

MPR listener question: Reports said that arctic air was invading Minnesota this week all the way from Siberia. Is that true, and how much colder might it have been if we had abundant snow cover in Minnesota?

Answer: Yes, indeed arctic air did invade this week. A massive area of arctic high pressure positioned over north-central Canada near Great Bear Lake reached a central pressure of 1058 mb (31.24 inches of mercury on your

common barometer). High pressure cells of this magnitude at high polar latitudes tend to circulate air over the poles from Siberia, so that there is actually some cross-polar flow. This extremely high pressure cell is analogous to the arctic high pressure that produced so many all-time low temperature records across the region back on February 1-2 in 1996 (recall -60 F at Tower, MN and -32 F in the Twin Cities!). Over a dozen communities around Minnesota reported lows of -50 F or colder back in 1996, while the coldest readings around the state this week were in the -20s F and a few -30s F. The primary difference between then and now is snow cover, ample in 1996 and negligible in 2003. You could easily say that we could have been 10 to 20 degrees F colder this week if we had significant snow cover.

Twin Cities Almanac for January 24th:

The average MSP high temperature for January 24 is 22 degrees F (plus or minus 15 degrees standard deviation), while the average low is 5 degrees F (plus or minus 15 degrees standard deviation).

MSP Local Records for January 24th:

MSP weather records for January 24th include: highest daily maximum temperature of 57 degrees F in 1981; lowest daily maximum temperature of -16 degree F in 1904; lowest daily minimum temperature of -33 degree F in 1904; highest daily minimum temperature of 33 degrees F in 1919; record rainfall of 1.21 inches in 1967; and record snowfall of 6.0 inches in 1972. Maximum snow depth has been 35 inches in 1982; there have been 21 measurable snowfalls since 1948.

Average dew point for January 24th is 7 degrees F, with a maximum of 36 degrees F in 1944 and a minimum of -31 degrees F in 1961.

All-time state records for January 24th:

Scanning the state climatic data base: the all-time high for January 24th is 69 degrees F at Montevideo (Chippewa County) in 1981, still the all-time state record high for January; the all-time low is -57 degrees F at Pokegama Falls (Itasca County) in 1904.

Words of the Week: Stagnation area

This term is used occasionally by forecasters, but more frequently by research meteorologists who study air pollution. It refers to a region where the surface air has accumulated pollutants because inversions have persisted for four or more days, with winds less than 17 mph, no frontal passages, and no precipitation. This can occur under hot, high pressure cells in the summer, or under very cold, arctic type high pressure cells in the winter.

Stagnation with the current arctic high pressure system is unlikely as a series of fronts will move through starting this weekend.

Outlook:

Some warming, with a chance of snow early in the weekend. Colder on Sunday, then another chance of snow early next week with milder temperatures prevailing.

To: Cathy Wurzer, Jim Bickal, Julie Siple, and Eugene Cha
From: Mark Seeley
Re: Suggestions for MPR's Morning Edition, Friday, Jan 31, 2003

Topic: Preliminary Climate Summary for January, 2003

January may be remembered for two characteristics: wild swings in temperature and the very belated appearance of winter snow cover around the state. Temperature departures early in the month were remarkably positive, 30 to 35 degrees F above normal in places. The highest reading was 60 F at Fairmont on the 8th. Later in the month very cold temperatures arrived, with readings that were 15 to 20 degrees F colder than normal. The lowest reading was -35 F at Embarrass on the 22nd. After a prolonged period with no snow cover, especially in western and southern counties, the last week of the month (27-31) brought 2-3 inches of snowfall to many areas. The lack of snow cover, combined with some very cold temperatures and dry soils, pushed the frost depths down significantly during the month. Frozen soil depth at the beginning of the month ranged from 10-16 inches, but by the end of the month, it ranged from 30 to 45 inches.

Similar to November and December, January precipitation was lacking in most counties. Some places reported less than 0.10 inches. Some communities did report over 5 inches of snowfall, including Duluth with 5.7, International Falls with 7.0, Moorhead with 5.6, Littlefork with 6.5, Tower with 5.0, and Morris with 5.1.

Despite wild swings in daily temperature, the average for the month ended up close to normal, in some cases 1 to 2 degrees F above normal for January. Minnesota reported the coldest temperature in the contiguous 48 states seven times during the month. Maximum windchill readings occurred on the 23rd, ranging from -30 to -45 F, the coldest values since the National Weather Service instituted the new Windchill calculations in November of 2001. The maximum wind speed for the month occurred on the 9th at Jackson, MN with 54 mph gusts.

MPR listener question: This week, a newspaper article mentioned that following the wettest ever June through October period in the Twin Cities, the November to January period has proven to be the driest in 111 years. How often do back to back extremes in precipitation occur across the seasons like this?

Answer: Yes, indeed the contrast in precipitation extremes has certainly grabbed people's attention. However, this is not a singular occurrence in the climate record of the Twin Cities. As is often the case, the historical record provides us with other examples of back to back precipitation extremes across the seasons. The table below lists 5 such occurrences in the Twin Cities climate record since 1891.....all values in inches..

EXCESSIVE PRECIPITATION			DEFICIENT PRECIPITATION		
TIME PERIOD			TIME PERIOD		
yr.	Jun-Oct	Rank	yr.	Nov-Jan	Rank
2002	29.89	wettest	2003	0.41	driest
1900	28.99	2nd wettest	1901	1.29	7th driest
1903	25.05	8th wettest	1904	1.28	11th driest
1986	22.56	13th wettest	1987	1.56	16th driest
1904	22.33	14th wettest	1905	1.42	14th driest

Normal Jun-Oct = 17.23 Normal Nov-Jan = 3.98

Note that the excessive summer and early fall precipitation comes from convection (thunderstorms) that is capable of delivering large doses of rainfall in one event, while the deficit in late fall and winter precipitation comes from the lack of large scale, moisture bearing winter storms passing across the area. Because the moisture deficits of late fall and winter are relatively small numbers (note normal for the Nov-Jan period is only 3.98 inches), late winter and early spring when convective storms become more frequent, can readily make up for these deficits with one or two significant events, rather than a number of storm passages. Thus moisture deficits initiated in the late fall or winter are rarely carried through into the following spring and early summer.

Topic: Speaking of moisture deficits.....

Thanks in part to El Nino, portions of Australia are experiencing their worst drought conditions in 144 years. Some areas have imposed water conservation measures. In fact, the Environment Minister in the state of Victoria, Sherryl Garbutt has suggested a rather novel water conservation measure called "Share Your Shower." She suggests that huge quantities of water could be saved if people would shower together. This idea doesn't pose much of a problem for couples living in partnership (married or otherwise), but she goes on to state that you could find a "sympathetic friend" to take a shower with. I suppose there are those with enough courage to give it a try in the name of conservation!!!! Anyway, Garbutt's remarks were written about in a recent edition of the Bulletin of the American Meteorological Society.

Twin Cities Almanac for January 31st:

The average MSP high temperature for January 24 is 21 degrees F (plus or minus 13 degrees standard deviation), while the average low is 3 degrees F (plus or minus 14 degrees standard deviation).

MSP Local Records for January 24th:

MSP weather records for January 24th include: highest daily maximum temperature of 46 degrees F in 1995; lowest daily maximum temperature of -5 degree F in 1918; lowest daily minimum temperature of -25

degree F in 1994; highest daily minimum temperature of 34 degrees F in 1968 and 1993; record rainfall of 0.35 inches in 1908; and record snowfall of 6.2 inches in 1908. Maximum snow depth has been 23 inches in 1969; there have been 13 measurable snowfalls since 1948.

Average dew point for this date is 4 degrees F, with a maximum of 35 degrees F in 1989 and a minimum of -33 degrees F in 1985.

All-time state records for January 31st:

Scanning the state climatic data base: the all-time high for this date is 57 degrees F at Springfield (Brown County) and Lambertton (Redwood County) in 1989; the all-time low is -55 degrees F at Embarrass and Tower (St Louis County) in 1996.

Word of the Week: Labrador Keratopathy

Sometimes referred to as a type of snow blindness, Labrador keratopathy is a degeneration in the cornea of the eye caused by exposure to excessive UVB radiation. A number of years ago Canadian doctors found a relatively high incidence of this problem in Labrador, specifically in people who live around 55 to 56 degrees north latitude. This portion of NE Canada has a longer lasting and geographically a more extensive season of snow cover than other countries at a similar latitude (the United Kingdom for example). Residents in this part of Canada are exposed to relatively higher amounts of UVB radiation as a result of reflectance off the snow cover. At lower latitudes, snow cover is not as long-lasting, while at higher latitudes the reduced day length and excessively cold temperatures which keep residents indoors more of the time limit exposure to UVB radiation.

In Minnesota, we have had little snow reflectance to cope with this winter.

Outlook:

Warmer than normal with a mixture of precipitation (snow, sleet, freezing rain) across the state over the weekend and into Monday. Then cooler and drier, with temperatures trending below normal.

To: Perry Finelli, Cathy Wurzer, Jim Bickal, Julie Siple,
and Eugene Cha
From: Mark Seeley
Re: Suggestions for MPR's Morning Edition, Friday, Feb 7, 2003

Topic: Groundhog Day snowfall

The 3.8 inches of snow that fell on Groundhog Day (Sunday, Feb 2) was the 3rd highest total historically for that date in the Twin Cities area. The 6.0 inch storm total snowfall, occurring over the 2nd and 3rd of the month was the second highest storm total historically, surpassed only by the 6.5 inches that fell in 1983. The Twin Cities now reports 8.2 inches of snowfall for February which is above normal.

Some locations reported new daily precipitation records as a result of this storm. Olivia reported a record 11 inches of snowfall on February 3rd, and also a record precipitation amount of 1.01 inches (liquid) after melting. Canby reported a new record precipitation for February 3rd as well with 1.16 inches. Redwood Falls reported a new record precipitation for February 2nd with 0.75 inches.

Topic: Pothole Prognostications

Many studies have shown that pavement is more prone to crack and develop potholes when it is wet and subjected to numerous freeze-thaw cycles. Under these conditions, abundant potholes can be expected. The freeze-thaw cycles produce thermal expansion and contraction in the water contained in cracks, along with the pavement and underlying roadbed material. This eventually produces larger cracks and cavities in the pavement that are then subjected to further breakage by the load of traffic. In addition, as the days grow longer in February, and the sun angle gets higher, clear day solar radiation can produce dramatic heating of paved surfaces during the day, even when the observed air temperature remains below freezing.

In the absence of moisture, the freeze-thaw cycles are not as efficient in cracking and breaking up pavement. The absence of snow this winter has been a blessing in this regard as there has been little moisture to seep into pavement cracks and cavities. For the Twin Cities area there have been 40 freeze-thaw cycles (more than average for this period) recorded in the daily air temperature pattern since November 1st, but nearly all have occurred with the absence of precipitation. This has meant relatively few potholes to repair so far.

However, this week the scenario has changed, with many parts of the Metro area reporting significant amounts of snowfall, ranging from 5 to 10 inches. Now, subsequent freeze-thaw cycles may inflict more damage on our roads and produce potholes that will require repairs. So be careful driving out there!

MPR listener question: I heard you tell Cathy Wurzer that February might be the snowiest month this winter. That sounds unusual. How often does it happen?

Answer: Of the 119 winters in the Twin Cities snowfall records (back to 1884), February has been the snowiest month 16 times, or just 13.5 percent of the time. The list below shows all of the months and the frequency that each was the snowiest month of winter.....

November 13 times (11 percent)
December 23 times (19 percent)
January 34 times (28.5 percent)
February 16 times (13.5 percent)
March 29 times (24 percent)
April 4 times (3 percent)

Twin Cities Almanac for February 7th:

The average MSP high temperature for February 7 is 23 degrees F (plus or minus 13 degrees standard deviation), while the average low is 5 degrees F (plus or minus 14 degrees standard deviation).

MSP Local Records for February 7th:

MSP weather records for February 7th include: highest daily maximum temperature of 53 degrees F in 1987; lowest daily maximum temperature of -14 degree F in 1933; lowest daily minimum temperature of -24 degree F in 1972; highest daily minimum temperature of 36 degrees F in 1925; record rainfall of 0.94 inches in 1928; and record snowfall of 3.0 inches in 1892, 1904, and 1932. Maximum snow depth has been 22 inches in 1967; there have been 9 measurable snowfalls since 1948.

Average dew point for this date is 5 degrees F, with a maximum of 38 degrees F in 1965 and a minimum of -32 degrees F in 1972.

All-time state records for February 7th:

Scanning the state climatic data base: the all-time high for this date is 62 degrees F at Browns Valley (Traverse County) and Madison (Lac Qui Parle County) in 1987; the all-time low is -53 degrees F at Leech Lake (Cass county) in 1899.

Words of the Week: Veering and Backing Winds

Meteorologists have used these terms for generations, primarily in giving marine and shipping forecasts. Each term refers specifically to how the wind is expected to change over the forecast period. A veering wind means the direction from which the wind blows will be changing in a clockwise manner, for example from SW to W. A backing wind means the direction from which the wind blows will be changing in a counterclockwise

manner, for example from SE to NE.

Outlook:

Chance of snow this weekend, especially in northern counties. Temperatures will continue colder than normal over the weekend and into next week. There will be another chance for snow by Wednesday and Thursday.

To: Cathy Wurzer, Jim Bickal, Julie Siple, and Eugene Cha
From: Mark Seeley
Re: Suggestions for MPR's Morning Edition, Friday, Feb 14, 2003

HAPPY VALENTINE'S DAY

Topic: Lake Pepin Ice and Mississippi River Navigation

The recent dominance of arctic air over the region thickened the ice layer on Lake Pepin in SE Minnesota. According to the District Army Corps of Engineers, ice thickness varies from 15 to 21 inches there. In order to open the Mississippi River to barge tows in the spring, Lake Pepin ice generally needs to be 6 inches or less. So, considerable melting will have to occur there before a decision to open the river for navigation is made.

Topic: Windy Tuesday

The strongest winds of the winter occurred over parts of Minnesota on February 11 (Tue) this week. Many locations reported wind gusts greater than 50 mph, reducing visibility at times to only a few feet. The following were the maximum winds reported on Tuesday afternoon....

Faribault 51 mph Pipestone 50 mph Jackson 56 mph
Worthington 56 mph Fairmont 60 mph Windom 63 mph
Sioux Falls 51 mph

Some blizzard warnings were issued in southern and western counties, more as a result of blowing snow, rather than snow falling from clouds.

In addition, some places reported windchill values ranging from -30 to -40 F.

MPR listener question: With all the blowing snow this week around the state, I wondered how fast does the wind have to blow to move snow around the landscape after it has already been deposited?

Answer: Previous research on this question, shows that the wind speed required to transport snow on the ground varies with snow density. The higher the density (firmer the snow pack) the more wind it takes. Sometimes it takes winds up to 23-25 mph to move aged or crusted snow around. However, on average a wind speed of 16 mph or greater will generally move snow around, causing blowing and drifting across Minnesota roads and highways. This was certainly the case earlier this week, as ditches filled with combinations of snow and soil in southwestern Minnesota.

Topic: The Residence Time of a Water Molecule

How fast does the average water molecule cycle through a particular

reservoir? The average residence time that a water molecule spends in any particular reservoir depends upon the combined effect of reservoir size and the rates at which water either replenishes or depletes the reservoir.

Applying mass budgeting techniques to each hydrologic feature of the Earth's climate, water molecules would cycle through the clouds most rapidly, spending an average of only 1.3 hours in a cloud as a cloud droplet or ice crystal, and between 9 to 10 days as a water vapor molecule in the atmosphere. On the Earth's land surface, a water molecule would only remain for approximately 2 weeks, but as ground water (well below the surface), it would remain in the top soil for approximately 3 months or longer. When water percolates below the top soil into bedrock aquifers, it may remain there for thousands or tens of thousands of years. Because of the immense size of the oceans, a water molecule could spend an average 3300 years circulating in the world oceans. One of the longest recycling times for a water molecule may be in one of the polar ice caps or large glaciers of the world, where the average residence time could be on the order of 11,000 to 12,000 years.

These average residence times verify observations that clouds are indeed short lived, with new water molecules from the atmosphere rapidly replenishing the water droplets and ice crystals that are continually removed from the cloud base by precipitation (as rain or snow) and from both the cloud base and the cloud top by evaporation (or sublimation) into the atmosphere. The water vapor in the atmosphere recycles on the same time scales as those average time scales that we associate with weather systems that appear on weather maps.

Twin Cities Almanac for February 14th:

The average MSP high temperature for February 14 is 25 degrees F (plus or minus 12 degrees standard deviation), while the average low is 8 degrees F (plus or minus 13 degrees standard deviation).

MSP Local Records for February 14th:

MSP weather records for February 14th include: highest daily maximum temperature of 48 degrees F in 1934 AND 1954; lowest daily maximum temperature of -5 degree F in 1920; lowest daily minimum temperature of -21 degree F in 1936; highest daily minimum temperature of 32 degrees F in 1911; record rainfall of 0.43 inches in 1950; and record snowfall of 6.4 inches in 1950. Maximum snow depth has been 21 inches in 1979; there have been 14 measurable snowfalls since 1948.

Average dew point for this date is 11 degrees F, with a maximum of 42 degrees F in 1954 and a minimum of -33 degrees F in 1943.

All-time state records for February 14th:

Scanning the state climatic data base: the all-time high for this date is 66 degrees F at Windom (Cottonwood County) in 1954; the

all-time low is -47 degrees F at Bagley (Clearwater County) in 1906.

Word of the Week: MMU

Not really a word, but sort of an acronym, this stands for Mobile Meteorological Unit. A number of countries, including the NATO nations, have weather services or branches of the military that train meteorologists for specific forecasting duties associated with military or emergency deployment of personnel. They compose the Mobile Meteorological Units which can be deployed anywhere in the world to set up instruments, and use modern satellite and electronic equipment to provide a very localized and specialized weather forecasting service. Sometimes they have been used in support of oil spill clean-ups, fighting wild fires, search and rescue missions, or special military operations.

Outlook:

Chance of snow early this weekend, especially in southwestern counties. Temperatures will continue colder than normal over the weekend, then early next week, they will rise above normal bringing a chance for statewide mixed precipitation Monday and Tuesday. Colder weather will return towards the end of the week, but not near as cold as experienced earlier this month.
by Wednesday and Thursday.

To: Cathy Wurzer, Jim Bickal, Julie Siple, and Eugene Cha
From: Mark Seeley
Re: Suggestions for MPR's Morning Edition, Friday, Feb 28, 2003

Topic: Celebrity Trivia....

Do you know what Diane Sawyer, Dick Van Dyke, Raquel Welch, Pat Sajak, Dan Rather, and David Letterman have in common? Each launched their media career as a weathercaster!!!

Topic: Preliminary Climate Summary for February

February temperatures were colder than normal across the state, ranging from just 3 degrees F below normal to as much as 7 degrees F colder than normal. On a statewide basis, and for the Twin Cities specifically this February fell in the coldest third of the historical climate distribution of temperature. The extremes of temperature around the state this month ranged from -36 F at Tower on the 25th to 55 degrees F at Theilman (Wabasha County) on the 21st. Minnesota reported the coldest temperature in the 48 contiguous states on nine dates in February, maintaining our reputation for cold weather with the nation's media.

Precipitation was generally less than normal for February at most locations, though a few places reported above normal amounts, including Olivia, Forest Lake, Redwood Falls, Springfield, and Rochester. Several snowfalls earlier in February contributed to above normal totals for the month. The Twin Cities reported 10.7 inches, 3 inches above normal and the most in February since 1994. Olivia, Forest Lake, and Cook all reported over 12 inches for the month.

MPR listener question: How much does the average number of days per year with measurable precipitation vary around the state?

Answer: Well, it is quite variable if you ask me....the table below shows the current "normals" (1971-2000) for average number of days per year with measurable precipitation for locations from northern, central, western, eastern and southern areas in the state.....just a sampling, but it shows the variability...

Location	Ave # days/year with measurable precip (.01 plus)	Location	Ave # days/year with measurable precip (.01 plus)
Twin Cities	119	Rochester	121
Duluth	134	Worthington	95
Inl Falls	129	Crookston	92
Fairmont	100	Milaca	94
Montevideo	80	Hibbing	120

Twin Cities Almanac for February 28th:

The average MSP high temperature for February 28th is 32 degrees F

(plus or minus 12 degrees standard deviation), while the average low is 15 degrees F (plus or minus 12 degrees standard deviation).

MSP Local Records for February 28th:

MSP weather records for February 28th include: highest daily maximum temperature of 57 degrees F in 1932; lowest daily maximum temperature of -9 degree F in 1962; lowest daily minimum temperature of -26 degrees F in 1962; highest daily minimum temperature of 38 degrees F in 1895; record rainfall of 0.51 inches in 1951; and record snowfall of 7.5 inches in 1906. Maximum snow depth has been 24 inches in 1962; there have been 14 measurable snowfalls since 1948.

Average dew point for this date is 15 degrees F, with a maximum of 40 degrees F in 1932 and a minimum of -40 degrees F in 1962.

All-time state records for February 28th:

Scanning the state climatic data base: the all-time high for this date is 62 degrees F at Milan and St Peter in 1905, and again at Canby in 1932; the all-time low is -50 degrees F at Pokegama Dam in 1897.

Words of the Week: Pleion and Antipleion

In the old days before meteorologists and climatologists talked about significant climate departures as "anomalies", they used these terms to describe areas with abnormal and persistent positive and negative departures in the elements of climate. These terms were introduced by the famous Polish meteorologist, oceanographer and geologist, Henryk Arctowski (1871-1958) who was the first to keep an entire year of meteorological observations in the Antarctic.

Like the word anomaly, these words imply a character to the long term climate trend or pattern, such as a prolonged warm spell of many months. The pleion is taken from the Greek, meaning greater than average or normal, and antipleion means less than. Thus one signifies an area of positive departure in the pattern of temperature, pressure, or precipitation, while the other signifies an area of negative departure.

Using pleionic terminology for the current winter, Minnesota would be described as a pleion with respect to the depth of soil freezing (above normal), but an antipleion with respect to February temperature (colder than normal)

Outlook:

Kind of an unsettled weekend coming up with a chance for snow in on Saturday. Much colder temperatures settling in for Sunday through Wednesday, with some overnights below 0 F. Chance of snow for Tuesday through Thursday. Then, moderating temperatures by next weekend.

To: Cathy Wurzer, Jim Bickal, Julie Siple, and Eugene Cha
From: Mark Seeley
Re: Suggestions for MPR's Morning Edition, Friday, March 7, 2003

Snowfalls of 2 to 3 inches on Monday of this week, ushered in some very cold air from Canada. On Sunday, Thompson in Manitoba, Canada had reported a low of -47 F, giving evidence for the type of arctic air to expect this week.

Ice cover on Lake Superior is estimated at over 90 percent coverage, the highest fraction since February 1996. Last complete ice cover of Lake Superior was in winter 1978-1979.

Topic: Cold March Trivia

The all-time record cold for March 5th in Minnesota was nearly set on Wednesday this week. Tower, MN reported a morning low of -39 degrees F, the coldest in the nation. This temperature just missed tying the all-time coldest Minnesota reading on March 5th, which was -40 degrees F at Pokegama Dam in 1890 (quite an old record!). It was a new record March 5th low for Tower, and Embarrass set a new record low for the date as well with -38 F.

International Falls set two new record lows this week, one of -25 degrees F on March 4th, and one of -30 degrees F on March 5th. Grand Forks, ND also set a record low on March 5th with -25 degrees F. Other new record lows set on March 5th included -27 degrees F at Hibbing and at Ely, and -17 F at St Cloud.

The coldest temperature ever measured in Minnesota during March was -50 F at Pokegama Dam on March 2, 1897. The latest in the spring that a -40 F reading has been recorded is March 24, 1974 when Thorhult (Beltrami County) reported -41 F. The latest in the spring for a -30 F or colder temperature is March 31, 1975 when Tower reported -32 degrees F.

Topic: Deep ground frost

The absence of heavy snow cover, combined with drier soil conditions and bitterly cold temperatures have pushed the depth of frost past 50 inches in some places. Locally on the St Paul campus of the University of Minnesota the frost depth under bare soil is 52-53 inches, the deepest since February of 1989. Some reports from northern Minnesota suggest frost has penetrated beyond 60 inches in some areas.

The deep frost has caused problems with soil heaving, as well as frozen septic systems and water lines. Road beds may need to be repaired this spring if there is too much displacement of soil due to frost. Locally, on the St Paul campus, frost depths of 50 inches or greater have been rather rare. The only occurrences I can find historically are listed

below in reverse chronological order.....

February 21, 1989 frost depth 52 inches
February 22, 1981 frost depth 60 inches
March 14, 1980 frost depth 52 inches
March 10, 1978 frost depth 57 inches
February 15, 1977 frost depth 61 inches
March 1, 1968 frost depth 70 inches (record)
March 7, 1966 frost depth 64 inches
April 4, 1965 frost depth 60 inches
March 10, 1963 frost depth 64 inches

Historical averages for maximum winter frost depth range from 18 inches in southern counties to 36 inches in north central counties.

MPR listener question: This past weekend in Andover our outdoor thermometer registered 39 degrees F at 3:00 pm in the afternoon on Saturday, March 1st, but by 7:00 am Sunday morning, March 2nd it read -6 degrees F, a drop of 45 degrees! What is the largest change in temperature over a 24 hour period in Minnesota?

Answer: Yes, indeed there were some extraordinary swings in temperature over the first weekend of March, from the 1st to the 2nd. Others reporting even larger ranges from maximum to minimum temperature in that period included:

Location	Max Temp	Min Temp	Temp Range
Winona	49 F	0 F	49 F
Winnebago	42 F	-7 F	49 F
Canby	38 F	-12 F	50 F
Lamberton	43 F	-11 F	54 F
Warroad	30 F	-30 F	60 F

The temperature difference at Warroad was the largest 24 hour change in their climatological record.

The largest 24 hour temperature difference I can find in the state climate records occurred at Lamberton (Redwood County) over April 2-3, 1982 when following an afternoon high of 78 degrees F, the overnight low plummeted to 7 degrees F, a drop of 71 degrees F.

Twin Cities Almanac for March 7th:

The average MSP high temperature for March 7 is 32 degrees F (plus or minus 11 degrees standard deviation), while the average low is 16 degrees F (plus or minus 12 degrees standard deviation).

MSP Local Records for March 7th:

MSP weather records for March 7th include: highest daily maximum temperature of 73 degrees F in 1987; lowest daily maximum temperature of 4 degree F in 1932; lowest daily minimum temperature of -16

degrees F in 1960; highest daily minimum temperature of 41 degrees F in 1987; record precipitation of 0.95 inches in 1917; and record snowfall of 11.5 inches also in 1917. Maximum snow depth has been 23 inches in 1962; there have been 14 measurable snowfalls since 1948.

Average dew point for this date is 13 degrees F, with a maximum of 44 degrees F in 1983 and a minimum of -25 degrees F in 1960.

All-time state records for March 7th:

Scanning the state climatic data base: the all-time high for this date is 78 degrees F at Marshall, New Ulm and St Peter in 1987; the all-time low is -38 degrees F at Littlefork (Koochiching County) in 1913.

Word of the Week: Gelid

This term is taken from the Latin word "gelidus", meaning icy, frosty, or cold. In describing climate or issuing a weather forecast sometimes the writer will use gelid (JEL-id) to describe bitter cold conditions like we experienced this week in Minnesota.

Outlook:

Snow most sections of the state on Saturday, followed by very cold temperatures on Sunday. Chance for scattered snow showers on Monday, mostly north. A gradual warming trend will take over bringing temperatures up into the 40s F by late in the week.

To: Cathy Wurzer, Jim Bickal, Julie Siple, and Eugene Cha
From: Mark Seeley
Re: Suggestions for MPR's Morning Edition, Friday, March 14, 2003

Topic: TWo University Public Engagement Programs in April

We have a two major public engagements coming up on the St Paul Campus in April. The first, on Friday, April 4th is the inaugural lecture in the newly endowed Larson Allmaras Lecture Series on Emerging Issues in Soil and Water. The program will feature remarks by the new Commissioner of the Minnesota Pollution Control Agency, Sherly Corrigan, followed by a lecture from Dr. Rattan Lal of Ohio State University. Dr. Lal is an expert on the carbon cycle, and has written one of the most authoritative books on Carbon Sequestration. This program will take place at 2:30 pm in Room 335 Borlaug Hall.

on Saturday, April 5th, the College of Agricultural, Food, and Environmental Sciences presents its annual "Classes Without Quizzes." You can come and hear about all kinds of interesting things going on at the university, choosing among nine various lectures ranging from genomics, to food security, to wind energy, to climate change, and more. I'm one of the speakers. For more information go to the college web site..

<http://alumni.coafes.umn.edu/forum/>

Topic: Cold Reputation

Minnesota has lead the nation in cold temperatures so far this month (March) as the following reports represent the coldest temperatures in the 48 contiguous states...

March 1 -15 F at Tower

March 5 -39 F at Tower

March 6 -34 F at Tower

March 10 -20 F at Embarrass and Fosston

March 12 -18 F at Embarrass

March 13 -15 F at Crane Lake

Topic: Cold=Ice=Frozen Soil=Long Thaw

The cold spell earlier this month in historical perspective represented the third coldest ever March 1-10 in the modern state records. Only 1943 and 1960 were colder in early March. This exacerbated already thick lake ice and deeply frozen soils. Last week, we noted that the deep soil frost will take some time to thaw this spring. Similarly lake ice, now up to 50 inches thick in some places, will take a good long time to disappear as well, as it did in those other years with a cold March like 1943 and 1960. In addition, ice dams may be a problem on some Minnesota rivers.

In the meantime, we might see more examples of ice ridge effects in the form of damage to shorelines, docks, and cottages along Minnesota lakes. Through various freeze and thaw cycles that produce cracking, melting and re-freezing of the ice, the ice expands along the shoreline pushing or lifting the soil or any structures on its surface. In addition as thawing temperatures become more prevalent, there will be a thermal expansion of the ice that will contribute further to this pushing action.

Sometimes as the ice breaks up on Minnesota lakes, strong winds or pressure differences across the surface produce rafted ice, where large blocks of ice are lifted over the top of other ice. This effect is sometimes visible in March and April on Minnesota's larger lakes like the Lower Red Lake, Leech Lake, or Mill Lacs Lake. In fact on Mill Lacs, Highway 169 on the west, and highway 47 on east are sometimes impacted by ice blown by strong winds across the lake.

Lake property owners may not like to hear this, but a significant storm will affect the state from Sunday through Tuesday next week, bringing strong enough winds to move some of the thawing ice floes around the lakes.

