

To: Greg Magnuson, Bob Potter, and John Bischoff
From: Mark Seeley
Re: Suggestions for MPR's Morning Edition, Friday, Jan 1, 1996

Topic: Anniversary of Cold Wave in January of 1912

Eighty-four years ago one of the most persistent cold spells settled across Minnesota. The temperature in the Twin Cities fell below zero on the 1st of January and did not rise above zero until mid morning of January 13th. Overnight lows of -30 and -31 degrees F were recorded on the 11th and 12th, respectively. The high temperature on January 11th was -19 degrees F. Windchill values on the 5th, the 9th and the 11th were in the -60 to -80 degree F range. Hibernation was the most common activity. This turned out to be the coldest January on record in the Twin Cities, with an average temperature of -3 degrees F.

Almanac: Average maximum temperature locally for today's date is 20 (plus or minus 13 degrees standard deviation) and the average minimum is 5 (plus or minus 14 degrees standard deviation).

MSP records for today's date include: a maximum temperature of 43 degrees in 1898, 1902 and 1984; a minimum temperature of -28 degrees F in 1912 and 1924; record precipitation of 0.63 inches in 1932; and record snowfall of 4.7 inches in 1994.

Greatest snowdepth on this date locally, 19 inches in 1970.

Last measurable snowfall on this date was 1994 when a record 4.7 inches fell in the Twin Cities. Since 1948, 11 measurable snowfalls have been recorded at the MSP airport on this date.

Scanning the state climatic data base: the all-time high for today's date is 57 degrees F at Crookston in 1902; the all-time low is -43 degrees F at Tower in 1896, at Pokegama Dam and Detroit Lakes in 1924, and at Agassiz National Wildlife Refuge (Marshall County) in 1968.

Average dew point temperature for today is 5 degrees F. The highest dew point on this date is 36 degrees, while the lowest is -28 degrees.

Words of the Week: Green, Red and Yellow Snow

This is a snow surface that contains a greenish tint as the result of the growth of microscopic algae within. Sometimes found in the spring within firn (old) snow around lakeshores. Other algae, notably cryoplankton (one celled plants) sometimes grow in old snow and produce a reddish tint. This can also occur from the deposition of red dust and soil particles borne by strong winds off the western prairies.

Yellow snow has many connotations, but in forested regions it is often caused by the presence of pine or cypress pollen which falls on the snow crust or surface.

Topic: The Ill-Fated WWII British Weather Ships

There is an interesting article in the recent edition of Weather magazine (Royal Met Society of the UK) about two weather ships used by the Met Office Dept of Marine Operations during WWII. From September of 1940 to late June of 1941, two merchant ships, the SS Arakaka and the SS Toronto City sailed the Atlantic, between Canada and England, and used wireless telemetry to send in hourly reports of wind, cloud type, air and sea temperature, barometric pressure, and many other parameters. Pilot balloons were also launched and tracked by these ships to determine upper level winds. All of these data were used by U.K. forecasters back in England to provide guidance for Navy and RAF operations during the war. The code name used for these ships was "Panthers", and the overall operation was highly classified, not becoming public information until 1975.

The operation was one of great risk, but deemed necessary to help England defend itself from the German forces. The operation also helped advance the science of making meteorological observations at sea and improved the instrumentation. The two meteorological officers (names Portass and Proud) along with the crews from these ships were lost in the summer of 1941. Both ships were sunk by German U-boats in the mid Atlantic.

Outlook:

Looks like the storms missed us again. Dry and cold through the weekend, with a chance for snow on Monday. Then warming up Tuesday through Friday of next week, with temperature averaging above normal.

To: Greg Magnuson, Bob Potter, and John Bischoff
From: Mark Seeley
Re: Suggestions for MPR's Morning Edition, Friday, Jan 12, 1996

Topic: Diurnal Temperature Patterns

The daily pattern of temperature now shows high temperatures occurring around 2 to 3 pm in the afternoon and lows around 6 am in the morning. This pattern prevails in the absence of cold front passages during the day, which of course can cause the temperature to plummet even in the middle of the afternoon. As the sun angle increases towards spring and days get longer, the afternoon high temperature will occur later and later. By May and June the high temperature will typically be reached about 4:30 to 5:00 pm.

Right now, the average daily range from low to high is about 17 to 20 degrees F. It will start to become more variable in February and March as the increasing sun angle combined with the degree and duration of cloud cover become more influential on how rapidly the surface heats during the day. The mean diurnal temperature range typically peaks in May, with values between 25 and 30 degrees F. In dry springs, radiative heating and cooling of the surface, combined with the passage of strong cold fronts can produce remarkable daily temperature ranges, sometimes greater than 60 degrees F. Lamberton, MN on April 3rd of 1982 had a low of 7 degrees and an afternoon high of 78 degrees F.

Conversely, the low sun angle, high degree of cloudiness and somewhat higher wind speeds make November (and to a slightly less degree December as well) the period with the smallest mean daily temperature range, typically around 14 to 16 degrees F. In fact there have been numerous cases historically (58 since 1891) when the daily temperature range was less than 3 degrees on November days in the Twin Cities.

Almanac: Average maximum temperature locally for today's date is 22 (plus or minus 12 degrees standard deviation) and the average minimum is 5 (plus or minus 14 degrees standard deviation).

MSP records for today's date include: a maximum temperature of 48 degrees in 1987; a minimum temperature of -31 degrees F in 1912; record precipitation of 0.70 inches in 1935; and record snowfall of 7.0 inches in 1916.

Greatest snowdepth on this date locally, 18 inches in 1984.

Last measurable snowfall on this date was 1993 when 6.2 inches fell in the Twin Cities. Since 1948, 18 measurable snowfalls have been recorded at the MSP airport on this date.

Scanning the state climatic data base: the all-time high for today's date is 58 degrees F at Brown's Valley and Wheaton

(western MN) in 1987; the all-time low is -53 degrees F at Pine River Dam (Crow Wing County) in 1912.

Average dew point temperature for today is 6 degrees F. The highest dew point on this date is 35 degrees, while the lowest is -38 degrees.

Words of the Week: Haar

Originally a Scottish term this one is for listeners who play scrabble. The term refers to a cold fine drizzle or cooling sea fog which blows in from the North Sea in northeast England or eastern Scotland. It occurs most frequently in the summer but can occur in other seasons as well. It is somewhat analogous to the fog or mist that sometimes blows in to NE Minnesota off Lake Superior.

Community Notes: Ely and Winton, MN

Located at the termination of Hwy 169 in northeastern Minnesota, these communities lie along the border of Lake and St Louis Counties just south of the Boundary Waters Canoe Area. The Iron Range lies to the west and Superior National Forest to the north, south and east.

As one of the few long term climate stations in the northeast, the Ely-Winton records have been used to help quantify the climate of Superior National Forest, providing much needed information to forest and wildlife managers in the area.

The first observer there was the Reverend William Farrell, who started daily observations of temperature and rainfall at Ely in March of 1911. Since that time, the personnel at the Ranger Station in Ely and the Power Plant in Winton have taken daily observations.

Some climate statistics for the Ely-Winton area: frosts have occurred well into June, but never in July. The all-time highest temperature in the area was recorded during our June heatwave last summer, when the mercury reached 100 degrees F on June 19th. The all-time lowest temperature was -45 degrees F on February 12, 1967. Ely-Winton reported 73 inches of snow in 1972, but normally record about 44 inches per year. Heaviest rainfall was 4.83 inches on May 20, 1970.

Outlook:

Looks like a continuation of relatively mild temperatures next week. Chance of snow Sunday, then again Tuesday through Thursday of next week. But high temperatures should remain in the 20s and 30s. Where has winter gone?

Table relating to mean diurnal temperature range:

MSP 1891-1995

Frequencies of various diurnal temperature ranges, expressed as max-min for a given date. Shown by month.

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
TMAX - TMIN LESS THAN OR EQUAL TO 1 DEGREES F											
2	0	0	0	0	0	0	0	0	0	0	4
TMAX - TMIN LESS THAN OR EQUAL TO 2 DEGREES F											
11	5	7	2	0	0	0	0	2	6	15	21
TMAX - TMIN LESS THAN OR EQUAL TO 3 DEGREES F											
31	24	29	10	4	0	0	3	12	22	58	62
TMAX - TMIN GREATER THAN OR EQUAL TO 40 DEGREES F											
28	16	11	25	14	1	0	1	5	6	1	12

MSP RECORD: 12/26/03 TMAX=34, TMIN=-17

From Greg Spoden:

Number of MN climate stations showing the highest and lowest mean diurnal temperature ranges by month.

Highest mean diurnal temperature range occurrence

Month	No. of stations
Feb	11
May	81
Jun	9
Aug	16
Sep	9
Oct	2

Lowest mean diurnal temperature range occurrence

Mar	6
Nov	85
Dec	34

1995 National Weather Service Blizzard Criteria

Applies to a forecast period of 3 hours or longer

Sustained or frequent wind gusts of 35 mph or greater

Considerable falling or blowing snow

Visibility of less than 1/4 mile

Potentially dangerous temperatures

To: Greg Magnuson, Bob Potter, and John Bischoff
From: Mark Seeley
Re: Suggestions for MPR's Morning Edition, Friday, Jan 19, 1996

Forecaster's terminology: Snow Flurry

A snow flurry is popularly used by forecasters to refer to a snow shower which is very light and very brief in duration. It often comes from an isolated rapidly moving cloud or cloud system which is associated with the backside of a cold front.

Topic: Followup to Temperature Range Discussion of Last Week

With the blast of arctic air last weekend, came some remarkably large shifts in temperature over a very brief period (perhaps 30 hours or less). Listed below are the high temperatures reached on Saturday, followed by the lows on Sunday night for several locations in Minnesota.

Hallock from 42 degrees F to -13 degrees F
Itasca State Park from 40 degrees F to -19 degrees F
Canby from 52 degrees F to -5 degrees F
Aitkin from 44 degrees F to -16 degrees F
Grand Rapids from 41 degrees F to -19 degrees F
Tower from 45 degrees to -40 degrees F (an 85 degree drop!)

Question from MPR's Joaquin Estus: Is it colder in Alaska or the Twin Cities?

Mean Monthly Temperature Normals Rounded to Nearest Whole Number:

Anchorage, AK											
JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
15	19	23	36	47	53	58	56	48	35	21	17
Fairbanks, AK											
-9	-4	9	31	50	59	62	57	45	25	3	-6
Minneapolis-St Paul, MN											
12	18	31	46	59	68	74	71	61	49	33	18

The answer depends on which part of Alaska you compare. The interior, as represented by Fairbanks is consistently much colder, ranging from 30 degrees F cooler in November to 9 degrees F cooler in May. Anchorage, located on the top of the Cook Inlet off the Gulf of Alaska is a coastal climate. It is generally colder than the Twin Cities, except for the middle of winter, when snow cover and dry high pressure systems keep Minnesota temperatures somewhat colder, while the Gulf of Alaska and Cook Inlet waters moderate the temperature of Anchorage. We also experience higher temperature variability during winter than Anchorage does.

Almanac: Average maximum temperature locally for today's date is 23 (plus or minus 14 degrees standard deviation) and the average minimum is 5 (plus or minus 14 degrees standard deviation).

MSP records for today's date include: a maximum temperature of 49 degrees in 1921; a minimum temperature of -34 degrees F in 1970; record precipitation of 0.57 inches in 1988; and record snowfall of 7.5 inches in the same storm of 1988.

Greatest snowdepth on this date locally, 22 inches in 1967.

Last measurable snowfall on this date was 1988 when a record 7.5 inches fell in the Twin Cities. Since 1948, 10 measurable snowfalls have been recorded at the MSP airport on this date.

Scanning the state climatic data base: the all-time high for today's date is 61 degrees F at Milan (Chippewa County) in 1900; the all-time low is -47 degrees F at Pokegama Dam in 1937 and at Bigfork in 1963 (both in Itasca County).

Sunday, the 21st is an anniversary of sorts. On that date in 1888, a low temperature of -52 degrees F was recorded at Delano in Wright County. This is perhaps the lowest temperature ever recorded so near to the Twin Cities area.