Topic: Final 2002 Tornado Statistics

The new issue of Weatherwise magazine reports some interesting tornado statistics in 2002. Minnesota reported a total of 28 tornadoes, more than Arkansas, Alabama, Mississippi, and even Oklahoma (16). Texas and Kansas reported the most, with 123 and 114, respectively. Another unusual tornado feature in 2002 was that November 10th produced the largest number of storms nationally, with 70 tornadoes reported. Such numbers are more frequently associated with outbreaks in April, May, or June.

MPR listener question: I noticed quite a difference between shoveling last weekend's snowfall in the Twin Cities (5 inches) and this Tuesday's snowfall (2 inches). The snowfall on Tuesday seemed heavier and crustier, more difficult to shovel. Was the snow density different?

Answer: Yes, I noticed the difference in shoveling myself. The weekend snowfall occurred with air temperatures ranging from just 7 to 10 degrees F. It definitely was light and fluffy, with a snow/water ratio of about 23 to 1 according to National Weather Service measurements at Chanhassen. The snowfall on Tuesday was a bit denser, with snow/water ratio of 18 to 1, so you might say the snow was heavier to shovel. It fell with an air temperature that ranged from 28 to 30 degrees F. However, I think another factor to consider with the Tuesday snowfall is the fact that

previous to the event the air temperature had reached nearly 40 degrees F and warmed the surface. This cause a little more melting as the snow fell, producing an underlying mix of snow, water, and ice. This is much harder to get a shovel blade underneath.

Twin Cities Almanac for March 14th:

The average MSP high temperature for March 14 is 36 degrees F (plus or minus 12 degrees standard deviation), while the average low is 20 degrees F (plus or minus 12 degrees standard deviation).

MSP Local Records for March 14th:

MSP weather records for March 14th include: highest daily maximum temperature of 62 degrees F in 1973 and 1990; lowest daily maximum temperature of 8 degree F in 1906; lowest daily minimum temperature of -10 degrees F in 1897; highest daily minimum temperature of 45 degrees F in 1973; record precipitation of 0.81 inches in 1989; and record snowfall of 9.0 inches just last year (2002). Maximum snow depth has been 26 inches in 1962; there have been 13 measurable snowfalls since 1948.

Average dew point for this date is 21 degrees F, with a maximum of 57 degrees F in 1990 and a minimum of -16 degrees F in 1960.

All-time state records for March 14th:

Scanning the state climatic data base: the all-time high for this date is 73 degrees F at Pipestone in 1935; the all-time low is -40 degrees F at Detroit Lakes (Becker County) in 1897.

Words of the Week: Whymper's apparition

Edward Whymper was a British mountaineer of the 19th Century who wrote extensively about his expeditions and observations. After six failed attempts, he successfully scaled the Matterhorn in July, 1865. But on his descent, four of this climbing party slipped and were killed. Only the breaking of the rope which held them all together saved Whymper and the other two climbing guides. He later wrote about this in the book Scrambles Among the Alps. In his narrative he describes seeing an atmospheric apparition after the death of his colleagues. This apparition took the form of 3 crosses formed from suspended ice crystals in the air caused (theoretically) by refraction of the light being reflected from the steep sloped mountain surfaces around him. Since his time, others have reported on atmospheric appartitions caused by suspended ice crystals. Some of these include sun dogs, sun pillars, and halos.

Outlook:

A warm, but wet thaw period is coming up. Temperatures will climb into the 40s and 50s F around the state, but by late

in the weekend there will be a chance for rain. A greater chance for rain will occur early next week, with a major storm expected in the middle of the nation. Expect strong winds, heavier rainfalls, and even some thunderstorms. The rain may turn to snow in the north by mid week.

To: Perry Finelli, Jim Bickal, Julie Siple, and Eugene Cha
From: Mark Seeley
Re: Suggestions for MPR's Morning Edition, Friday, March 21, 2003

Topic: March Brings a Variety of Clouds

Perhaps the greatest variety of cloud types are visible in Minnesota during the month of March. The combination of longer days, contrasting air masses, melting snow, a warming landscape, and stronger winds produce every kind of cloud. Of the ten major cloud types, we have already seen cirrus, cirrostratus, altostratus, nimbostratus, stratocumulus, stratus, cumulus, and fog this month. We have yet to see many cirrocumulus, cumulonimbus and altocumulus this month, but they will come as convection increases toward the end of the month. This cloud classification scheme dates all the way back to Englishman Luke Howard who introduced it in 1803. Cloud types are primarily based on shape, altitude, spatial coverage, and type of water composition (droplet or ice crystal).

Topic: March Temperature Swings

March 1-10 brought extreme cold and snow. Lowest temperature was -39 F at Tower, MN on the 5th. Ten days later brought record warmth, with Jackson, MN reporting 77 F on the 15th. This represents a temperature range across the state of 116 degrees F over a 10 day period. Thanks to the warmth, soils have started to thaw, down to about 8-12 inches. Frozen soils still persists below this layer and will take longer to completely thaw.

From several MPR listeners, a question: Can you describe the climate and recent weather in Iraq?

Answer: I am no expert on the climate of Iraq, but the literature describes it as mostly desert like, except for marshy areas along the Iranian border and the south. It is a climate of extremes, with very hot temperatures in the summer, under mostly cloudless skies, and cool temperatures in the winter, especially in the northern mountains along the border with Turkey, and in some of the plains. Snow is common in the mountains of the north during November through March. Most of the precipitation falls from December through April, with annual totals ranging only from 4 to 8 inches. This winter northern Iraq has had snow and colder than normal temperatures, especially in February.

Currently Iraq is experiencing the passage of stronger frontal systems, bringing rain to the north and strong winds across the plains. Temperatures are ranging from 40s and 50s F in the north to 70s and 80s F in the south. Partly cloudy skies with light winds are expected in southern Iraq over the next few days. There may be some showers in the northern mountains.

Winds are an important feature of the Iraq climate. A bora like

wind known as the Nashi blows from the north during the winter, usually as outflow from the central Asian high pressure system that dominates there. In the summer the same north wind is known as the shamal, and brings relief with cooler, drier air. Also in the summer a strong wind can blow from the south, off the Persian Gulf. This is called the Sharki wind and brings heat and oppressive humidity, pushing the Heat Index well over 120 F. At maximum strength, all of these winds can produce duststorms or black blizzards which reduce visibility to near zero. There was a duststorm reported in the region on Wednesday this week.

Forecasting the weather for military operations in Iraq is problematic. There are relatively few ground-based observing stations in the region, mostly at airports. But, the military typically deploys mobile meteorological forecasting units which make use of portable weather radar systems, automated-remotely placed weather stations with wireless communication capabilities, and satellite receiving stations. Combined with locally launched weather balloons and reports from aircraft reconnaissance, these technologies allow meteorologists to provide detailed forecast guidance for military operations.

Twin Cities Almanac for March 21st:

The average MSP high temperature for March 21 is 41 degrees F (plus or minus 12 degrees standard deviation), while the average low is 24 degrees F (plus or minus 10 degrees standard deviation).

MSP Local Records for March 21st:

MSP weather records for March 21st include: highest daily maximum temperature of 76 degrees F in 1938; lowest daily maximum temperature of 13 degree F in 1965; lowest daily minimum temperature of -8 degrees F in 1965; highest daily minimum temperature of 47 degrees F in 1938; record precipitation of 0.83 inches in 1904; and record snowfall of 3.2 inches in 1992. Maximum snow depth has been 23 inches in 1951; there have been 8 measurable snowfalls since 1948.

Average dew point for this date is 22 degrees F, with a maximum of 51 degrees F in 1946 and a minimum of -11 degrees F in 1965.

All-time state records for March 21st:

Scanning the state climatic data base: the all-time high for this date is 81 degrees F at Montevideo (Chippewa County) in 1910; the all-time low is -33 degrees F at Cotton (St Louis County) in 1965.

Words of the Week: Sap Moon, Crow Moon, Worm Moon, or Lenten Moon

All of these names are ascribed to the first full moon of March. Certainly there is logic to each one. Sap moon ties in well with the maple sap run, though this may range from February to April

depending on frozen soil and the severity of the winter season. Crow moon indicates more numerous and active crows. Worm moon refers to the fact that the ground thaws in March and may become warm enough for worm activity. Finally, Lenten moon is self explanatory as the Lenten season begins. The March full moon occurred on March 18th (Tuesday) this week.

Outlook:

Generally a dry weekend with above normal temperatures. Increasing clouds next week with chances for rain, beginning on Monday, and declining temperatures. Highs will mostly be in the 40s and 50s F next week with a good chance of precipitation toward the end of the week.

To: Cathy Wurzer, Jim Bickal, Julie Siple, and Eugene Cha
From: Mark Seeley
Re: Suggestions for MPR's Morning Edition, Friday, March 28, 2003

Topic: New Monthly and Seasonal Climate Outlooks

The Climate Prediction Center released the new monthly and seasonal outlooks on Thursday this week. They backed off from those of last month which called for drier and warmer conditions across eastern Minnesota. The outlook for April, May, and June calls for near normal temperature and precipitation across the state of Minnesota, as well as our neighboring states.

Topic: More on the Weather of Iraq

Now that the sand storm of mid-week has abated, Iraq's weather will be dominated by weak high pressure through Sunday, with mostly fair skies and warming temperatures. The length of time between weather systems that deliver wind and rain to the landscape starts to stretch out in April, ranging out to 5-7 days between weather fronts. Fair weather favors the allied forces, while disturbed weather which negates some of the deployment of technology and aircraft favors the Iraqi forces.

The weather tends to warm dramatically in April, with daily high temperatures reaching from the high 70s to high 80s F except in the northern mountains. Record highs in April have ranged from 105 to 117 F. As temperatures warm and precipitation diminishes, winds can kick up sand and dust somewhat more frequently, especially the north wind known as the shamal.

In the southern plains of Iraq closer to the Persian Gulf moisture, dew points can rise dramatically in April, reaching the 70s and 80s F. When combined with high temperatures in the 80s and 90s F, these conditions will produce uncomfortable Heat Index Values over 100 F. Maintaining proper hydration and energy levels among troops will be a challenge in such an environment.

Topic: 5-Year Anniversary of Most Severe March Tornado Episode

Saturday, March 29th marks the five-year anniversary of Minnesota's worst March tornado outbreak. Fourteen tornadoes struck across southern Minnesota during the afternoon and early evening of March 29, 1998, one reaching F4 level (winds greater than 207 mph) just northwest of Comfrey (Brown County). Two fatalities resulted from this outbreak and widespread damage occurred, especially in Comfrey, St Peter, and Le Center. Two of the tornadoes were exceptionally wide and were described by observers as a rolling fog bank. March tornadoes are especially rare in Minnesota, accounting for less than 2 percent of all historical occurrences.

There was a public information statement about the 1998 tornado outbreak released by Todd Krause of the National Weather Service in Chanhassen on Wednesday of this week.

Topic: Largest wind farm to be built in Iowa

Though the winds of Iraq have dominated the news this week, the winds of Iowa made it into the headlines on Wednesday as well when it was announced that billionaire Warren Buffett's company MidAmerican Energy will build the world's largest wind energy facility in northern Iowa, occupying up to 200 acres of farmland with 200 wind turbines. According to the Associated Press story, each turbine will produce 1.5 to 1.6 megawatts of power, generating a total output of 310 megawatts, enough to power 85,000 homes. This project alone will place Iowa third among states in wind power generation, behind only California and Texas. Farmers will be paid about \$4000 per turbine per year. As technology has produced more efficient wind turbines over the past decade, this alternative and renewable source of energy is being seriously considered and strongly advocated by many politicians, including Iowa's Governor Tom Vilsack. We can expect to see the deployment of many more wind turbines across the landscape in the next several years.

Question from an MPR listener: After the recent prolonged warm spell, will temperatures in March end up averaging above normal?

Answer: Probably not.....though we had a long run of above normal temperatures, especially from the 14th to the 24th, this did not entirely make up for the colder than normal period we experienced during the first two weeks of the month. Mean March temperatures will probably be near normal to colder than normal for most places around the state. Temperature extremes for March ranged from -39 F at Tower to 77 F at Jackson. The recent rain and snow this week will likely bring total precipitation values for March closer to normal for many Minnesota communities, probably within a few tenths of an inch. For northern and eastern counties in Minnesota March has been the snowiest month of the winter.

Twin Cities Almanac for March 28th:

The average MSP high temperature for March 28 is 45 degrees F (plus or minus 12 degrees standard deviation), while the average low is 28 degrees F (plus or minus 9 degrees standard deviation).

MSP Local Records for March 28th:

MSP weather records for March 28th include: highest daily maximum temperature of 78 degrees F in 1946; lowest daily maximum temperature of 21 degree F in 1899; lowest daily minimum temperature of -1 degrees F in 1923; highest daily minimum temperature of 51 F in 1946; record precipitation of 1.08 inches in 1896; and record snowfall of 6.5 inches in 1894. The maximum snow depth has been 22 inches in 1965; there have been 9 measurable snowfalls since 1948.

Average dew point for this date is 28 degrees F, with a maximum of 55 degrees F in 1981 and a minimum of -9 degrees F in 1923.

All-time state records for March 28th:

Scanning the state climatic data base: the all-time high for this date is 84 degrees F at Bemidji (Beltrami County) in 1946; the all-time low is -30 degrees F at Roseau in 1923.

Word of the Week: ORG

This is a relatively new acronym to the field of meteorology and stands for Optical Rain Gage. It is a device which measures the rate of precipitation, estimating the deposition of snow or water on a surface. It uses the attenuation of a light signal between two sensors to determine the size and distribution of droplets or ice crystals falling through the atmosphere. I don't know how reliable it is and to my knowledge it has yet to be adopted as a standard measurement by any governmental weather services.

Outlook:

A somewhat windy weekend and generally dry. Temperatures will be below normal. Increasing clouds on Sunday with a chance for precipitation in the central and northern counties. Scattered light precipitation and snow will hang around through Tuesday when temperatures start to warm up to above normal levels. There will be a chance for showers and thunderstorms by the middle of next week.

To: Cathy Wurzer, Jim Bickal, Julie Siple, and Eugene Cha
From: Mark Seeley
Re: Suggestions for MPR's Morning Edition, Friday, April 4, 2003

Topic: An April Fools Weather Tease

April 1st and 2nd brought very warm conditions to southern Minnesota, with many communities reporting highs in the 60s F and some as high as the mid 70s F. These were the warmest conditions seen for the first of April since 1986. But they certainly raised false hopes regarding the rest of the week. Snow in the north, wind and rain in the south, with temperatures only in the 30s and 40s F for much of the rest of the first week of April.

Topic: The color of precipitation

Now that we are moving (albeit it slowly) out of the Winter precipitation regime (mostly stratus cloud layers) into the Spring precipitation mode (convective, vertical clouds), the colors for precipitation that we see in radar displays both on television and the Internet web sites will change. Video Integrator and Processor (VIP) displays translate the Doppler 88-D radar echo patterns to color coded contour maps. These maps are typically updated about every half hour. The precipitation type and intensity is inferred by the color coding. Dark blue is typical of moderate to heavy snow, light blue is for lighter snowfalls, and various shades of pink imply mixed frozen precipitation (freezing rain, sleet, etc). Green is the color code for light rainfall. More intense rainfall is coded as yellow and usually signifies some thunder as well. Moderate to strong thunderstorm type rainfall is coded as magenta or red. These colors indicate relatively larger droplet sizes, and of course intense rainfall. As we get deeper into April, we will notice more and more of the yellow and reddish colors in radar displays. The Doppler radar displays played over a time series of echo returns allows forecasters to determine whether individual thunderstorm cells are strengthening or weakening.

More on the color of precipitation in radar displays can be found at..

<http://cirrus.sprl.umich.edu/wxnet/radsat.html>
<http://weather.noaa.gov/radar/national.html>

Topic: Anniversary of largest April snowfall.....

Seventy years ago today, April 4, 1933 brought April's heaviest 24 hour snowfall to the state of Minnesota, when Pigeon River Bridge (the immigration station along the Canadian border in Cook County) measured an accumulation of 28 inches of snow. Combined with winter's leftover snow cover, this produced a snow depth of 3 feet, an amount that took until the end of the month to fully melt.

Topic: Literary diversions of the old Crop/Weather Reports

In the late 19th Century, the USDA and the Weather Bureau collaborated in producing a weekly crop-weather bulletin that unlike its modern counterpart offered a wide range of reading for the subscriber, including poetry, advertising, pearls of wisdom, recent agricultural research findings, crop conditions, and of course weather summaries. Some excerpts from the bulletin of April 15, 1896.....

Little drops of water
Freezing on the walk
Makes the man who steps there
Indulge in naughty talk

The deep ground temperature outside Paris, France is a constant 53 degrees F, while that of Mammoth Cave in Kentucky is 54 F. The deep ground temperature in St Paul (at 43 feet) is 50 F.

A second hand aneroid barometer used previously by the Weather Bureau is for sale....\$10 with case....

A farmer says that he first met his wife in a storm,
took her to their first ball in a storm,
popped the big question in a storm,
and has lived in a storm every since.

There was an article on principles for establishing and maintaining rural cemeteries....and a 50-acre farm six miles west of Minneapolis was for sale at \$50 cash.

And finally, no agricultural field activity was reported as temperatures had been too cold.....

Question from an MPR listener: What are the temperature extremes for the month of April in Minnesota?

Answer: The all-time April temperature extremes in the Twin Cities are 2 degrees F on April 13, 1962, and 95 degrees F on April 21, 1980. The all-time extreme values statewide are -22 degrees F on April 6, 1979 at Karlstad (Kittson County) and at Tower on April 6, 1982; and a high of 101 degrees F at Hawley (Clay County) on April 22, 1980.

Twin Cities Almanac for April 4th:

The average MSP high temperature for today's date is 49 degrees F (plus or minus 12 degrees standard deviation), while the average low is 31 degrees F (plus or minus 8 degrees standard deviation).

MSP Local Records for April 4th:

MSP weather records for today's date include: highest daily maximum temperature of 81 degrees F in 1921; lowest daily maximum

temperature of 27 degree F in 1920 and 1995; lowest daily minimum temperature of 5 degrees F in 1995; highest daily minimum temperature of 62 F in 1921; record precipitation of 0.77 inches in 1932; and record snowfall of 7.2 inches in 1957. The maximum snow depth has been 9 inches in 1975; there have been 9 measurable snowfalls since 1948.

Average dew point for this date is 26 degrees F, with a maximum of 65 degrees F in 1929 and a minimum of -9 degrees F in 1995.

All-time state records for April 4th:

Scanning the state climatic data base: the all-time high for this date is 89 degrees F at Tracy (Lyon County) in 1929; the all-time low is -17 degrees F at Tower (St Louis County) in 1975.

Word of the Week: SEAWIFS

This is an acronym for a high resolution NASA satellite associated with the Sea-viewing Wide Field of View Sensor project. The sensors measure the optical properties of the oceans which vary with the abundance and kind of marine life, including phytoplankton and other microscopic organisms. Analysis of SEAWIFS images will aid in determining the variability of chlorophyll and marine phytoplankton, including the timing and abundance of Spring blooms. This will aid in assessing the role of the oceans in the global carbon cycle.

SEAWIFS images are high resolution and provide detailed views of both land and ocean surfaces. Some of the best satellite images of the dust storms that occurred in Iraq last week were provided by this satellite as well. These can be seen at their web site...

<http://seawifs.gsfc.nasa.gov/SEAWIFS.html>

Outlook:

Cool, but mostly dry on Saturday, then increasing chances for precipitation Sunday and Monday, mostly in southern counties. Continued below normal temperatures through Tuesday, then a warming trend will start, bringing in above normal temperatures for the second weekend of April.

To: Cathy Wurzer, Jim Bickal, Julie Siple, and Eugene Cha
From: Mark Seeley
Re: Suggestions for MPR's Morning Edition, Friday, April 11, 2003

Topic: Record snows in the south, Warm at the Falls this week..

Though the 71 degrees F high temperature at International Falls, MN on Wednesday, April 9th did not set a new record, it was only the 3rd time in history that the temperature has reached 70 F or higher there on that date.....the others were 72 F in 1977 and 77 F in 1987. Many other Minnesota communities reported highs of 70 F or above on Wednesday as well, including....

Benson 70 F Morris 70 F Moorhead 73 F
Crookston 70 F Fergus Falls 72 F Warroad 70 F
Roseau 72 F Wheaton 72 F Hallock 75 F

Of the list above, only Hallock set a new daily high temperature record that day. Strangely, high temperatures in southern Minnesota counties on Wednesday were 20-25 degrees F cooler than in the north thanks to the recent snowfall across the south.

Earlier in the week on Monday (April 7th) record snowfalls were reported across portions of southern Minnesota and South Dakota. The following stations reported new record amounts..

Sioux Falls, SD 5.1 inches Fairmont 12 inches
Albert Lea 13 inches Blue Earth 12 inches
Winnebago 11 inches St James 10 inches
Amboy 7 inches Rochester 5.5 inches

Topic: Severe Weather Awareness Week

The National Weather Service has been providing educational material about severe weather this week to help prepare the public for the type of severe weather that convective storms can bring, primarily hail, lightning, severe thunderstorm winds, tornadoes, and flash floods. Actually April is an appropriate month, because all of these types of weather in addition to blizzards and winter storms can occur in April.

Topic: High Pressure Brings Extremely Dry Air in April...

A strong high pressure system over the state on Wednesday brought some extraordinary dry air. The absence of snow cover and strong sun produced highs in the 70s F in western and northern areas of the state. But the dew points were very low, mostly in the teens, so the atmospheric humidity was truly desert-like. The following table is an afternoon comparison between some Minnesota communities and some Arizona locations:

Location	Air temperature	Dew Point	Relative Humidity
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Twin Cities	55 F	12 F	18 pct
Moorhead	73 F	16 F	11 pct
Fergus Falls	72 F	12 F	10 pct
Benson	70 F	0 F	6 pct
Cambridge	61 F	12 F	15 pct
Tucson, AZ	89 F	33 F	13 pct
Flagstaff, AZ	64 F	13 F	13 pct
Grand Canyon, AZ	65 F	15 F	14 pct

Topic: Hazards of High Pressure Weather Systems

Though most Minnesotans associate high pressure with sunny skies, mild, dry air, and very light winds, strong high pressure systems can also produce four types of undesirable weather: cold waves, heat waves, drought (when persistent for a long enough period) and associated high fire danger, and lastly, air pollution episodes due to stagnant inversions that allow air quality to deteriorate.

The high pressure system on Wednesday produced high fire danger conditions in portions of western and northern Minnesota, as over 60 fires were reported. Indeed, until vegetation starts to bud and green-up, such high pressure systems are likely to raise the fire danger across the state given the absence of over-winter precipitation in many areas.

Question from an MPR listener: What is the range in mean annual temperature around the state of Minnesota? Also, what is the range in mean annual precipitation?

Answer: Using the most recent climate normals for the period from 1971 to 2000, mean annual temperature in the state ranges from 35-36 degrees F in far north-central sections to over 48 degrees F at Winona in the southeast. For the Twin Cities the mean annual temperature is 45.4 degrees F. Mean annual precipitation across the state ranges from 18-19 inches in Kittson County (far northwestern MN) to 35 inches in Caledonia (Houston County in SE, MN). The Twin Cities mean annual precipitation is 29.41 inches.

Twin Cities Almanac for April 11th:

The average MSP high temperature for today's date is 53 degrees F (plus or minus 11 degrees F standard deviation), while the average low is 34 degrees F (plus or minus 8 degrees standard deviation).

MSP Local Records for April 11th:

MSP weather records for today's date include: highest daily maximum temperature of 83 degrees F in 1968; lowest daily maximum temperature of 25 degree F in 1940; lowest daily minimum temperature of 12 degrees F in 1940; highest daily minimum temperature of 57 F in 1977; record precipitation of 0.95 inches in 2001; and record

snowfall of 5.7 inches in 1929. The maximum snow depth has been 4 inches in 1980; there have been 2 measurable snowfalls since 1948.

Average dew point for this date is 29 degrees F, with a maximum of 59 degrees F in 1945 and a minimum of -1 degrees F in 1940.

All-time state records for April 11th:

Scanning the state climatic data base: the all-time high for this date is 92 degrees F at Browns Valley (Traverse County) and Madison (Lac Qui Parle County) in 1977; all-time low is -4 degrees F at Baudette (Lake of the Woods county) in 1940.

Word of the Week: Icesat

This is one of the new NASA satellites equipped with sensors to study the Earth climate system. The acronym stands for Ice, Cloud, and Land Elevation Satellite. This satellite will measure the growth and retreat ice in Greenland and Antarctica, polar stratospheric clouds, topography, and the height of landscape vegetation. More on this NASA satellite can be found at....

<http://icesat.gsfc.nasa.gov/>

Outlook:

Continuing partly cloudy with mild temperatures into the weekend. Increasing chances for rainfall in the north by Sunday, and statewide later in the day on Monday. Temperatures will be generally above normal throughout the period. Thunderstorms may be more common next week, and welcome too, as most places could use the moisture.

To: Cathy Wurzer, Jim Bickal, Julie Siple, and Eugene Cha
From: Mark Seeley
Re: Suggestions for MPR's Morning Edition, Friday, April 18, 2003

Topic: New summer climate outlooks....

The Climate Prediction Center released the new outlook for summer on Thursday of this week. The temperature outlook for summer favors above normal temperatures across 80 to 90 percent of the U.S. landscape through September. This is a bold and unusual forecast for the CPC, based primarily on recent above normal temperature trends and soil moisture conditions (dry in the west). The above normal temperature outlook includes Minnesota.

Regarding precipitation, the outlook is for equal chances of above or below normal rainfall for the summer in Minnesota.

Topic: New State Record Highs on April 13-14, 2003

New all-time state high temperature records were set on April 13 and 14 earlier this week. Both Benson and Montevideo reported highs of 93 degrees F on those dates, while Madison also reported a high of 93 F on April 14th. Numerous individual community record highs were set on both days as well, including an 89 F reading in the Twin Cities on April 14th....recall last year a new record high of 91 F was set on April 15th...

Topic: The efficiency of rainfall

Following a very warm and desert-like start to April, the Minnesota landscape was desperately in need of rainfall. Fire danger had risen to the severe and extreme categories, while farmers were waiting for topsoil moisture to be replenished enough to cultivate a seedbed for planting.

Rainfall arrived on Tuesday night, and in a very efficient manner. Most soils in Minnesota have an infiltration rate ranging 0.1 to 1.50 inches per hour, depending on soil texture, compaction, degree of saturation, slope, vegetative cover and other features. The rainfall lasted for over 20 hours in many places, producing amounts ranging from 1 to 4 inches. This translates to a mean hourly rainfall rate of 0.05 to 0.20 inches, a rate that is highly efficient for recharging the soil profile, since only a small fraction runs off. The widespread distribution, total quantity, and rate of deposition were tailor-made to alleviate the fire threat across the state and to inspire agricultural producers to get ready to roll for the planting season at

the next opportunity!

Interestingly enough, frost went out of most Minnesota soils this past week and earthworms became active. Their bore holes actually enhanced infiltration of the rainfall to deeper layers of the soil....so we should thank Mother Nature for the earthworms as well.

Finally, Rochester, Eau Claire, WI, MSP, St Cloud and many other stations reported new record rainfall for April 16th. It appears that this will start a wetness trend that will last through Easter and into early next week.

Topic: Costing out the weather service.....

Federal income taxes were due by midnight on Tuesday of this week. Did you know that the base operational budget for our National Weather Service during 2001 was approximately \$693 million, which translates to a service that provides local warnings and forecasts, as well atmospheric and hydrological research and environmental data, but costs each U.S. citizen only approximately \$2.46 per year? That's a bargain if you ask me.

Question from an MPR listener: I noticed the first reports of hail this Spring came on Tuesday this week as northern St Louis County reported 1 inch to 1.75 inch diameter hail. Isn't this unusual for April?

Answer: Yes, indeed it is unusual in two respects, related to time and geographical location. According to climatology, hail in April occurs only about once in every 3-4 years in Minnesota. It occurs with even less frequency in northern St Louis County which reports hail only about once per year. Perhaps they have already had their dose of hail for this year.

Twin Cities Almanac for April 18th:

The average MSP high temperature for today's date is 58 degrees F (plus or minus 12 degrees F standard deviation), while the average low is 38 degrees F (plus or minus 8 degrees standard deviation).

MSP Local Records for April 18th:

MSP weather records for today's date include: highest daily maximum temperature of 89 degrees F in 1985; lowest daily maximum temperature of 31 degree F in 1953; lowest daily minimum temperature of 21 degrees F in 1953; highest daily minimum temperature of 61 F in 1915; record precipitation of 0.98 inches in 1928; and record snowfall of 1.0 inches in 1898 and 1939. The maximum snow depth has been 4 inches in 1983; there have been 4 measurable snowfalls since 1948.

Average dew point for this date is 33 degrees F, with a maximum of 63 degrees F in 1908 and a minimum of 3 degrees F in 1988.

All-time state records for April 18th:

Scanning the state climatic data base: the all-time high for this date is 94 degrees F at Marshall (Lyon County) in 1985; all-time low is 2 degrees F at Gunflint Lake (Cook County) in 1983.

Words of the Week: Capillary flow and gravity flow of soil moisture

Following the rainfall this week and the associated soil moisture recharge, the redistribution of that moisture will take place throughout the upper layers of soil by both capillary flow and gravity flow. Where the soil layers are saturated (holding as much water as the pore space will allow), excess water will be distributed deeper into the soil profile by the pull of gravity. Where soils are not saturated, capillary flow (a gradient flow from thicker water films in the soil to thinner water films in the soil) will still occur. Over a period of hours to days this redistribution will help insure that moisture is stored at deeper layers for plants to use later in the coming growing season.

Outlook:

Generally cloudy with chances for rainfall over the Easter weekend. Temperatures will fluctuate either side of normal depending on the extent of cloudiness. Chance of showers and thunderstorms will carry over into Monday, then partly cloudy weather for Tuesday...

To: Cathy Wurzer, Jim Bickal, Julie Siple, and Eugene Cha
From: Mark Seeley
Re: Suggestions for MPR's Morning Edition, Friday, April 25, 2003

Earlier this month, Minnesota made the weather headlines with record-setting snowfall amounts in southern counties on the 7th and new state record high temperatures of 93 F on the 13th and 14th. On Wednesday (April 23) of this week, we made the national news again with the lowest temperature reading in the conterminous states of 17 F at Embarrass. This however, was not a record value for Embarrass, as they have been as low as 12 F on that date.

Topic: Shakespeare on Ice

In recent years we have heard about the success of ice hotels in Canada and Scandanavian countries. These are temporary hotels made of block ice that have most of the accoutrements of regular hotels, popular with tourists for the novel experience. According to the latest Bulletin of Meteorology, a small town north of Stockholm, Sweden has had some success this year with an ice theatre. They constructed an ice replica of the London Globe Theatre, complete with an open-air partial roof, and staged a production of Hamlet. Theatre patrons could stay at a nearby ice hotel, complete with an ice bar, ice block stools, and an ice cinema showing movies on an ice screen. I don't know what it cost, but there's another idea for our own International Falls community to consider.

Topic: Only a remnant of weather service left in Afghanistan

Lt Colonel Robert Russell reported to the American Meteorological Society on the conduct of weather operations in Afghanistan last year. Weather Services were provided by the Air Force Weather Service, over which he presides as chief. The coalition forces found that the Taliban had completely dismantled the government weather service in Afghanistan, though they had not destroyed the equipment. The Taliban believed that meteorology and forecasting were nothing more than sorcery! The Air Force Weather Service helped re-establish weather services in Afghanistan by training civilians there to make the measurements and utilize modern technologies in making forecasts. It will be interesting to observe if Afghanistan develops a sound government weather service that gains the respect of its citizenry.

Topic: Update on lake ice out and soil temperatures

Many lakes in southern Minnesota counties lost their ice in late March or earlier this month. This was on the order of a few days to a week or more earlier than historical averages.

In central Minnesota, the ice went out on Mille Lacs Lake

earlier this week, close to the normal historical date. Most lakes in northeastern and north-central counties are still ice covered and will not be ice free until later next month.

Ice floes are still abundant in parts of Lake Superior as water temperatures range from 32 to 34 F.

Soil temperatures have warmed nicely this week reaching the 40s and 50s F at the 4 inch depth. Gardeners and farmers alike have been busy tilling, spreading manure, and planting.

Question from an MPR listener: Given the wild swings in temperature that have occurred in both March and April, I am wondering if May might bring more of the same. What are the all-time extreme temperatures in May?

Answer: In the Twin Cities area, the all-time extreme May temperatures range from 106 F (May 31, 1934) to a chilly 18 F (May 3, 1967). On a statewide basis the extremes are 108 F at several locations (New Ulm, Fairmont among others) on May 31, 1934, and a frigid 4 F at Pine River Dam back on May 1, 1909.

Twin Cities Almanac for April 25th:

The average MSP high temperature for today's date is 61 degrees F (plus or minus 11 degrees F standard deviation), while the average low is 41 degrees F (plus or minus 8 degrees standard deviation).

MSP Local Records for April 25th:

MSP weather records for today's date include: highest daily maximum temperature of 91 degrees F in 1962; lowest daily maximum temperature of 37 degree F in 1950; lowest daily minimum temperature of 25 degrees F in 1907; highest daily minimum temperature of 65 F in 1990; record precipitation of 1.47 inches in 1902; and record snowfall of 3.2 inches in 1950. There have been 3 measurable snowfalls since 1948.

Average dew point for this date is 36 degrees F, with a maximum of 63 degrees F in 1990 and a minimum of 9 degrees F in 1933.

All-time state records for April 25th:

Scanning the state climatic data base: the all-time high for this date is 96 degrees F at Madison (Lac Qui Parle County) in 1962; the all-time low is 5 degrees F at Leech Lake Dam (Cass County) in 1909.

Word of the Week: Dro

Dro is short for Drop, the name of the cartoon character that teaches kids about weather in Australia. Popularized in books and online activities by the Bureau of Meteorology, Dro has taught thousands of

school age children simple lessons about the weather in Australia, including reading weather signs from clouds and how to understand a weather map on television. More on Dro can be found at the following web site....

http://www.bom.gov.au/lam/Students_Teachers/learnact.htm

Outlook:

continued warmer than normal into the weekend with a chance for some scattered showers developing late Saturday and into Sunday. Generally breezy throughout the period. Some chance for showers in the south and northeast on Monday and Tuesday with cooler temperatures.

To: Cathy Wurzer, Jim Bickal, Julie Siple, and Eugene Cha
From: Mark Seeley
Re: Suggestions for MPR's Morning Edition, Friday, May 2, 2003

Minnesota's reputation for cold was preserved during the month of April, when the state reported the nation's lowest temperature on three separate dates. On April 23rd, Embarrass reported a morning low of 17 degrees F. Again on April 29 and April 30, Embarrass reported morning lows of 12 F and 11 F, respectively, both record lows for that community, as well as lowest in the nation on those dates.

Topic: Preliminary April Climate Summary

Just as March, April continued to be a month of high climatic variability. Overall monthly mean temperatures were a degree or two either side of normal. Total precipitation was generally below normal, but some areas did receive abundant rainfall as a result of the storm on the 16th and 17th. St Cloud and Becker reported over 4 inches, while Pipestone reported over 6 inches. In fact Pipestone recorded its 2nd wettest April in over 100 years, falling just short of the 6.89 inches they received in 2001.

Temperature extremes for the month ranged from 94 degrees F at Milan (Chippewa County) on the 16th to -5 degrees F at Tower and Two Harbors on the 6th. Other than some significant precipitation amounts at mid-month, the northern counties reported very few days with measurable precipitation, and continued to be very dry, with low lake levels, stream flows, and high fire danger. The strongest winds for the month, nearly 60 mph, occurred along the northshore of Lake Superior on the 16th.

Total snowfall for April was generally in the single digits, with some exceptions. Those receiving more significant amounts includes Duluth with 13 inches, International Falls with 13 inches, Grand Portage with 10 inches, Two Harbors with 10.5 inches, and in the south Lakefield reported 10 inches, Caledonia 12 inches, Grand Meadow 12 inches, and Preston nearly 11 inches.

Topic: Interpreting Radar Colors

As we get deeper into the Spring season, convective weather is likely to become more frequent and most Minnesotans will undoubtedly tune into the local weather radar via TV or the Internet to anticipate the timing and amount of rainfall. A reminder of the color coding used in radar depiction certainly cannot hurt.

Deep blue indicates an hourly rainfall rate of .01 to .09 inches; aqua-blue indicates a rate of 0.1 to 0.4 inches;

green indicates 0.5 to 0.9 inches; yellow indicates 1.0 to 1.9 inches; red indicates roughly 2 to 4 inches; and violet or magenta indicates 4 or more inches per hour. These rates rarely show up in rain gages as the storm movement usually causes the rainfall to vary in rate considerably over any particular spot on the landscape.

Question from an MPR listener: With the local commercial TV stations continually touting their own doppler radar systems, I was curious about how many doppler radar systems the National Weather Service has?

Answer: Nationwide, the National Weather Service operates about 120 doppler radar systems, dispersed across the country to maximize the spatial coverage. Their units are called WSR-88D meaning Weather Service Radar, 1988 Doppler version. They operate 24 hours a day unless periodically shut down for maintenance. Coverage is not perfect, notably in New Mexico, eastern Montana and northern Nevada. The state with the most NWS Doppler systems is Texas with 10, while some states such as New Jersey, Connecticut, and New Hampshire don't have any. In short range mode, the radar scans a radius equivalent to about 143 miles, while in long range mode it scans a radius of about 286 miles. In some areas the radar range is limited by topography (mountains).

The NWS Doppler radar system provides many regional and national composite views of major storm systems at a frequency of at least twice per hour. To my knowledge the commercial doppler systems owned by various TV stations do not provide similar products.

Twin Cities Almanac for May 2nd:

The average MSP high temperature for today's date is 63 degrees F (plus or minus 12 degrees F standard deviation), while the average low is 42 degrees F (plus or minus 9 degrees standard deviation).

MSP Local Records for May 2nd:

MSP weather records for today's date include: highest daily maximum temperature of 91 degrees F in 1959; lowest daily maximum temperature of 38 degree F in 1909; lowest daily minimum temperature of 24 degrees F in 1961; highest daily minimum temperature of 70 F in 1959; record precipitation of 1.49 inches in 1944; and record snowfall of 2.2 inches in 1954. There have been 2 measurable snowfalls since 1948.

Average dew point for this date is 38 degrees F, with a maximum of 64 degrees F in 1959 and a minimum of 15 degrees F in 1940.

All-time state records for May 2nd:

Scanning the state climatic data base: the all-time high for this date is 97 degrees F at Montevideo (Chippewa County) and at Morris

(Stevens County) in 1959; the all-time low is 7 degrees F at Angus (Polk County) in 1907.

Word of the Week: Banamurrai'yung

This word is used to by the Australian aborigine to describe the present season in their country. Though the Bureau of Meteorology in Australia divides the year into the four traditional season, Spring, Summer, Fall, and winter, the native peoples had for thousands of years divided the calendar into six seasons based on the flowering habits of native plants. The Bureau of Meteorology is now studying the accuracy and utility of the aboriginal seasons for predicting climatic trends. The Banamurrai'yung is the name given to the period from March to May when the lillipilli tree produces tiny sour berries. It signals a cool, wet period (fall to winter transition on the modern calendar) and indicates a time to make cloaks (or buy sweaters) for keeping warm.

Outlook:

Generally a nice Spring day on Saturday, with increasing clouds, declining temperatures and increasing chances for showers coming on Sunday and carrying over into Monday, especially in southern Minnesota. The cooler, showery period will be short-lived and give way to a warming trend by Tuesday, with another chance for showers later next week.

To: Cathy Wurzer, Jim Bickal, Julie Siple, and Eugene Cha
From: Mark Seeley
Re: Suggestions for MPR's Morning Edition, Friday, May 9, 2003

Topic: May's weather already has our attention.....

We are not very deep into May yet, but the month's weather has certainly grabbed our attention. In northern Minnesota, Embarrass reported a morning low of just 11 degrees F on the 2nd, the lowest temperature in the nation that day. May 4th and 5th brought severe weather to the nation (primarily the central and southeastern states), and heavy rains to parts of Minnesota as well. The following locations reported new daily record rainfall amounts on May 5th..

Rochester 1.53 inches Albert Lea 2.59 inches
Harmony 1.37 inches Rushford 1.50 inches Wabasha 1.39 inches

Looks like more heavy rains are on the way at least in the near term, so a wetter than normal month may be in store for many in southern Minnesota. Albert Lea already reports over 3.25 inches, while Rochester, Moorhead, Grand Meadow, and Preston are well over 2 inches for the month.

Topic: A significant severe weather outbreak this week....

Severe weather has certainly made the news this week, particularly in states like Missouri, Arkansas, Louisiana, Mississippi, Alabama, Illinois, and Tennessee. Meteorologists are calling this week's tornado outbreak one of the largest and most destructive in recent years.

What constitutes a tornado outbreak? Severe weather meteorologists have wrestled with this questions for years. One definition that is widely accepted includes the following characteristics: at least six separate tornadoes occurring within 24 to 48 hours in the same general geographic region and associated with the same storm system (usually a low pressure center). Of the nearly 260 tornado reports filed so far this month, 171 occurred over the 48 hours from late on May 4th to early on May 6th. These were associated with the same weather system and occurred across the central and southeastern states. So you might say that this spell of severe weather meets the criteria to be defined as a tornado outbreak. One of the most significant tornado outbreaks in history occurred on April 3-4, 1974 when 148 separate twisters traveled across eight states and caused 315 fatalities.

With 40 fatalities reported this week due to the tornado outbreak, this death toll already matches the total deaths reported from tornadoes in the years 2000 and 2001. In 2002, a total of 55 deaths were associated with tornadoes. With approximately 150 separate tornadoes reported so far this month, it appears that May of 2003 will easily exceed the recent historical average of 180 tornadoes

nation-wide during the month of May. Last year (2002) produced the fewest number of tornadoes nationwide since 1988, but 2003 appears to be a far more active year so far. 1998 was the worst year for tornado frequency with over 1400 tornadoes reported, and associated with 130 deaths.

The annual death toll in the nation due to tornadoes since the mid 1980s has been 53. Though significant, this is less than the annual death toll from lightning (57), floods (85), and heat waves (165) over the same period. Heat wave fatalities tend to come in waves similar to what tornado outbreaks do. The heat wave of July, 1995 was blamed for nearly 1000 deaths nationwide, while that of late July and early August of 1999 was blamed for over 500 deaths.

It would appear that here in Minnesota our chances for severe weather will diminish after May 11th as we are going to be subjected to a spell of cool, dry Canadian air for a period of several days.

MPR listener question: How many hail reports are filed each year in Minnesota and when is the peak time?

Answer: Over the past dozen years the average is about 120-130 hail reports each year. The lowest number occurred in 1988 (drought year) with just 49, while the highest number was in 1998 with 412 reports. The peak months for hail reports are May and June, representing about 50 percent of all annual occurrences. The peak date for hail frequency in Minnesota is June 1st.

Twin Cities Almanac for May 9th:

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

MSP Local Records for May 9th:

MSP weather records for today's date include: highest daily maximum temperature of 91 degrees F in 1987; lowest daily maximum temperature of 40 degree F in 1924; lowest daily minimum temperature of 27 degrees F in 1961; highest daily minimum temperature of 69 F in 1896; record precipitation of 1.14 inches in 1918; and record snowfall of 0.4 inches in 1924. There have been no snowfalls on this date since 1948.

Average dew point for this date is 39 degrees F, with a maximum of 66 degrees F in 1985 and a minimum of 10 degrees F in 1966.

All-time state records for May 9th:

Scanning the state climatic data base: the all-time high for this date is 99 degrees F at Milan (Chippewa County) in 1928; the all-time low is 9 degrees F recorded at an elevation of 2010 ft

by the U.S. Forest Service near Isabella (Lake County) in 1966.
(Polk County) in 1907.

Word of the Week: Chaff

These are thin flat pieces of metallic foil that are dropped from aircraft to provide a target for weather radar to detect. Their dispersion helps provide a measure of winds aloft and their fall characteristics and signal are similar to rain drops so radars can be tested and calibrated by utilizing them from time to time.
fall

Outlook:

Partly to mostly cloudy over the weekend with a chance for showers and thunderstorms, especially in southern counties through early Sunday. Cooler and breezy Sunday and Monday with lows in the 30s and 40s F. Generally dry and cool until Wednesday and Thursday, when clouds will become more numerous with a chance for showers.

To: Cathy Wurzer, Jim Bickal, Julie Siple, and Eugene Cha
From: Mark Seeley
Re: Suggestions for MPR's Morning Edition, Friday, May 16, 2003

First tornado reports of the season in Minnesota this week. On Wednesday, May 14, a brief tornado touchdown was reported near Sleepy Eye in Brown County, and a brief tornado touchdown was also reported near Lake Crystal in Blue Earth County. The Storm Prediction Center says that this May has set a new record tornado reports, with over 425 so far. The last month with a number close to that was June 1992.....

Topic: May weather imagery in poetry....

The contrasts in this week's weather resembles the imagery of Shakespeare's Sonnet 18, inspired by the month of May centuries ago.....

"Shall I compare thee to a summer's day?
Thou art more lovely and more temperate:
Rough winds do shake the darling buds of May,
And summer's lease hath all too short a date:
Sometimes too hot the eye of heaven shines,
And often is his gold complexion dimm'd.....

Robert Louis Stevenson was also inspired by the month of May and the power of the sun, which he called the World's gardener...

Summer Sun

Great is the sun, and wide he goes,
Through empty heaven without repose;
And in the blue and glowing days
More thick than rain he showers his rays....
Above the hills, along the blue,
Round the bright air with footing true,
To please the child, to paint the rose,
The gardener of the World, he goes.

Topic: Natural air conditioning can be felt in May

May can bring either mid summer like weather or near winter like weather across the state, sometimes on a single day. Take May 17, 1987 for example. Redwood Falls and other southwestern MN communities were sweltering in 97 degrees F heat, while persistent fog, drizzle and an easterly wind off Lake Superior, kept Duluth in the 40s F for most of the day. That's why so many Minnesotans carry a parka or jacket when they head north in the summer! That's what you call geographic air conditioning.

Another form of air conditioning in May is temporal, based on the premise if the weather is uncomfortable just wait for a bit. Examples of this scenario abound, including a stifling afternoon

of 90 F temperatures in Milan, MN on May 21, 1934, followed by an overnight drop to 30 degrees F. Conversely, on May 4, 1997 the day started out rather frigid in Cloquet at 18 F, but warmed nicely to 70 F by afternoon.

Topic: A reminder to protect yourself from UV radiation

Having seen too many cases of sunburn already around the university campus, I thought it might be wise to remind listeners that it is the mid-May to mid-August period that is most important to protect yourself from sun damage to both your skin and eyes. Wear sun block and sunglasses when you plan to spend considerable time outdoors, especially during mid-day.

The National Weather Service and the Environmental Protection Agency use the UV Index to assess the potential for damaging ultraviolet radiation on any given day. The UV Index is weighted to the time of year, landscape elevation and forecast of sky conditions. It ranges from 0 to 10. Values of 7 or higher mean that sunburn can occur after 30 minutes exposure for those who are fair skinned. At values of 7 or greater it is recommended that you wear UV blocking sunglasses and put on sun screen with a protection factor of 15 or greater. Starting about mid-May potential UV Index values rise to 7 in Minnesota. From that time until mid-August, a UV Index of 7 or greater will occur on average 20 to 30 days, with a peak in late June and early July.

Some web sites which host UV information and UV forecasts are listed below.....

http://www.cpc.ncep.noaa.gov/products/stratosphere/uv_index/uv_current.html
(Climate Prediction Center UV Forecast for specific cities)

<http://www.epa.gov/sunwise/uvindexcontour.html>
(EPA UV Forecast Map)

Topic: The new monthly and seasonal climate forecasts

These are due out from the Climate Prediction Center on Thursday of this week.....more later

MPR listener question: My grandmother was from the Iron Range. She used to tell us grandchildren a story that when she was a young girl they made a snowman in mid-May. Do you think that really happened or did she have the date wrong?

Answer: It is probably true, and further I would speculate that it was this week (May 15-16) in 1929, 74 years ago! My answer is based on the fact that a strong late Spring storm system crossed the state back then and brought very cold polar air to produced a significant snowfall in northern Minnesota. Many places in north-central and northeastern Minnesota reported between 2 and 3 inches of snowfall with temperatures in the teens and twenties F.

Twin Cities Almanac for May 16th:

The average MSP high temperature for today's date is 69 degrees F (plus or minus 11 degrees F standard deviation), while the average low is 48 degrees F (plus or minus 8 degrees standard deviation).

MSP Local Records for May 16th:

MSP weather records for today's date include: highest daily maximum temperature of 94 degrees F in 1934; lowest daily maximum temperature of 48 degree F in 1950; lowest daily minimum temperature of 31 degrees F in 1929; highest daily minimum temperature of 68 F in 1962; record precipitation of 1.10 inches in 1905; and record snowfall of 0.1 inches in 1929. There have been no snowfalls on this date since 1948.

Average dew point for this date is 42 degrees F, with a maximum of 71 degrees F in 1962 and a minimum of 16 degrees F in 1973.

All-time state records for May 16th:

Scanning the state climatic data base: the all-time high for this date is 100 degrees F at Beardsley (Big Stone county) in 1934; the all-time low is 12 degrees F recorded at Meadowlands (St Louis County) in 1929.

Words of the Week: Saddle Point and Saddle Back

These two terms must have been coined by cowboy meteorologists! The saddle point (sometimes called a col) refers to a focal point in the air pressure pattern depicted on a weather map. The lowest point of air pressure in a trough or depression between two high pressure ridges is called a saddle point, while conversely, the highest point in a ridge (high pressure system) between two lows is also called a saddle point. Back in 1916, meteorologist A.J. Henry wrote of the low pressure saddle, "in summer the pressure saddle is more frequently the seat of local thunderstorms, which are repeated as long as this distribution of pressure lasts,...it is the best breeding place for summer afternoon thunderstorms."

The saddle-back is a term used by both meteorologists and pilots. It refers to a certain type of cloud pattern that looks like a saddle. The saddle-back is the cloudless, quiet air overlying a lower cloud deck between two towering cumulus congestus or cumulonimbus (thunderheads) clouds. Commercial jet aircraft often fly high above these menacing cloud forms, but low flying aircraft will sometimes fly through the saddle-back to avoid longer detours around the thunderheads.

Outlook:

Generally a nice day on Saturday around the state.....increasing clouds with a chance for showers on Sunday in the north and west.

Continuing chances for widely scattered showers on Monday and Tuesday with cooler temperatures. Generally drier and cooler for the balance of next week.

To: Cathy Wurzer, Jim Bickal, Julie Siple, and Eugene Cha
From: Mark Seeley
Re: Suggestions for MPR's Morning Edition, Friday, May 23, 2003

Frost reports were widespread across eastern Minnesota and northwestern Wisconsin on Wednesday morning this week (May 21). Locations reporting frost included....

Hibbing 28 F Grand Marais 32 F Silver Bay 30 F
Ely 32 F Cook 30 F Aitkin 30 F
Floodwood 29 F Babbitt 32 F Tower 26 F
Embarrass 24 F Butternut, WI 26 F Haywood, WI 28 F
Phillips, WI 32 F Eau Claire, WI 32 F Clam Lake, WI 32 F

The 24 degrees F at Embarrass, MN was the coldest in the nation for Wednesday, May 21st, the second time this month that Minnesota has reported the nation's lowest reading (the other was 11 F at Embarrass back on May 2nd). More frosts were reported in northeastern counties on Friday morning (May 23) as well.

Topic: May is already quite wet for some.....

Spells of heavy rain earlier this month have some communities already reporting above normal total precipitation for the month. The Twin Cities, along with Albert Lea and Grand Meadow have reported well over 5 inches of rainfall for the month so far. Wabasha and Stillwater have recorded more than 6 inches. Widespread rains have helped to alleviate fears of a dry growing season in the agricultural areas of the state, however, the dry north-central and northeastern counties have continued to see little precipitation come their way. Some places like International Falls, Littlefork, Gunflint Lake, Grand Portage, and Embarrass all report less than 1 inch of rainfall so far this month.

Topic: Insurance industry taking a hit in May....

Earlier this week the insurance industry produced an early estimate of the insured losses associated with the nearly 500 tornadoes (a monthly record number) and numerous heavy thunderstorms that have occurred in the nation so far this month. The estimate exceeds \$2.2 billion, while over \$1 billion in claims have already been filed. Alabama will probably file a significant number of claims due to both tornadoes and flooding. They report the wettest May in history with up to 15 inches of rainfall in places. Guess insurance premiums will be going up in some states.....

Topic: Weather trivia for the Memorial Holiday Day...

Begun as Decoration Day (to decorate graves with flowers) with a declaration from General John A. Logan of the Grand Army of the Republic on May 30, 1868, this holiday began

in honor of those who lost their lives fighting the Civil War. The end of May was good timing for the production of fresh flowers. Congressman John Garfield (later President Garfield) gave the first memorial address at Arlington National Cemetery on that date, as then President Andrew Johnson had just endured a Senate Impeachment hearing.

From 1868 to 1971, May 30th was the designated Memorial Day, which over time became a holiday to honor all those who died in service to their country. Since 1971, the holiday has been designated to be the last Monday of May. Speeches, parades, picnics, and memorial services have become standard observances on this date. As such the weather of the day has been taken note of, especially when it has been decidedly uncomfortable or inhospitable for such outdoor activities.

In Minnesota, Memorial Day weather has certainly on occasion left its mark. The very first holiday, May 30, 1868 was rainy. In fact, since that day 135 years ago, it has rained on 43 Memorial Days, a frequency of 32 percent of the time (about 1 out of 3 years). On Memorial Day of 1877 it rained cats and dogs, over 3 inches in the Twin Cities, probably washing away some of the flowers left in the local cemeteries. Again, on Memorial Day of 1917 it rained all day, totaling nearly 2 inches. The longest string of dry Memorial Days occurred from 1923 to 1936, 14 consecutive years. Conversely, from 1880 to 1883, and again from 1941 to 1944 the holiday was wet four consecutive years.

Average high temperature on Memorial Day is in the low 70s F in the Twin Cities, with a morning low in the lower 50s F. Memorial Day of 1934 was 98 degrees F with a Heat Index value of 113 F, an all-time high for the holiday. Conversely, and as recently as 1992, Memorial Day saw cloudy, cool, and windy weather produce a very chilly day with highs only in the 40s F. This Memorial Day (Monday the 26th) looks to start out cool in the 40s F, but will warm nicely to near 70 F most areas in the state.

MPR listener question: I read about a new national study concerning straight-line wind storms, sometimes called downbursts or derechos like the one that devastated the BWCA in July of 1999. How many of these occur each year? Does Minnesota get very many?

Answer: The new study being coordinated by the National Center for Atmospheric Research will compile data on past straight-line wind storms including those that struck Minnesota, notably the 1995 storm that closed Itasca State Park, the 1998 storms that severely damaged the Highland Park neighborhood of St Paul, and the 1999 storm that flattened trees in the BWCA. These large straight-line wind storms are far less frequent than other

forms of severe weather, with about 8-12 occurring across the nation each year. In Minnesota we see one of these storm types about once every 2-3 years.

Twin Cities Almanac for May 23rd:

The average MSP high temperature for today's date is 71 degrees F (plus or minus 8 degrees F standard deviation), while the average low is 50 degrees F (plus or minus 7 degrees standard deviation).

MSP Local Records for May 23rd:

MSP weather records for today's date include: highest daily maximum temperature of 87 degrees F in 1950 and 1972; lowest daily maximum temperature of 52 degrees F in 2001; lowest daily minimum temperature of 28 degrees F in 1963; highest daily minimum temperature of 67 F in 1975 and 1991; record precipitation of 1.56 inches in 1975; and no record of snowfall on this date.

Average dew point for this date is 47 degrees F, with a maximum of 69 degrees F in 1991 and a minimum of 22 degrees F in 1930.

All-time state records for May 23rd:

Scanning the state climatic data base: the all-time high for this date is 96 degrees F at Hallock (Kittson County) and Worthington (Nobles County) in 1928, at Canby (Yellow Medicine County) in 1950, and at Argyle (Marshall County) in 1980; the all-time low is 19 degrees F recorded at Roseau in 1917.

Words of the Week: The Camelot Climate Index (CCI)

Developed by Jan Null, formerly a National Weather Service forecaster in California, this climate index is based on the lyrics from the Fredrick Lowe song in the stage musical "Camelot." It is a song about living in the perfect climate, never too hot, never too cold, never too dry, never to wet. The perfect climate would have a CCI score of 100, but Null developed this weighted index to deduct points from this perfect score based on temperature, precipitation, sunshine, and humidity. He deducts points for days over 90 degrees F, days below 32 degrees F, too many rainy days, too much snow, not enough sunshine, etc...No where in America can you find a perfect score of 100, but a number of California cities score in the 80s on the CCI scale (seems biased to California if you ask me). The Twin Cities scores a 63 on the CCI and ranks 118th among a 158 American cities evaluated. More on this index can be found at the following web site....

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

Outlook:

Generally a nice three day Memorial weekend coming up with pleasant temperatures, partly cloudy skies and light winds. The weather will be generally dry until Wednesday or Thursday next week. Temperatures

will gradually warm.

To: Jim Bickal, Cathy Wurzer, Julie Siple, and Eugene Cha
From: Mark Seeley
Re: Suggestions for MPR's Morning Edition, Friday, May 30, 2003

2003 Spring Weather Anomaly:

Other than one 80 degree F day in April and two in May, it has been somewhat cooler than normal so far this Spring in the Twin Cities, allowing a slower greening up of the landscape and greater longevity to flowering plants (our lilacs had blossoms for over two weeks, tulips were out a long time, and now our white spiraea have been in blossom for several days.

The longest wait for 80 degree F temperatures occurred in 1924 and 1935, when 80 degree F temperatures were not reached until June 12th in the Twin Cities.

Eighty degree F temperatures can sometimes take even longer to arrive in northern Minnesota. In 1935, Grand Rapids did not report 80 degrees F or greater until June 29; in 1947 it did not reach 80 degrees F or greater in Roseau until July 2; and Babbitt did not see 80 degrees F or greater in 1967 until July 9th.

MPR Listener Question:

MPR Listener Question: What is the northern most weather reporting station in Minnesota and what is the southern most? How many miles apart are they?

At 49 degrees 19 minutes north latitude, Flag Island on Lake of the Words is the most northerly climate station in Minnesota, and the most northerly in the contiguous 48 states. The most southerly stations are Harmony in Fillmore County and Spring Grove in Houston County. Both are located at 43 degrees and 34 minutes north latitude. The distance from Spring Grove to Flag Island is roughly 500 miles. Obviously, Flag Island is a much colder place on average than either Spring Grove or Harmony. However, it is also a much drier place. Average annual precipitation in both Spring Grove and Harmony is well over 30 inches, while at Flag Island it is barely 22 inches.

Topic: Preliminary May Climate Summary

The average temperature for May around the state ranged from 1 to 3 degrees F cooler than normal. Rainfall was mixed, with many stations in the south and east reported above normal amounts, and several western and northeastern stations reporting below normal amounts. Temperature extremes ranged from 85 degrees F at Chaska on the 28th to just 11 degrees F at Embarrass on the 2nd. The heaviest thunderstorm produced 3.59 inches of rainfall at Wabasha.

Twin Cities Almanac for May 30th:

The average MSP high temperature for this date is 75 degrees F (plus or minus 9 degrees standard deviation), while the average low is 53 degrees F (plus or minus 7 degrees standard deviation).

MSP Local Records for May 30th:

MSP weather records for this date include: highest daily maximum temperature of 98 degrees F in 1934; lowest daily maximum temperature of 54 degrees F in 1922; lowest daily minimum temperature of 37 degrees F in 1947; highest daily minimum temperature of 69 degrees F in 1937; record precipitation of 1.80 inches in 1917; and no record of snow on this date.

Average dew point for May 30th is 51 degrees F, with a maximum of 72 degrees F in 1918 and a minimum of 24 degrees F in 1964.

All-time state records for May 30th:

Scanning the state climatic data base: the all-time high for this date is 108 degrees F at Pipestone in 1934; the all-time low is 21 degrees F Bigfork (Itasca County) in 1964.

Words of the Week: Zonal and Meridional

Meteorologists will often use these terms to describe the upper level wind patterns which indicate the trajectory of air masses and weather systems. Zonal refers to a wind flow pattern which runs along parallels of latitude, that is easterly or westerly. For our midwest region, zonal would refer to a west to east flow trajectory which is associated with a somewhat moderate or quiet weather pattern and not much change in air mass. Meridional refers to a wind flow pattern which runs parallel to meridians of longitude, that is southerly or northerly. This pattern brings large changes in air mass and very active weather systems to our midwest region, with oscillating southerly and northerly winds every few days.