Average dew point temperature for today is 4 degrees F. The highest dew point on this date is 34 degrees, while the lowest is -41 degrees.

Words of the Week: Haar

Originally a Scottish term this one is for listeners who play scrabble. The term refers to a cold fine drizzle or cooling sea fog which blows in from the North Sea in northeast England or eastern Scotland. It occurs most frequently in the summer but can occur in other seasons as well. It is somewhat analogous to the fog or mist that sometimes blows in to NE Minnesota off Lake Superior.

Outlook:

Storm aftermath will leave us with cold weather throughout the weekend. That was a strong storm. The thunder and lightning which came with it were indeed unusual for January. Less than one tenth of one percent of all January MSP observations historically have shown the occurrence of thunder.

Snow and blowing snow were common features. Many locations including Hallock, Crookston, Fergus Falls, Detroit Lakes, Thief River Falls, Fosston, Wheaton, Morris, Marsahll and Montevideo reported 9 or more hours of -70 to -90 degree F windchill values. Many snowfalls of 9 to 12 inches were reported in the north and rainfalls (much of it freezing) of 1.0 to 1.6 inches were reported in the south. This morning's MSP low of -18 degrees is the coldest so far this winter.

Moderating temperatures by Tuesday and Wednesday with a chance for more snow continuing right through to next weekend. Good old fashion winter returns for awhile.

To: Greg Magnuson, Bob Potter, and John Bischoff
From: Mark Seeley
Re: Suggestions for MPR's Morning Edition, Friday, Jan 26, 1996

Many occurrences of 30, 40 and even 50 below temperatures this week in northern Minnesota. Some record low values included -57 degrees F at Tower and Embarrass, -41 at International Falls and Baudette and -44 F at Ely.

Forecaster's terminology: snow advisory and heavy snow warning

A snow advisory is issued if snowfall amounts of 3 inches or greater are expected over a 12 hour period, or between 3 and 6 inches of snow is expected within 24 hours. A heavy snow warning is issued if more than 6 inches is expected to occur within 24 hours. Should other combinations of conditions exist which include dangerous windchills or considerable blowing and drifting, then a winter storm warning would be issued instead of a heavy snow advisory.

Question from MPR's Joaquin Estus: Is it colder in Alaska or the Twin Cities? Normal high and low for today's date in Anchorage, AK are 21 and 8 degrees F, in Fairbanks they are -1 and -18, while for MSP they are 20 and 2 degrees.

On Wednesday of this week, the high and low in Anchorage was 1 degrees and -6 degrees, respectively, while for the Twin Cities, it was 10 degrees and 0 degrees. Fairbanks, on the other hand reported a high of -6 and a low of -10 degrees.

Mean Monthly Temperature Normals Rounded to Nearest Whole Number:

Anchorage, AK											
JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
15	19	23	36	47	53	58	56	48	35	21	17
Fairbanks, AK											
-9	-4	9	31	50	59	62	57	45	25	3	-6
Minneapolis-St Paul, MN											
12	18	31	46	59	68	74	71	61	49	33	18

The answer depends on which part of Alaska you compare. The interior, as represented by Fairbanks is consistently much colder, ranging from 30 degrees F cooler in November to 9 degrees F cooler in May. Anchorage, located on the top of the Cook Inlet off the Gulf of Alaska is a coastal climate. It is generally colder than the Twin Cities, except for the middle of winter, when snow cover and dry high pressure systems keep Minnesota temperatures somewhat colder, while the Gulf of Alaska and Cook Inlet waters moderate the temperature of Anchorage. We also experience higher temperature variability during winter than Anchorage does.

Almanac: Average maximum temperature locally for today's date is 20 (plus or minus 14 degrees standard deviation) and the average minimum is 2 (plus or minus 16 degrees standard deviation).

MSP records for today's date include: a maximum temperature of 52 degrees in 1931; a minimum temperature of -26 degrees F in 1897; record precipitation of 0.16 inches in 1951; and record snowfall of 3.4 inches in 1910.

Greatest snowdepth on this date locally, 24 inches in 1982.

Last measurable snowfall on this date was 1993 when 0.1 inches fell in the Twin Cities. Since 1948, 17 measurable snowfalls have been recorded at the MSP airport on this date.

Scanning the state climatic data base: the all-time high for today's date is 60 degrees F at Faribault (Rice County) in 1944; the all-time low is -55 degrees F at Pokegama Dam in 1904 though this is somewhat disputable because of the exposure of the thermometer. It was -51 degrees F on this date in 1927 at Grand Rapids, MN.

Average dew point temperature for today is 0 degrees F. The highest dew point on this date is 36 degrees, while the lowest is -41 degrees.

Words of the Week: Cow Storm

This is one Gary Larson, creator of the Far Side would fancy. It is the term used to describe a gale (40 mph or greater winds) of Ellesmere Island (Canada), said to be so strong that it blows the horns off the cows. Not that there would be any cows on Ellsmere Island anyway. It is about 80 degrees latitude. But it is often up there at Canadian weather stations like Eureka and Alert that the world's coldest windchill values are report, sometimes in the -120 to -140 degree F range, suggesting that if the cow's horns don't blow off they freeze off!

Outlook:

Snow today in southern Minnesota, with heavier snow in the southeast. Clearing on Saturday but remaining cold throughout the weekend. Some moderation of temperatures to near seasonal normals by the middle of next week. But chances of more snow on Monday and again Wednesday through Friday.

To: Greg Magnuson, Bob Potter, and John Bischoff
From: Mark Seeley
Re: Suggestions for MPR's Morning Edition, Friday, Feb. 2, 1996

Forecaster's terminology: Partly Cloudy

This term is used in forecasts to describe the expected character of day with respect to sky conditions. It indicates expected cloud cover ranging from 0.3 to 0.6 throughout the day. Often times the degree of cloudiness will vary somewhat from morning to afternoon, especially in summer.

Almanac: Average maximum temperature locally for today's date is 21 (plus or minus 13 degrees standard deviation) and the average minimum is 3 (plus or minus 15 degrees standard deviation).

MSP records for today's date include: a maximum temperature of 48 degrees in 1991; a minimum temperature of -28 degrees F in 1965; record precipitation of 0.80 inches in 1983; and record snowfall of 6.2 inches in the same storm of 1983.

Greatest snowdepth on this date locally, 22 inches in 1969.

Last measurable snowfall on this date was 1994 when 0.2 inches fell in the Twin Cities. Since 1948, 18 measurable snowfalls have been recorded at the MSP airport on this date.

Scanning the state climatic data base: the all-time high for today's date is 66 degrees F at Wheaton (Traverse County) in 1991; the all-time low is -51 degrees F at Pokegama Dam in 1905 though this is somewhat disputable because of the exposure of the thermometer. It was -47 degrees F on this date in 1886 at Park Rapids, MN.

Average dew point temperature for today is 3 degrees F. The highest dew point on this date is 34 degrees, while the lowest is -33 degrees.

Words of the Week: Cooking Snow

Sometimes referred to as water snow, this is dense snow which when melted yields a higher than normal water content. This may be as much as a third to a half inch of water per inch of snow. In pioneer times when snow was melted and used as winter water supply, cooking snow could be harvested in kettles and boiled for food preparation or for drinking.

Topic: Ice crystals found in snow

The shape of ice crystals, the building block of snowflakes, vary considerably. Shape and size are dependent on the temperature and water vapor conditions within clouds. At very cold temperatures, 5 degrees F and colder, small hexagonally shaped hollow columns and dendritic (multiple branching) shapes of ice crystals are common. At warmer temperatures, 20 to 30 degrees F, ice needles and flat hexagonally shaped plates are the more common shapes of ice crystals.

Snowflakes are typically aggregates of these ice crystals and can reach considerable size in relatively warm moist conditions. Snowflakes with diameters as large as 10 inches have been observed in very still conditions. On the other hand, in dense cold dry air such as we have been having this week, snowflakes tend to be very small aggregates of ice crystals.

Outlook:

Remaining colder than normal, but dry into the weekend, moderating to near seasonal normals by Tuesday or Wednesday, then actually exceeding the freezing mark by next weekend.

To: Greg Magnuson, Bob Potter, and John Bischoff
From: Mark Seeley
Re: Suggestions for MPR's Morning Edition, Friday, Feb. 9, 1996

Living in Minnesota: where else does Mother Nature occasionally slap you in the face with a cold wave or a blizzard to remind you of how fragile and risky life can be? Or for that matter surprise you with astonishing beauty such as a hoarfrost or a display of northern lights. Like the farmer who uses a two x four to get the mules attention, Moe striking Curly across the nose, or the neglected child tugging on Dad's pant leg, Mother Nature sometimes grabs us by the throat, awakening us from complacency and says, "hey, look what I can do."

Recent cold wave: The recent six day period from January 30 to February 4, 1996 was certainly historical in the magnitude and duration of cold. Anyway you slice it (or chip it) the temperatures statewide were brutal. The only analogous historical periods in Minnesota's climate records are January 7-12, 1912 and February 6-11, 1899. In all three cases, the mean statewide temperature (average of all official climate stations) for the six day period was -20 degree F or colder. This is on the order of 30 to 35 degrees colder than normal.

In 1899, the cold wave struck the Gulf and eastern seaboard states with greater ferocity. Parts of Florida received 3.5 inches of snow and record lows occurred including:
-6 degrees F at Atlanta -4 degrees F at Shreveport
7 degrees F at New Orleans 10 degrees F at Jacksonville
-2 degrees F at Tallahassee -15 degrees F in D.C.

Ice flows were observed at New Orleans going out into the Gulf of Mexico.

Forecaster's terminology: Partly Cloudy

This term is used in forecasts to describe the expected character of day with respect to sky conditions. It indicates expected cloud cover ranging from 0.3 to 0.6 throughout the day. Often times the degree of cloudiness will vary somewhat from morning to afternoon, especially in summer.

Almanac: Average maximum temperature locally for today's date is 23 (plus or minus 13 degrees standard deviation) and the average minimum is 5 (plus or minus 15 degrees standard deviation).

MSP records for today's date include: a maximum temperature of 52 degrees in 1966; a minimum temperature of -33 degrees F in 1899; record precipitation of 0.92 inches in 1965 (a spring flood year); and record snowfall of 9.0 inches in 1909.

Greatest snowdepth on this date locally, 21 inches in 1967.

Last measurable snowfall on this date was 1995 when 0.4 inches fell in the Twin Cities. Since 1948, 10 measurable snowfalls have been recorded at the MSP airport on this date.

Scanning the state climatic data base: the all-time high for today's date is 63 degrees F at Canby (Yellow Medicine County) in 1991; the all-time low is -59 degrees F at Leech Lake Dam in 1899 (Cass County).

Average dew point temperature for today is 6 degrees F. The highest dew point on this date is 46 degrees, while the lowest is -30 degrees.

Words of the Week: Cooking Snow

Sometimes referred to as water snow, this is dense snow which when melted yields a higher than normal water content. This may be as much as a third to a half inch of water per inch of snow. In pioneer times when snow was melted and used as winter water supply, cooking snow could be harvested in kettles and boiled for food preparation or for drinking.

Topic: Ice crystals found in snow

The shape of ice crystals, the building block of snowflakes, vary considerably. Shape and size are dependent on the temperature and water vapor conditions within clouds. At very cold temperatures, 5 degrees F and colder, small hexagonally shaped hollow columns and dendritic (multiple branching) shapes of ice crystals are common. At warmer temperatures, 20 to 30 degrees F, ice needles and flat hexagonally shaped plates are the more common shapes of ice crystals.

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Outlook:

Looks like a chance for snow statewide on Saturday, lingering a bit in the north on Sunday. Near seasonal normal temperatures into the middle of next week, then turning sharply colder from Thursday through Saturday, though not as bitter as we have already experienced.

To: Greg Magnuson, Bob Potter, and John Bischoff
From: Mark Seeley
Re: Suggestions for MPR's Morning Edition, Friday, Feb. 16, 1996

How does 109 to 112 degrees F sound? That's what parts of Australia have been experiencing this week.

Topic: Spring snowmelt and flood potential

Gary McDevitt will discuss the official outlook statement from the National Weather Service. Although soil moisture levels are high, soil frost is deep in some places, and snow water equivalents are in the 3 to 6 inch range, late winter thaws of relatively brief duration may help gradually drain the landscape of many Minnesota watersheds and ease the flood threat this spring.