Outlook:

Cooler early in the weekend chance of showers again Monday and Tuesday. Generally cooler and drier for the balance of next week.

To: Jim Bickal, Cathy Wurzer, Julie Siple, and Eugene Cha
From: Mark Seeley
Re: Suggestions for MPR's Morning Edition, Friday, June 6, 2003

Topic: Heat

Not much hot weather around here, but plenty over India and Pakistan lately, with temperatures well over 120 degrees F and Heat Index values ranging from 125 to 135 degrees F. The town of Sibi in Pakistan, not far from the Afghan border reported a high of 125 F on Wednesday this week. Heat Index values well over 110 F have been common for nearly 3 weeks. The estimated death toll from the current heat wave is now over 1200 people. Last year a similar heat wave in May killed over 1000 people in India, while in a 1998 heat wave over 2500 people perished.

Over the past decade in America, heat waves have become the number one cause of annual fatalities among the weather elements, surpassing lightning, tornadoes, floods, winter storms, and hurricanes. Between 200 and 250 annual fatalities are attributed to the heat. A recent book titled Heat Wave: A Social Autopsy of Disaster in Chicago by Eric Klinenberg documents the failings of that city to respond to a serious weather threat in the summer of 1995 when over 750 citizens perished over a few days in July.

Speaking of heat, it has certainly been frequently absent this Spring in Minnesota. The Twin Cities have reported only three 80 plus degrees F days so far. Normally by this date we would have seen 8-9 such days. The most recent comparable Springs were 1996 when just 2 80 degrees F days had occurred by June 6th, and 1993 when only one occurred. This Spring, some northern Minnesota communities like Hibbing have yet to see an 80 F temperature.

Topic: Good Hair Days....

An interesting feature by the BBC Weather Centre crossed my desk this week about using forecasts to select which day to go to the hair dresser. Apparently it is not productive or very fashionable to go to the hair dresser on a windy, wet, or high humidity day, because your new coiffure will be shortlived and therefore the time and effort waisted. Isobel Lang of the BBC Weather Centre suggests that when women schedule their salon appointments they look at the weather forecast to see which days will be fair, dry, and with little wind.

MPR Listener Question: How does the daily maximum temperature in Minnesota vary from summer to winter in terms of the time of occurrence? It seems in the summer that it actually occurs after I get home from work.

Answer: Assuming you have a day job, you are absolutely right! In winter, the time of the daily maximum temperature is most generally between 2:00 and 3:00 pm, lagging solar noon (maximum elevation of the sun) slightly. However, in the summer (June, July, August), the time of maximum daily temperature is typically 5:00 to 6:00 pm, lagging solar noon by several hours. Thus, that cold lemonade or beer you are drinking on the front porch after work is not just to relieve the stress of your work day, it is also intended to make the hottest time of the day a little more tolerable!

Local Almanac:

Twin Cities Almanac for June 6th:

The average MSP high temperature for this date is 75 degrees F (plus or minus 10 degrees standard deviation), while the average low is 55 degrees F (plus or minus 8 degrees standard deviation).

MSP Local Records for June 6th:

MSP weather records for this date include: highest daily maximum temperature of 95 degrees F in 1979 and 1987; lowest daily maximum temperature of 54 degrees F in 1901; lowest daily minimum temperature of 36 degrees F in 1897; highest daily minimum temperature of 74 degrees F in 1925; record precipitation of 1.59 inches in 1974.

Average dew point for June 6th is 53 degrees F, with a maximum of 73 degrees F in 1925 and a minimum of 26 degrees F in 1926.

All-time state records for June 6th:

Scanning the state climatic data base: the all-time high for this date is 106 degrees F at Pipestone in 1933; the all-time low is 20 degrees F at Remer (Cass County) in 1985.

Words of the Week: The fading memory syndrome

In terms of severe weather preparedness this term often gets kicked around. Severe weather such as tornadoes, floods, blizzards, hurricanes, and straight-line winds occur infrequently enough in many places, that public memory fades in the years following a disaster. This results in reduced attention to disaster preparedness, severe weather drills, and disaster response and mitigation measures. There are many incidents in the past that show following years of benign weather, a disastrous weather event or episode can lead to greater damages (losses) and higher mortality because disaster preparedness and management plans were long neglected. This has been the case for some tropical cyclones in the Indian Ocean in recent years as cited in an article in the current Bulletin of American Meteorological Society.

Outlook:

Generally cooler than normal and showery for the next week, particularly for Sunday, with a respite on Monday and a return of showers Tuesday through Thursday.

To: Jim Bickal, Cathy Wurzer, Julie Siple, and Eugene Cha
From: Mark Seeley
Re: Suggestions for MPR's Morning Edition, Friday, June 13, 2003

Topic.....a look back in time at weather on this date.....

One month ago, the National Weather Service reported over 400 tornadoes in the first 10 days of May, inflicting an estimated \$2.2 billion in damages across midwestern and southeastern states.

One year ago, the Minnesota State Climatology Office reported 4 to 14 inches of rainfall in Lake of the Woods and Roseau Counties, leading to the worst ever flooding on the Roseau River in northwestern, MN.

Ten years ago, the great flood of 1993 was underway in southern Minnesota and Iowa, with some of the highest ever flows recorded on the Minnesota River Valley and the Mississippi River Valley. Many places in southern Minnesota reported over 15 inches of rainfall in June. All of Iowa was declared a federal disaster area.

Twenty years ago, a cool and wet spring retarded crop growth and development, making the corn crop more susceptible to insect damage. Sure enough, it was the worst outbreak of European Corn Borer in state history, leading to statewide yield reductions that amounted to hundreds of millions of dollars in losses for the state's farmers.

Fifty years ago, severe thunderstorms across southern Minnesota produced some of the greatest crop losses ever due to straightline wind damage and hail.

One hundred years ago, Minnesota's corn and potato crops were recovering from a rare June frost.

Topic: New National Weather Service State Forecast....

Today begins a new format for the state forecast issued twice daily by the National Weather Service (roughly 5 am and 5 pm). Rather than a written narrative, the new format includes a tabular listing of sky conditions, high and low temperatures, and precipitation probability for a seven day period. Nine cities representing a north to south transect across the state will be routinely listed in these forecasts. Forecasts for additional cities, along with state weather summaries and forecast discussion can still be obtained by the public at the National Weather Service Forecast Office web site...

<http://www.crh.noaa.gov/mpx/index.html>

Topic: U.S. Windsurfing National Championships

This week's National Windsurfing Championships are taking place on Lake Okabena near Worthington and Windom, MN. Conditions were relatively unfavorable on Wednesday this week with easterly to southeasterly winds ranging from only 8 to 13 mph in the afternoon. However, conditions improved on Thursday, as winds from the south and west picked up, averaging between 12 and 18 mph, with gusts up to 26 mph. A warming trend over the weekend will likely produce some stronger afternoon winds on Lake Okabena, particularly on Saturday. Should make for some exciting races on the lake.

MPR Listener Question: How much water fell in Lake of the Woods and Roseau Counties last June to produce that record flooding on the Roseau River?

Answer: The thunderstorm rains of June 9-10 produced most of the flooding. These storms ranged from 4 to 14 inches. Additional rains on June 22nd produced a second flood crest. If we examine analysis by the Minnesota State Climatology Office, the rainfall on June 9-10 alone was equivalent to over 300 billion gallons of water. This is approximately 60 times the volume of water contained in Lake Calhoun. Much of this water was discharged across the landscape by the Roseau River watershed.

Local Almanac:

Twin Cities Almanac for June 13th:

The average MSP high temperature for this date is 79 degrees F (plus or minus 9 degrees standard deviation), while the average low is 58 degrees F (plus or minus 7 degrees standard deviation).

MSP Local Records for June 13th:

MSP weather records for this date include: highest daily maximum temperature of 100 degrees F in 1956; lowest daily maximum temperature of 49 degrees F in 1947; lowest daily minimum temperature of 37 degrees F in 1969; highest daily minimum temperature of 77 degrees F in 1956; record precipitation of 1.81 inches in 1892.

Average dew point for June 13th is 55 degrees F, with a maximum of 73 degrees F in 1905 and a minimum of 29 degrees F in 1933.

All-time state records for June 13th:

Scanning the state climatic data base: the all-time high for this date is 104 degrees F at Redwood Falls in 1956; the all-time low is 23 degrees F Remer (Cass County) in 1985.

Words of the Week: The SWEAT Index

The SWEAT Index was derived by the Air Force, not for putting cadets through basic training, but for indicating the potential

for severe weather, a topic which pilots are keenly interested in. This acronym stands for Severe Weather Threat Index and uses atmospheric stability, wind shear and wind speeds aloft (taken from radiosonde reports). In general the differences in temperature, dew point and winds measured at the 850 mb and 500 mb levels of the atmosphere are considered in this index. Values of 250 or greater indicate a potential for severe weather. The SWEAT Index is not used as much as it used to be, as more sophisticated indices have taken its place.

Outlook:

A warming trend is on the way, with a return of 80 degrees F readings in at least southern Minnesota. There will be some chance for scattered thunderstorms with these warmer readings and higher humidity. But there is a stronger chance for showers and thunderstorms toward the middle and end of next week.

To: Jim Bickal, Cathy Wurzer, Julie Siple, and Eugene Cha
From: Mark Seeley
Re: Suggestions for MPR's Morning Edition, Friday, June 20, 2003

Weekend Agenda:

The summer solstice will occur on Saturday, June 21st as the midday sun stands over the Tropic of Cancer, 23.5 degrees north latitude, producing the longest day of the year for the northern hemisphere. Here in Minnesota that translates to a day length ranging from 15 hours and 20 minutes in southern counties to 16 hours and 10 minutes in Lake of the Woods.

Saturday is also the 27th running of Grandma's marathon from Two Harbors to Duluth. Looks like generally fine weather for Saturday, starting off with clear skies, and temperatures in the 50s F, warming through the 60s and well into the 70s F during the race. Dew points will probably remain in the low 50s F during the race, with little chance for precipitation. However, southerly winds of 12 to 18 mph blowing against the runners may present some problem.

Topic: The weather and climate for the Grand Excursion of 1854

Last Friday's TPT Almanac program highlighted the planned 150 year anniversary celebration of the Grand Excursion journey up the Mississippi River from the Quad Cities in Iowa to the Twin cities in Minnesota. The planned Grand Flotilla of steamboats will duplicate this historic journey from June 25 to July 5, 2004, with many associated events and celebrations.

The original Grand Excursion took place from June 6-10 in 1854 as a promotional trip, touting the virtues of the northwestern territories. It was conceived by Henry Farnam, the builder of the Chicago and Rock Island railroad, the first railroad to extend to the upper Mississippi River Valley. According to the Galena Jeffersonian newspaper, the intent was "to make a thousand more or less, men of capital and influence acquainted with the enchanting beauty, the boundless resources.....of the Great West." President Millard Fillmore and over 1200 citizens, including politicians, artists, writers, reporters, and business leaders took the railroad from Chicago to Rock Island, Illinois, then boarded five steamboats to head up the river toward St Paul, Minnesota.

The success of the Grand Excursion was enormous, as shortly afterward, the region attracted millions of investment dollars and thousands of immigrants. I think that the unusual weather and climate of early June in 1854 had a great deal to do with the success. Let's examine a little evidence as taken from the Ft Snelling weather observations, summarized by St Paul weather historians Charles Fisk and Tom St Martin.....

The Spring of 1854 came early, with prairie fires noted in March,

April and early May. Ice break-up on the Mississippi River started in March, with the last floes observed in early April. The combined April and May rainfall was nearly 7 inches causing a rise in the Mississippi River and probably eliminating riverboat pilot concerns about snags, sandbars, or shallow waters.

The river valley landscape was abundantly green and lush by the time of the Grand Excursion departure on June 6th. Area strawberries were ripe and ready to pick by June 2nd, and during the week, weather observers noted that "all the common prairie flowers were in bloom." Just prior to the departure of the riverboats on June 6th, the weather had been unsettled with thunderstorms and three consecutive days with measurable rainfall. History notes that after a short, rainy stay in Dubuque, Iowa on the afternoon of the 6th (Tuesday), the steamboats set off for a night passage to La Crosse. A Canadian high pressure system settled in over night, bringing clear skies, calm winds, low dew points, and cool temperatures. Overnight lows on June 7th and 8th were close to 40 degrees F, too cold for mosquitoes and other insects to be very active. But, days were bright and sunny with highs in the 60s F. It is also noted that on Wednesday (June 7th), President Fillmore's daughter Mary Abigail borrowed a horse and rode to the top of the bluffs near Trempealeau, WI where she marveled at the magnificent views and waved her handkerchief to the steamboat passengers in the channel below. The steamboat pilots blew their whistles at her, the sound echoing across the river valley from bluff to bluff.

The Grand Excursion arrived Wednesday night on Lake Pepin. Four of the boats were lashed together and proceeded across the lake as barge tows now do. The high pressure system provided a cool, calm, and beautiful night as the lights from the boats "danced and streamed on the waters." The low dew points and cool temperatures again likely prohibited much insect activity, while a nearly full June moon lit up the surrounding bluffs. It is noted that the night was spent in "dancing, music, and flirtations."

The boats arrived earlier than expected in St Paul on Thursday, June 8th. The weather was still magnificent with morning lows in the 40s and highs in the mid to high 60s F. Passengers were treated to visits at St Anthony Falls, Minnehaha Falls, Fort Snelling and Fountain Cave, then a gala dinner and dance. The boats and passengers departed shortly after midnight on Friday, June 9th to return to Rock Island, arriving there on Saturday, June 10th. Again the weather on the return trip was perfect, though slightly warmer, with highs in the 70s and lows in the 50s F, under mostly clear skies.

Journalists wrote wonderful stories of the beauty and majesty of the upper Mississippi River landscape, but probably did not realize they had traveled the river valley under the best weather conditions possible at that time of year. Temperatures were 10 to 12 degrees F cooler than normal with comfortably low dew points (keeping the insect activity to a minimum), light winds and beautifully clear skies under a nearly full moon (full on June 10th). The river was deep enough but not too fast flowing for easy navigation and the landscape was blanketed with lush

vegetation and flowering plants. Had they stayed a bit longer in St Paul, they might have seen another side of the weather.....the Ft Snelling observer noted on June 15th that "the weather is awful hot these days (dew points in the high 60s to low 70s F with highs in the mid to upper 80s F)...only good for growing crops and mad dogs..." A severe storm on July 4th damaged trees and buildings in St Paul, a hamlet of only 6000 people back then.

Nevertheless, the Grand Excursion did accomplish its purpose and there was an influx of money and people into the region. One such person was a pioneer named Ira O. Seeley who explored the Zumbro River in 1853 and settled in Wabasha County with his family in the fall of 1854, just months after the hoopla over the Grand Excursion. He founded the town of Mazeppa and was the first District 12 elected representative to the territorial and state legislature in 1857-58. He was my great-great grandfather.

Topic: New Seasonal Climate Outlook.....

On Thursday afternoon this week, the Climate Prediction Center released the new seasonal outlook for July, August, and September. Because of expected abundant moisture and cloud cover over southern Minnesota, this area of the state is expected to record a cooler and wetter than normal July. The remainder of the state is most likely to see near normal conditions prevail in July, and for that matter over the July through September period.

MPR Listener Question: What is the typical raindrop size distribution from a summer thunderstorm in Minnesota?

Answer: Technically, droplet sizes with diameters less than 0.5 mm (0.02 inches) are classified drizzle, while all those that are larger are classified as raindrops. Measurements of raindrop size distributions have shown a range in diameters of 0.5 mm (0.02 inches) to 8 mm (0.31 inches) in heavy tropical downpours. Lower, stratoform clouds tend to produce smaller and narrower ranges in raindrop sizes, while the vertical clouds of the tropics (and the summers in the mid latitudes) produce a larger range and predominately larger droplet sizes. Over Minnesota, a typical range from thunderstorm activity is 1 to 3 mm diameter droplets (0.04 to 0.11 inches), with very large droplets up to 6 mm in diameter (0.24 inches) possible from the largest of thunderstorms. The raindrop size distribution has been shown to be related to the vertical height of the clouds (the higher cloud tops tend to produce larger drops) and the rate of rainfall. For example, rainfall rates of just 0.5 inches per hour may exhibit predominately raindrops with diameters 0.05 to 0.10 inches, while heavier thunderstorm rainfall rates of 2 inches per hour, may exhibit predominately raindrops with diameters of 0.10 to 0.15 inches. Strong vertical updrafts, winds in excess of 30 mph are required for some of the larger raindrops to form within clouds.

Local Almanac:

Twin Cities Almanac for June 20th:

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 7 degrees standard deviation).

MSP Local Records for June 20th:

MSP weather records for this date include: highest daily maximum temperature of 98 degrees F in 1933; lowest daily maximum temperature of 54 degrees F in 1946; lowest daily minimum temperature of 41 degrees F in 1992; highest daily minimum temperature of 75 degrees F in 1943; record precipitation of 1.92 inches in 1927.

Average dew point for June 20th is 55 degrees F, with a maximum of 78 degrees F in 1909 and a minimum of 31 degrees F in 1992.

All-time state records for June 20th:

Scanning the state climatic data base: the all-time high for this date is 104 degrees F at Olivia (Renville county) and Stewart (McLeod County) in 1988; the all-time low is 23 degrees F Remer (Cass County) in 1985.

Words of the Week: Wing dams

Wing dams are man-made rock piles that are strategically placed along rivers to trap sediment and force current flow to the main navigational channel, helping to keep sufficient depth for boats to travel. They also prevent current from causing shorelines to erode. Many river fish use the still waters on the leaside of wing dams as places to feed and rest.

Outlook:

Pleasant early in the weekend with sunny skies and warming temperatures. Increasing clouds late on Saturday. Sunday through Wednesday shows a chance for thunderstorms, some perhaps heavy. Temperatures will warm above normal as well, with higher dew points, especially on Monday and Tuesday.

To: Jim Bickal, Cathy Wurzer, Julie Siple, and Eugene Cha
From: Mark Seeley
Re: Suggestions for MPR's Morning Edition, Friday, June 27, 2003

Topic: A Traumatic Week of Weather.....

A nearly stationary frontal boundary separating very warm and humid air from cooler Canadian air persisted over the state from Sunday, June 22nd through Wednesday, June 25th and produced numerous episodes of convective thunderstorms, especially across central counties of the state. Areas in Todd, Douglas, and Morrison Counties reported anywhere from 8 to 10 inches over this period, flooding many county and township roads. Parts of Wright, Sherburne, Anoka, and Chisago Counties reported from 5 to 7 inches, primarily over the 24th and 25th. Numerous new daily rainfall records were set.

Alexandria in Douglas County reported three consecutive days of record setting rainfall, totaling over 10 inches, and producing a monthly total in excess of 12 inches, shattering all previous June rainfall records. Alexandria reported nearly 1.40 inches of rainfall in only 8 minutes on Tuesday, and this was accompanied by wind gusts up to 73 mph, a real example of "driving rain." Both Little Falls and Long Prairie reported about 8 inches for the week and are approaching new June rainfall records as well.

Tuesday night and Wednesday morning produced torrential rains in many locations just north of the Metro area. Monticello reported 7.60 inches of rainfall, while Elk River reported 8.19 inches, both all-time rainfall record events for those communities. Several neighborhoods in the Metro area reported flooded roads and basements. Elsewhere around the state Meeker, Renville, and Yellow Medicine Counties reported tornadoes, while seven other counties reported damaging straight-line winds, and eleven counties reported hail damage.

It is somewhat ironic that all of this thunderstorm activity coincided with the National Weather Service's Lightning Safety Awareness Week.

Topic: Weather and Retail Sales.....

Datamonitor is a business information provider specializing in industry analysis. They recently completed a study of the weather sensitivity in grocery and clothing sales across the United Kingdom. They estimate that as much as 4.5 billion pounds (roughly \$7.5 billion) of revenue is lost each year because retailers fail to take advantage of weather forecasts in adapting supply chains, stock levels, shop displays, and marketing promotions. The study pointed out that on selected grocery items such as meat

products, fresh produce, and soft drinks sales can increase or decrease by as much as 300-400 percent over short periods of time simply due to changeable weather conditions. In a recent example, trusting a forecast that the days before the Easter weekend were going to be hot, the Safeway grocery chain was able to adjust stock levels and tailor in-store promotions to realize an increase in sales of over 2 million pounds from the previous year. Conversely, a failure to adjust stock and promotions to a highly changeable weather pattern cost another grocer an estimated loss of 1 million pounds in sales over the course of a week, and a loss of another 250,000 pounds in wastage (spoilage in produce, meat, dairy and bread products).

This makes me wonder how well our own Minnesota grocers and clothing retailers follow the weather forecast. Perhaps some MPR listener knows the answer.

MPR Listener Question: I have heard you talk about weather effects on human health, e.g. poor air quality, lack of sunlight, respiratory ailments, heat stress, and weather pains. What about moodiness and mental function? Are there any recent studies relating these to weather?

Answer: As a matter of fact, some recent psychiatric studies reported in the latest Bulletin from the American Meteorological Society show that behavior associated with "spring fever" can be related to the weather. Oscillating patterns of giddiness, depression, and intense impulses are thought to be related to the added ambition and expectation we set for ourselves in the Spring. Taking advantage of the longer days and pleasant conditions outside seems to be our number one goal. The added sunlight (higher sun angle and longer days) of Spring and Summer causes humans to produce less melatonin, the hormone that is responsible for the urge to sleep. Psychiatrists suggest that this condition (needing or wanting less sleep) prompts us to set high expectations and perhaps over-do or try to over achieve. In some instances this can lead to obsession, depression, and stupid decision making.

Local Almanac:

Twin Cities Almanac for June 27th:

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 7 degrees standard deviation).

MSP Local Records for June 27th:

MSP weather records for this date include: highest daily maximum temperature of 104 degrees F in 1934; lowest daily maximum temperature of 61 degrees F in 1911; lowest daily minimum temperature of 44 degrees F in 1925; highest daily minimum temperature of 79 degrees F in 1933; record precipitation

of 2.00 inches in 1953.

Average dew point for June 27th is 59 degrees F, with a maximum of 76 degrees F in 1959 and a minimum of 36 degrees F in 1925.

All-time state records for June 27th:

Scanning the state climatic data base: the all-time high for this date is 108 degrees F at New London (Kandiyohi County) in 1934; the all-time low is 30 degrees F at Tower (St Louis County) in 1992.

Words of the Week: Satellite tornado

A satellite tornado will develop independently from the primary tornado. It is usually a smaller, separate funnel, often extending out of the same cloud base. Typically it is associated with strong primary tornadoes, and may in fact orbit around them below the same cloud base. A satellite tornado is much weaker than the companion primary tornado, and it is shorter lived. It is not like a suction vortex which can sometimes be seen as a small, intense rotation inside of the primary tornado.

Outlook:

Chance of showers and thunderstorms on Saturday, then partly cloudy Sunday. Generally dry and pleasant Sunday and Monday, with an increasing chance for showers, starting in northern counties by Tuesday. A continued chance for showers and thunderstorms for the balance of next week, including July 4th. Temperatures will again be in a warming trend with higher humidity.

To: Jim Bickal, Cathy Wurzer, Julie Siple, and Eugene Cha
From: Mark Seeley
Re: Suggestions for MPR's Morning Edition, Friday, July 4, 2003

HAPPY 4TH OF JULY.....

Topic: Nation continues on a record pace for tornadoes....

Tropical Storm Bill emerged from the Gulf of Mexico earlier this week, drenching several southeastern Gulf states. It also produced many severe thunderstorms and over 30 tornadoes. This brought the number of tornadoes reported across the nation this year close to 1000, a record setting pace for so early in the summer. The record number of annual tornadoes is 1424 set in 1998.

Our own weather continued unsettled this week, with numerous severe thunderstorms, damaging winds and hail reported for the second consecutive week.

Topic: WMO Press Release....

The World Meteorological Organization issued a press release this week commenting on the number of record extremes in climate so far this year. This may have been partly motivated by the fact that both France and Switzerland (Geneva is home base to the WMO) recorded record warmth in the month of June. In fact, for Switzerland it was the warmest June in 250 years. Other climate aberrations include the heat wave in India and record monsoon rains in Sri Lanka. The WMO says that some climatologists think that the frequency in extreme weather events may continue to increase.

This comment is countered somewhat by recent research of American climatologists that shows the overall frequency of extreme weather events and episodes (tornadoes, floods, winter storms, hurricanes, etc) is not changing for the most part, but the consequences in terms of economic losses, displacement of populations, insurance rate adjustments, and rebuilding of infrastructure is quite profound. They point out that population density and distribution, infrastructure development (cities, highways, waterways, utilities, etc) and land use changes over time have made many areas more vulnerable to the negative consequences of severe weather.

It may take some time to sort out the true trends in the frequency of severe weather events and episodes worldwide, but there is a clear upward trend in the associated losses and consequences.

Topic: Preliminary June climate summary.....

Average June temperatures were slightly cooler than normal for most

Minnesota communities, ranging from 1 to 2 degrees below the 30 year average. Extreme temperatures ranged from 94 degrees F at Chaska on June 25th to just 25 degrees F at Embarrass on June 1st.

Rainfall was highly variable in June. Parts of Northwestern and central Minnesota received abundant rainfall, over 10 inches in some cases. Conversely, the northeast, southwest and southern counties were generally drier than normal. Alexandria, one of the wetter communities with over 10 inches, reported measurable rainfall on 17 days in June.

Maximum rainfall from individual storms was 8.19 inches at Elk River on June 25th. The highest wind gust was 73 mph at Alexandria on June 23rd.

MPR Listener Question from Mike Mulcahy in the MPR newsroom: What is the probability of a 100 degrees F day in Minnesota?

Answer: The probability for having a 100 degrees F day varies somewhat geographically. Climatology shows that for west-central counties this temperature is reached at least once during the summer about every 3 years. Further north and east, a 100 degrees F reading is seen at least once every 4 to 6 years, except along the shore of Lake Superior where some communities have never reported a temperature that high. During the summers of 1936 and 1988 some western Minnesota communities reported between 15 and 18 100 degrees F days. Whew!

In the Twin Cities climate record, a 100 degrees F temperature occurs about once every 4 years historically, but we have not seen one since July 13, 1995, about an eight year gap. The longest spell in the Twin Cities between 100 degrees F days was from June 13, 1956 to July 8, 1974, a period of over 18 years.

What is important for MPR listeners to realize is that although true 100 degrees F temperatures are a relatively rare occurrence, a 100 degrees F Heat Index (combined effect of temperature and dew point) is far more frequent and has occurred in four of the past 5 summers. Such Heat Index values present a health threat.

Local Almanac:

Twin Cities Almanac for July 4th:

The average MSP high temperature for this date is 82 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 4th:

MSP weather records for this date include: highest daily maximum temperature of 100 degrees F in 1949; lowest daily maximum temperature of 58 degrees F in 1967; lowest daily minimum temperature of 43 degrees F in 1972; highest daily minimum

temperature of 80 degrees F in 1999; record precipitation of 2.27 inches in 1900.

Average dew point for July 4th is 59 degrees F, with a maximum of 77 degrees F in 1977 and a minimum of 40 degrees F in 1972.

All-time state records for July 4th:

Scanning the state climatic data base: the all-time high for this date is 107 degrees F at Worthington (Nobles County) and at Pipestone (Pipestone County) in 1936; the all-time low is 27 degrees F at Tower (St Louis County) in 1972.

Words of the Week: la tormenta

This is the Spanish word for storm, be it a tropical storm, winter storm, or thunderstorm. Sometimes you will see the term used in weather forecast discussion from Mexico, Spain, or Cuban weather services. For example, this week the tropical storm that emerged from the Gulf of Mexico and struck the Louisiana coast was called la Tormenta Tropical Bill.

Outlook:

Generally a bit cooler for the 4th of July weekend. A chance for scattered thunderstorms, mostly Sunday. Remember it has rained nearly 35-40 percent of the time historically on the 4th of July in the Twin Cities. The downward trend in temperatures should continue into early next week, with a chance for showers Sunday through Wednesday. Some may be quite heavy.

To: Jim Bickal, Cathy Wurzer, Julie Siple, and Eugene Cha
From: Mark Seeley
Re: Suggestions for MPR's Morning Edition, Friday, July 11, 2003

Topic: New record hailstone size being verified....

Severe thunderstorms in Nebraska back on June 22nd may have produced a new record size hailstone for the United States. With cloud tops as high as 71,000 feet, massive thunderstorm complexes passed over Hamilton County, Nebraska on that Sunday night. Hail began to fall, producing 10 to 12 inch diameter impact craters in the soil surface. Most of the hailstones broke up on impact, some falling through the roof of several homes. Two of the hailstones from Aurora, NE were collected and preserved for National Weather Service inspection and measurement. One measured 6.5 inches in diameter and 17.3 inches in circumference, while the other measured 7 inches in diameter and 18.75 inches in circumference. The recognized record hailstone size in the United States is from a thunderstorm over Coffeyville, KS on September 3, 1970 that produced a stone 5.7 inches in diameter and 17.5 inches in circumference. Staff from the National Center for Atmospheric Research will soon determine whether or not one of the Aurora, NE hailstones represents a new record.

Topic: Record cold July 10th.....

Persistent cloudiness and northerly winds combined to keep July 10th on the cool side. A number of locations reported new record cold daytime highs for the date, including.... Rochester at 68 F, La Crosse at 66 F, Eau Claire (WI) at 64 F, and Osceola (WI) at 66 F.

Topic: Interesting weather related economic statistics to ponder..

Industries directly affected by the weather (agriculture, construction, energy, transportation and outdoor recreation) account for nearly 10 percent of Gross Domestic Product (GDP). Combined with other climate sensitive industries (manufacturing, marketing, etc) this total rises to about 25 percent of GDP, or \$2.7 trillion.

Drought causes an average annual loss of \$6 to \$8 billion to the U.S. economy.

Seventy percent of air traffic delays are attributed to weather, accounting for \$4.2 billion lost in economic efficiency, to say nothing of emotional trauma.

The average annual consequence of tornadoes, hurricanes, and floods amounts to about \$11.4 billion in damages. In recent years more accurate hurricane watches and warnings have save about \$2.5 billion in damage costs.

*taken from Fair Weather: Effective Partnerships in Weather and Climate Services, a 2003 publication of the National Research Council.

Topic: Did you know?

When the federal government weather service was first created by Congress in 1870, they called their thrice daily predictions "probabilities." Later in 1876, they referred to their predictions as "indications." Then by 1889, they used the term "forecasts." This terminology remained in place for nearly a century until recent years when the weather service started emphasizing "probabilistic forecasts" that are based on purely numerical computer output. In simple terms, today's forecast is the most probable outcome from a set of derived numbers that represent a distribution of probable outcomes based on measurements, forecast models, and climatology.