In fact a thaw period appears to be in store next week, at least across southern Minnesota, as the period from Tuesday through Saturday favors above normal temperatures. The outlook for March favors somewhat below normal temperatures and near normal precipitation. However with the abundance of moisture in the soil and on the surface, even individual storms may be significant enough to increase the risk of flooding in some areas.

Forecaster's terminology: Partly Cloudy

This term is used in forecasts to describe the expected character of day with respect to sky conditions. It indicates expected cloud cover ranging from 0.3 to 0.6 throughout the day. Often times the degree of cloudiness will vary somewhat from morning to afternoon, especially in summer.

Almanac: Average maximum temperature locally for today's date is 26 (plus or minus 13 degrees standard deviation) and the average minimum is 9 (plus or minus 15 degrees standard deviation).

MSP records for today's date include: a maximum temperature of 60 degrees in 1981; a minimum temperature of -26 degrees F in 1936; record precipitation of 0.17 inches in 1990; and record snowfall of 3.2 inches in 1938.

Greatest snowdepth on this date locally, 26 inches in 1967.

Last measurable snowfall on this date was 1990 when 2.9 inches fell in the Twin Cities. Since 1948, 8 measurable snowfalls have been recorded at the MSP airport on this date.

Scanning the state climatic data base: the all-time high for today's date is 67 degrees F at Canby (Yellow Medicine County) in 1981; the all-time low is -59 degrees F at Pokegam Dam in 1903 (Cass County). This record is suspect because it is much colder than other temperatures recorded that morning (-47 at Detroit Lakes) and because the observer noted that his thermometer was only a foot or so above the snow covered surface.

Average dew point temperature for today is 11 degrees F. The highest dew point on this date is 38 degrees, while the lowest is -29 degrees.

Words of the Week: Snow Water Equivalent

This term is exactly what it implies. A core sample of snow cover is removed from a spot using an inverted cylinder. The snow is melted down and measured as an equivalent precipitation amount in inches. For example, Hallock in Kittson County, along the Red River Valley reported a snow depth of 25 inches earlier this week, with a snow water equivalent of 5.7 inches. This implies that the equivalent of 5.7 inches of water lies on top of the landscape in that area of the state and will be absorbed or runoff as the thawing period begins.

This type of information from Minnesota cooperative weather observers is very useful during February and March when the National Weather Service and River Forecast Office must make estimates of expected stream flows in the major watersheds.

Outlook:

Somewhat cooler than normal this weekend, then starting to warm up later on Sunday and into next week. Chance of rain or snow Monday and Tuesday, then dry and warm the rest of the week, with high temperatures getting into the 30s and the 40s.

To: Greg Magnuson, Bob Potter, and John Bischoff
From: Mark Seeley
Re: Suggestions for MPR's Morning Edition, Friday, Feb. 23, 1996

Listener question: Tom, from Golden Valley, asked if the leap year date of February 29 shows any unusual climate characteristics, since we only have data for that date once every four years.

Naturally, since we sample the environment of that date much less than the other days of the year, there are some notable features in the records for Feb. 29. For one thing, the record minimum temperature for Feb. 29th at MSP is only -9 degrees F. This is far warmer than the record lows for adjacent dates (-26 F on Feb. 28 and -32 F on March 1) which of course occurred in non-leap years. Surprisingly the record high temperature for Feb. 29 is 54 degrees F which is not too different from the adjacent dates. This is perhaps evidence to support the idea of more frequent cases of warm air advection on that date than cold wave outbreaks.

Another interesting feature of the climate statistics for Feb. 29 is the very modest precipitation records. Record precipitation at MSP for the date is only 0.05 inches and record snowfall a mere 0.7 inches. Because we have sampled only 25 leap years in the MSP record, it is understandable that we have not coincidentally measured precipitation from many large storms.

Lastly, since the extra day is really an extension of winter with a mean daily temperature of only 22 degrees F, Feb. 29 typically adds another 43 Heating Degree Days to our heating season.

Thanks to Tom for the interesting question.

Topic: International Weather Anomalies

Minnesota coffee shops have been loaded with conversations about the unusual and record breaking weather this winter, especially the extreme windchills, persistent ice, and record low temperatures. But other regions around the world have experienced some equally noteworthy weather anomalies. Soybean growers in southern Brazil have experienced an exceedingly wet growing season, with some areas reporting 10 inches above normal. While the Scandinavian countries, particularly Norway have been very dry this winter, parts of England and southern Europe have been exceedingly wet. Unusually deep snow fell in central and northern England, while southern France has had rainfall in excess of 6 inches above normal. Heavy rains and flooding in Morocco claimed 19 lives as well.

Almanac: Average maximum temperature locally for today's date is 30 (plus or minus 12 degrees standard deviation) and the average minimum is 13 (plus or minus 13 degrees standard deviation).

MSP records for today's date include: a maximum temperature of 59 degrees F in 1958; a minimum temperature of -18 degrees F in 1910; record precipitation of 0.63 inches in 1977; and record

snowfall of 6.0 inches in 1922.

Greatest snowdepth on this date locally, 27 inches in 1967.

Last measurable snowfall on this date was 1994 when 1.1 inches fell in the Twin Cities. Since 1948, 13 measurable snowfalls have been recorded at the MSP airport on this date.

Scanning the state climatic data base: the all-time high for today's date is 66 degrees F at Luverne (Rock County) in 1958; the all-time low is -44 degrees F at Pine River Dam (Crow Wing County) way back in 1889.

Average dew point temperature for today is 15 degrees F. The highest dew point on this date is 37 degrees, while the lowest is -23 degrees.

Words of the Week: Sastrugi

This is a Russian term. It refers to the wave-like sharp ridges of hard snow which are characteristic of the wind swept flat prairie and polar plains, where prevailing winds may chiefly come from one direction for a long period of time. Sastrugi are also called wind ridges and are oriented perpendicular to the prevailing wind, with a gentle slope to the windward and a steep slope to the leeward. Large sastrugi have been observed on glaciers and ice sheets of Greenland and Antarctica, but they can be found in the prairie landscapes of the Dakotas, the Red River Valley in NW Minnesota, and other exposed landscapes. Being of a higher density, they are usually the last snow features to melt off in the late winter and early spring.

Outlook:

Precipitation diminishing Friday night, turning cooler over the weekend with temperatures approaching seasonal normals. Another chance for mixed precipitation and windy early next week, then sharply cooler mid week into the weekend. The gradual melting and draining of the Minnesota landscape should continue.

To: Greg Magnuson, Bob Potter, and John Bischoff
From: Mark Seeley
Re: Suggestions for MPR's Morning Edition, Friday, Mar. 1, 1996

March sometimes comes in like a lion and goes out like a lamb.
Looks like that's what's in store this year.

March months which have come in "like a lion and out like a lamb" or in "like a lamb and out like a lion" are remembered for both their storminess and temperature deviation. Standard deviations in daily max and min temperature are generally in the 10 to 11 degree F range during March. Occasionally temperature deviations exceed one standard deviation during the first and last weeks of the month. Using temperature records for the first and last week of March from the Twin Cities, spanning 1900-1995 the following characteristic years fell out.....

"In like a lamb/out like a lion"	"In like a lion/out like a lamb"
1921	1920
1923	1925
1924	1943
1934	1945
1937	1955
1964	1978
1966	1989
	1995

Temperature records confirm these years, 15 in all, fell into one category or the other. But 15 out of 96 years is only 15 percent of the time when this old saying has been true, at least based on temperature standard deviations for March.

Though it has been quite cold this week and not conducive to thinking about Spring, we are gaining a great deal of daylight. From the 1st to the 31st of March we will gain over 1.5 hours of daylight. By the Vernal Equinox on the 20th, the midday elevation of the sun will be 45 degrees above the southern horizon.

Looks like the first part of March will be cooler than normal and unsettled with good chances for snow in the north starting on Saturday and carrying over into much of next week.

Almanac: Average maximum temperature locally for today's date is 32 (plus or minus 12 degrees standard deviation) and the average minimum is 15 (plus or minus 13 degrees standard deviation).

MSP records for today's date include: a maximum temperature of 59 degrees F in 1990; a minimum temperature of -32 degrees F in 1962; record precipitation of 1.65 inches in 1965; and record snowfall of 4.0 inches in 1907.

Greatest snowdepth on this date locally, 23 inches in 1962 and again in 1967.

Last measurable snowfall on this date was 1987 when 1.7 inches fell in the Twin Cities. Since 1948, 7 measurable snowfalls have been recorded at the MSP airport on this date.

Scanning the state climatic data base: the all-time high for today's date is 70 degrees F at Milan (Chippewa County) in 1992,

where the Opjorden family has been making daily observations since 1893; the all-time low is -47 degrees F at Bigfork (Itasca County) in 1962.

Average dew point temperature for today is 14 degrees F. The highest dew point on this date is 39 degrees, while the lowest is -34 degrees.

Words of the Week: Frostburn

Unlike frostbite which can occur to exposed skin in the outdoors, this type of injury is associated with damage to the skin caused by contact with metal surfaces which are well below the freezing point (32 degrees F). Though we don't often experience severe windchills which can cause frostbite during March, we still experience cold enough mornings such that if children touch metal poles, stair railings or other metal objects with bare hands they might suffer from frostburn. So keep those mittens and gloves on!

Outlook:

Remaining very cold, much below normal for the first full week of March. Chances for snow periodically throughout the weekend, especially in the north and then in the south as well for the period from Monday through Wednesday of next week.

To: Greg Magnuson, Bob Potter, and John Bischoff
From: Mark Seeley
Re: Suggestions for MPR's Morning Edition, Friday, Mar. 8, 1996

Topic: Soil Frost and Soil Temperature

Soils freeze up nearly every winter in Minnesota. It is rare when they only freeze up a few inches. The maximum depth of freezing varies geographically around the state and is influenced by snow cover, soil moisture, and vegetative cover. Early snow covers prevent deep penetration of frost. Some recent frost depths are 20 inches at St Paul Campus, 37 inches at Waseca (Southern Experiment Station) and 40 inches at Crookston (Northwest Experiment Station).

Loss of protective snow cover combined with episodes of Arctic type cold air intrusions have caused soil temperatures to plummet recently in some areas of the state. Some measured temperatures at the 4 inch depth have been as low as the single digits to the middle teens F. This may be bad news with respect to winterkill of alfalfa and pasture grasses.

Just as we dispelled the myth about the high frequency of "in like a lion, out like a lamb" March weather in our discussion last week, I would like to comment on the loss of soil frost. Indeed, our days are getting longer as the sun gets higher in the sky this month. And indeed as we lose the snow and ice cover the soil will become exposed to the sun and start to thaw. But the thawing process occurs from both the top and the bottom of the frost layer. Below 3 meters, soil temperature is almost a constant 48 degrees, thus a heat source for thawing the frozen layer of soil above is always present. Because this spring thawing comes from both above and below, the final frost layer is often around 16 to 20 inches below the surface. When this layer is finally thawed the ponded water often seen perched on top of frozen soil can disappear overnight.

Almanac: Average maximum temperature locally for today's date is 33 (plus or minus 10 degrees standard deviation) and the average minimum is 17 (plus or minus 11 degrees standard deviation).

MSP records for today's date include: a maximum temperature of 61 degrees F in 1898; a minimum temperature of -7 degrees F in 1967; record precipitation of 0.80 inches in 1990; and record snowfall of 5.7 inches in 1928.

Greatest snowdepth on this date locally, 22 inches in 1962.

Last measurable snowfall on this date was 1990 when 1.7 inches fell in the Twin Cities. Since 1948, 13 measurable snowfalls have been recorded at the MSP airport on this date.

Scanning the state climatic data base: the all-time high for

today's date is 80 degrees F at Mankato in 1987; the all-time low is -35 degrees F at Big Falls (Koochiching County) in 1943. On this date in 1967, Theilman in Wabasha County reported a daytime high of 28 degrees F and a nighttime low of -28 degrees, a mere 56 degree daily temperature range.

Average dew point temperature for today is 15 degrees F. The highest dew point on this date is 42 degrees, while the lowest is -15 degrees.

Words of the Week: Ice Run

This is not a trip to the local SuperAmerica or Tom Thumb for a bag of ice cubes. This term refers to the initial breakup of river ice during the late winter and early spring. Flows of ice are usually somewhat shortlived, lasting from 1 to 3 days. This often occurs on the major rivers of Minnesota during the month of March. Large flows of ice can sometimes jam up in narrow channels and produce local flooding, as often occurs along the Root River in SE Minnesota.

Late Winters: Speaking of ice, there was a recent article by the Kandiyohi County Historical Society) about the long hard winter of 1856-57 in Minnesota. Following heavy snow and cold temperatures from December through March, April of 1857 was the coldest on record, averaging 13 degrees F below normal for the month. Pioneer settlers walked across the ice on Chisago Lake (Chisago County) on May 11th and snow cover was still observed in the wooded hills around Duluth-Superior as late as June 24th. Should we ever have a winter last so long in modern times, we'd have to conduct the fishing opener in May as an ice fishing affair.

Outlook:

Looks like a moderation in temperature over the weekend and then quite a dramatic warm up next week. It's about time, but with the abundant snow cover in many areas, I hope we don't thaw out too fast.

To: Greg Magnuson and John Bischoff
From: Mark Seeley
Re: Suggestions for MPR's Morning Edition, Friday, Mar. 15, 1996

Interesting article in this past month's Weather Magazine (Royal Meteorological Society) about the wind and weather effects on battle campaigns. Hurricane, Lightning, Thunderbolt, Tornado, Typhoon, and Whirlwind are all weather features, but they are also the names of military aircraft. During battle, the weather can greatly amplify or inhibit the effectiveness of any tactics used. Severe Russian winters effectively destroyed the campaigns of Napoleon and Hitler. Cavalry campaigns in WWI were based on forcing your opponent to ride through the lower terrain, where the ground was wetter and the going was slow. Keeping the wind and sun on your back has always been a rule of thumb, even back to the days of ancient Greece and Rome. Even in modern times, Nato aircraft have used low cloud or the blinding low sun angle to help disguise their approaches to targets on the ground in Bosnia.

Almanac: Average maximum temperature locally for today's date is 36 (plus or minus 11 degrees standard deviation) and the average minimum is 20 (plus or minus 12 degrees standard deviation).

MSP records for today's date include: a maximum temperature of 69 degrees F in 1927; a minimum temperature of -7 degrees F in 1897; record precipitation of 0.85 inches in 1945; and record snowfall of 5.0 inches in 1899.

Greatest snowdepth on this date locally, 24 inches in 1962.

Last measurable snowfall on this date was 1990 when 0.8 inches fell in the Twin Cities. Since 1948, 11 measurable snowfalls have been recorded at the MSP airport on this date.

Scanning the state climatic data base: the all-time high for today's date is 72 degrees F at Pipestone and Tracy in 1930, at New Ulm and Winnebago in 1935, and most recently at Browns Valley in 1981; the all-time low is -49 degrees F at Pokegama Falls (Itasca County) in 1897.

On this date in 1897 Detroit Lakes reported a morning low of -43 degrees F, by the next afternoon (March 16) the temperature was 45 degrees F, a rise of 88 degrees F in one day! Shows the impact of air mass and wind direction during the month of March.

Average dew point temperature for today is 20 degrees F. The highest dew point on this date is 48 degrees, while the lowest is -11 degrees F.

Words of the Week: Ramsonde or Ram Penetrometer

This is a cone-tipped metal rod designed to be driven into deposits of snow and ice. The measured force required to drive the rod a given distance into the snow or ice pack is

an indication of the physical properties, primarily density.

This is not used much anymore. Observers take core samples and melt them down, or snow water equivalence are taken by remote sensing techniques.

Topic: Remote Sensing of Snow Water Equivalence

This is the time of year when the National Operational Hydrologic Remote Sensing Center of the National Weather Service (located in Chanhassen, MN) contributes mightily to the effort to provide water supply outlooks, spring flood outlooks, and river and stream flow forecasts.

Airborne snow surveys are made over 1500 flight lines covering 25 states and 7 Canadian provinces. Sensors designed to measure the attenuation of gamma radiation emitted from the ground are used to estimate snow water equivalence. Terrestrial gamma radiation is emitted from potassium, uranium and thorium radioisotopes in the upper 8 inches of the soil layer. Fall flight lines establish the background signal for this emitted radiation. Then, during the late winter when snow covers the land, the flight lines are flown again. The mass of water contained in the snow cover attenuates or blocks the terrestrial radiation signal from the radioisotopes in the soil. The difference between the airborne radiation measurements made over bare ground in the fall and over snow cover in the winter can be used to estimate a mean areal snow water equivalence with an average error of less 0.5 inches.

These data are commonly factored into the spring flood outlooks and streamflow forecasts which we receive from the National Weather Service for the major watersheds in our region.

Outlook:

Looks like mild conditions will be coming to an end for awhile after today. Increasing clouds on Saturday and cooling down starting on Sunday. A chance for rain, sleet and snow from late Saturday into early Monday. Below normal temperatures next week with a somewhat greater chance for precipitation toward the weekend.

The new 30 day outlook for April calls for near normal temperature and precipitation in Minnesota.

To: Bob Potter, Greg Magnuson and John Bischoff
From: Mark Seeley
Re: Suggestions for MPR's Morning Edition, Friday, Mar. 22, 1996

Almanac: Average maximum temperature locally for today's date is 42 (plus or minus 12 degrees standard deviation) and the average minimum is 24 (plus or minus 10 degrees standard deviation).

MSP records for today's date include: highest daily maximum temperature of 71 degrees F in 1945, lowest daily maximum temperature of 14 degrees F in 1940; lowest daily minimum temperature of -4 degrees F in 1940, highest daily minimum temperature of 44 degrees F in 1910; record precipitation of 1.40 inches in 1952; and record snowfall of 13.7 inches in 1952 as well.

Average dew point on this date is 23 degrees, with a maximum of 49 degrees F and a minimum of -10 degrees F

Greatest snowdepth on this date locally, 20 inches in 1951 and 1965.

Last measurable snowfall on this date was 1993 when 0.2 inches fell in the Twin Cities. Since 1948, 10 measurable snowfalls have been recorded at the MSP airport on this date.

Scanning the state climatic data base: the all-time high for today's date is 81 degrees F at Pipestone in 1939; the all-time low is -30 degrees F at Pokegama Falls (Itasca County) and Pine River Dam way back in 1888.

Words of the Week: Ephemeral Erosion

This term comes from the Greek word ephemeros meaning something which lasts just one day, is short lived or transient by nature. Certainly certain weather features brought on by storms can be thought of as ephemeral.

We are coming to the time of year when the soils are exposed to the erosive forces of wind and water (both snowmelt runoff and rainfall). Ephemeral erosion refers to the short-lived erosion which occurs from rapid snowmelt or rainfall events that produce gullies and rivulets in the landscape. This type of erosion, though relatively short in duration can carry off significant amounts of sediment and plant residues into our drainage ditches, streams and rivers. As native perennial vegetation greens up and fields are planted to crops, the soil surface becomes more protected from wind and rainfall effects.

Topic 1:

Memorable features of the recent winter:

The severity of the recent winter is for the most part disguised by the mean monthly statistics which show few significant deviations in terms of precipitation or temperature. October was wetter than normal statewide and produced some early snowfall deposition in northern parts of the state, a sign of an early winter. This was followed by November temperatures which ranked in the coldest 10 percent this century for most of the state, with many below

zero readings in northern Minnesota. By mid November, most of us realized that the hibernal season was here as temperatures averaged 10 to 15 degrees colder than normal and winchill values of -30 to -40 degrees had already occurred. Migrating birds and hibernating animals took note and disappeared from our landscape.

Exceptionally low windchill readings continued to occur, albeit in somewhat brief episodes. The second week of December produced WC readings from -50 to -60 and accelerated the formation of thick lake ice, though not thick enough for some early season snowmobilers.

Then winter turned wimpy in time for the holiday season, with mild temperatures prevailing until the week following the New Year. The episodes of very cold weather began to occur again, this time accompanied by more snow in the north, but rain and ice in the south. One to two inches of rain fell in many places and formed an ice sheet or an ice covered snow pack over the landscape. The effects of the smothering ice may yet be noticed this spring as damaged vegetation tries to emerge from the thawing soil.

Snow accumulations in the north reached near record values, as many of the observers reported snow depths ranging from 3 to 5 feet. The combined effects of deep snow and episodes of severe cold produced very stressful weather for wildlife, including Minnesota's deer population. Supplemental deer feeding was started by the DNR.

As the end of January approached, instead of moderating, winter's grip tightened to a stranglehold. The period from January 30 to February 5 was one of the coldest weeks in the history of the state, with a mean statewide temperature for the week of -20 degrees F, and many individual community records were shattered. The -60 degree F state record recorded at Tower, MN on February 2 made the national news. Windchill values fell into an unheard of abyss, somewhere between -70 and -100 degrees F around the state. After so many days in the deep freeze, making 0 degrees F again seemed like a heatwave.

Brief spells of warmer than normal temperatures later in February teased us and helped rid the landscape of some ice, but then the end of the month and the first ten days of March saw temperatures average 15 to 20 degrees colder than normal. A mid March spell of mild temperatures and the Vernal Equinox have once again given us hope for spring-like shirt sleeve weather in the not too distant future. But, despite the fact that the sun has gained over 22 degrees in midday altitude and that daylength is over 3.25 hours longer than it was in early January (gaining 3 to 4 minutes each day now), our soils are still frozen, there is still very cold air to the north and the atmospheric patterns suggest that we may need to take a tranquilizer to calm our spring fever. The balance of March appears to favor colder than normal temperatures on the whole, with brief excursions to near normal or slightly above normal conditions. At least that pattern should help alleviate any flooding threat from the melting snowpack.

Topic 2: Remote Sensing of Snow Water Equivalence

This is the time of year when the National Operational Hydrologic Remote Sensing Center of the National Weather Service (located in Chanhassen, MN) contributes mightily to the effort to provide water supply outlooks, spring flood outlooks, and river and stream flow forecasts. Their products can be viewed on the World Wide Web at URL <http://www.nohrsc.nws.gov>

Airborne snow surveys are made over 1500 flight lines covering 25 states and 7 Canadian provinces. Sensors designed to measure the attenuation of gamma radiation emitted from the ground are used to estimate snow water equivalence. Terrestrial gamma radiation is emitted from potassium, uranium and thorium radioisotopes in the upper 8 inches of the soil layer. Fall flight lines establish the background signal for this emitted radiation. Then, during the late winter when snow covers the land, the flight lines are flown again. The mass of water contained in the snow cover attenuates or blocks the terrestrial radiation signal from the radioisotopes in the soil. The difference between the airborne radiation measurements made over bare ground in the fall and over snow cover in the winter can be used to estimate a mean areal snow water equivalence with an average error of less 0.5 inches.

These data are commonly factored into the spring flood outlooks and streamflow forecasts which we receive from the National Weather Service for the major watersheds in our region.

Outlook:

Looks like we will not escape from March without at least one stormy week. Starting this weekend and lasting to about the middle of next week, we should see some snow in the north and mixtures of snow, sleet and rain in the south. It will also stay pretty windy, with temperatures averaging below normal. Mother Nature testing our patience for spring I guess.

To: Bob Potter, Greg Magnuson and John Bischoff
From: Mark Seeley
Re: Suggestions for MPR's Morning Edition, Friday, Mar. 29, 1996

Topic: Unusual week of weather

What an interesting week. Record snowfall for March 25th at many places, including the 10.5 inches at MSP. Record low minimum and maximum temperatures and the -10 degrees F at MSP on March 26th was latest that such a low temperature has occurred in the month of March in the Twin Cities, breaking the previous record for a -10 degree F reading which was on March 16, 1900. We recorded a -12 degree F reading at the St Paul Campus on Tuesday (March 26)

In addition the very low relative humidity of 20 to 30 percent on Tuesday combined with the strong sun produced a good deal of sublimation and evaporation as steam could be seen rising from a variety of surfaces. This was evident on parked cars when the snow and ice which had collected on roof tops and hoods disappeared without melting first.