MPR Listener Question: I've noticed that we have had thundestorms every night since July 4th. Do the numerous fireworks displays of July 4 have anything to do with this?

Answer: Indeed, I too have noticed that some weather observers in southern and central Minnesota have reported thunderstorms on six or more days since the 4th of July holiday. I suspect that larger scale features of the atmosphere have had more to do with this than any residual effects of fireworks pollution, though in some local environments perhaps the material released into the atmosphere amplified the amount of local rainfall. Morris, for example reported two consecutive days with rainfall of 1 inch or more, unusual for a west central Minnesota community.

In fact some of those thunderstorms this week have been severe and brought near record breaking amounts of rainfall, although the only true record I could find was 1.34 inches at Babbitt on the 9th. Others reported large amounts that day included...
St Peter 1.75 Mankato 1.72 Morris 1.15
Hibbing 1.07 Cass Lake 1.37 Gull Lake 1.23

One possible effect of the July 4th holiday was the air quality alert issued for the Twin Cities by the MPCA on July 5th as a result of the small particulates left in the atmosphere and held there by an overnight inversion.

Local Almanac:

Twin Cities Almanac for July 11th:

The average MSP high temperature for this date is 84 degrees F (plus or minus 8 degrees standard deviation), while the average low is 64 degrees F (plus or minus 6 degrees standard deviation).

MSP Local Records for July 11th:

MSP weather records for this date include: highest daily maximum temperature of 106 degrees F in 1936; lowest daily maximum temperature of 66 degrees F in 1941; lowest daily minimum temperature of 49 degrees F in 1945; highest daily minimum temperature of 82 degrees F in 1936; record precipitation of 3.75 inches in 1909.

Average dew point for July 11th is 60 degrees F, with a maximum of 78 degrees F in 1966 and a minimum of 42 degrees F in 1985.

All-time state records for July 11th:

Scanning the state climatic data base: the all-time high for this date is 110 degrees F at Cromwell Township (Clay County) in 1894: the all-time low is 30 degrees F at Meadowlands (St Louis County) in 1985.

Words of the Week: Pirry, Parry, or Perry

These are not MPR news reporters!! They are terms used by the Scottish Weather Service to describe sudden squalls, or brief heavy falls of rain. Technically the use of any of these terms also implies wind equivalent to a "half gale" on the Beaufort wind scale (winds of 20-22 mph). Some brief thunderstorms that occurred around the state this week might have been classed as a "perry."

Outlook:

Generally a pleasant weekend with somewhat warmer temperatures and mostly dry conditions. Increasing cloudiness on Monday and Tuesday with a chance for thundershowers, especially in northern areas. Temperatures may rise above normal by a few degrees starting early next week.

To: Jim Bickal, Perry Finelli, Julie Siple, and Eugene Cha
From: Mark Seeley
Re: Suggestions for MPR's Morning Edition, Friday, July 18, 2003

Topic: Record rainfalls, tornadoes, and unusual July fogs..

The excessive moisture of late June has continued for some this month. Onamia on the southern end of Lake Mille Lacs had reported a new record rainfall on July 3rd of 2.77 inches, while Pine River with 1.75 inches and Wadena with 1.85 inches recorded new record rainfalls on July 10th. Monday, July 14 produced more records, with International Falls recording a record 1.55 inches and Forest Lake recording a record 2.21 inches.

The storms on July 14th produced at least 4-5 tornadoes across Blue Earth and Waseca Counties in southern Minnesota. Some caused damage to homes and farmsteads

July 14th also brought an unusual pea soup fog to parts of Minnesota, as dew points rose into the low 70s F following earlier rainfalls that produced plenty of evaporation and saturated the lower atmosphere. Visibilities fell off to less than 1/4 miles in many places, including the Twin Cities between 8:00 and 11:00 pm Monday night. July has the least incidence of fog in the Twin Cities, with a frequency of about once every 3 years.

Topic: : Anniversary Week for Minnesota's Top Rain Storm

Today (July 18) is the anniversary of perhaps the most prolonged intense rainfall ever recorded in the state. This thunderstorm complex occurred in 1867 over western and central Minnesota, but was especially heavy in parts of Douglas, Pope and Stearns Counties, affecting the pioneer communities of Osakis, Westport, and Sauk Centre. Beginning late on Wednesday, July 17th, lasting all day July 18th, and into the early morning of Friday July 19th, heavy thunderstorms drenched the landscape with up to 36 inches of rainfall. Unfortunately measurements of the storm were not made by official rain gages in those days, but several people did record measurements via buckets and barrels which filled up. According to Tom St Martin, Minnesota weather historian, George B. Wright, a pioneer land surveyor in the area, documented the event and reported on it in some detail to the Minnesota Academy of Natural Sciences years later (1876). In his account, the Pomme de Terre, Chippewa, and Sauk Rivers, normally creeks at that time of year, became lakes several miles wide. The storm generated runoff caused the Mississippi to rise several feet, washing out bridges and logging booms right through the Twin Cities area. The total number of logs washed away was estimated to exceed 25 million. The mosquito population was reported as the worst ever for the balance of that 1867 summer.

Topic: Texas hurricane Claudette brings damages and relief..

Hurricane Claudette struck the central Texas coast on Tuesday this week bringing 2 to 6 inch rains, and winds up to 85 mph. Damages were particularly severe near Port O'Connor and surroundings. Two deaths were attributed to this hurricane.

As it migrated across southern, central and western Texas, the remnants of Claudette actually brought relief from drought and heat. Some areas saw their first significant rains since mid June, particularly around San Antonio. A summer heat wave had been dominant in west Texas, and this too was alleviated. Lubbock which had reached a high of 102 degrees F on Tuesday, fell to just 62 degrees F by Wednesday morning as the storm brought rain, clouds, and northeastern winds.

Topic: New climate outlook for August through October...

For the period from August through October, the Climate Prediction Center suggests we will have equal chances of below or above normal values of temperature and rainfall. No distinct trends are apparent and no particular consistent signal is shown by several of the forecast models. At least this suggests we'll have no prolonged spells of stressful weather.

MPR Listener Question: How many days with at least 3 inches of rainfall have occurred in the Twin Cities climate record?

Answer: Since the official records started in 1891, only nineteen days with three inches or greater rainfall are recorded for the Twin Cities. The most was 9.15 inches on July 23, 1987.

Local Almanac:

Twin Cities Almanac for July 18th:

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 18th:

MSP weather records for this date include: highest daily maximum temperature of 101 degrees F in 1940; lowest daily maximum temperature of 64 degrees F in 1911; lowest daily minimum temperature of 52 degrees F in 1962 and again in 1984; highest daily minimum temperature of 78 degrees F in 1986; record rainfall of 2.94 inches in 1895.

Average dew point for July 18th is 62 degrees F, with a maximum of 79 degrees F in 1957 and a minimum of 44 degrees F in 1910.

All-time state records for July 18th:

Scanning the state climatic data base: the all-time high for this date is 109 degrees F at Beardsley (Big Stone County) and Morris (Stevens County) in 1940; the all-time low is 32 degrees F at Floodwood (St Louis County) in 1910 and at Roseau in 1912.

Words of the Week: Argo float

Named for the Greek ship Argo that Jason sailed in search of the golden fleece, the Argo float is a device used to measure salinity and temperature in the ocean. Each float drifts with the currents at a depth of 1000 to 2000 meters below the surface. Every 10 days it rises to the surface and makes a profile measurement of temperature and salinity, then from the surface transmits its position, along with these data via satellite to meteorological researchers. The data are used to study the climate influences of ocean circulations. Approximatley 150 Argo floats are currently deployed in the Indian Ocean for studying tropical cyclones and the Indian monsoon. They are battery powered and typically last about four years.

Outlook:

Chance of showers and thunderstorms later in the day on Saturday, and Sunday. Some may be severe. Then drier weather, with another chance for showers and thunderstorms in southern counties by Thursday and Friday. Temperatures will be a few degrees cooler than normal for much of next week.

To: Jim Bickal, Cathy Wurzer, Julie Siple, and Eugene Cha
From: Mark Seeley
Re: Suggestions for MPR's Morning Edition, Friday, August 1, 2003

Topic: Preliminary July Climate Summary

For the most part temperatures averaged out near normal, with more communities reporting small negative (cooler than normal) departures than positive ones (above normal). Extreme temperatures around the state ranged from 96 degrees F at Browns Valley on the 19th to just 34 degrees F at Embarrass and Tower on the 18th.

Total rainfall during the month for most was below normal. Some areas did receive above normal rainfall, including International Falls, Alexandria, Morris, Crookston, Onamia, Cook, Babbitt, and Tower. There were scores of hail reports and some tornadoes, especially on July 14th and 19th. Nine tornadoes were reported on the 14th and another three on the 19th. Crop damage due to hail was reported in Todd and Morrison Counties.

Topic: Other Weather Headlines in July....

Parts of China continued to suffer from flooding....western Europe experienced a heat wave....southern France had the worst fire season in years....Hurricane Claudette drenched parts of southern and western Texas.... the Montana fire season intensified...wetter July in history at Fairbanks, Alaska, hottest July in history at Phoenix, Arizona..record high temperatures in South Dakota (114 F at Academy and 112 F at Winner, SD on July 25th)

Topic: Oppressive dew points strike again...inflate Heat Index

For the 5th time in the past six summers, Minnesota recorded dew points in the 80s F. This was also accompanied by the highest Heat Index values of the year so far. On Saturday, July 26th, southerly winds brought warm, humid air into the state, making for a highly uncomfortable afternoon and evening. The following were some of the Heat Index values (combinations of temperature and dewpoint) reported that day..

Moose Lake 111 F	Maple Lake 110 F	Hutchinson 108 F
Rush City 115 F	New Ulm 105 F	Glencoe 113 F
Cambridge 110 F	St James 105 F	Lakeville 105 F
Mora 105 F	Duluth Harbor 113 F	Faribault 111 F
Austin 108 F	Crystal 105 F	Owatonna 108 F
Red Wing 105 F	Winona 105 F	U of MN 106 F

Tropical like dew points of 80 F or higher were reported from Maple Lake, Glencoe, Hutchinson, Duluth Harbor, St James, Faribault, Owatonna, Lakeville, Austin, and the University of Minnesota St Paul Campus. The 81 degrees F dew point at Duluth Harbor was most probably a record high.

MPR Listener Question: How many days have reached or exceeded 90 degrees F in the Twin Cities this year? What's average? What are the most extreme numbers?

Answer: The Twin Cities climate record shows an average of 15 days per year with temperatures of 90 F or higher. So far this year only 4 such days have been recorded, all occurring in the month of July. The most ever were 44 days in 1988, the drought year. The fewest number, zero, occurred in 1902, 1915, and 1993. Historically, two-thirds of all 90 F days have occurred in the months of July and August, but they have also shown up as early as April 15 (2002) and as late as October 10 (1928).

Local Almanac:

Twin Cities Almanac for August 1st:

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 6 degrees standard deviation).

MSP Local Records for August 1st:

MSP weather records for this date include: highest daily maximum temperature of 101 degrees F in 1988; lowest daily maximum temperature of 61 degrees F in 1903; lowest daily minimum temperature of 49 degrees F in 1962; highest daily minimum temperature of 78 degrees F in 1964; record rainfall of 2.03 inches in 1975.

Average dew point for August 1st is 61 degrees F, with a maximum of 79 degrees F in 1955 and a minimum of 33 degrees F in 1927.

All-time state records for August 1st:

Scanning the state climatic data base: the all-time high for this date is 110 degrees F at Montevideo (Chippewa County) in 1988; the all-time low is 31 degrees F at Cloquet (Carlton County) in 1920.

Words of the Week: Total Threat

This term is used by the National Severe Storms Laboratory to define the average number of days per year when severe thunderstorms and associated weather (tornadoes, straight line winds of 58 mph or greater, and/or 3/4 inch hail) occur within a 25 mile radius of any particular geographic location. Across Minnesota this ranges from less than 1 day to as many as six days per year. The greatest total threat from severe thunderstorms being in the southern counties. Some states like Oklahoma, Florida, and Texas average as many as 15-18 days per year using this index.
geographic location.

Outlook:

Generally cooler than normal temperatures over the weekend with a chance for widely scattered showers, especially on Saturday, and especially in the east and northeast sections. Drier Monday and Tuesday, with a returning chance of showers and a warming trend by Wednesday. If concerned about gardens and your lawn, the first half of August looks to be drier than normal, so keep watering....

To: Jim Bickal, Cathy Wurzer, Julie Siple, and Eugene Cha
From: Mark Seeley
Re: Suggestions for MPR's Morning Edition, Friday, August 8, 2003

Announcement: Remember what happened at Alexandria, MN earlier this summer, at Roseau, MN last June, in the Twin Cities in the Spring of 2001, and all over the state in April of 1997...floods. Minnesota is subject to two kinds of flooding, that due to rapid and abundant spring snow melt, and that due to persistent and intense thunderstorm rainfalls.

Climatological trends and flood frequencies, flood vulnerability, risk management, floodplain management, and flood loss mitigation strategies are among the topics that will be addressed at the Minnesota Flood Summit Sponsored by the Department of Homeland Security/FEMA, the Minnesota Department of Public Safety, and the Minnesota DNR. The Summit will be held on August 27th at the Radisson South in Bloomington. This meeting will bring together elected officials, state agencies, city managers, emergency managers and others concerned with reducing flood losses. I will be one of the speakers. Those interested in attending can learn more at the Minnesota Division of Homeland Security and Emergency Mangement web site....

<http://www.dem.state.mn.us/>

Topic: Hot in Europe....

While Wednesday brought a pleasant day with near seasonal temperatures to Minnesota (highs in the upper 70s to low 80s F), parts of Europe continued to swelter with some afternoon highs pushing or surpassing daily record values..

London 96* F Paris 103F* Madrid 100 F
Rome 105 F Brussels 98 F Lisbon 102 F
Geneva 98 F Salzburg 90 F Dusseldorf 93 F

The 103 F reading in Paris was a new record high for the month of August.

The 96 F reading in London was a new all-time high for the city, breaking the record of 95 F that occurred in August of 1990. Gravesend in England reported a temperature of 97 degrees F, a record there, but still short of the all-time high in England which was 99 degrees F at Cheltenham on August 3, 1990.

A rather humorous story reported by the BBC referred to the English habit of countryside walks which are often taken for both exercise and fresh air. In the Yorkshire Dales, some were escaping the heat with shaded evening walks, except a few people chose to wear no clothing. This greatly upset the local constable and apparently a few hikers were arrested.

Wine makers in France, Germany and Italy are welcoming the heat wave, remembering that the last heat wave of this magnitude, over 50 years ago in 1947, helped produce some of the most outstanding wine ever, with rich body, exceptional color, and wonderful bouquet.

One clear distinction between the European heat wave this summer and our recent Minnesota heat waves (1995, 1999, and 2001) is that Europe's is a dry heat wave, with very low dew points and humidities, increasing the fire danger substantially. In fact numerous fires have been reported in France, Spain and Portugal. Conversely, our recent heat waves have been driven by high dew point temperatures more so than high air temperatures...in other words they have been steamy heat waves.

Topic: Hard to forecast.....

The current weather pattern is making it difficult to forecast for Minnesota, especially regarding precipitation. The absence of a consolidated jet stream (winds aloft) makes it difficult to assess the direction and speed of movement of various convective thunderstorms. In addition the pattern of convective thunderstorm development is very diffuse and spotty. This means that forecasters are bound to include some chance of thunderstorms in their forecasts even though the areal coverage and the total amount of rainfall are likely to be very limited. In a way this can mislead the home gardener into thinking there is no need to water, as there is a chance for showers nearly everyday. The landscape has become dry enough, that watering is probably a good idea whether it rains or not.

MPR Listener Question: I heard you speak about the Heat Index readings of 100 F to 115 F around the state on July 26th and that this has happened during the month more frequently in recent years. But what about August? Do we ever get similar Heat Index values in the Twin Cities during August?

Answer: Yes we do, but not as frequently. Short-lived episodes, just a day or two in length occurred in August 1913 and August 1936, each producing Heat Index values of 105 to 108 degrees F. Longer spells of several days occurred in August 1947, 1964, 1988, and 2001. The spell from August 5 to August 7, 2001 produced Heat Index values as high as 114 F in the Twin Cities.

Local Almanac:

Twin Cities Almanac for August 8th:

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 August 8th:

MSP weather records for this date include: highest daily maximum temperature of 96 degrees F in 1894 and 1914; lowest daily maximum temperature of 66 degrees F in 1972; lowest daily minimum temperature of 50 degrees F in 1972; highest daily minimum temperature of 75 degrees F in 1914; record rainfall of 2.22 inches in 1987.

Average dew point for August 8th is 59 degrees F, with a maximum of 75 degrees F in 1995 and a minimum of 37 degrees F in 1927.

All-time state records for August 8th:

Scanning the state climatic data base: the all-time high for this date is 105 degrees F at Beardsley (Big Stone County) in 1936 and 1958; the all-time low is 33 degrees F at Thorhult (Beltrami County) in 1964.

Words of the Week: Sun Kinks

Actually this is a railroad term, but it does relate to the weather. Large temperature changes or temperature extremes cause rails to expand and/or contract excessively, especially on bright sunny hot days, like those occurring in Europe lately. This can lead to sun kinks or bending of the rails. These are sometimes visible if you look down the line of track closely. Occasionally these kinks are large enough that they can prevent drawbridges from opening or closing properly. In extreme conditions of high temperature rail tracks can warp and buckle causing derailments, especially if the tracks are welded rather than jointed. In England and France this week, rail traffic has been slowed because of the threat of serious sun kinks.

Outlook:

Chance of showers and thunderstorms on Saturday in the west, eastern and southern sections on Sunday. Then a drier period settling in for early next week, with warmer temperatures. Chance for showers again in southern Minnesota toward the end of next week.

To: Jim Bickal, Cathy Wurzer, Julie Siple, and Eugene Cha
From: Mark Seeley
Re: Suggestions for MPR's Morning Edition, Friday, August 15, 2003

PROMO: The 7th Annual MPR MIDDAY State Fair Weather Quiz...

Question: We have names for various groups of animals, a pride of lions, a murder of crows, a gaggle of geese. But what do we call a group of meteorologists (a shame, ashamed, an embarrassment!)

Question: Historically, what is the windiest month of the year in Minnesota? (April)

Question: When was the latest Spring snowfall in Minnesota? (June 4, 1935, 1.5 inches in Koochiching County)

Question: What's the difference between a meteorologist and a climatologist? (the meteorologist contends with the uncertainties of tomorrow, while the climatologist conveys the certainties of the past)

If these questions tweak your interest, be sure to catch the MIDDAY broadcast on August 21st, live from the Minnesota State Fair at 11:00 am. Gary and Mark will be doing the 7th Annual Minnesota Weather Quiz, with a live audience as well as open phone lines. Mark promises easier questions taken from his Morning Edition commentaries. All those who participate this year will be eligible for a prize. If you plan to visit the fair that day, come on over to the MPR booth at Judson and Nelson. Those who want, may take the weather quiz on line by going to the MPR State Fair web site.

ANNOUNCEMENT: Remember what happened at Alexandria, MN earlier this summer, at Roseau, MN last June, in the Twin Cities in the Spring of 2001, and all over the state in April of 1997...floods. Minnesota is subject to two kinds of flooding, that due to rapid and abundant spring snow melt, and that due to persistent and intense thunderstorm rainfalls.

Climatological trends and flood frequencies, flood vulnerability, risk management, floodplain management, and flood loss mitigation strategies are among the topics that will be addressed at the Minnesota Flood Summit Sponsored by the Department of Homeland Security/FEMA, the Minnesota Department of Public Safety, and the Minnesota DNR. The Summit will be held on August 27th at the Radisson South in Bloomington. This meeting will bring together elected officials, state agencies, city managers, emergency managers and others concerned with reducing flood losses. I will be one of the speakers. Those interested in attending can learn more at the Minnesota Division of Homeland Security and Emergency Mangement web site....

<http://www.dem.state.mn.us/>

Topic: Follow up on last week's weather headlines....

The heat wave continued in parts of Western Europe, with Bern, Switzerland reporting a new all-time high temperature record of 98 degrees F on Wednesday this week. Also, on Wednesday this week the health ministry in France attributed over 3,000 deaths in that country to the heat wave of the past two weeks.

Earlier in the week Turin, Italy set a new record high with 107 degrees F and London recorded its first ever 100 degrees F day. The heat wave is providing a significant challenge to health care providers in European countries, as a vast majority do not have air conditioning.

Meanwhile, Typhoon Etau, a name that translates to "storm cloud" pummeled Japan with 15 inches of rain and 40 foot seas earlier in the week.

Topic: A preliminary assessment of mid-summer....

Following a rather turbulent May, June, and early July which brought a number of severe thunderstorms, hail, and tornadoes (35 at last count) to the state, who would have guessed that many areas would turn so dry. Many communities have reported less than 0.75 inches since July 15th, a figure that is 3 or more inches below normal for most locations. Some of those very dry areas include....

Willmar with 0.67 inches, Hastings with 0.69 inches, New Ulm with 0.66 inches, Windom with 0.35 inches, Preston with 0.44 inches, Grand Meadow with 0.40 inches, Rochester with 0.47 inches, La Crosse, WI with 0.45 inches, Chanhassen with 0.31 inches, St Paul with 0.53 inches, and Winona with just 0.25 inches. The figure of 0.25 inches at Winona is record dryness for the July 15 to August 15 period, beating the old record of 0.40 inches in 1964, while the figure of 0.35 inches at Windom is also a record for the period, beating the value of 0.38 inches in 1982.

While the dryness has certainly stressed gardens and parks in the Metro area, agricultural areas have seen variable affects depending on soil type, and soil water holding capacities. Finer textured soils, with deep root zones have been able to provide sufficient water for major crops, while coarse textured soils, or shallow soils on eroded slopes have not been able to satisfy the crop water needs.

MPR Listener Question: I note that just 0.62 inches of rainfall in the Twin Cities (MSP airport) has been reported for July 15 to August 15. No wonder everyone is watering. How does this measly rainfall total rank historically for dryness in mid-summer?

Answer: That rainfall total for the July 15 to August 15 period

is the 8th driest historically. Certainly far short of what is needed in mid summer for lawns and shallow rooted plants. The other drier periods in rank order were....

1920	0.13 inches	1894	0.36 inches	1982	0.38 inches
1946	0.40 inches	1936	0.46 inches	1947	0.50 inches
1925	0.61 inches				

There have been only 5 days with measurable rainfall since July 15th, not a record, but close. There were only 3 such days in 1936.

Local Almanac:

Twin Cities Almanac for August 15th:

The average MSP high temperature for this date is 82 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 August 15th:

MSP weather records for this date include: highest daily maximum temperature of 103 degrees F in 1936; lowest daily maximum temperature of 63 degrees F in 1897; lowest daily minimum temperature of 47 degrees F in 1960; highest daily minimum temperature of 76 degrees F in 1937; record rainfall of 1.23 inches in 1966.

Average dew point for August 15th is 59 degrees F, with a maximum of 75 degrees F in 1987 and a minimum of 41 degrees F in 1976.

All-time state records for August 15th:

Scanning the state climatic data base: the all-time high for this date is 108 degrees F at Beardsley (Big Stone County) in 1937 and at Madison (Lac Qui Parle County) in 1988; the all-time low is 25 degrees F at Remer (Cass County) in 1985.

Words of the Week: Turloughs and Dew Ponds....

Turloughs, literally dry lakes, are sinkholes in the limestone areas of western Ireland. Mostly dry, they can fill up and become temporary lakes following a wet spell that causes the water table to rise above the rocky surface.

Dew ponds are depressions in the downs or upland areas which remain filled with water thanks to overnight condensation runoff from dew, mist or fog. They only survive in very moist or coastal climates.

Outlook:

Warm start to the weekend with high dew points. Less heat and humidity next week, and a chance for showers and thunderstorms by Wednesday.

To: Morning Edition Listeners
From: Mark Seeley
Re: Suggestions for MPR's Morning Edition, Friday, August 22, 2003

The normal WeatherTalk commentary is unavailable this week....
MPR listeners are encouraged to go to the MPR State Fair web
site and take the 7th Annual MPR Minnesota Weather Quiz...
see how you do by going to

http://access.mpr.org/features/0308_statefair/

See below for some State Fair weather Trivia...
(answers appear below the list of questions....)

1. What year has been the driest State Fair?
2. What year has been the wettest State Fair?
3. What has been the coldest temperature measured during the State Fair?
4. What has been the warmest temperature measured during the State Fair?
5. What has been the highest dew point measured during the State Fair?
6. During this year's State Fair (August 21 to Sept 1), which date has the highest climatological probability for rainfall and which date has the lowest?
7. Based on historical climatology, during the State Fair's 12 day run, how many days does it rain?
8. Thunderstorms have hampered the State Fair in the past. When was the heaviest thunderstorm and what was the total rainfall?
9. What is the prevailing wind direction during the State Fair?
10. What has been the coldest daytime temperature during the State Fair?

Answers:

1. 1968 with a rainfall total of 0.08 inches.
2. 1977 with a rainfall total of 9.48 inches.
3. 36 degrees F on September 1, 1974.
4. 97 degrees F on September 1, 1913
5. 77 degrees F (super sticky) on August 28, 1955.
6. 40 percent historical frequency on August 22
and 25 percent historical frequency on August 24.
7. On average 3-4 days with measurable rainfall.

8. 4.5 inches on the night of August 30, 1977
(MSP airport reported 7.28 inches).
9. South-southwest wind is most prevalent during the fair.
10. A chilly 58 degrees F on August 31, 1958

To: Morning Edition Listeners
From: Mark Seeley
Re: Topics for MPR's Morning Edition, Friday, August 29, 2003

DON'T FORGET TO TAKE THE MPR STATE FAIR WEATHER QUIZ AT
http://access.mpr.org/features/0308_statefair/

The high of 97 degrees F at the State Fairgrounds on Sunday, August 24 tied the record for the highest temperature ever at the Minnesota State Fair (September 1, 1913 was 97 F).

Looks like MPR Day at the Fair (Aug 29) will be magnificent, with partly cloudy skies, low humidity, and temperatures in the 70s F.

Topic: Preliminary Climate Summary for August 2003

August temperatures averaged warmer than normal everywhere around Minnesota. Observers report average monthly temperatures from 2 to 5 degrees F warmer than normal and several 90 F plus days. Temperature extremes during August ranged from 101 degrees F at Browns Valley (Traverse County) on the 18th to just 32 degrees F at Tower (St Louis County) on the 12th.

Rainfall was lacking just about everywhere in the state during August. Just a few observers like Grand Portage and Warroad reported over 3 inches. Most places reported less than half of normal rainfall. Some approached the all-time record for driest August, including Rochester with 0.34 inches, driest August since the 0.31 inches in 1941; Winona with 0.32 inches, driest August since the 0.02 inches in 1894; Alexandria (one of the wettest places in June and July) with just 0.28 inches, driest August since the 0.18 inches in 1969. Dodge Center in southeast MN reported just 0.20 inches, their driest August ever.

MPR listener question: I heard that we have had seven days this month with 90 degrees F or higher temperatures in the Twin Cities, and that August was our hottest month of the summer. How often does this happen?

Answer: Indeed, August has been the hottest of the summer this year. It is not exceptionally unusual for August to be the hottest month of the summer. This happens with a historical frequency of about once every four years. In fact, this was the case for five consecutive summers from 1958 to 1962, and most recently it happened in 1996. The last time we had August temperatures as hot as this year (average of 74.7 F) was 1995. But this August may be the warmest since 1983.

The seven days with temperatures of 90 F or above was a bit unusual, the most for August since the summer of 1988. On average, there are four days in August with temperatures that high.

Local Almanac:

Twin Cities Almanac for August 29th:

The average MSP high temperature for this date is 79 degrees F (plus or minus 8 degrees standard deviation), while the average low is 59 degrees F (plus or minus 7 degrees standard deviation).

MSP Local Records for August 29th:

MSP weather records for this date include: highest daily maximum temperature of 96 degrees F in 1969; lowest daily maximum temperature of 60 degrees F in 1915; lowest daily minimum temperature of 45 degrees F in 1911; highest daily minimum temperature of 74 degrees F in 1899; record precipitation of 2.05 inches in 1964.

Average dew point for August 29th is 58 degrees F, with a maximum of 76 degrees F in 1945 and a minimum of 34 degrees F in 1931.

All-time state records for August 29th:

Scanning the state climatic data base: the all-time high for this date is 103 degrees F at Beardsley (Big Stone County) in 1921; the all-time low is 22 degrees F at Tower in 1976.

Words of the Week: Prognostic Chart and Agnostic Chart

A prognostic chart, often referred to by meteorologists as a "prog" depicts the expected pressure pattern or height pattern of a given synoptic chart (typically scaled to a country, a continent, or an entire hemisphere) for some specified future time, perhaps 24 hours or even 196 hours ahead. Positions of weather fronts and cloud formations are often shown on these charts, which assist forecasters in determining the areal coverage of different weather types. Various progs are produced several times each day by the National Weather Service using a variety of models.

An agnostic chart, is the tongue-in-cheek term used by forecasters to refer to a prog which no one believes. This may be due to observed differences in the local weather conditions, errors in the forecast model, or bad initial measurements to set up the model run. I suppose economists must have a similar term for their bad forecasts.

Outlook:

Looks like a fine Labor Day weekend, with cooler than normal temperatures and only a slight chance for showers in northeastern sections of the state. Cooler than normal conditions will exist into the first week of September, with a chance for showers by Tuesday or Wednesday next week. The need to water gardens, trees, and lawns will continue.

To: Morning Edition Listeners
From: Mark Seeley
Re: Topics for MPR's Morning Edition, Friday, September 5, 2003

Many media stories this week were based on the fact that Minnesota recorded one of its driest Augusts (and even July and August combined), as well as one of its warmest Augusts. The combination produced many detrimental effects.....and a few positive ones....

DRY AIR + DRY LANDSCAPE = LARGE DAILY TEMPERATURE RANGE

This is one of the standard rules of thumb in climatology and certainly held true to form this week. After starting out the morning at 39 F on Thursday (Sept 4), Benson, MN reported a high of 81 F by late afternoon. Similarly, International Falls reported a record tying low Thursday morning of 33 F, then climbed to a high of 68 F by evening. Both Tower and Embarrass reported the first frost of September with 32 degrees F on Thursday morning (Sept 4)...not unusual for them.

Topic: Soil moisture reports.....

We have all heard how dry the soils are around the state, but how about some actual data.....