Almanac: Average maximum temperature locally for today's date is 45 (plus or minus 12 degrees standard deviation) and the average minimum is 28 (plus or minus 10 degrees standard deviation).

MSP records for today's date include: highest daily maximum temperature of 83 degrees F in 1986, lowest daily maximum temperature of 13 degrees F in 1969; lowest daily minimum temperature of -5 degrees F in 1969, highest daily minimum temperature of 57 degrees F in 1910; record precipitation of 0.62 inches in 1924; and record snowfall of 11 inches in 1924 as well.

Average dew point on this date is 25 degrees, with a maximum of 53 degrees F and a minimum of -13 degrees F.

Greatest snowdepth on this date locally, 27 inches in 1965.

Last measurable snowfall on this date was 1983 when 0.3 inches fell in the Twin Cities. Since 1948, 5 measurable snowfalls have been recorded at the MSP airport on this date.

Scanning the state climatic data base: the all-time high for today's date is 83 degrees F at Winona in 1910, later tied in 1986 at MSP, Gaylord, Stillwater and St Paul's Holman Field; the all-time low is -23 degrees F at Itasca State Park in 1921.

Words of the Week: Snow Banner

This term refers to the snow which is seen blowing from a hill or mountain crest, often fanning out into a banner shape. Sometimes from high mountain tops this is mistaken for volcanic smoke. Other terms used to describe this phenomenon

are snow smoke or snow plume.

Community Notes: Stillwater, MN

River stage has been recorded in this community since the 1850s. The river gage readings taken today are important in forecasting the flows and flood potential on both the St Croix and the Mississippi Basins.

Daily precipitation records were started by Myron Brown in April of 1905, but daily max/min temperature records did not start until 1944. There are surprisingly few long term climate records along the St Croix River, so the Stillwater climate record is an important one.

Climate records at Stillwater include: 106 degrees F on July 3-4, 1990; -40 degrees F on January 9, 1977; 7.98 inches of rainfall on June 1, 1967; and 17 inches of snowfall on January 23, 1982. On April 9, 1987 after a chilly overnight low of 16 F the temperature rose 64 degrees to a high of 80 F in the afternoon.

Preliminary March Summary:

Temperatures for the month of March have averaged 5 to 8 degrees colder than normal with several recording setting cold temperatures as well. Precipitation has generally been less than normal, except for parts of southern Minnesota which received from 1 to 2.5 inches from the storm earlier this week.

Outlook:

Stormy Friday into early Saturday. Don't know whether to say snow or rain. We'll see. Drier by Monday, but staying on the cooler side of seasonal normals. Perhaps moderating in the 40s and 50s for Easter Weekend next week.

To: Bob Potter, Greg Magnuson and John Bischoff
From: Mark Seeley
Re: Suggestions for MPR's Morning Edition, Friday, Mar. 29, 1996

Almanac: Average maximum temperature locally for today's date is 45 (plus or minus 12 degrees standard deviation) and the average minimum is 28 (plus or minus 10 degrees standard deviation).

MSP records for today's date include: highest daily maximum temperature of 83 degrees F in 1986, lowest daily maximum temperature of 13 degrees F in 1969; lowest daily minimum temperature of -5 degrees F in 1969, highest daily minimum temperature of 57 degrees F in 1910; record precipitation of 0.62 inches in 1924; and record snowfall of 11 inches in 1924 as well.

Average dew point on this date is 25 degrees, with a maximum of 53 degrees F and a minimum of -13 degrees F

Greatest snowdepth on this date locally, 27 inches in 1965.

Last measurable snowfall on this date was 1983 when 0.3 inches fell in the Twin Cities. Since 1948, 5 measurable snowfalls have been recorded at the MSP airport on this date.

Scanning the state climatic data base: the all-time high for today's date is 83 degrees F at Winona in 1910, later tied in 1986 at MSP, Gaylord, Stillwater and St Paul's Holman Field; the all-time low is -23 degrees F at Itasca State Park in 1921.

Words of the Week:

Topic: Remote Sensing of Snow Water Equivalence

This is the time of year when the National Operational Hydrologic Remote Sensing Center of the National Weather Service (located in Chanhassen, MN) contributes mightily to the effort to provide water supply outlooks, spring flood outlooks, and river and stream flow forecasts. Their products can be viewed on the World Wide Web at URL <http://www.nohrsc.nws.gov>

Airborne snow surveys are made over 1500 flight lines covering 25 states and 7 Canadian provinces. Sensors designed to measure the attenuation of gamma radiation emitted from the ground are used to estimate snow water equivalence. Terrestrial gamma radiation is emitted from potassium, uranium and thorium radioisotopes in the upper 8 inches of the soil layer. Fall flight lines establish the background signal for this emitted radiation. Then, during the late winter when snow covers the land, the flight lines are flown again. The mass of water contained in the snow cover attenuates or blocks the terrestrial radiation signal from the radioisotopes in the soil. The difference between the airborne radiation measurements made over

bare ground in the fall and over snow cover in the winter can be used to estimate a mean areal snow water equivalence with an average error of less 0.5 inches.

These data are commonly factored into the spring flood outlooks and streamflow forecasts which we receive from the National Weather Service for the major watersheds in our region.

Outlook:

To: Bob Potter, Greg Magnuson and John Bischoff
From: Mark Seeley
Re: Suggestions for MPR's Morning Edition, Friday, Apr. 5, 1996

Topic: Slow Spring

This has been the type of winter which Minnesota folklore is founded upon. It lingers and lingers. Even saw ice fisherman out on the lakes in the pickups earlier this week!

The month of March was certainly cold in Minnesota. Historically speaking March of 1996 was in the coldest 20 percent in southern Minnesota and the coldest 10 percent in northern areas since 1895. This puts a bookend on our winter with respect to temperature anomalies. Winter started early because last November happened to fall in the coldest 10 percent historically as well. So the combined early start to winter and late finish have made the hibernal season unusually long for us. In fact many areas of northern Minnesota still have 2 to 3 feet of snow on the ground.

Soil frost is still deep in many places.

At Crookston, soil is frozen from the surface to 45 inches
At Morris, soil is frozen from the surface to 28 inches
At Lamberton, soil is frozen from 3 inches to 13 inches
At Waseca, soil is frozen from 17 inches to 40 inches
At St Paul, soil is frozen from 4 inches to 21 inches

Had a question this week, "Isn't this rather late in the year to have not recorded a 60 degree F temperature yet in the Twin Cities?" Yes, but it is not especially unusual to go this long without seeing 60 degrees F. Since 1891, there have been 35 years when we have not recorded 60 degrees F by this date. The latest we have gone before reaching the 60 degree F mark was 1904 when it did not occur until April 26th.

We are setting a record today. MSP has not recorded a temperature of 60 degrees F or greater since October 17, 1995. This marks 171 consecutive days below 60 degrees which is a new record for longevity, breaking the old record of 170 days below 60 degrees F recorded in the winters of 1950-51 and 1959-60.

On the other hand we have reached 70 degrees F or better by this date in 31 springs since 1891.

Almanac: Average maximum temperature locally for today's date is 50 (plus or minus 11 degrees standard deviation) and the average minimum is 32 (plus or minus 8 degrees standard deviation).

MSP records for today's date include: highest daily maximum temperature of 80 degrees F in 1991, lowest daily maximum temperature of 29 degrees F in 1982; lowest daily minimum temperature of 12 degrees F in 1979, highest daily minimum temperature of 60 degrees F in 1921; record precipitation of 0.78 inches in 1967; and record snowfall of 1.5 inches in 1964.

Average dew point on this date is 27 degrees, with a maximum of 50 degrees F and a minimum of -2 degrees F.

Greatest snowdepth on this date locally, 8 inches in 1975.

Last measurable snowfall on this date was 1982 when 0.3 inches fell in the Twin Cities. Since 1948, 6 measurable snowfalls have been recorded at the MSP airport on this date.

Scanning the state climatic data base: the all-time high for today's date is 88 degrees F at Madison (Lac Qui Parle County) in 1991; the all-time low is -18 degrees F at Warroad in 1936.

Words of the Week: Wire-Weight Gage

This is a type of river gage still routinely used in many places. A weight is suspended from a wire and lowered from a bridge of known elevation down to the water surface. The distance from the bridge to the water surface is usually measured by counting the number of revolutions of a drum or coil as the wire is released to lower the weight. Sometimes the drum or coil has a counter on it which relates directly to river stage. The Army Corps of Engineers, U.S. Geological Survey and National Weather Service still use these measurements on major river basins.

Community Notes: Stillwater, MN

River stage has been recorded in this community since the 1850s. The river gage readings taken today are important in forecasting the flows and flood potential on both the St Croix and the Mississippi Basins.

Daily precipitation records were started by Myron Brown in April of 1905, but daily max/min temperature records did not start until 1944. There are surprisingly few long term climate records along the St Croix River, so the Stillwater climate record is an important one.

Climate records at Stillwater include: 106 degrees F on July 3-4, 1990; -40 degrees F on January 9, 1977; 7.98 inches of rainfall on June 1, 1967; and 17 inches of snowfall on January 23, 1982. On April 9, 1987 after a chilly overnight low of 16 F the temperature rose 64 degrees to a high of 80 F in the afternoon.

Outlook:

Unseasonably cold this weekend, with a chance of snow on Saturday. Then cool and dry Sunday and Monday. Some moderation in temperature Tuesday through Friday next week, but still a few degrees colder than normal. Perhaps we will climb to normal temperatures by next weekend.

To: Bob Potter, Greg Magnuson and John Bischoff
From: Mark Seeley
Re: Suggestions for MPR's Morning Edition, Friday, Apr. 12, 1996

Beautiful weather on Wednesday and Thursday. Saw quite a few short sleeves and cutoffs on campus. Warm temperatures, low humidity and much sun produced a great deal of evaporation. Many people took advantage of the warm spell to air out their houses for the first time and remove storm windows.

Lost more soil frost as well. Only about 6 inches left in the soil under sod (top 3 inches thawed), and about 10 inches left under bare soil (thawed to about 10 inches, then frozen from 10 to 20 inches down).

Topic: Comments on Lake Ice Out

DNR has been wrestling with the speculation that lake ice will still be present in some areas for the Fishing Opener scheduled for May 11. This should not be misconstrued as a measure of some unique climate anomaly that is occurring this spring. Certainly, there will still be lake ice in some northern counties for the Fishing Opener, but this is not all that unusual.

Jim Zandlo, our State Climatologist points out that ice out dates on most Minnesota lakes in recent years have been earlier than historical averages, perhaps biasing our view toward an earlier spring. There have been occurrences of remarkably late springs and late ice out dates. Gunflint Lake in Cook County has lost ice as late as May 26 (1966), Vermillion in St Louis County as late as May 23 (1950), and Mille Lacs as late as May 8th (1975). Locally, Waconia Lake in Carver County has lost lake ice as late as May 1 (1965) and White Bear Lake as late as May 4 (1950). In pioneer times, Chisago Lake had lake ice as late as May 11 (1857) and Minnetonka had lake ice to May 5th in 1858.

Lake ice out dates this year will likely be one week to 12 days later than normal according to the State Climatology Office. Who knows may that will produce some voracious fish.

Almanac: Average maximum temperature locally for today's date is 55 (plus or minus 12 degrees standard deviation) and the average minimum is 35 (plus or minus 8 degrees standard deviation).

MSP records for today's date include: highest daily maximum temperature of 83 degrees F in 1931, lowest daily maximum temperature of 28 degrees F in 1950; lowest daily minimum temperature of 12 degrees F in 1962, highest daily minimum temperature of 60 degrees F in 1941; record precipitation of 0.67 inches in 1983; and record snowfall of 6.0 inches in 1962.

Average dew point on this date is 31 degrees, with a maximum of 54 degrees F and a minimum of -1 degrees F.

Greatest snowdepth on this date locally, 3 inches in 1962.

Last measurable snowfall on this date was 1991 when 1.1 inches fell in the Twin Cities. Since 1948, 3 measurable snowfalls have been recorded at the MSP airport on this date.

Scanning the state climatic data base: the all-time high for today's date is 90 degrees F at Beardsley (Big Stone County) in 1931; the all-time low is -6 degrees F at Roseau in 1950.

Words of the Week: Staff Gage

Last week we mentioned the measuring of a stream or a river stage using a wire weight gage lowered from a bridge of known elevation. A staff gage also measures river stage and is more commonly seen around the state. Its name stems from the fact that it often looks like a wooden staff, similar to that used for walking support. It is a graduated scale depicted on posts, piers, pilings, or bridge supports partially submerged along a stream or river bed which show the measured height of the water. These are common on many watersheds in Minnesota.

A second form of staff gage is biological. That's the staff member that an office manager often consults to determine how staff morale is!

Community Notes: Pipestone, MN

This county seat in southwestern Minnesota has a population of about 4500. It sits upon the Buffalo Ridge and is one of the highest points in the state at 1735 ft above sea level.

Daily climate observations were started by Mr. D.S. Harris in June of 1898. Since that time over two dozen volunteer observers have kept a continuous record of daily climate observations. Currently staff at the Pipestone National Monument make daily observations. This climate record is important to SW Minnesota, as it represents a time series of observations high in the landscape and because there are so few climate stations in the area.

Records at Pipestone include: a high temperature of 108 degrees F on 8/3/30, 5/30/34, 7/5/36, and 7/15/36; a low temperature of -40 degrees F on 1/12/12; 6.18 inches of rainfall on 6/17/57; 12 inches of snowfall on 2/10/65 and 12/28/82; 39 inches of snow on the ground on 3/1/69; and a temperature rise of 63 degrees F, overnight low of -32 degrees and afternoon high of 41 degrees F on 1/6/24.

Outlook:

Looks like a chance for precipitation into early Sunday, then dry and cooler than normal until Tuesday. The storm path favors snow in central and northern Minnesota, where soil temperatures are still in the low 30s. However snowfall in southern Minnesota will likely melt with soil temperatures in the low 40s there.

Perhaps a large warm up for Wednesday through Saturday of next week, with some storminess during the middle of the week.

To: Bob Potter, Greg Magnuson and John Bischoff
From: Mark Seeley
Re: Suggestions for MPR's Morning Edition, Friday, Apr. 19, 1996

Topic: Sap Weather

We have been bemoaning the lingering winter-like conditions and the delayed spring which is occurring in Minnesota this year. Late snow cover, deep soil frost, ice jams on rivers, April snowfalls, persistent lake ice have all been discussed. In addition, the weather has also tested the patience of the Minnesota maple syrup producer.

I looked into the climatic effects on this industry and found some interesting information. To have the potential for a good maple sap harvest, you need a good growing season (which we had in 1995) and adequate to surplus fall soil moisture recharge (which we also had in 1995). A good, persistent winter snow cover is helpful as well. Then in late winter, night and day temperatures should start oscillating below and above the freezing level (32 degrees F) to stimulate pressure changes in the tree which then cause a sap flow. The ideal temperature range is 20s F at night followed by upper 30s to mid 40s F during the day. These temperature oscillations should be accompanied by sunny skies and light or calm winds to maximize sap flow.

In Minnesota, sap flow most often occurs in March, but may linger as late as early May in northern counties. On rare occasions it actually starts in February. The longer growing season in southern counties allows trees to produce and store more sugar than the shorter growing season in northern sections. During the sap runs, daytime temperatures of 50 degrees F or above are detrimental to sap quality because bacteria invade and multiply more rapidly producing a darker amber color. Higher temperatures also promote more rapid phenological development of the trees shortening the period to bud swelling, when maple sap goes off flavor or buddy and is no longer harvested. Lower temperatures in the 30s and 40s during harvest help prevent sap fermentation.

This winter and spring sap runs were significantly delayed by colder than normal temperatures and deeply frozen soil which prevented root uptake of water, even though soil moisture was adequate to surplus in most places. There was also a relatively low frequency of days in February and March when night/day temperatures oscillated within the proper range (5-10 degrees either side of freezing) to stimulate pressure changes in the tree (bark, stems, twig, and roots) which force the sap to run. The frequency of the proper night/day temperature range has been much higher during April with 14 of the first 17 days showing oscillations either side of the freezing mark. This has brought on a rather later than normal sap run which will probably not last too long, at least in southern MN. Therefore production may be down from what might have been expected from a favorable 1995 growing season and fall soil moisture recharge. The recent warm up in southern MN will probably end the sap run as bud swelling is

initiated and the sap becomes "buddy." However, parts of central and northern MN still with snow cover will probably continue to have sap runs for the rest of the month as overnight minimums will more frequently approach and fall below the freezing mark.

Old sayings about the maple sap season:

"If the trees go into winter with wet feet, there will be a good sap season." (potential was good this year)

"Sap runs better by day than by night." (certainly, temperature rises sharply during the day assisted by the sun)

"Sixty-three percent of the sap is said to drop before noon." (the sharpest temperature rise occurs in the am and winds usually pick up in the afternoon which slows the sap run)

Almanac: Average maximum temperature locally for today's date is 59 (plus or minus 12 degrees standard deviation) and the average minimum is 39 (plus or minus 9 degrees standard deviation).

MSP records for today's date include: highest daily maximum temperature of 87 degrees F in 1985, lowest daily maximum temperature of 35 degrees F in 1928; lowest daily minimum temperature of 19 degrees F in 1928, highest daily minimum temperature of 67 degrees F in 1985; record precipitation of 1.27 inches in 1970; and record snowfall of 1.2 inches in 1982.

Average dew point on this date is 35 degrees, with a maximum of 62 degrees F and a minimum of 6 degrees F.

Greatest snowdepth on this date locally, 3 inches in 1983.

Last measurable snowfall on this date was 1982 when 1.2 inches fell in the Twin Cities. Since 1948, only 2 measurable snowfalls have been recorded at the MSP airport on this date.

Scanning the state climatic data base: the all-time high for today's date is 95 degrees F at Canby, Lamberton and Springfield in 1985; the all-time low is -3 degrees F at Tower in 1897.

Words of the Week: Jack Wax

Unlike our usual words of the week, this is not a weather, soil, or agricultural term at all and may not be well known outside the maple syrup industry. Jack Wax is a special treat often eaten at the end of the maple sap harvesting season during a "sugaring off party." Hot maple syrup from the evaporator is poured onto snow or crushed ice and eaten with the fingers as a treat. Sort of like an amber colored snowcone I suppose.

Community Notes: Pipestone, MN

This county seat in southwestern Minnesota has a population of about 4500. It sits upon the Buffalo Ridge and is one of the highest points in the state at 1735 ft above sea level.

Daily climate observations were started by Mr. D.S. Harris in June of 1898. Since that time over two dozen volunteer observers have kept a continuous record of daily climate observations. Currently staff at the Pipestone National Monument make daily observations. This climate record is important to SW Minnesota, as it represents a time series of observations high in the landscape and because there are so few climate stations in the area.

Records at Pipestone include: a high temperature of 108 degrees F on 8/3/30, 5/30/34, 7/5/36, and 7/15/36; a low temperature of -40 degrees F on 1/12/12; 6.18 inches of rainfall on 6/17/57; 12 inches of snowfall on 2/10/65 and 12/28/82; 39 inches of snow on the ground on 3/1/69; and a temperature rise of 63 degrees F, overnight low of -32 degrees and afternoon high of 41 degrees F on 1/6/24.

Outlook:

Somewhat stormy into the weekend. Locally, dew point temperatures climbed into the 50s for the first time in many months, indicating advection of greater water vapor into the region. Snow is possible up north, showers and thundershowers in the south into early Saturday. Falling temperatures Sunday and Monday with temperatures cooler than normal. Somewhat on the cool and dry side for next week until Thursday and Friday when a storm system migrates across the region.

The Climate Prediction Center outlook for May is indefinite, with no significant trend above or below normal indicated for either temperature or precipitation.

To: Bob Potter, Greg Magnuson and John Bischoff
From: Mark Seeley
Re: Suggestions for MPR's Morning Edition, Friday, Apr. 26, 1996

Soil temperatures climbed by 5 to 7 degrees this past week. The ice went out on Lake Minnetonka on Wednesday (Apr 24) of this week, about 9 days later than normal. There is still 18 or more inches of ice on some northern MN lakes.

National Weather Service staff will be out at the Mall of America in the WCCO Community Booth on the 2nd Floor of the west wing all day Friday to meet the public and answer questions as part of Tornado Awareness Week.

A listener called to ask if it is unusual that we have only had two days so far above 70 degrees F in the Twin Cities and shouldn't we have seen at least one 80 degree day by now?

Indeed, we are following a recent trend. Since 1991, April has been colder than normal every year (albeit marginally so in '94). We reached 71 degrees on April 11th and 70 degrees on April 19 earlier this month. Historically speaking, since 1891 we have reached at least 75 degrees in the Twin Cities by April 26 in 7 years out of 10 (about 70 percent of the time), further we have recorded at least one 80 degree temperature by this date about 37 percent of the time

Topic: Arbor Day Appreciation for Trees

Last week we talked about maple syrup and praised the maple tree. Today, being Arbor Day, I would like to extend the praise to all trees. Minnesota is home to over 50 species of trees, including the Red (Norway) Pine our state tree.

Harvesting trees provides us with food, lumber, and paper. In addition, some of the byproducts of trees, including resins, gums, and latex are used to make cosmetics, perfumes, soap, adhesives, inks, rubber and medicines. But maintaining live trees in the landscape also has many advantages and environmental benefits.

Trees remove carbon dioxide from the atmosphere and release oxygen. They also remove a number of air pollutants.

In the rural landscape trees have been used as shelterbelts to reduce wind erosion, and to provide wildlife habitat.

In the home landscape, trees can provide an effective barrier to reduce noise, as well as drifting dusts, aerosols and odors. They also visually improve a barren or ugly landscape view.

Trees can also help reduce home energy use. Planting tall dense trees upwind can provide an effective windbreak to reduce the heat carried off from a house in the winter. Deciduous trees can be planted to shade west facing windows, garages, air conditioning units, and paved areas reducing the heating

of these areas in the summer months when their canopies are full, but allowing the benefits of direct sunlight in the winter months when their canopies are bare and sun angles are low.

In general, trees improve the local climate by moderating the extremes of wind, solar radiation, temperature and humidity. Thus, planting a tree remains one of the simplest environmental improvements anyone of us can make.

Almanac: Average maximum temperature locally for today's date is 62 (plus or minus 11 degrees standard deviation) and the average minimum is 41 (plus or minus 8 degrees standard deviation).

MSP records for today's date include: highest daily maximum temperature of 85 degrees F in 1970, lowest daily maximum temperature of 32 degrees F in 1950; lowest daily minimum temperature of 26 degrees F in 1950, highest daily minimum temperature of 60 degrees F in 1915; record precipitation of 1.26 inches in 1893; and record snowfall of 3.0 inches in 1893.

Average dew point on this date is 36 degrees, with a maximum of 59 degrees F and a minimum of 16 degrees F.

No measurable snowfall on this date and no measurable snow depth either in the Twin Cities since 1948.

Scanning the state climatic data base: the all-time high for today's date is 94 degrees F at Marshall (Lyon County) in 1962: the all-time low is 13 degrees F at Thief River Falls (Pennington County) in 1956.

Words of the Week: Dendrochronology

"Dendro" is the Greek term for tree and chronology, the study of time. As early as the 15th century, Leonardo da Vinci wrote about using the succession of wide and narrow growth rings of trees to assess long term wet and dry cycles of climate. Thus the science of constructing long-term climate variations from tree rings was born and continues today.

Much has been learned about historical variations in precipitation in many western U.S. watersheds from studies of drought site species, including Douglas fir, Ponderosa pine, and Bristle cone pine. In California, some historical climate reconstruction has been done using rings from the giant sequoia, going back over 3000 years. In the northeastern U.S. analyses of the rings of hemlock have been similarly used.

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in June of 1898. Since that time over two dozen volunteer observers have kept a continuous record of daily climate observations. Currently staff at the Pipestone National Monument make daily observations. This climate record is important to SW Minnesota, as it represents a time series of observations high in the landscape and because there are so few climate stations in the area.