The University of Minnesota Research and Outreach Center at Lamberton (Redwood County) has been keeping soil moisture data since 1960. The recent September 1st measurement shows a value of only 1.66 inches of water in the top 5 feet of soil. This is the lowest value measured for this time of year since 1988 (1.54 inches back then). There have been six other years when the September soil moisture values have been this low or lower (1967, 1973-1976, 1988).

In addition, soil moisture measurements made at the University of Minnesota Southern Research and Outreach Center at Waseca, show totals of less than 5 inches in the top 5 feet, with nearly all of the moisture in the 4th and 5th foot below the surface. This is remarkably low as well, though not a record for their measurements.

Topic: Pencil Pushing on the Drought Impacts....

The summer drought in Minnesota (designated as a category one, moderate drought by the Drought Mitigation Center in Nebraska) certainly has had some impact around the state. The two-fold effect of lack of rainfall since mid July, combined with one of the warmest Augusts in recent memory has produced.....

- low stream flows and lake levels, with abundant algae blooms
- increased fire danger, especially in forested areas

- reduced yield expectations for Minnesota corn and soybean farmers
- extensive watering to maintain landscape plants and gardens

Some agronomists and farmers have estimated anywhere from a 10 percent to a 30 percent yield loss for corn and soybeans. At today's commodity prices (\$2.45/bu for corn and \$5.85/bu for soybeans, last year's crop yields (2002) would have a value of about \$4.4 billion, based on 6.7 million acres of corn yielding 157 bu/a, and 7.1 million acres of soybeans yielding 43.5 bu/a (values reported by MN Agricultural Statistics Service). Acreage estimates for the 2003 growing season in Minnesota were higher for soybeans, at 7.6 million acres, and lower for corn grain at 6.55 million acres. Still, taking an across the board 10 percent yield reduction for this year's crop, the estimated value at current commodity prices is about \$4.0 billion, \$400 million less than last year. But if yield reductions of corn and soybeans are as high as 30 percent, as some have estimated, the estimated value at current commodity prices is only about \$3.0 billion, \$1.4 billion less than last year.

Minnesota's small grain production (wheat, barley, and oats) seems to be less affected, having matured and been harvested prior to the maximum drought impact. Irrigated crops like dry beans and potatoes have done well, while livestock producers will get little late season hay from their dry alfalfa fields, and may have to use more corn silage for feed.

Homeowners have seen a significant increase in their water bills, not so much for the purpose of keeping a lush looking landscape, but just to keep vegetation and trees alive. Some have reported water costs as much as 50 percent higher.

Any silver lining to a summer drought?....perhaps less pesky insects (mosquitos), more successful outdoor weddings and festivals, more beverage sales, and reduced drying costs for farmers who will store their harvest.....and perhaps scores of secondary benefits.

MPR listener question: I have heard that in the Twin Cities we need a good 3 to 4 inches of rainfall to replenish lost soil moisture from the summer drought. How often do we get 4 or more inches of rainfall in the month of September?

Answer: The Twin Cities climate record (1891-2002) shows September rainfall totals of 4 inches or greater 26 times in the past 112 years, about 23 percent frequency. Record rainfall in September is 7.77 inches in 1903. Though it may be unrealistic to think that September rainfall will bail us out of the drought, it is more likely that total autumn rainfall prior to soil freeze-up may do the trick. Often times a very high percentage (as much as 60 to 80 percent) of September through November precipitation is stored in the soil and replenishes what was lost over the summer.

Local Almanac:

Twin Cities Almanac for September 5th:

The average MSP high temperature for this date is 77 degrees F (plus or minus 10 degrees standard deviation), while the average low is 57 degrees F (plus or minus 8 degrees standard deviation).

MSP Local Records for September 5th:

MSP weather records for this date include: highest daily maximum temperature of 98 degrees F in 1922; lowest daily maximum temperature of 58 degrees F in 1926; lowest daily minimum temperature of 36 degrees F in 1962; highest daily minimum temperature of 77 degrees F in 1912; record precipitation of 2.57 inches in 1946.

Average dew point for September 5th is 55 degrees F, with a maximum of 78 degrees F in 1990 and a minimum of 31 degrees F in 1924.

All-time state records for September 5th:

Scanning the state climatic data base: the all-time high for this date is 103 degrees F at Tracy (Lyon County) in 1922: the all-time low is 24 degrees F at Tower in 1993.

Words of the Week: : Isophane or Isophene

These words are derived from Greek terms, iso meaning equal and phainein meaning to show. Either word is used to refer to a line drawn through geographical points on a map where a given seasonal phenological event occurs at the same time. For example, the dates of flowering for crab apple trees, or the blooming of lilacs in the spring might be depicted as isophanes on a map. Certainly, later this month on the Minnesota DNR web site and in our local newspapers we will see such maps depicting the progress of fall color changes around the state. These too, might be called isophane maps.

Outlook:

Some summer-like heat will return for the weekend, with no rain in sight until the middle of next week. Optimistically, the chances for seeing rain next week are growing, and some models show as much as an inch or greater by Friday.

To: Morning Edition Listeners
From: Mark Seeley
Re: Topics for MPR's Morning Edition, Friday, September 19, 2003

Those interested in Minnesota weather may want to sign up for the Compleat Scholar Course called "Distinguishing El Nino from El Nonsense: Understanding Minnesota Weather and Climate. The 5-session course begins on Monday, October 20th at 6:30 pm on the St Paul Campus. If interested call 612-624-4000. This course includes a tour of the National Weather Service Forecast Office in Chanhassen.

For those who like cool, crisp nights for sleeping the return of overnight lows in the 40s F was certainly welcome. The Twin Cities had not seen lows in the 40s F since June 1st.....Though the autumnal equinox does not occur until next Tuesday (9/23), cool fall-like weather will dominate Minnesota this weekend, following the beneficial rains of Wednesday and Thursday this week. Speaking of rains, Rochester set a new rainfall record on the 18th with 1.26 inches, and Red Wing also set a record that day with 1.43 inches.

Topic: Assessing a lifetime of weather....

My wife recently showed me an article from This England magazine that reminded me of a forgotten truth about weather watching..... longevity counts! The article was about a Lincolnshire shepherd named Percy Plummer. He spent his entire life (1903-1979) observing the weather, even serving in the Royal Observer Corps during World War II. Among the farm and town folk in Lincolnshire he was a highly regarded observer and forecaster, often relying on his own personal observations and records of the past in making his predictions.

Percy believed in the accuracy of some of the old weather lore, including such sayings as....

"when the wind is in the east, 'tis neither good for man nor beast."

And "A January Spring is no fine thing."

He also coined some of his own weather lore....

"When the Scarlet Pimpernel is wide open and the duck weed's risen on the pond, it will be a fine and right day."

or, "When old ewes bleat and skip like lambs, it's going to rain."

Though we now live in a highly mobile society in America, those who choose to stay in one place throughout their lives accumulate tremendous knowledge of climate and weather variation. This is valuable experienced-based knowledge that can be an asset to the local community in better understanding the environment and making predictions about the future. We are blessed to have many communities in Minnesota with over 100 years of daily climate records thanks to the diligence of volunteer observers, some of whom served over an entire lifetime. Most would admit that over the course of a lifetime, we experience a broad range in weather

and climate conditions, but it is probably only a small sample compared to the full range of conditions Mother Nature can offer.

Topic: The Weekend Effect

An article recently published in the Proceedings of the National Academy of Sciences (authors Forster and Solomon) suggests there is a weekend effect in the temperature pattern of many major cities in the United States. This is demonstrated by a difference in the mean daily temperature range of weekdays versus weekends. Thirty-five percent of the cities studied showed a significant difference in the daily temperature range recorded over weekends during a recent 50 year period. The scientists attribute this to changes in the character of the atmosphere within a city that probably relate to variable emissions from human activity, distinguishably different on weekends versus weekdays. For some cities the daily temperature range was greater on the weekends, while for others it was less.

I checked the current year's temperature record in the Twin Cities and found the following differences in mean daily temperature range when comparing weekends to weekdays....the list is by month for 2003

Month	Mean Daily Temp (F) Range on Weekdays	Mean Daily Temp (F) Range on Weekends	Difference (F)
January	15.3	16.4	+1.1
February	19.5	15.3	-4.2
March	15.9	22.6	+6.7
April	18.2	19.6	+1.4
May	19.4	18.7	-0.7
June	19.0	19.9	+0.9
July	17.7	18.8	+1.1
August	19.6	20.9	+1.3
Sept (1-16)	23.1	20.5	-2.6

The pattern is somewhat confusing. There are differences in daily temperature range of weekdays versus weekends, but they go in both directions, some larger and some smaller. It appears that the differences may be more attributable to cloud cover, precipitation, or wind that accompanies frontal passages. For example, the weekends in February were generally cloudier and windier than the weekdays, thus the smaller daily temperature range. Conversely, in March the weekends were over 33 percent sunnier than weekdays, producing a greater temperature range. The generally larger daily temperature ranges shown for August and September are likely due to the very dry atmosphere that dominated the state during the summer drought.

MPR listener question: Can Hurricane Isabel affect our weather?

Answer: Not directly, but it appears it may have some effect in shifting the upper air steering pattern (jetstream) over North America during the upcoming weekend. A buckling of the upper air pattern will allow colder air to slip deeper into Minnesota and produce some unseasonably cold temperatures,

perhaps speeding up the color change in deciduous trees around the state.

Local Almanac:

Twin Cities Almanac for September 19th:

The average MSP high temperature for this date is 71 degrees F (plus or minus 11 degrees standard deviation), while the average low is 51 degrees F (plus or minus 8 degrees standard deviation).

MSP Local Records for September 19th:

MSP weather records for this date include: highest daily maximum temperature of 94 degrees F in 1895; lowest daily maximum temperature of 48 degrees F in 1926; lowest daily minimum temperature of 33 degrees F in 1991; highest daily minimum temperature of 72 degrees F in 1891; record precipitation of 2.98 inches in 1901; and a trace of snowfall in 1927.

Average dew point for September 19th is 51 degrees F, with a maximum of 72 degrees F in 1907 and a minimum of 25 degrees F in 1937.

All-time state records for September 19th:

Scanning the state climatic data base: the all-time high for this date is 104 degrees F at Beardsley (Big Stone County) in 1895: the all-time low is 20 degrees F which has occurred in a number of years, including 1896 at Lambert (Red Lake County), 1897 at Tower (St Louis County), 1901 at Pokegama Dam (Itasca County), and 1929 at Cloquet (Carlton County).

Words of the Week: Marine trumpets

This is what the Italian weather service calls waterspouts, or tornadoes that form over water. The shape of these systems suggests a vision of a vertically oriented trumpet is my guess as to the origin of the term.

Outlook:

Cooler over the weekend with overnight lows in the 30s and 40s F. Increasing chance for showers later Sunday and continuing Monday and Tuesday next week. A warm, dry trend will begin on Wednesday and bring temperatures back above the 70 F mark toward the end of the week.

To: Morning Edition Listeners
From: Mark Seeley
Re: Topics for MPR's Morning Edition, Friday, September 26, 2003

For those who want to learn about the weather, there are still some openings in my Compleat Scholar class this fall. It starts Monday, October 20th and runs for five consecutive Monday evenings. "Distinguishing El Nino from El Nonsense: Understanding Minnesota's Weather and Climate" will include a tour of the National Weather Service Forecast Office. If interested, call 612-624-4000

Topic: Preliminary Climate Summary for September, 2003

With just four days left in September, how can we characterize the month's weather? Most places have reported warmer than normal conditions, with average monthly temperatures from 1 to 3 degrees greater than the historical average. The highest temperature in the state was 97 degrees F at Browns Valley on the 6th, while the lowest was 27 degrees F at Embarrass on the 16th. However it appears even colder air may affect the state on the 29th and 30th.

Rainfall for September was generally above normal in northwestern, northeastern and southwestern counties, but below normal elsewhere. Several places reported over 4 inches of rainfall for the month, including.....

Crookston 4.01" Warroad 4.51" Babbitt 4.76"
Cook 5.35" Embarrass 4.71" Hibbing 4.24"
Tower 5.47" Montevideo 4.66" Pipestone 4.28"
Worthington 4.11" Marshall 4.62"

Soil moisture reserves were partially replenished where the heavier rains fell, though most of the state would still welcome abundant moisture this fall.

A few days in September were exceptionally windy, bringing gusts to over 40 mph, near 50 mph in the far northwest (on the 24th).

Topic: Two Fall climatic benchmarks.....

Anybody remember 1942?

September 26, 1942 is a climatic benchmark of sorts in that it marks the earliest fall occurrence of a significant snowfall in Minnesota. Though MSP officially recorded 1.7 inches (most of which fell from 8 pm on the 25th to 8 am on the 26th), many of the city parks reported 2 or more inches. Much of this melted during the day on the 26th, but the heavy wet snow damaged trees and shrubs which had not lost their leaves. Elsewhere around the state the snow was heavier yet and required some shoveling. At Bird Island in Renville County 8 inches fell,

while at Sauk Center in Stearns County they recorded 9 inches.

Anybody remember 1892?

October 1, 1892 brought a very rare heavy hail storm to St Paul, perhaps the worst ever recorded in the month of October. St Paul weather historian Tom St Martin has written about this storm. Hailstones actually piled up in the streets, some being half of the size of hen's eggs. The lightning and thunder which accompanied the storm caused many horses to bolt. An Anheuser-Busch driver was thrown from his wagon by a startled team of horses, while another driver of a grocery wagon was knocked to the street by a bolt of lightning which killed his horse. In contrast, the city of Minneapolis reported little or no rainfall from the storm.

Subsequently, the climatological record for the Twin Cities shows that October hail storms only occur about once every 50 years. So they are indeed a rare October weather event.

Topic:

MPR listener question: I know that the average date for first Fall frost in the Twin Cities area is about October 7-10, but how often does it come in September here?

Answer: In the 112 years since official National Weather Service records began for the Twin Cities (1891), there have been 23 years (about 21 percent frequency) when the first Fall frost occurred in September, most recently in 2000 when it frosted on September 24th. 1974 brought the earliest frost ever, on September 3rd, while 1942 brought five separate September frosts. Incidentally, there have been five years when the first fall frost did not arrive until November (1900, 1921, 1924, 1940, and 1958), with the latest occurring on November 7, 1900.

Local Almanac:

Twin Cities Almanac for September 26th:

The average MSP high temperature for this date is 66 degrees F (plus or minus 10 degrees standard deviation), while the average low is 45 degrees F (plus or minus 7 degrees standard deviation).

MSP Local Records for September 26th:

MSP weather records for this date include: highest daily maximum temperature of 87 degrees F in 1923; lowest daily maximum temperature of 41 degrees F in 1942; lowest daily minimum temperature of 27 degrees F in 1965; highest daily minimum temperature of 64 degrees F in 1998; record precipitation of 1.81 inches in 1930; and 1.7 inches of snowfall in 1942.

Average dew point for September 26th is 46 degrees F, with a maximum

of 70 degrees F in 1986 and a minimum of 20 degrees F in 1965.

All-time state records for September 26th:

Scanning the state climatic data base: the all-time high for this date is 93 degrees F at Madison (Lac Qui Parle County) and Redwood Falls (Redwood County) in 1974; the all-time low is 11 degrees F at Crookston (Polk County) in 1893.

Word of the Week: SMART Radar

This acronym stands for Shared Mobile Atmospheric Research and Teaching radar, a radar system mounted on a flatbed truck that can be deployed to measure the winds under a severe convective storm, or even a hurricane that makes landfall. These detailed measurements allow researchers to view the landscape effects on strong wind fields. They are used by researchers at Texas Tech, Texas A&M, and Oklahoma Universities, as well as those at the National Severe Storms Lab.

Outlook:

Cool spell of weather over the weekend and lingering into next week. Chance of frosts around the state Sunday through Tuesday morning. Scattered showers possible on Saturday and Sunday, again by Wednesday of next week. Cold start to October.

To: Morning Edition Listeners
From: Mark Seeley
Re: Topics for MPR's Morning Edition, Friday, October 3, 2003

For those who want to learn about the weather, there are still some openings in my Compleat Scholar class this fall. It starts Monday, October 20th and runs for five consecutive Monday evenings. "Distinguishing El Nino from El Nonsense: Understanding Minnesota's Weather and Climate" will include a tour of the National Weather Service Forecast Office. If interested, call 612-624-4000

Topic: Widespread frosts with a taste of winter this week....

Many places around the state of Minnesota recorded their first fall frosts this week, including the Twin Cities metro area. This not only ended the growing season for gardeners and farmers, but also greatly accelerated the fall leaf color change. Some low temperature were record tying. On Wednesday, October 1st, Grand Forks, ND tied a record low with 23 degrees F, similarly, Eau Claire, WI tied a record low with 25 degrees F, and Hallock in northwestern Minnesota also tied a record low that day with just 18 degrees F, also the lowest temperature reported in America on Wednesday. International Falls set a new low temperature record on Wednesday with a reading of 20 degrees F. Even high temperatures remained very cold on Wednesday just reaching the 40s F in many places, marking one of the coldest October 1st dates in Minnesota history.

Thursday morning, October 2nd was very cold as well, with the following communities reporting record lows...

Red Wing 19 F Hutchinson 19 T Waseca 17 F
Grand Meadow 18 F Owatonna 19 F Rochester 19 F
Embarrass, MN reported the coldest temperature in the nation on Thursday morning with just 13 degrees F. A very dry atmosphere contributed to the rapid overnight heat loss, as the Twin Cities set a record low dew point on Wednesday night a reading of only 17 degrees F.

Snow arrived in Koochiching, Itasca, St Louis, Lake, and Cook counties in northern Minnesota this week. The communities of Baudette, International Falls, Ely, Eveleth, Orr, Silver Bay, and Duluth all reported some snowfall. In fact, International Falls reported 0.1 inches of snowfall on both September 29 and 30. That was the first measurable September snowfall there since 1993. Historically, International Falls sees measurable September snowfall about once every eight years.

Topic: Saying good-bye to a valued colleague....

Don Essler, a hydrometeorological technician with our Twin Cities National Weather Service Forecast Office passed away this week. He joined the staff of the Twin Cities forecast office in 1976, and was known for his appreciation and support of the volunteer weather

observer network in the state. In fact with a number of weather observers, Don was on a first name basis. He also hosted some of my classes for visits to the National Weather Service Office and was both patient and gracious in explaining the technologies used in observing systems.

Don was a friend of many in the meteorological community and certainly a valued public servant. Minnesotan's are lucky for having him on weather duty for so many years.

Topic: Revised look at 2003 European heat wave....

The Ministry of Health in France now reports that heat-related deaths from the record-setting August heat wave probably ranged between 15,000 and 18,000. This is an astonishing number, well beyond the traumatic heat waves of the 1990s that caused over one hundred deaths in Philadelphia (1993) and over 600 deaths in Chicago (1995). Both of those American cities have since responded by having better heat wave planning and response plans to provide relief shelters and appropriate health care to their citizens. I suspect that France will soon draft similar plans to better protect their citizens.

Another revised report on the 2003 summer heat wave in Europe notes that August 10th produced a new all-time temperature record in the United Kingdom, 101.3 degrees F at Brogdale in Kent. Never before had a temperature of 100 degrees F or more been measured in the United Kingdom, and their records go all the way back to 1659!

MPR listener question: How often does the Twin Cities see snowfall in October?

Answer: Historically, going all the way back to 1820 using Ft Snelling, St Paul, and National Weather Service Twin Cities observations, measurable snowfall occurs in October about 35 percent of the time, or a little better than one in three years. In fact it has snowed each of the last two Octobers. The most October snowfall in the modern National Weather Service era is 8.2 inches in 1991 (Halloween blizzard year). The largest amounts in the old pioneer records (19th Century) were 11.0 inches in 1820 at Ft Snelling and 14.0 inches in downtown St Paul in 1873.

Local Almanac:

Twin Cities Almanac for October 3rd:

The average MSP high temperature for this date is 66 degrees F (plus or minus 10 degrees standard deviation), while the average low is 46 degrees F (plus or minus 8 degrees standard deviation).

MSP Local Records for October 3rd:

MSP weather records for this date include: highest daily maximum temperature of 86 degrees F in 1976; lowest daily maximum temperature of 41 degrees F in 1935; lowest daily minimum temperature of 26 degrees F in 1996; highest daily minimum temperature of 65 degrees F in 1931; record precipitation of 2.62 inches in 1903; and a trace of snowfall in 1935.

Average dew point for October 3rd is 42 degrees F, with a maximum of 64 degrees F in 1926 and a minimum of 18 degrees F in 1989.

All-time state records for October 3rd:

Scanning the state climatic data base: the all-time high for this date is 95 degrees F at Ada (Norman County) in 1922 and again at Milan (Chippewa County) in 1938; the all-time low is 10 degrees F at Argyle (Marshall County) in 1989.

Word of the Week: Earth's oldest voices

This isn't really a meteorological expression, but perhaps it is arguably a climate expression, though derived from Native American culture and others. What are the oldest sounds on Earth?

They are the sounds of wind, waves, and running water....all elements of the Earth's climate. Before any life forms existed, millions of years ago, there was the voice of the Earth's atmosphere, wind generated by air pressure gradients (high and low pressure cells) and the differential heating of land and water surfaces. There was also the voice of the Earth's water, waves generated by wind and tidal forces, and running water responding to the forces of gravity. Pretty basic stuff here, but obviously, the oldest sounds on our planet. Sounds that many of us find comforting and peaceful. In fact some doctors prescribe these sounds to relax patients or help them sleep better at night.

Outlook:

Generally cool weather through the weekend with considerable cloudiness and wind. A significant warming trend will begin after Sunday, with high temperatures climbing back into the 50s and 60s F. Gradual return of moist air will mean a chance for showers later next week.

To: Morning Edition Listeners
From: Mark Seeley
Re: Topics for MPR's Morning Edition, Friday, October 10, 2003

Topic: A contrasting October so far.....

Having begun the month with record setting low temperatures on the 1st and 2nd (teens and low twenties F) Minnesotans were asking questions like, "what's the winter forecast, how often does it snow in October, will we ever see 70 degrees F again?" Lo and behold, the other shoe dropped this week, and many new record high temperatures were set or tied on October 7th including.....

MSP tied record of 85 F, Rochester tied record of 83 F, Olivia tied record of 88 F, Fergus Falls tied record of 88 F; and new records were set at Hibbing with 83 F, Brainerd with 85 F, Park Rapids with 85 F, Moose Lake with 86 F, Pine River with 84 F, Grand Rapids with 82 F, Roseau with 86 F, Wadena with 88 F, Morris with 89 F, St Cloud with 86 F, Red Wing with 88 F, Willmar with 90 F, Glenwood with 90 F, and Benson with 91 F. Some were not far below the all-time state record temperature for October 7th of 94 degrees F at Red Lake in 1963 and again at Canby in 1993. Then again, a few more record high temperatures were set on Wednesday, October 8th as well, including 85 F at Fargo, 81 F at Rochester, 81 F at Hibbing.

Such temperatures brought questions like, "how late do the golf courses stay open, are public outdoor pools still available for swimming, how often do we have to run air conditioners in October?" The October warmth was not unlike that of 1993 and 1997, but perhaps most similar to that of 1856 when drought had the Minnesota landscape bone dry going into the month and early frosts had already killed off much of the vegetation. Several days of 80 degrees F temperatures followed by thunderstorms produced widespread prairie fires across the state that lit the nighttime skies. Fires burned several farmsteads in MN, IA, and SD. The fire danger is higher this year too, as the state could still use some soaking rainfall this fall, after the midsummer drought.

Topic: Changing day length effects on daily temperature...

As we continue to lose daylight hours this month, you may notice an increase in the daily temperature range. Though the sun will heat the dry landscape substantially during the day (as we have seen this week), the longer nights allow for more cooling to occur, dropping the overnight lows to a greater degree than just a month ago. This produces a larger daily temperature range in the absence of significant cloud cover (note the 47 degrees F spread in daily temperature at St Cloud on Wednesday of this week).

Another temperature effect of day length is change in the time of day that the maximum temperature occurs. Again, in the absence

of persistent cloud cover, or drastic change in air mass because of a strong frontal passage, the time of the maximum temperature is typically 5:00 to 6:00 pm in July, 4:00 to 5:00 pm this time of year (October), and during the very short days of December, the maximum temperature occurs between 3:00 and 4:00 pm.

MPR listener question: Having moved here just last year from New Jersey, and recently experienced both winter and summer like temperatures in the first ten days of October, I am curious to know what the extreme October temperatures are in this state?

Answer: The all-time state temperature extremes for October are likely far greater than those of New Jersey....they are a high of 98 degrees F at Beardsley (Big Stone County) in western Minnesota on October 5, 1963, and an all-time low of -16 degrees F at Roseau on October 26, 1936 (with 3 inches of snow on the ground).

MPR listener question: From a listener in Okabena, MN (Jackson County).....it used to be that cool, wet weather in the first two weeks of October would help replenish lost soil moisture from the summer. But, in recent years, it seems early October has been dominated by dry, warm weather. Has there been a change in the weather pattern?

Answer: Indeed, the recent decline in early October precipitation in Jackson County is evident in the climate data. Only four of the past sixteens years show above normal frequency of rainfall events in the first 15 days of the month, most recently last year. Conversely, a change in the temperature pattern of early October is simply not evident, though both 1997 and 1984 were unusually warm. Despite evidence for a drier signal in the climate data for early October, I cannot say whether or not there has been a significant change in the weather pattern. Perhaps the jet stream is remaining north of us longer into the fall season and therefore not directing rain-bearing weather disturbances our way.

Local Almanac:

Twin Cities Almanac for October 10th:

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 9 degrees standard deviation).

MSP Local Records for October 10th:

MSP weather records for this date include: highest daily maximum temperature of 90 degrees F in 1928; lowest daily maximum temperature of 38 degrees F in 1906; lowest daily minimum temperature of 25 degrees F in 1964; highest daily minimum temperature of 63 degrees F in 1930; record precipitation of 1.89 inches in 1898; and 2.5 inches of snowfall in 1977.

Average dew point for October 10th is 41 degrees F, with a maximum of 67 degrees F in 1949 and a minimum of 16 degrees F in 1932.

All-time state records for October 10th:

Scanning the state climatic data base: the all-time high for this date is 93 degrees F at Tracy (Lyon County) in 1928; the all-time low is 8 degrees F at Roseau in 1932.

Word of the Week: CASA

This is a relatively new acronym and stands for Center for Collaborative Adaptive Sensing of the Atmosphere, a partnership involving the National Severe Storms Laboratory, the National Weather Service and a number of universities, including Oklahoma, Massachusetts, Colorado State, and Puerto Rico. This group will deploy new, smaller Doppler radars utilizing existing cellular towers around the country. The network of smaller radar systems will supplement the National Weather Service national network, filling in holes in spatial coverage and providing better detection and definition of local severe storms, some of which escape the scans of the national network. CASA technology should help provide forecasters with useful and timely information in severe weather situations when they have to alert the public about potential for urban flooding, lightning strikes, damaging winds, local hail, and even tornadoes. It is a \$40 million project.

Outlook:

Chance of showers and even thunderstorms Saturday, with declining temperatures into next week, much closer to normal for this time of year. Rather breezy on most days as well...chance of showers later in the week.

To: Morning Edition Listeners
From: Mark Seeley
Re: Topics for MPR's Morning Edition, Friday, October 17, 2003

Topic: New Seasonal Climate Outlook

The Climate Prediction Center issued the latest winter outlook on Thursday this week. For Minnesota and the western Great Lakes region, the CPC does not predict above or below normal conditions (temperature or precipitation) for this winter. Their forecast models do not converge on similar solutions, so there are equal chances for above or below normal conditions to prevail in the region.

Topic: An Anniversary Worth Acknowledging....

Tomorrow, October 18th marks the 115th Anniversary of the founding of the University of Minnesota Agriculture School, now known simply as the St Paul Campus (my home). Prior to this, the property was known as the university farm, but formal teaching of agriculture began on this date in 1888 with a class of 47 students. The campus is now home to the College of Agriculture, Food, and Environmental Sciences; College of Natural Resources, College of Human Ecology, College of Biological Sciences, and College of Veterinary Medicine.

Topic: Lake Superior climate

We have spoken a number of times about the effects that Lake Superior has on the north shore climate of Minnesota. It clearly affects the temperature, wind, precipitation, and cloudiness of north shore communities like Two Harbors, Grand Marais, Knife River, Beaver Bay, etc. But how about the climate over the lake itself? Thanks to the NOAA National Data Buoy Center and the deployment of instrumented buoys on Lake Superior over the past two decades, we are learning more about the climate patterns over the lake itself.

Some examples.....along the western edges of the lake, the mean annual surface water temperature is about 42 degrees F. But because water absorbs and surrenders heat energy quite slowly compared to land, the range and variation in monthly temperatures is quite out of phase with the climate stations along the north shore. Average water temperatures in October are warmer than those of June as a result of the time lag effect of summer warming. Maximum water temperatures, ranging from 55 to 65 F typically occur in August, sometimes even early September. The land stations show maximum air temperature values in July. The coldest air temperatures occur in January and are often well below zero F, while the coldest the lake ever gets is about 31-32 degrees F, a temperature it may hold steady for most of the winter, even into the month of May.

The windiest month on the lake is November (remember the gales of November) with winds of 20 mph or more common in that month, and gusts well over 40 mph. Expectedly, the maximum wave heights also occur in November, with an average value of about 3.5 ft, and extreme values over 15 ft.

The maximum difference between air temperature and water temperature occurs in the months of November and December, when the air temperature may be as much as 20-25 degrees F colder than the water, and in June when the air temperature may be as much as 15 to 20 degrees F warmer. Interestingly enough, this time of year (October) the average air and water temperatures are quite close to each other. For example on Wednesday this week, the water temperature near the Apostle Islands was 44 degrees F, while the air temperature was 45 F.

Speaking of the Lake Superior climate, our state climatologist, Jim Zandlo is doing a snow study along the north shore of Minnesota to help with our understanding of the influence of the lake on adjacent land areas, particularly the deposition of snow from the lakeshore into the upland areas. More snow observers are being sought for this study in Cook, Lake, and St Louis County. If MPR listeners have an interest in this they can go to our web site www.134.84.160.120 and click on the "Snow Rules" section.

MPR listener question: Since our gardens are still dry and in need of precipitation, we were discussing how often the Twin Cities gets precipitation of 1 inch or more per day. It seems most of the daily record values on the calendar are 1 inch or more until the winter season, then many record precipitation amounts are less than 1 inch. Which months have the highest frequency of 1 inch daily precipitation and do you think we still have a chance of seeing something like that this fall?