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Outlook:

Looks cooler than normal with a chance for rain and snow showers for Sunday and Monday. Cooler and drier than normal most of next week then a significant warm up is for the weekend when we might actually see above normal temperatures for a change.

To: Bob Potter, Greg Magnuson and John Bischoff
From: Mark Seeley
Re: Suggestions for MPR's Morning Edition, Friday, May 3, 1996

Total rainfall from the storm on May 2nd was 0.66 inches at the St Paul Climatological Observatory. This is the greatest amount recorded since the 1.15 inches were fell in the rain and ice storm on Jan 17-18.

Well the Wisconsin fishing opener is tomorrow (May 4) and the opener for Minnesota is next Saturday (May 11) and already I have had many enquiries about what the weather will be like for these fishing openers. I find it somewhat odd that so many Minnesotans enquire about the weather for the fishing opener on May 11th, but few if any seem concerned about the weather for Mother's Day on May 12th.

Many lakes in northern Minnesota still have ice on them, up to 12-16 inches in places. The Governor's opener at Bemidji may encounter ice in places.

Daytime soil temperatures have reached 50 degree F (even 60 degrees in places) this week, which is good news for Minnesota farmers trying to get row crops planted. Crops will germinate more readily at these temperatures, and they are expected to rise further next week. Some corn planting has occurred in southern Minnesota this week.

Topic: Distance running at the summer Olympics

I have heard a number of athletes (runners primarily) speculate about the distance running events at the Atlanta Olympic Games this summer, particularly the marathon. One primary concern is running in the heat and humidity that is common to Atlanta in the summer. The muscles of the body generate 11 times as much heat when running as they do when the body is at rest. This heat must be dissipated or the athlete can be subject to hyperthermia (elevated body temperature). Ideal temperatures for marathon running have been estimated to range from 50 to 57 degrees F. This would represent an unusually cold overnight low temperature in the Atlanta area during the summer, which more typically sees overnight minimums on the order of 10 to 20 degrees warmer than that. The combined heat and humidity of summer in Atlanta is not exactly conducive to the dissipation of heat from the body.

But an additional factor to consider may be the wind. Convective thunderstorms, common to the SE states are often accompanied by strong wind flows which precede their occurrence. Research has shown that a 10 mph headwind will increase a runner's energy expenditure by 8 percent, but a 25 mph wind will increase it by 44 percent. Runners may stay in tight groupings during these type of conditions to take turns shielding each other from the wind.

Don't look for any distance running records to be broken at the Atlanta games.

Almanac: Average maximum temperature locally for today's date is 65 (plus or minus 12 degrees standard deviation) and the average minimum is 43 (plus or minus 9 degrees standard deviation).

MSP records for today's date include: highest daily maximum temperature of 93 degrees F in 1949, lowest daily maximum temperature of 35 degrees F in 1954; lowest daily minimum temperature of 18 degrees F in 1967, highest daily minimum temperature of 65 degrees F in 1959; record precipitation of 1.72 inches in 1912; and record snowfall of 0.2 inches in 1954.

Average dew point on this date is 39 degrees, with a maximum of 66 degrees F and a minimum of 13 degrees F.

The only measurable snowfall on this date since 1948 occurred in 1954 when 0.2 inches was recorded. A snow storm on May 2-3 deposited a total of approximately 2.5 inches and produced windchill temperatures of -5 degrees F.

Scanning the state climatic data base: the all-time high for today's date is 97 degrees F at Bird Island and Willmar in 1949; the all-time low is just 6 degrees F at Crookston and Fosston (Polk County) in 1967.

Words of the Week: Jevon's effect

This term refers to the disturbance in the distribution and amount of rainfall caused by the rain gage itself. William Stanley Jevons, a 19th century English mathematician and economist proposed in 1861 that the rain gage commonly used for the measurement of precipitation produces a disturbance in the air flowing past it, causing an irregularity in the distribution and therefore the catch collected in the gage. He showed that the loss of rainfall which would normally have been caught by the gage is proportional to the wind speed. Subsequent to his findings, the British developed a rain gage which was mounted closer to the ground (approx 1 ft above the surface) and another gage was developed which fit within a hole such that the lip of the gage was flush with the surface of the ground. Since that time several devices have been invented to shield rain gages from these effects of winds and eddies interacting with the gage.

By the way, this is one of the few historical examples of an economist making a significant contribution to the field of climatology. Later in his career, Jevons sought a statistical correlation between business cycles and the sunspot cycle.

Outlook:

Perhaps a rainy weekend in store, with a chance for showers both Saturday and Sunday mornings, then a bit warmer, albeit close to seasonal normals next week until Thursday when we might actually see above normal temperatures! These warmer temperatures may linger into the fishing opener weekend.

To: Greg Magnuson and John Bischoff
From: Mark Seeley
Re: Suggestions for MPR's Morning Edition, Friday, May 10, 1996

Northern Minnesota has just come through one of the coldest ever March-April periods. Records for the University of Minnesota Northwest Experiment Station at Crookston show that the March-April mean temperature during 1996 was only 24.8 degrees F. This is nearly 8 degrees colder than the historical average and the third coldest March-April since 1890 (only 1893 at 22.2 degrees and 1950 at 24 degrees were colder).

Embarrass reported two below zero readings during April and a low of only 9 degrees F as recently as April 27th. Generally speaking the area encompassed by Lake of the Woods south to Leech Lake and east to Lake Superior will probably still contain a number of ice covered lakes for the Fishing Opener on Saturday, May 11.

Dave Ruschy of our climate group points out that we have yet to see a 70 degree day on a weekend this spring. Our two earlier 70 degree F days fell on a Thursday (4/11 at 71 F) and a Friday (4/19 at 70 F) in April. The historical average for a 70 degree weekend is April 13, so we are well past that. In fact we have yet to see 72 degrees F in the Twin Cities area. The latest occurrence for this was in 1892, when we didn't record 72 degrees F until May 18th.

Topic: 50th Anniversary of worst May snow storm at MSP

This weekend marks the 50th anniversary of the worst May snow storm in the Twin Cities, May 11-12, 1946, when 3.0 inches fell and brought temperatures down to the mid to upper 20s. Just like this year, May 11-12 fell on a Saturday and Sunday. However, unlike this year, temperatures in April and early May had already reached the 80s and there were definite signs of spring as most vegetation had blossomed and leafed out. Emerged corn, flax and barley crops were damaged, along with fruit trees and berries.

The snow storm started on Saturday (May 11) early evening about 5 pm and lasted into the night and early morning of the 12th. Morning windchill values on both days ranged into the single digits and all-time state low temperature records for May 11th and 12th were set at Fosston and Hallock, respectively, as each recorded 11 degrees F.

I might add that there is documentation of one other 3 inch snow storm in the MSP record, which occurred on May 20th of 1892. However the associated temperatures were not as cold as those of 1946.

Almanac: Average maximum temperature locally for today's date is 66 (plus or minus 10 degrees standard deviation) and the average minimum is 45 (plus or minus 8 degrees standard deviation).

MSP records for today's date include: highest daily maximum temperature of 90 degrees F in 1987, lowest daily maximum temperature of 43 degrees F in 1902; lowest daily minimum temperature of 28 degrees F in 1907, highest daily minimum temperature of 68 degrees F in 1896; record precipitation of 1.40 inches in 1986; and record snowfall of just a trace in 1946, 1948, 1960, and 1966.

Average dew point on this date is 40 degrees, with a maximum of 64 degrees F and a minimum of 14 degrees F.

Scanning the state climatic data base: the all-time high for today's date is 97 degrees F at Beardsley in 1928; the all-time low is just 11 degrees F at Roseau in 1981.

Words of the Week: Fiducial point

From the Latin fiducia, meaning trust or confidence. In meteorology this is taken as a standard reference point on a scale. For example in thermometry, 212 degrees F or 100 degrees C is the boiling point of water and 32 degrees F or 0 degrees C is the melting point of ice. Thus instruments exposed to these conditions should show the associated temperature. Another example is that a hygrometer exposed to a fog layer should indicate 100 percent relative humidity.

In analyses of satellite imagery and aerial photography, landscape features with known coordinates (latitude, longitude) serve as fiducial points for identifying the location of other features.

In the broadcast news category, I am sure that MPR news represents a fiducial point which marks the top end of the scale!

Outlook:

Looks to be dry for both the Fishing Opener and Mother's Day. Temperatures on the cooler than normal side, but winds should be light on Saturday and Sunday with a fair amount of sunshine. Sunday should be a better day than Saturday. Chance of showers by Wednesday and Thursday, primarily in southern Minnesota, with considerably warmer temperatures toward next weekend.

To: Bob Potter, Greg Magnuson and John Bischoff
From: Mark Seeley
Re: Suggestions for MPR's Morning Edition, Friday, May 17, 1996

51 of the past 59 days (Mar. 18 to May 15) we have recorded below normal temperatures. That's about 86 percent. Around the state, many locations have reported below normal daily temperatures between 85 and 90 percent of the time since the Vernal Equinox in March. Everyday this month had been colder than normal until yesterday, May 16th.

Topic: Listener question

A listener who has heard us discuss the lateness of spring and the consistency of below normal temperatures since late March, asked if this pattern is an indication of a cooler than normal summer. Looking at some of the other remarkably analogous cold spring weather patterns (years like 1967, 1950, 1907, 1892 and 1893) shows that in only one case (1893) were summer temperatures above normal. Four of the five years with spring temperature conditions like those of 1996 showed summer temperature patterns that were colder than normal. Of course this is not a large enough statistical sample to be able to test any correlation. But we shall see!

The new summer outlook from the Climate Prediction Center of the National Weather Service suggests that the period from June through August may see somewhat higher than normal temperature conditions. This contrasts with the historical data for analogous springs (above paragraph). So, we'll have to see what happens.

Almanac: Average maximum temperature locally for today's date is 70 (plus or minus 10 degrees standard deviation) and the average minimum is 49 (plus or minus 8 degrees standard deviation).

MSP records for today's date include: highest daily maximum temperature of 93 degrees F in 1987, lowest daily maximum temperature of 48 degrees F in 1916; lowest daily minimum temperature of 31 degrees F in 1915, highest daily minimum temperature of 69 degrees F in 1911; record precipitation of 1.17 inches in 1938.

Average dew point on this date is 45 degrees, with a maximum of 68 degrees F and a minimum of 21 degrees F.

Scanning the state climatic data base: the all-time high for today's date is 100 degrees F at New Ulm and Pipestone in 1934; the all-time low is just 16 degrees F at Tower in 1983.

Word of the Week: Astraphobia

Also termed astraphobia, this derives from the Greek terms astrape meaning lightning and phobia meaning fear. It is the morbid fear of lightning and thunder. Certainly lightning should be feared, unfortunately some people who suffer from this disease are completely incapacitated by storms which bring lightning and thunder. Incidentally, climatology shows that the highest frequency of thunderstorms occurs in June in Minnesota.

Outlook:

Perhaps some showers and thunderstorms late Saturday into early Sunday. Then primarily dry until mid-week, Wednesday or Thursday. Somewhat warm temperatures and higher dew points over the weekend will give way to cooler than normal temperatures for next Tuesday through Thursday. But a drier week should assist farmers with their planting and weed control operations.

To: Bob Potter, Greg Magnuson and John Bischoff
From: Mark Seeley
Re: Suggestions for MPR's Morning Edition, Friday, May 24, 1996

The movie "Twister" is doing extremely well at the box office. For those listeners who are Internet users, there are a few sites where they could learn quite a bit more about tornadoes.

1. The National Severe Storms Lab at Norman, OK
<http://www.nssl.uoknor.edu>
2. The Tornado Project team:
<http://www.tornadoproject.com>
3. The National Weather Service Central Region and Severe Storms Center in Kansas City, MO
<http://www.crhnwscr.noaa.gov>
4. The Tornado and Storm Research Organization (TORRO)
<http://www.zetnet.co.uk/oigs/torro>

Topic: Olfactory senses

Now that the weather is more seasonal the smell of fresh cut grass, as well as blooming lilacs, crab apple and lily of the valley are making my walk to and from work most pleasant this week.