Answer: The highest frequency for precipitation events of one inch or more in the Twin Cities area can be found in the months of June, July, and August, each showing an average occurrence of about once per year. May and September are next with a historical frequency a little greater than once every two years. There is about a 40 percent frequency for 1 inch precipitation events in the month of October, a 20 percent historical frequency for November, and only a 10 percent historical frequency for December. Chances are we'll see more precipitation the last ten days of this month. During this interval, I would not be surprised to see a daily amount of 1 inch or more. The climatological odds for this certainly tail off in November and December.

Your question also prompted me to examine the daily record values for precipitation in the Twin Cities area. The table below shows the monthly climate frequency in the Twin Cities (1891-2002) of record values for daily precipitation that equal or exceed 1 inch....

Month	Number of days showing a record precipitation equal to or greater than 1 inch
January	2
February	4
March	14
April	11
May	29
June	29
July	30
August	31
September	25
October	23
November	15
December	6

This distribution suggests that we are more likely to see record precipitation values of 1 inch or more occur in the fall than in the spring.....something I didn't realize.

Local Almanac:

Twin Cities Almanac for October 17th:

The average MSP high temperature for this date is 60 degrees F (plus or minus 11 degrees standard deviation), while the average low is 41 degrees F (plus or minus 9 degrees standard deviation).

MSP Local Records for October 17th:

MSP weather records for this date include: highest daily maximum temperature of 84 degrees F in 1910; lowest daily maximum temperature of 33 degrees F in 1930; lowest daily minimum temperature of 22 degrees F in 1948 and 1952; highest daily minimum temperature of 62 degrees F in 1910 and 1953; record precipitation of 0.97 inches in 1968; and a trace of snowfall in 1925 and 1990.

Average dew point for October 17th is 38 degrees F, with a maximum of 66 degrees F in 1994 and a minimum of 8 degrees F in 1948.

All-time state records for October 17th:

Scanning the state climatic data base: the all-time high for this date is 90 degrees F at Long Prairie, Beardsley, and Moorhead in 1910; the all-time low is 2 degrees F at Bemidji and Cass Lake in 1952.

Word of the Week: Barodontalgia

This is the name given to a painful condition of the teeth brought on by atmospheric (barometric) pressure changes. A change in air pressure outside the tooth may produce a significant difference from that inside the tooth. This condition can affect flyers ("flyer's toothache") and divers ("diver's toothache), but in

some cases it is due to rapid air pressure changes associated with the approach or passage of weather fronts. In extreme cases a filling can pop out. Doesn't sound very nice!!

Outlook:

Warming trend into the weekend, with a chance of showers in far northeastern sections. Cooler after Monday and continuing most of next week. More unsettled weather beginning late Tuesday with a series of low pressure systems moving across the area and increasing chances for precipitation.

To: Morning Edition
From: Mark Seeley
Re: Topics for MPR's Morning Edition, Friday, October 24, 2003

DON'T FORGET TO SET YOUR CLOCK BACK ONE HOUR ON SATURDAY NIGHT!

Topic: New state record for October 19th....

The string of warm days earlier this week produced a number of high temperature records for individual communities, but perhaps the most remarkable record occurred on Sunday, October 19th when Browns Valley, MN (Traverse County) reported 90 degrees F. A temperature this high is most unusual for the second half of October, and was indeed a new state record high for October 19th, breaking the old record of 88 F at Milan in 2000 and at Winona in 1950. There have been only five other years in Minnesota history, when temperatures of 90 F or higher have been recorded in the second half of the month: they were 1910, 1927, 1947, 1950, and 1958. October 30, 1950 at Canby, MN marks the latest fall occurrence of 90 degrees F in the state. But the rest of this October looks to be colder than normal around the state.

Topic: The urban heat island may be a misnomer...

A recent paper in the Journal of Climate by scientists at the National Climatic Data Center suggests that some so-called urbanization effects, may in fact be far more local effects. In a paper titled "Assessment of Urban Versus Rural In Situ Surface Temperatures in the Contiguous United States" the authors conclude that some detected urban warming, as well as detected urban cooling over long periods of time, may be due to local landscape changes such as planting of trees or new grass, changes in nearby paved surfaces, construction of buildings, development of nearby parks, changes in local traffic patterns, etc. These more microscale features of the urban environment can have more profound effects on temperature readings than the larger scale impact of new expressway systems, skyscrapers, or power plants. I find this paper an interesting substantiation of the view long held by our own State Climatologist Jim Zandlo, that microscale changes around climate observation sites can have more significant impact than so-called urbanization effects.

Topic: The stormdefender for your dog....

As reported in the recent Bulletin of the American Meteorological Society, an electrical engineer has invented a garment that will ease the anxiety experienced by dogs when a thunderstorm approaches. Called the stormdefender, this garment is a cape that can be placed on the animal to remove the static charge from its fur, a charge that builds up with the approach of a storm and

creates their anxiety in the first place. More information can be found at the inventor's web site...www.stormdefender.com
I think the cape just comes in one color....white.

MPR listener question: I have been continuing to water my trees and shrubs this month as the Extension Service recommends. I see that the MSP airport has reported only one day with measurable rainfall in October (0.48" back on the 11th). Is this unusual? Has it ever rained on just one day in October?

Answer: Indeed, October has been quite dry so far. On average we see precipitation (snow or rain) on 8 days in October, but this year just one day so far. The driest ever October was in 1952 when it rained just 0.01 inches on one day (the 13th). The most recent exceptionally dry October was in 1993 when it rained on only four days, totaling just 0.79 inches. Since 1891, there have been only 5 Octobers when it rained on three or fewer days.

Local Almanac:

Twin Cities Almanac for October 24th:

The average MSP high temperature for this date is 55 degrees F (plus or minus 10 degrees standard deviation), while the average low is 36 degrees F (plus or minus 8 degrees standard deviation).

MSP Local Records for October 24th:

MSP weather records for this date include: highest daily maximum temperature of 80 degrees F in 1989; lowest daily maximum temperature of 36 degrees F in 1926 and 1981; lowest daily minimum temperature of 17 degrees F in 1960; highest daily minimum temperature of 59 degrees F in 2000; record precipitation of 1.00 inches in 1899; and 0.9 inches of snowfall in 1981.

Average dew point for October 24th is 35 degrees F, with a maximum of 60 degrees F in 1963 and a minimum of 11 degrees F in 1960.

All-time state records for October 24th:

Scanning the state climatic data base: the all-time high for this date is 87 degrees F at Beardsley (Big Stone County) in 1924; the all-time low is -5 degrees F at Isabella (Lake County) in 1976.

Word of the Week: The box and whisker diagram....

This graphical representation of data is used in more scientific fields than climatology. It is typically a combination of bar and line graph, oriented to a vertical scale. The center point of the bar shows the median value (of say daily temperature), while the edges of the bar show the 25th and 75th percentile

values of the distribution. The edges of the line (called a whisker), extending out from either end of the bar, show the extreme values of the data (for example, the all-time high and low temperature values).

An interesting outcome in the use of the bar and whisker diagram to depict temperatures of urban and rural communities is that the whiskers are usually longer for rural areas, indicating a wider range of daily temperature is measured there than in urban areas.

Outlook:

How does colder, with rain or snow showers sound? Looks like the last week of the month will be dominated by a cooling trend with more frequent chances for precipitation and stronger winds. Some snow and rain mixture will likely occur in places. Pick out a warm Halloween costume this year for the kids.

To: Morning Edition
From: Mark Seeley
Re: Topics for MPR's Morning Edition, Friday, October 31, 2003

Topic: Preliminary Climate Summary for October

It appears that mean October temperatures will range from 1 to 3 degrees F warmer than normal for most communities around the state. Temperature extremes during the month ranged from just 13 degrees F at Embarrass back on the 2nd, to 90 degrees F at Milan on the 7th and at Browns Valley on the 7th and the 20th..the latter being a new all-time state high temperature for that date.

Despite recent rainfalls and snowfalls, most communities will report below normal totals for the month, unfortunate for farmers and gardeners who are hoping to see soil moisture recharged before winter sets in. The largest single precipitation event of the month occurred at Ada in Norman County when they received 1.07 inches of rain on October 11th.

The strongest winds of the month occurred on October 28th (Tuesday) with gusts of 50 mph or greater in Morris, Madison and Ortonville. The first three weeks of the month brought mostly sunny skies, while the last week of the month produced almost continuous cloud cover.

Topic: Record snowfall amounts in northeastern Minnesota...

A winter storm brought record snowfall amounts to many communities on Monday and Tuesday (October 27-28) this week. The following were new daily snowfall records reported by various observers...

Duluth 4.0 inches
Tower 6.0 inches
Bigfork 8.0 inches
Virginia 5.0 inches
Littlefork 4.1 inches
Cook 3.5 inches
Cotton 3.0 inches

Topic: A brewer's bonus for Europe's summer heat wave...

Interbrew, one of Europe's largest brewery organizations reported record sales in the summer as a result of increased consumption brought on by the persistent heat wave conditions. Volume sold rose by 6 to 13 percent in key markets, and they reported an earnings gain of 7.7 percent.

MPR listener question: What is the climatology for Halloween in the Twin Cities....averages....extremes....etc?

Answer: Well, the mean high and low temperatures for Halloween are listed in the Almanac section below (53/35 F), as well as the all-time high and low temperatures (83 F and 16 F). The climate data show that precipitation occurs about one third of the time (35 times in the past 111 years), while measurable snow is quite rare, having occurred only four times in the past 111 years, the most memorable occurrence 8.2 inches in 1991. The average wind speed on Halloween is about 8-9 mph.

What surprised me most about the climate history of Halloween is the number of times the evening Wind Chill Index was 15 degrees F or colder...rather nippy to be out "trick or treating." Since 1891, there have been 23 times (21 percent frequency) when the Wind Chill Index fell below 15 F, most recently just 14 F last Halloween. From a Wind Chill standpoint, the coldest historical Halloweens have been....

1905 -8 degrees F	1935 -6 degrees F
1912 2 degrees F	1934 2 degrees F
1954 3 degrees F	1926 4 degrees F
1919 5 degrees F	1930 6 degrees F
1966 9 degrees F	1991 9 degrees F

It goes without saying that these values are not conducive to the ballerina or surfer costume ideas, but perhaps more compatible for astronauts and deep sea divers.

Local Almanac:

Twin Cities Almanac for October 31st:

The average MSP high temperature for this date is 53 degrees F (plus or minus 11 degrees standard deviation), while the average low is 35 degrees F (plus or minus 8 degrees standard deviation).

MSP Local Records for October 31st:

MSP weather records for this date include: highest daily maximum temperature of 83 degrees F in 1950; lowest daily maximum temperature of 30 degrees F in 1951 and 1981; lowest daily minimum temperature of 16 degrees F in 1996; highest daily minimum temperature of 57 degrees F in 1933; record precipitation of 0.85 inches in 1991; and 8.2 inches of snowfall in 1991 (the start of the Halloween Blizzard).

Average dew point for October 31st is 34 degrees F, with a maximum of 60 degrees F in 1974 and a minimum of 4 degrees F in 1996.

All-time state records for October 31st:

Scanning the state climatic data base: the all-time high for this date is 86 degrees F at Worthington (Nobles County) in 1950; the all-time low is -2 degrees F at Park Rapids (Hubbard County)

in 1951.

Words of the Week: Winter Storm Warning, Winter Storm Watch and Winter Weather Advisory

Some listeners are confused about the use of these terms by the National Weather Service. Because next week is Winter Hazards Awareness Week, it is a good time to define these terms.....

A Winter Storm Warning is issued when 6 inches or more of snowfall is expected within a 12 hour period, or 8 inches or more in a 24 hour period. It may also be issued for lesser snowfall amounts if significant blowing and drifting, dangerous wind chills, or freezing rain are also expected.

A Winter Storm Watch is posted if there is a likelihood that these storm conditions will develop over a 12 to 48 hour period.

A Winter Weather Advisory is issued if there is any combination of snow, sleet, freezing rain, freezing fog or high wind that produces inconvenience or higher risk for travel.

Earlier this week a Winter Storm Warning was issued for some northeastern counties in Minnesota.

Outlook:

Continued mostly cloudy and unsettled weather over the weekend and early next week. Temperatures will be colder than normal with chances for mixed precipitation (snow or rain) and relatively strong winds, especially Tuesday through Thursday. Some moderation in temperature by the end of next week.

To: Morning Edition
From: Mark Seeley
Re: Topics for MPR's Morning Edition, Friday, November 7, 2003

First below zero F reading of the season was reported at Crookston, MN on Friday morning, November 7th. They reported a temperature of -2 degrees F, with a wind chill of -19 degrees F. So far this month most communities are reporting temperatures that average 8 to 12 degrees F colder than normal.

Question: What do the words pea, penny, mothball, walnut, hen egg, baseball, tea cup, and grapefruit have in common?

Answer: They are all used by the National Weather Service to describe the size of hail.....pea (0.25"), penny (0.75"), mothball (0.88"), walnut (1.50"), hen egg (2.00"), baseball (2.75"), tea cup (3.00"), and grapefruit (4.00")....

Topic: Cold and snowy start to November....

A week after some record setting snows in northeastern Minnesota, the month of November began with record setting cold and snow as well. Monday morning lows in the single digits in northwestern Minnesota counties were near record setting, but the lowest in the nation was Minot, ND where they recorded a new record low of -4 degrees F on November 3rd. A warm front moving up from the south produced overrunning precipitation (over the top of the cold polar air) on Monday that resulted in some record setting snowfall amounts in Minnesota. Some of the the new record snowfall amounts for November 3rd included Canby with 6.0 inches, Little Falls with 6.5 inches, Benson and Dawson each with 5.5 inches, Morris with 4.5 inches, and Madison and Milaca each with 4.5 inches as well. Strong winds with this system caused 4-6 foot waves along Lake Superior shores.

The slow moving frontal system brought additional record setting snowfalls on Tuesday, November 4th as well, though displaced more to the north. Some of the records for Tuesday included International Falls with 9.0 inches (also a new record precipitation of 0.6 inches), Grank Forks, ND with 5.4 inches, Cloquet with 5.0 inches, and Littlefork with 4.0 inches.

By Thursday morning, November 6th, an arctic air mass had brought overnight lows down into the single digits F for many northern and western Minnesota communities. Crookston, Park Rapids, Morris, Madison, and Thief River Falls all reported a morning low of just 1 degree F. Consequently, soils were beginning to freeze up to a depth of 2-3 inches. This is 2-3 weeks earlier than normal for most area soils.

MPR listener question: A listener from Duluth writes to ask the chances of having a white Thanksgiving and safe lake ice for fishing?

Answer: A white Thanksgiving is pretty common in the Duluth area. Checking the statistics (most recent 55 years of data) for 1 inch or more of snow cover on this holiday, the Duluth area shows a historical frequency of about 76 percent, three years out of every four. Conversely, in the Twin Cities, the historical frequency for 1 inch or more of snow cover on Thanksgiving is just 42 percent, not even once every two years. In fact, snow cover has been absent on Thanksgiving in both Duluth and the Twin Cities for three of the past five years (1998, 2001, and 2002).

The table below summarizes snowfall frequency and snow cover frequency on Thanksgiving Day for both Duluth and the Twin Cities since 1948....

Location	Percent frequency with snowfall	Max snowfall	Percent frequency 1" snow depth	Max snow depth
Duluth	42%	8.1" (1981)	76%	17" (1983)
Twin Cities	22%	5.0" (1970)	42%	10" (1983)

Concerning the question about safe lake ice, remember that the Minnesota DNR recommends a minimum of 4 inch thickness for pedestrian ice fishing. First appearance of ice on shallow lakes in northeastern Minnesota on average occurs between October 30th and November 7th, but reports of complete ice cover show a range in dates from November 10 to December 10. Recent cold temperatures have promoted the formation of ice on many lakes, but it is not sufficiently thick enough to support human weight loads. We would need several more days of temperatures well below freezing prior to Thanksgiving, and even then it is wise to check with the DNR or resort operators before going out ice fishing.

Local Almanac:

Twin Cities Almanac for November 7th:

The average MSP high temperature for this date is 46 degrees F (plus or minus 11 degrees standard deviation), while the average low is 30 degrees F (plus or minus 9 degrees standard deviation).

MSP Local Records for November 7th:

MSP weather records for this date include: highest daily maximum temperature of 68 degrees F in 1915 and 1969; lowest daily maximum temperature of 15 degrees F in 1991; lowest daily minimum temperature of -6 degrees F in 1991; highest daily minimum temperature of 49 degrees F in 1977; record precipitation of 1.67 inches in 1915; and record snowfall of 4.2 inches in 1947. There have been four measurable snowfalls on this date since 1945. Maximum snow depth on this date was 16 inches in 1991.

Average dew point for November 7th is 30 degrees F, with a maximum of 62 degrees F in 1915 and a minimum of -10 degrees F in 1991.

All-time state records for November 7th:

Scanning the state climatic data base: the all-time high for this date is 78 degrees F at Montevideo (Chippewa County) in 1931;

the all-time low is -20 degrees F at Redby (Beltrami County) in 1936.

Words of the Week: Sierra, Tango, and Zulu

These are the code words used in AIRMETs (acronym for "AIRman's METeorological information, including statements and advisories) routinely issued by the Aviation Weather Center and the Alaska Aviation Weather Unit and Volcanic Ash Advisory Center.

Sierra refers to a message about IFR (instrument flight rules) weather or mountain obscuration. Tango refers to a message about turbulence, strong surface winds, and windshear. Zulu refers to a message about icing and freezing levels in the atmosphere. All of these messages are of critical importance to pilots and updated every six hours, or more frequently if needed.

Outlook:

Very cold Saturday morning, with perhaps several below zero readings in northern counties. Increasing cloudiness later in the weekend, with warmer temperatures. There will be a chance for snow in the north and central, with perhaps some rain in southern areas late Sunday through Monday, and again on Wednesday. Temperatures will warm into the 40s F, perhaps even 50 F in some places next week.

To: Morning Edition
From: Mark Seeley
Re: Topics for MPR's Morning Edition, Friday, November 14, 2003

For the second time this month, Minnesota reported the nation's lowest temperature reading (contiguous 48 states) with -2 degrees F at Hallock on Thursday morning (Nov 13). Earlier, on November 8th Embarrass, MN had reported the nation's low with -19 degrees F.

Topic: More cold records in November....

Despite some recent moderation, temperatures for the first two weeks of November have averaged 6 to 10 degrees cooler than normal around the state. Record cold temperatures occurred on November 7, 8, and 9...the table below shows these records.

For November 7th...

International Falls reported a record low of -9 F
Grand Forks, ND reported a record low of -9 F and a record cold maximum temperature of 12 F
Duluth reported a record cold maximum temperature of just 16 F

For November 8th...

Duluth reported a record cold maximum temperature of 19 F and a record low of -5 F
International Falls reported a record low of -13 F
Warroad reported a record low of -7 F and a record cold maximum temperature of 11 F
Embarrass reported a record low of -19 F
Hibbing reported a record low of -11 F
Canby reported a record low of -3 F
Grand Forks, ND reported a record low of -13 F
Crookston reported a record cold maximum temperature of 7 F
Fergus Falls reported a record cold maximum temperature of 13 F
Aitkin reported a record low of -4 F and a record cold maximum temperature of 14 F

For November 9th...

Redwood Falls reported a record low of 3 F
Lamberton reported a record low of 4 F

Bare soil froze up for the first time under these conditions, in some areas going to a depth of 5 inches. However the recent moderation in temperature has allowed the soil to thaw. The climate trend for the rest of November is expected to be warmer than normal, so for those who still may have to work the soil, perhaps taking soil samples or planting garden bulbs, this is the last call!!

Topic: an economic benefit to the cold weather...

Retailers reported this week that in the midwest clothing sales were up in the first ten days of November as a result of the cold weather. Seems that customers were fixed on preparing for winter as they purchased boots, gloves, hats, coats and warm clothing.

MPR listener question: Is November the windiest month in Minnesota?

Answer: It may seem that way this year, and certainly for individual years the month with the highest mean wind speed may vary. But, climatically, April has been shown to be the windiest month for most locations in Minnesota. In April, both strong cold fronts as well as daily convection (thunderstorms) can produce wind, while in November, the strongest winds come exclusively from frontal passages rather than thunderstorms. In fact, November is the second or third windiest month for most communities in Minnesota, because the frequency of strong frontal passages begins to increase.

Speaking of wind, the cold front that passed over the state on Wednesday of this week (November 12) certainly brought some strong winds. Fairmont, St James, Winthrop, Albert Lea, and Waseca reported wind gusts over 50 mph, while Blue Earth reported a wind gust of 65 mph. Gusts in the Twin Cities approached 40 mph.

Local Almanac:

Twin Cities Almanac for November 14th:

The average MSP high temperature for this date is 41 degrees F (plus or minus 11 degrees standard deviation), while the average low is 26 degrees F (plus or minus 10 degrees standard deviation).

MSP Local Records for November 14th:

MSP weather records for this date include: highest daily maximum temperature of 71 degrees F in 1990; lowest daily maximum temperature of 12 degrees F in 1940; lowest daily minimum temperature of 0 degrees F in 1919; highest daily minimum temperature of 52 degrees F in 2001; record precipitation of 0.80 inches in 1926; and record snowfall of 2.5 inches in 1951. There have been seven measurable snowfalls on this date since 1945. Maximum snow depth on this date was 8 inches in 1991.

Average dew point for November 14th is 26 degrees F, with a maximum of 53 degrees F in 1964 and a minimum of -2 degrees F in 1959.

All-time state records for November 14th:

Scanning the state climatic data base: the all-time high for this date is 75 degrees F at Madison (Lac Qui Parle County) in 1990; the all-time low is -20 degrees F at Itasca State Park (Clearwater County) in 1940 and at Bigfork (Itasca County) in 1959.

Words of the Week: Wailer

This is an older term used to describe a fallen tree that lies in the fork of another tree and sometimes causes a howling or wailing sound. This annoying sound is produced when winds are high and cause the trees to rub against each other or vibrate.

Outlook:

Chance of scattered rain or snow showers in the central and south on Saturday, otherwise cloudy with near normal temperatures over the weekend. Chance for mixed showers again Monday into Tuesday with a warming trend next week. Daytime temperatures should make the 40s and 50s F.

To: Morning Edition
From: Mark Seeley
Re: Topics for MPR's Morning Edition, Friday, November 21, 2003

Topic: New Monthly and Seasonal Climate Outlook

On Thursday afternoon this week the Climate Prediction Center released the new winter outlook for December through February. The outlook suggests equal chances of above or below normal precipitation over the period, but favors above normal average temperatures for the winter. The temperature outlook follows the trend seen in five of the past six winters.

Peculiar weather this week.....Monday brought some thunderstorms to parts of Minnesota, even producing some hail in the far northwestern counties, very unusual for November. In the meantime, at higher latitudes and to the northwest of us, very cold air is in evidence and perched to descend upon us over the next several days. Dawson in the Yukon Territory of Canada reported a low Wednesday morning of -44 F, while Arctic Village in Alaska reported a low of -51 F. Though both of these are known as cold places, these temperature values are about 20 degrees colder than average for this time of year.

Topic: Twin Cities snowfalls over Thanksgiving weekend

Historical data for the Twin Cities (1891-2002) show that measurable snowfall on Thanksgiving Day itself occurs only about 20 percent of the time, but for the four day weekend as a whole, measurable snowfall occurs better than 60 percent of the time. In recent years, Thanksgiving holiday snowfalls have been even less frequent than historical data would suggest. It has snowed on Thanksgiving day only once in the past 10 years, while it has snowed over the four day holiday weekend, five times in the past ten years, though only once in the most recent six.

As to the coming Thanksgiving holiday next week, it appears that with the change in the weather pattern expected over the weekend, we will have a good chance of seeing snow over the holiday period next week.

MPR listener question: I have heard you remark about the lack of normal precipitation this year. Which area of the state is the driest?

Answer: For the entire year so far, southeastern Minnesota counties show precipitation departures that range from 9 to 12 inches less than normal. This is substantial. For communities like Rochester and Winnebago it is the driest year since 1988. They have barely received 20 inches of precipitation so far. For the Twin Cities officially, we are about 6 inches behind normal in 2003.

Local Almanac:

Twin Cities Almanac for November 21st:

The average MSP high temperature for this date is 37 degrees F (plus or minus 11 degrees standard deviation), while the average low is 24 degrees F (plus or minus 10 degrees standard deviation).

MSP Local Records for November 21st:

MSP weather records for this date include: highest daily maximum temperature of 67 degrees F in 1990; lowest daily maximum temperature of 8 degrees F in 1921 and 1929; lowest daily minimum temperature of -1 degrees F in 1929; highest daily minimum temperature of 42 degrees F in 1963; record precipitation of 0.54 inches in 1994; and record snowfall of 4.8 inches in 1989. There have been thirteen measurable snowfalls on this date since 1945. Maximum snow depth on this date was 8 inches in 1957 and 1981.

Average dew point for November 21st is 20 degrees F, with a maximum of 58 degrees F in 1990 and a minimum of -9 degrees F in 1978.

All-time state records for November 21st:

Scanning the state climatic data base: the all-time high for this date is 72 degrees F at Tracy, Lamberton, and Luverne (all in southwestern Minnesota) in 1962; the all-time low is -25 degrees F at Tower (St Louis County) in 1978.

Word of the Week: Woolpack

This is a term coined by meteorologists to describe a type of cloud form. It most often refers to cirrocumulus or altocumulus clouds that have a fleecy, bundle like appearance that resembles flocks of sheep or lambs. I believe it was British meteorologists that first used the term. Some of our warm front clouds this week actually resembled a woolpack.

Outlook:

Looks like a cold, snowy period coming up and beginning in earnest over the weekend. There will be plenty of wind as well. Our soils can use the moisture, but it looks like much of the precipitation will be in the form of snow. A significant winter storm will affect the region Sunday into Monday. Consequently most of next week, including Thanksgiving, looks to be colder than normal.

To: Morning Edition
From: Mark Seeley
Re: Topics for MPR's Morning Edition, Friday, November 28, 2003

Topic: Anniversary of 1960 storm on the northshore....

On this date in 1960, a severe storm produced waves 20 to 40 feet high on the Minnesota side of Lake Superior. Duluth was buried under a foot of snow, and clocked wind gusts to 73 mph. The northshore of Lake Superior was flooded, and property along the shore was battered. The North Shore highway between Duluth and Grand Marais was closed for a time by the build up of water and ice. Water from the huge waves closed businesses in Tofte, Schroeder, and Little Marais. Thousands of cords of pulpwood were washed into Lake Superior, and up to three feet of water flooded the main street of Grand Marais, where life-long residents said they had only seen two such storms in history, one on New Year's Eve of 1937 and one on November 18, 1958. Thunder accompanied this storm as well. Duluth also reported a record-setting precipitation amount with 2.24 inches, which was the all-time single day record for November until the storm of November 10, 1998 which brought 2.26 inches of precipitation.

Elsewhere around the state on this date in 1960, a severe ice storm left 0.25 to 0.75 inches of ice coating trees, buildings, cars, and power lines, primarily in western Minnesota. Over 20 communities were left without power. In the Litchfield area over 40 power poles were toppled by the weight of ice.

Topic: A wrap-up on the recent heavy snowfall event....

Preceding the bigger snowfall event of last weekend, some western Minnesota communities experienced a significant snowburst from a relatively minor low pressure system on Friday, November 21st. Madison (Lac Qui Parle County) reported a new record of 10.5 inches of snowfall, while Dawson, just south of Madison also reported a new record with 7 inches.

The bigger snow event occurred on Saturday and Sunday, November 22-23, and blanketed nearly all of the state, only leaving the far northwestern counties with just a trace of snow and the far southeast with mostly rain. A broad swath of 6-10 inches of snowfall was reported across the central and northern sections of the state. Some areas reported record snowfall amounts for November 23rd, including Milan with 10 inches, Canby with 10 inches, Grand Marais with 10 inches, Virginia with 12 inches, and Pokegama Dam and Brainerd, both with 13 inches.

Topic: A preliminary climate summary for November, 2003

Though just a few days away from the end of the month, we can draw a few conclusions from the weather observations so far. Most communities are reporting average November

temperatures that are 1 to 3 degrees F cooler than normal. The extreme temperatures for the month occurred at Embarrass, with a low of -19 F on the 8th, and at Mankato, with a high of 65 F on the 11th.

Total precipitation for the month was generally less than normal, despite the recent snows. A few locations reported above normal precipitation including Marshall with 1.56 inches, La Crescent with 2.83 inches, Rushford with 2.75 inches, and Caledonia with 3.24 inches. Total monthly snowfall was 20 inches or more in the north, at such places as International Falls, Tower, Babbitt, and Littlefork.

MPR listener question: What is your take on the forecasting of last weekend's snow storm?

Answer: I don't watch much TV, so I cannot share much of a perspective in that regard. I do follow the National Weather Service (NWS) forecasts via NOAA weather radio and the Internet. I thought the NWS handled the forecast well, giving us a good deal of lead time to plan, and a range of conditions to expect. Remember that quantified snow forecasts are one of the greatest challenges to meteorologists, especially regarding the geographic distribution, e.g. who will get the most and who will get the least. Though the storm will not be remembered in the context of great historical Minnesota weather events, it was the most significant storm of the season so far, and we were given plenty of notice. I was appalled to read that despite this, there were well over 200 traffic accidents reported.

Local Almanac:

Twin Cities Almanac for November 28th:

The average MSP high temperature for this date is 31 degrees F (plus or minus 11 degrees standard deviation), while the average low is 17 degrees F (plus or minus 11 degrees standard deviation).

MSP Local Records for November 28th:

MSP weather records for this date include: highest daily maximum temperature of 58 degrees F in 1941; lowest daily maximum temperature of 4 degrees F in 1896; lowest daily minimum temperature of -8 degrees F in 1891 and 1985; highest daily minimum temperature of 43 degrees F in 1913; record precipitation of 1.08 inches in 1987; and record snowfall of 7.3 inches in 1983. There have been 13 measurable snowfalls on this date since 1945. Maximum snow depth on this date was 15 inches in 1983.

Average dew point for November 28th is 16 degrees F, with a maximum of 43 degrees F in 1913 and a minimum of -13 degrees F in 1985.

All-time state records for November 28th:

Scanning the state climatic data base: the all-time high for this date is 72 degrees F at Amboy (Blue Earth County) in 1998; the all-time low is -36 degrees F at Bemidji (Beltrami County) in 1896.

Words of the Week: Pole of Cold

Coldest temperatures in the northern hemisphere have not been measured at the North Pole, but about 100-200 miles south of there in northeastern Siberia. Colder air held near the land surface under a strong "Siberian High Pressure" system in winter contributes to this feature. On Wednesday morning of this week, Jakutsk in Siberia reported a low of -43 F, while some miles away the town of Tomtor reported a low of -65 F, probably the lowest temperature measured this month in the northern hemisphere.

This town, Tomtor, located in the Oymyakon district of Siberia, has acquired the name "Pole of Cold" because it truly represents the coldest pool of air in the northern hemisphere. It was -94 F there in 1926. The tourism industry has acknowledged the uniqueness of this area and each winter between late November and March, there are package vacation deals offered to tour the Pole of Cold region. Air and rail systems can get you to the region, then you will travel to Tomtor via 4WD Jeep, each equipped with up to three extra heaters for comfort and safety. In the town of Tomtor, you are greeted by the mayor, visit the Pole of Cold Monument, and are given a certificate for framing that verifies your wintertime presence there.

Outlook:

Somewhat warmer than normal temperatures over the Thanksgiving weekend, with a slight chance for widely scattered snow flurries on Saturday and Sunday, especially in the northern sections. It will be windy, with winds in excess of 30 mph in places. Generally near normal or above normal temperatures for the first week of December. It will be mostly dry early in the week, with an increasing chance for precipitation by next Thursday and Friday.

To: Morning Edition
From: Mark Seeley
Re: Topics for MPR's Morning Edition, Friday, December 5, 2003

Topic: Sound carries well in dense air.....

A scientist and former meteorologist was studying the language of elephants in the wild, and especially their mating calls. He found that the females emit an extremely low tone (long sound wave) mating call at certain times of the year, but they wait to do so typically until sunset or shortly after. These sounds can be heard by male elephants from as far as 10 miles. He inferred that elephants were using their meteorological knowledge in two respects: (1) sound travels much farther over a landscape when there is a temperature inversion (colder, denser air near the surface) and this is often the case shortly after sunset; (2) surface winds often subside and calm after sunset and therefore permit sound to be detected at greater distances (not having to compete against the aeolian sounds of the wind). In addition, sounds of longer wavelength tend to travel farther in the atmosphere than high pitched (short wavelength) sounds. On the other hand, perhaps elephants are simply in a more romantic mood after the sun goes down.

This story reminded me of a winter trip I made with the Cub Scouts to the St Croix River Valley. It was February and the river was quite frozen. In fact snowmobilers were making use of the frozen flat surface to race each other. We went for a night hike under clear and calm conditions, but on the return trip to camp, some of the boys got way behind the group. When we stopped to wait for them, we noticed that we could hear their conversation even though they were hundreds of yards behind. In the cold, stable night air it occurred to me that we were indeed inside of a "speaking tube" (a term coined by atmospheric physicist W.J. Humphreys of the National Weather Service in the 1930s) formed by the river valley. In this environment sound waves were being confined to the river valley and reflected not only from the frozen river, but from the banks and side slopes around us. In such an environment, sounds remain audible to the human ear over much greater distances than most other positions on the landscape.

MPR listener question: I have heard you say that of all the recent climate trends perhaps the most striking is the pattern of above normal temperatures in the winter. Hasn't this been the case with the month of December in particular?

Answer: Indeed, you are quite right. Ten of the most recent twelve Decembers have been dominated by above normal temperatures, not only in frequency of days above normal, but also rather large temperature departures. The most recent exception to this trend was December of 2000, the coldest since the record

setting December of 1983. Find below a table showing a summary of tempratures for the most recent six Decembers in the Twin Cities. The frequency and magnitude of above normal temperatures are clearly evident.....

Year	Number of days with above normal temperatures (deg. F)	Maximum daily departure (deg. F)
1997	27	+21
1998	22	+24
1999	23	+30
2000	1	-25
2001	24	+27
2002	25	+22

With the exception of December 2000, nearly 78 percent of all days showed above normal temperatures. This is remarkable to me.

Local Almanac:

Twin Cities Almanac for December 5th:

The average MSP high temperature for this date is 30 degrees F (plus or minus 10 degrees standard deviation), while the average low is 16 degrees F (plus or minus 10 degrees standard deviation).

MSP Local Records for December 5th:

MSP weather records for this date include: highest daily maximum temperature of 63 degrees F in 2001; lowest daily maximum temperature of 7 degrees F in 1937, 1955, and 1958; lowest daily minimum temperature of -9 degrees F in 1977; highest daily minimum temperature of 36 degrees F in 2001; record precipitation of 0.81 inches in 1909; and record snowfall of 7.0 inches in 1909. There have been 13 measurable snowfalls on this date since 1945. Maximum snow depth on this date was 20 inches in 1991.

Average dew point for December 5th is 17 degrees F, with a maximum of 58 degrees F in 2001 and a minimum of -19 degrees F in 1977.

All-time state records for December 5th:

Scanning the state climatic data base: the all-time high for this date is 65 degrees F at Winona in 1998 and 2001; the all-time low is -33 degrees F at Cook (St Louis County) in 1964.

Words of the Week: the Stradivarius climate

A recent article brought to light the possible relationship between climate and the quality sound made by a Stradivarius violin. Dendrochronologist (tree-ring expert) Henri Grissino-Mayer from the University of Tennessee and Climatologist Lloyd Burckle of Columbia University teamed up to study the unique acoustic properties of the famed Stradivarius violins in the context of the prevailing

climatic conditions when Antonio Stradivari made them. It seems that the Alpine spruce trees growing in Europe from 1645-1715 showed extraordinary wood density as a result of their slow growth. This period of time, known climatically as the Maunder minimum period when sunspot activity was very low, represents the heart of the "little Ice Age" in western Europe (mid 14th Century to the mid 19th Century). Stradivari used this wood to make his most venerated violins in the so-called golden age period of 1700-1720. The authors concluded that the narrow tree rings added strength and special tonal qualities to the violins, and along with the skill of the violin maker and perhaps the varnish or wood treatments used produced a musical instrument that cannot be duplicated.

Outlook:

Generally warmer than normal through the weekend and then a chance for precipitation late Sunday, Monday, and Tuesday. Cooler after Tuesday, with highs generally in the teens and 20sF.

To: Morning Edition
From: Mark Seeley
Re: Topics for MPR's Morning Edition, Friday, December 12, 2003

BRRR.....Lynn Lake in northwestern Manitoba reported a temperature of -42 F on Thursday morning.....somewhat closer to home, Warroad, MN reported the nation's low on Thursday morning with -20 degrees F, while Tower, MN reported the nation's low on Friday morning with -30 degrees F.

Topic: Record December 9th snows....

A large, slow moving low pressure system spread snow throughout the midwest on Tuesday, December 9th. The Twin Cities set a new snowfall record with 9.5 inches, Sioux Falls, SD a new record with 8.0 inches, and River Falls, WI also reported a new record of 11.0 inches. Several others in the area reported new record amounts for the date as well, including the following...

Faribault 7.0" Zumbrota 8.0" Waseca 7.0"
Springfield 10.0" Fairmont 6.0" New Ulm 6.3"

Topic: Economic consequences of natural disasters....

This week, the Finance Initiative of the United Nations Environment Program issued a brief synopsis of the economic consequences of natural disasters during the year 2003, most of which were weather-related. Their numbers show a total loss estimated at \$60 billion worldwide, with about \$15 billion representing insured losses, a big hit for the insurance industry. These values were up from those of 2002 which showed worldwide losses of \$55 billion, and insured losses of \$11 billion. Both years were short of the record year for losses from natural disasters which was 1999 with an estimated \$100 billion.

Some of the bigger losses in 2003 were associated with: (1) the heat wave and drought in Western Europe with an estimated agricultural loss of \$10 billion; (2) widespread flooding in China with property damage and agricultural losses in excess of \$8 billion; (3) numerous tornadoes in the United States during the months of April and May resulted in over \$3 billion in losses.

These large economic consequences considered in the context of global warming, prompted officials of the United Nations Environment Program to encourage nations and industries to consider emission (carbon) trading and investment in alternative energy technologies as options to reduce greenhouse gas emissions. They estimate that the cost of polluting the atmosphere will likely go up as a result of regulation.

Rock 'n' Roll and Greenhouse Emissions....

Speaking of emissions trading, there was an unusual announcement in the American Meteorological Society's Bulletin this week concerning the new, "environmentally friendly" posture of the Rolling Stones Band. It seems that they offered nine carbon-neutral concerts during their recent tour sponsored by a British company called Future Forests. This carbon-neutral strategy is based on the calculated carbon dioxide emissions of each person who attends the concert, factoring in energy usage, transportation and other factors. These emissions were offset by using some concert revenues to plant over 3000 carbon fixing trees across the Scottish landscape. The Rolling Stones are thought to be the first popular band to adopt this strategy for reducing greenhouse gas emissions.

MPR listener question: Does 10 inches of new snowfall this week in the Twin Cities, predispose us to have a colder than normal December? My experience suggests the answer is "yes."

Answer: Indeed, history would suggest that you have answered your own question correctly. The record snowfall of 9.5 inches recorded at Chanhassen on Tuesday of this week ranks with the all-time heaviest single day snowfalls during the month of December. Examining the climate records, I found 11 years when a single storm dumped 6 or more inches of snowfall in the Twin Cities during the first half of December. The associated mean monthly temperature for those Decembers gives strong evidence for your answer.....

Year	Largest daily snowfall for December 1st-16th	Mean Monthly Temperature (F)	Departure from Normal (F)
1884	6.0"	8.6	-10.1
1902	7.0"	15.6	-3.1
1909	7.0"	12.8	-5.9
1927	6.3"	8.8	-9.9
1934	7.4"	15.0	-3.7
1961	7.4"	15.3	-3.4
1969	6.0"	20.3	+1.6
1983	6.3"	3.7	-15.0
1985	8.4"	7.7	-11.0
1995	7.1"	19.1	+0.4
2000	7.0"	7.6	-11.1

In nine of these eleven Decembers the deposition of significant snowfall in the first half of the month is associated with a rather significant negative departure in mean monthly temperature.

Local Almanac:

Twin Cities Almanac for December 12th:

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

MSP Local Records for December 12th:

MSP weather records for this date include: highest daily maximum temperature of 53 degrees F in 1968; lowest daily maximum temperature of -1 degrees F in 2000; lowest daily minimum temperature of -14 degrees F in 1903; highest daily minimum temperature of 37 degrees F in 1928; record precipitation of 0.49 inches in 1991; and record snowfall of 4.6 inches in 1941. There have been 15 measurable snowfalls on this date since 1945. Maximum snow depth on this date was 16 inches in 1950.

Average dew point for December 12th is 9 degrees F, with a maximum of 49 degrees F in 1968 and a minimum of -19 degrees F in 1962.

All-time state records for December 12th:

Scanning the state climatic data base: the all-time high for this date is 64 degrees F at Tracy (Lyon County) in 1913; the all-time low is -39 degrees F at International Falls (Koochiching County) in 1995.

Word of the Week: REDTI

This of course is another government acronym, but perhaps one we'll hear more about this winter. It stands for Residential Energy Demand Temperature Index and it was created by scientists at the National Climatic Data Center. It is based on a nationwide view of the population weighted heating and cooling degree days that relate so closely to residential energy use. Constructing this index allows those in the energy industry to examine long term climatic fluctuations and their impact on energy use in the United States. The REDTI values can be viewed for the most recent 3-month period, or for any other historical period by going to the National Climatic Data Center web site at...

<http://lwf.ncdc.noaa.gov/oa/climate/research/cie/redti.html#desc>

This index might be interesting to track and compare with your home heating bills this winter.....

Outlook:

Starting out rather cold this weekend with increasing cloudiness and warmer temperatures by Sunday night. Chance of snow late Sunday through Wednesday with somewhat warmer temperatures and stronger winds.

To: Morning Edition
From: Mark Seeley
Re: Topics for MPR's Morning Edition, Friday, December 19, 2003

Topic: Remembering a friend, colleague and leader in agriculture..

A long-time departmental colleague at the University of Minnesota, Dr. Pierre Robert was killed in a traffic/pedestrian accident last week in Illinois. Pierre was Director of the Precision Agriculture Center and Professor in the Department of Soil, Water, and Climate. His leadership, knowledge, friendly spirit and good humor will be missed around the university and agricultural communities. He promoted precision agriculture with unfailing gusto because he truly believed in its combination of scientific principles, environmental stewardship, modern technology, and effective use of the state's soils database.

Topic: New Seasonal Climate Outlooks

The National Weather Service Climate Prediction Center released an updated winter outlook on Thursday of this week. Based on trends of recent years, they forecast the January through March period in Minnesota to be warmer than normal. Over the same period, they see equal chances for precipitation to be above or below normal.

Topic: Leading the nation in cold again.....

So far this month, Minnesota has reported the coldest temperature in the 48 contiguous states six separate times, including the following:

- December 2nd -8 F at Cook and Orr
- December 6th -4 F at Ely
- December 11th -18 F at Warroad and Thief River Falls
- December 12th -30 F at Tower
- December 17th -9 F at Park Rapids
- December 18th -2 F at Ely

As of today, Minnesota has recorded the lowest temperature in the 48 contiguous states 37 times in 2003.

MPR listener question: What have been the snowiest Decembers in the Twin Cities, and with 15 inches already recorded at Chanhassen, will this year be one of them?

Answer: Listed below are the ten snowiest Decembers in Twin Cities history (including the old Pioneer records).

Year	Total Snowfall for December (inches)	Number of days with measurable snowfall
1969	33.2	17
2000	30.2	18
1856	30.0	7
1968	28.7	14

1950	25.0	17
1902	24.0	12
1996	23.7	16
1927	22.8	15
1983	21.0	10
1982	19.3	7

As you can see most snowy Decembers are associated with a high frequency of daily snowfalls, exceptions being 1982 and 1856 which included only seven measurable snowfalls. The 1856-57 winter was one of the most severe in Minnesota history, with over 100 inches of snowfall in many areas, including the Twin Cities, and massive spring flooding on many Minnesota watersheds.

The current December snowfall total of nearly 15 inches in the Twin Cities would rank in the top 20 historically.

MPR listener question: What's has been the longest lasting snow storm in the Twin Cities area? It seems that most snowfall lasts for just a few hours up to a day in length.

Answer: The longest duration of continuous falling snow was from shortly after midnight on December 6th to shortly after 5 pm on December 9th, 1969, a period of 88 hours! This was very light snow, amounting to a total of only 14.0 inches, but the December total snowfall that year was 33.2 inches, an all-time record for the month.

Heavier and more memorable snow storms were not as long-lasting. For example, the Halloween Blizzard of 1991 (over 28 inches of snowfall) occurred over a period of 67 hours, while the Armistice Day Blizzard of 1940 (nearly 17 inches of snowfall) lasted about 55 hours.

Local Almanac:

Twin Cities Almanac for December 19th:

The average MSP high temperature for this date is 25 degrees F (plus or minus 13 degrees standard deviation), while the average low is 11 degrees F (plus or minus 14 degrees standard deviation).

MSP Local Records for December 19th:

MSP weather records for this date include: highest daily maximum temperature of 52 degrees F in 1923; lowest daily maximum temperature of -11 degrees F in 1983; lowest daily minimum temperature of -29 degrees F in 1983; highest daily minimum temperature of 38 degrees F in 1923; record precipitation of 0.51 inches in 1968; and record snowfall of 6.4 inches in 1951. There have been 21 measurable snowfalls on this date since 1945. Maximum snow depth on this date was 18 inches in 1983.

Average dew point for December 19th is 10 degrees F, with a maximum

of 39 degrees F in 1918 and a minimum of -31 degrees F in 1955.

All-time state records for December 19th:

Scanning the state climatic data base: the all-time high for this date is 58 degrees F at Winnebago (Faribault County) in 1923; the all-time low is -52 degrees F at Tower (St Louis County) and Mora (Kanabec County) in 1983.

Word of the Week: Aeolius

This word is taken from the mythical Greek god of the wind, Aeolus and is the name of a forecast model used by the United Kingdom Meteorological Office to predict air quality in street canyons of major metropolitan areas. The model uses measured or estimated emission sources (nitrous oxides, carbon monoxides, etc from autos), wind speed, traffic volume, and street geometry. The predictions can then be used to release air quality alerts to the public.

Outlook:

warmer temperatures under partly cloudy skies over the weekend. Chance for snow Monday and Tuesday. Warming continuing later next, including Christmas Day.

To: Morning Edition
From: Mark Seeley
Re: Topics for MPR's Morning Edition, Friday, December 26, 2003

Topic: The Minnesota weather of 2003...a review

WARM AND DRY:

Based on state averaged annual temperature and total precipitation, Minnesota recorded a warm and dry year in 2003. The statewide mean annual temperature of 42 degrees F falls in the warmest 20 percent historically, while the statewide average total precipitation of 22.25 inches falls in the driest 20 percent of historical years. These are not particularly memorable statistics, but in the details of the weather this past year, we do find some features that will be long remembered.....

TEMP EXTREMES:

Temperature extremes in 2003 included 101 degrees F at Browns Valley on August 18th, and -38 degrees F at Embarrass on March 5th. At least seven different communities hit the century mark in temperature last summer, while last winter brought at least 16 different communities a minimum temperature of -30 F or colder. The coldest temperatures came rather late in the winter near the end of February and in early March.

DROUGHT:

All but a handful of communities reported below normal precipitation in 2003. It was the driest year since 1988. Over sixty communities reported less than 20 inches, roughly six inches below the normal state annual average. Rochester reported the 12th driest year in history, while the Twin Cities recorded the 21st driest year since 1891. More severe moisture shortages were evident in some south-eastern communities. Red Wing and Preston recorded their 3rd driest year historically, while Waseca recorded its 5th driest year. Up north, International Falls recorded near all-time record dryness with just 16.73 inches of precipitation.

FROZEN GROUND:

The absence of significant snow cover combined with very cold temperatures in the late winter produced hundreds, if not thousands of frozen septic systems and water lines, especially in central and northern counties. Frost penetration into the soils was the deepest since the mid 80s, with some frost reported below six feet.

TORNADOES

In terms of severe convective weather, nearly all of the thunderstorms, tornadoes and hail occurred in June and July. There were 48 tornadoes reported in 2003, 34 classed F0 (73 mph or less), 11 classed F1 (73-112 mph), and 3 classed as F2 (113-157 mph). Probably the most damaging tornado was the one that passed through Buffalo Lake (Renville County) and Gibbon (Sibley County) on June 24th.

Month by month significant weather featured the following....

January:

Very warm January, with new records set on the 7th and 8th when temperatures were over 30 degrees above normal. A 60 F reading at Fairmont on the 7th was a new state record for the date. The cancellation of the Winter Carnival Giant Snow Slide in St Paul, was necessary because of the absence of snow, a characteristic the was in short supply all across the state.

February:

A ground blizzard struck the state on Groundhog Day (Feb 2). Snowfalls were highly variable ranging from less than 2 inches to 11 inches at Montevideo in western MN. Winds up to 63 mph dropped visibility to near zero in many areas.

March:

Maximum frost depths were seen in March when many septic systems and water lines froze. The late winter cold produced an unusual condition, Lake Superior was over 90 percent ice covered the first week of March. Wind blown ice ridges on Minnesota lakes produced some significant shoreline damages to cottages, retaining walls, and boat docks. A mid month warm up produced some record high temperatures on the 15th and 16th, when the mercury cracked 70 F in southern Minnesota. This proved to be a tease, as more winter-like weather brought up to a foot of snow to northern counties on the 27th and 28th.

April:

The month started with more snow. Snowfalls of 2 to 14 inches blanketed southern Minnesota counties on the 7th. Fairmont, Blue Earth, and Winnebago all reported new snowfall records for the date. For a brief period summer arrived in mid April as new record high temperatures were set on the 14th...the Twin Cities hit 89 F, Rochester 87 F, Benson 90 F, and Montevideo 93 F. This heat wave was followed by severe thunderstorms and heavy rains over the 15th to the 17th. A thunderstorm dumped over 4 inches of rain on Pipestone, while Tower reported golf ball sized hail. Most farmers welcomed the heavy rains before the start of the planting season.

May:

Some north-central and northeastern Minnesota counties remained dry, and the fire danger peaked in some areas. Very low stream flows were reported on the watersheds that feed Lake Superior. Conversely, in southern and central counties, colder than normal soils and frequent showers caused some delays in planting corn and soybeans.

June:

Most of the severe convective weather during 2003 occurred in June. Numerous reports of hail, tornadoes and heavy thunder showers were reported, particularly across southern and central counties. Alexandria in Douglas County reported one of the wettest June

months in history with over 10 inches. At one time every county and township road was flooded near that western Minnesota city.

July:

The first half of the month was dominated by severe weather, with numerous tornadoes and heavy thunderstorms. But, a mid-summer drought began to show its face in the second half of the month. One of the most striking features meteorologically was the absence of a jet stream for much of the latter part of the month.

August:

Drought intensified and became evident in the appearance of some crops and low flows on watersheds. The hottest temperatures of the summer occurred mid-month. The first weekend of the State Fair saw a temperature of 97 F at the fairgrounds, tying the all-time high temperature record at the Fair dating back to 1913. The month ended as one of the hottest and driest Augusts in recent memory.

September:

Soil moisture deficits reached their lowest levels since the drought year of 1988 in many areas. Welcome rains finally came over the 9th through the 12th bring relief to gardens and trees under stress, but too late for most crops. A somewhat rare late season tornado passed over Anoka county on the 26th.

October:

New record low temperatures came on the 2nd. Temperatures as low as the teens occurred in southern Minnesota counties. Summer returned from the 6th to the 10th with temperatures reaching into the 80s and low 90s F setting new records. The fire danger peaked in the north for a second time. Finally snows occurred in northern counties on the 27th and 28th. Some places reported 5 to 8 inches, including Two Harbors with 8.5 inches.

November:

Early snows hit central and southern Minnesota on the 3rd and 4th, with 2 to 7 inches reported. Interestingly enough, the snow was coincidental with Winter Weather Awareness Week. Record setting low temperatures occurred over the weekend of the Hunting Opener (7th-9th). Many northern and western areas reported lows that were below zero, including -19 F at Embarrass. On the 21st a heavy snow storm struck western counties, leaving as much as 10 inches of snow at Madison.

December:

The month brought more snow, with 4 to 11 inches on the 9th and 10th. Chanhassen reported a record 9.5 inches on the 9th. More snow came on the 15th and 16th with blowing and drifting causing some travel problems. A mild Christmas week in Minnesota made traveling and shopping easier.

MPR listener question: What is the working definition of a blizzard?

Answer: The National Weather Service uses the following criteria for releasing a blizzard warning: Sustained winds or frequent gusts of 35 mph or greater, falling or blowing snow that reduces visibility to 1/4 mile or less; duration of these conditions must be 3 hours or longer. Interestingly enough, there are no set temperature conditions, though more often than not, temperatures drop significantly and combined with the winds produce threatening windchill values. Canada uses a similar system, but also stipulates that a dangerous windchill condition exist. The British Meteorological Services also uses a somewhat similar definition, but specify visibility of 1/8 mile or less and winds of 30 mph or greater.

Local Almanac:

Twin Cities Almanac for December 26th:

The average MSP high temperature for this date is 25 degrees F (plus or minus 12 degrees standard deviation), while the average low is 8 degrees F (plus or minus 14 degrees standard deviation).

MSP Local Records for December 26th:

MSP weather records for this date include: highest daily maximum temperature of 51 degrees F in 1936; lowest daily maximum temperature of -9 degrees F in 1934; lowest daily minimum temperature of -27 degrees F in 1996; highest daily minimum temperature of 38 degrees F in 1959; record precipitation of 0.57 inches in 1936; and record snowfall of 5.1 inches in 1988. There have been 24 measurable snowfalls on this date since 1945. Maximum snow depth on this date was 20 inches in 1983.

Average dew point for December 26th is 10 degrees F, with a maximum of 48 degrees F in 1936 and a minimum of -28 degrees F in 1996.

All-time state records for December 26th:

Scanning the state climatic data base: the all-time high for this date is 57 degrees F at Fairmont (Martin County) and Zumbrota (Goodhue County) in 1936; the all-time low is -50 degrees F at Tower (St Louis County) in 1993.

Topic: Solitary Christmas in Antarctica

While we experienced a mild Christmas here in Minnesota, at least one woman spent Christmas alone in a very harsh environment, surrounded by ice and snow. Polar adventurer Rosie Stancer spent a solitary Christmas on the frozen landscape of Antarctica. Rosie from London, England is striving to become the first British woman to trek solo and unsupported to the South Pole.

Her journey started from the edge of Antarctica's Ice Shelf and is her third such adventure. Back in 1997, she was part of the first all-female expedition to reach the North Pole unassisted. Then in January 2000, the same team achieved the equivalent feat at the South

Pole.

It appears that there's something in the family which drives Rosie to meet such challenges. Her husband's grandfather, geologist James Wordie, was a member of Ernest Shackleton's Antarctic expedition aboard the ill-fated Endurance (reported about on MPR a few years ago). Famously, the Endurance was crushed to destroyed by the ice pack in 1915.

Actually Rosie experienced a relatively balmy Christmas in Antarctica, with constant sun and highs from -4 to -10 degrees F. Sure hope she makes her solo trek.....More on this adventure can be found on the BBC web site at.....

<http://www.bbc.co.uk/weather/world/news/24122003news.shtml>

Outlook:

Stormy for the weekend and much of next week leading up to the New Years holiday. Mixture of precipitation around the state this weekend will include rain, freezing rain, drizzle, and snow. Also much stronger winds on Saturday and Sunday may create some travel problems. Chance of snow around New Years, followed by much colder weather for the first few days of January.

To: Cathy Wurzer, Jim Bickal, Julie Siple, and Eugene Cha
From: Mark Seeley
Re: Suggestions for MPR's Morning Edition, Friday, Feb 21, 2003

HAPPY PLEDGE WEEK!

The Climate Prediction Center just released the new monthly and seasonal outlooks this week. For Minnesota, above normal temperatures are favored for March, then equal chances for above or below normal values for April and May.

Precipitation is expected to be near normal over the March through May period, except in northeastern sections of the state where it is expected to be drier.

Topic: Weather Myth and Trivia

This weekend, I will be attending the Annual Lake Superior Design Retreat of the American Institute of Architects in Duluth. The topic I am covering concerns "Weather Myth and Little Known Weather Facts".....I have some examples...

ALL HISTORICALLY DOCUMENTED MILD WINTERS IN MINNESOTA ARE ASSOCIATED WITH EL NINO EPISODES

OF ALL U.S. WEATHER FEATURES LIGHTNING CAUSES THE MOST ANNUAL FATALITIES

Wrong.....recent statistics show higher annual mortality due to heat waves and flooding.

No!.....though the presence of El Nino in the equatorial Pacific Ocean increases the probability that Minnesota will have a mild winter, it is far from a perfect correlation....in fact, during the El Nino episode of 1912, Minnesota recorded the second coldest winter in history!

WHAT IS THE SNOWIEST MONTH IN THE TWIN CITIES METRO AREA, JANUARY OR MARCH?

Both!!! Climatological records show that for different historical periods, each of these months has been the snowiest. March was the snowiest for the 1951 to 1980 period, but since that time, January has been the snowiest month.

MARCH OFTEN COMES IN LIKE A LION AND GOES OUT LIKE A LAMB (OR VICE VERSA)

Wrong!!! Climatological records of dramatic temperature variation (beyond a stand deviation) and storminess show that this has occurred only 15 times in the Twin Cities record since 1891.

FROST IS REMOVED FROM THE SOIL BY THE LONGER DAYS OF SPRING AND THE HIGHER ELEVATION ANGLE OF THE SUN

Wrong!!! Frost is removed by the energy of the sun heating the soil surface, by percolation of melting snow or rainfall, and also by the constant heat source of the soil itself at greater depths (beyond 2 meters) where the annual temperature is fairly constant in the high 40s F.

TRUE OR FALSE: ON JULY 3, 1876 DULUTH RESIDENTS MADE HOMEMADE ICE CREAM USING ICE HARVESTED FROM THE HARBOR!

True, one of only two times in history that harbor water has been cold enough and still enough to freeze due to a summer frost!!

OUR SOUTHERN AND GREAT LAKES NEIGHBORS OFTEN GET JANUARY THAWS, BUT WE RARELY DO HERE IN THE TWIN CITIES.

Wrong!!! Since 1891, the Twin Cities record shows only nine winters when we have not experienced a January thaw, here defined as two or more days with temperatures above 32 degrees F. Recall that on the 7th and 8th of January this year (2003) temperatures were nearly 30 degrees warmer than normal!

MPR listener question: Even though February has been a snowy month in places, the Twin Cities still shows less than 21 inches of total snowfall for the winter season. What is your best guess for snow amounts the rest of the season?

Answer: On average, we might expect about 15-16 additional inches of snowfall through April, which would bring the total up to 35 inches or so. However, the Climate Prediction Center suggests that we may see drier conditions in the months ahead. This might leave us with just an additional 3-5 inches. But, this is no where near the record for least snowfall. The biggest deficiency in snowfall occurred in the winter of 1930-31 when only 14.2 inches fell in the Twin Cities.

It would be well to remember the great variation in snowfall that is associated with March, ranging from 0.1 inches in 1981 to 40 inches in 1951.

Twin Cities Almanac for February 21ST:

The average MSP high temperature for February 21 is 29 degrees F (plus or minus 11 degrees standard deviation), while the average low is 11 degrees F (plus or minus 13 degrees standard deviation).

MSP Local Records for February 21ST:

MSP weather records for February 21st include: highest daily maximum

temperature of 59 degrees F in 1930; lowest daily maximum temperature of -1 degree F in 1963; lowest daily minimum temperature of -19 degrees F in 1939 and 1963; highest daily minimum temperature of 44 degrees F in 1930; record rainfall of 0.50 inches in 1966 and 1981; and record snowfall of 5.5 inches in 1962. Maximum snow depth has been 27 inches in 1967; there have been 15 measurable snowfalls since 1948.

Average dew point for this date is 13 degrees F, with a maximum of 52 degrees F in 1930 and a minimum of -33 degrees F in 1963.

All-time state records for February 21st:

Scanning the state climatic data base: the all-time high for this date is 63 degrees F at Winona in 1930 and repeated at Lamberton, Tracy, Springfield, and Theilman in 1981; the all-time low is -51 degrees F at Meadowlands (St Louis County) in 1939 and at Baudette (Lake of the Woods County) in 1966.

Word of the Week: Frigophobia

Taken from the list of phobias compiled by the Anxiety Disorders Association of America and the American Psychiatry Association, this term is used to refer to the fear of cold or cold things. Some people with this affliction will not venture outside when the temperature is below freezing.

Outlook:

Cooler this weekend with a chance of light snow, especially in southern areas and the Lake Superior shoreline. Drier next week, but with cold temperatures continuing. Chance of snow Wednesday and Thursday and warmer temperatures towards next weekend.