Warm, moist air and low atmospheric pressure contribute to our sensitivity and perception of smells. There is an intriguing article about this by Robert Henson in the current issue of Weatherwise magazine. The theme of the article is the smell of rain or how many people notice a change in the smell of the air just before a rain. There are several theories offered to explain this.

1. Just before a rain, changes in atmospheric pressure cause volatile, aromatic gases produced by bacteria to be released from the soil.
2. Increased moisture (higher water vapor) causes many plants to release volatile aromatic substances more abundantly, such as phenols from bushes and shrubs or terpenes from pine trees.
3. The warm moist air and lower atmospheric pressure which precede rain help keep our nasal passages clear (in the absence of allergens), and we are hypersensitive to smells, some of which we could not pick up under other types of atmospheric conditions.
4. Henson also points out the universal appeal to the smell of rain. Manufacturers of perfumes and fragrances have tried to capture it for many years. There is a psychological and emotional response to the smell of rain which is therapeutic. Many people have fond memories linked with it, or associate it with a maternal bond to Mother Earth, or an image of a clean, fresh and pure landscape. And of course crop producers love the smell of rain, because much of the time it evokes images of a healthy bottom line.

Almanac: Average maximum temperature locally for today's date is 71 (plus or minus 9 degrees standard deviation) and the average minimum is 51 (plus or minus 7 degrees standard deviation).

MSP records for today's date include: highest daily maximum temperature of 86 degrees F in 1977, lowest daily maximum temperature of 49 degrees F in 1893; lowest daily minimum temperature of 32 degrees F in 1925, highest daily minimum temperature of 64 degrees F in 1928; record precipitation of 0.91 inches in 1968.

This is also the latest date in May that we have ever recorded measurable snow in the Twin Cities, when 0.1 inches fell on this date in 1925. That was an interesting May. The early part of the month was dry which favored planting crops. Then the middle part of the month was warm and humid producing numerous heavy thunderstorms. On the 22nd temperatures in southern Minnesota reached a muggy 100 degrees F. Then 36 hours later on the morning of May 24th, temperatures had dropped by 65 to 70 degrees, with lows in the upper 20s and low 30s and snow falling in many places.

Average dew point on this date is 48 degrees, with a maximum of 71 degrees F and a minimum of 21 degrees F.

Scanning the state climatic data base: the all-time high for today's date is 98 degrees F at Beardsley in 1928; the all-time low is 22 degrees F at Cloquet in 1917 and at Roseau and Itasca in 1930.

Word of the Week: Tuba

I know, a large deep toned saxhorn with three to five valves used in orchestras. Well, in meteorology this is a long used name for a funnel cloud or pendant cloud. It is a visibly rotating column in the shape of an inverted cone (looks like a tuba) which descends from a cloud base (usually cumulonimbus). If it descends all the way to the Earth's surface it is known as a tornado, twister or waterspout.

Outlook:

Looks like a chance for rain Friday into Saturday, but only in southern MN. Cool temperatures statewide. Frontal boundary to our south will keep us on the cloudy side even if it doesn't rain. Highs mostly in the 50s and 60s. Sunday and Monday of Memorial Weekend should be dry for the most part, but cloudy with a chance for an isolated shower and thundershower late on Monday. Not exactly good tanning weather.

To: Bob Potter, Greg Magnuson and John Bischoff
From: Mark Seeley
Re: Suggestions for MPR's Morning Edition, Friday, May 31, 1996

Topic: Cold Spring and the Pocket Book

Though there has been some concern about the colder than normal spring, the late planting season and potential effects on the farmer's bottom line, all citizens of Minnesota have already felt the effects of this spring's weather in their energy bills.

Average temperatures for May are ranging from 3 to 5 degrees colder than normal. This is the coldest May since 1983 for most locations, and the coldest since 1967 for others. This pattern follows April temperatures which ranged from 4 to 7 degrees colder than normal, coldest since 1975; and March temperatures which averaged 5 to 8 degrees colder than normal, coldest since 1984. The end result is that heating degree days (the index used to estimate residential and commercial energy use, primarily for heating), for the past three months have ranged from 17 to 24 percent greater than normal. This is a fairly substantial departure, since the coefficients of variation for heating degree days are only 10 to 12 percent.

The total heating degree days (ave daily temperature accumulation below a base of 65 degrees F) for the three months, March - May is unequaled since the spring of 1975. I am sure that those citizens who pay their utility bills based on current energy use rather than in equal monthly installments can attest to this.

On the other hand, I am sure our children have been quite a bit more comfortable in school this spring. Many of our school buildings are poorly ventilated or not air conditioned and become increasingly uncomfortable near the end of the school year when outside temperatures can reach the 80s and 90s.

Almanac: Average maximum temperature locally for today's date is 74 (plus or minus 9 degrees standard deviation) and the average minimum is 54 (plus or minus 8 degrees standard deviation).

MSP records for today's date include: highest daily maximum temperature of 106 degrees F in 1934, lowest daily maximum temperature of 55 degrees F in 1897; lowest daily minimum temperature of 38 degrees F in 1897, highest daily minimum temperature of 75 degrees F in 1934; record precipitation of 2.39 inches in 1965.

Average dew point on this date is 50 degrees, with a maximum of 73 degrees F and a minimum of 27 degrees F.

Scanning the state climatic data base: the all-time high for today's date is 112 degrees F at Maple Plain in 1934; the all-time low is 22 degrees F at Milan and Campbell in 1897 and at Bigfork in 1964.

The high temperature record for this date (at Maple Plain) is also the highest temperature ever recorded in May. This occurred on the last day of May in 1934, the warmest May in the state records. Afternoon relative humidity that day was just 13 percent. In fact, being one of the driest Mays in the state record, relative humidities of less than 20 percent were recorded on 15 days that month. Most places received less than an inch of rain during the month, with Maple Plain reporting only 0.13 inches. Some of the worst dust storms ever recorded in the state occurred that month, depositing up to 6 inches of soil across many Minnesota roads. Western and northern areas were also plagued with brush, forest and peat fires.

On this date in 1946, the University of Minnesota Cloquet Forestry Center reported a high of 40 degrees, a low of 31 degrees and "snow flurries." Almost unbelievable!

Word of the Week: Konimeter (dust counter)

This is a generic name applied to an instrument which measures the dust content of the air. It comes from the Greek words *konia*, meaning dust and *meter* to measure. There are several types including a cascade impactor, a Aitken dust counter, an Owens dust counter and a nucleus counter. Some measure both the quantity and size distribution of particles in the lower atmosphere. Some were invented and patented during the Dust Bowl era of the 1930s.

Several types of konimeters are used in mines and cement mills to measure the dust content which workers are exposed to. Tolerable limits are imposed as standards to protect workers from health hazards.

Outlook:

Looks a bit unsettled and stormy for Friday and Saturday, then dry Sunday through Thursday, except perhaps in NE MN. Daily temperatures should be slightly either side of season normals, and there will be plenty of sunshine. Toward the end of the week and into next weekend, it looks like some warm and humid conditions will move into the region.

To: Bob Potter, Greg Magnuson and John Bischoff
From: Mark Seeley
Re: Suggestions for MPR's Morning Edition, Friday, June 7, 1996

Listener question: What has been the longest period in the Twin Cities without measurable rainfall during the growing season when garden and landscape plants need watering?

Most people might think that the answer to this question relates to the severe drought years of 1934, 1936, 1976 and 1988. Actually, no. The longest growing season period without measurable rainfall was 23 consecutive days, from 7/24 to 8/15 in 1947, a moderate drought year. One of 22 consecutive day duration (6/20 to 7/11) occurred in 1980, another moderate drought year.

Incidentally, the longest period without measurable rainfall that I could find in the state climate records was 79 consecutive days, which occurred in a number of locations from 11/9/43 to 1/26/44. Fortunately plants need little if any water during this period.

Movie Review: Fallacies in the movie "Twister"

This popular movie is composed of a heroic storyline and great special effects, but many meteorologists have been asked to comment on the scientific authenticity of the research depicted.

There are two major errors in the movie script. One is the message that the National Severe Storms Laboratory in Oklahoma is the lead governmental office for forecasting tornadoes. This is actually done by the National Weather Service Storm Prediction Center in Kansas City, MO. It is their responsibility. The Severe Storms Laboratory in Oklahoma is a research and training facility for meteorologists.

A second error lies in the message that tornado intensity as defined by the Fujita-Pearson Scale can be forecasted. The Fujita-Pearson Scale of tornadic intensity was developed from years of investigating tornado damage sites. The scale rating, F0 for weak with light damage to F5 for violent with incredible damage, was derived from estimating the forces required to cause the destruction observed. It is still that way. The intensity of a tornado is not identified until a damage survey has been done. Therefore tornado intensity is not forecasted!

Almanac: Average maximum temperature locally for today's date is 75 (plus or minus 9 degrees standard deviation) and the average minimum is 55 (plus or minus 8 degrees standard deviation).

MSP records for today's date include: highest daily maximum temperature of 94 degrees F in 1987 and 1988, lowest daily maximum temperature of 55 degrees F in 1901; lowest daily minimum temperature of 37 degrees F in 1901, highest daily minimum temperature of 71 degrees F in 1959; record precipitation of 2.91 inches in 1984.

Average dew point on this date is 54 degrees, with a maximum of 71 degrees F and a minimum of 31 degrees F.

Scanning the state climatic data base: the all-time high for today's date is 100 degrees F at Madison (Lac Qui Parle County) in 1987; all-time low is 22 degrees F at Tower (St Louis County) in 1897.

Community Notes: Austin, MN

This community of over 20,000 citizens lies in western Mower County not far from the Iowa border. Daily climate observations were begun there in 1937 and were the responsibility of the caretaker at the Hormel Country Estate for many years. Since the 1950s daily observations have been reported by radio station KAUS just south of town. These observations have been important for defining the climate of Mower County and the hydrology of the Cedar River in southern MN and northern IA.

Climate records at Austin show the following extremes: a high temperature of 100 degrees 6/21/88; a low of -42 degrees on 1/15/63; 4.55 inches of rainfall on 8/29/47; 13 inches of snow on 1/22/82; after an overnight low of 25 a daytime high of 80 degrees on 10/24/52; 10 consecutive days with measurable rain (twice) 6/7 to 6/16 1967 and 7/4 to 7/13 in 1994; and an almost unbelievable 56 consecutive days with no measurable precipitation (twice) 11/10/43 to 1/4/44 and 9/23 to 11/17 in 1952 (despite being located in one of the wetter regions of the state in terms of annual precipitation).

Word of the Week: Squall

This term is derived from the Scandinavian words sqvala and skvala, meaning a sudden or violent gush or shower. It's long used nautical definition, derived from Norwegian usage, refers to a sudden and severe local storm with strong winds, clouds, thunder, lightning and associated precipitation (rain, hail or snow). Something to be wary of if you are a ship captain. In land-based observational systems such as in the U.S. a squall may refer to a sudden burst of wind which is longer in duration than a mere gust (which are usually less than two minutes). During the spring and summer, a squall may refer to the sharp change in winds associated along a narrow band of active thunderstorm cells, or ahead of an advancing cold front (sometimes called a squall line).

Other parts of the world refer to squalls by different names such as the pampero (Argentina), the sumatra (S.E. Asia), the williwaw (Chile, Straits of Magellan), the cockeyed bob (Australia), and the abrolhos (Brazil).

Sometimes in Minnesota, we notice a squall cloud which forms just below the front edge of a thunderstorm cloud where the cold downward currents of air meet the warmer and more moist currents of air feeding into the thunderstorm and condensation occurs along a well defined horizontal axis.

Outlook:

Looks like a spell of nice summer weather is coming. Primarily dry with daytime highs in the 80s and nighttime lows in the 50s is the call for the weekend and the early part of next week.

Chance of showers and thundershowers by midweek, but temperatures will remain near or above seasonal normals. This should allow Minnesota crops to do a little catching up.

The thunderstorms and squalls reported around the state this week (over 1.5 inches of rain in places) may have marked the end of the prolonged negative temperature anomaly we have been experiencing this spring.

To: Bob Potter, Stephanie Curtis, Greg Magnuson and John Bischoff
From: Mark Seeley
Re: Suggestions for MPR's Morning Edition, Friday, June 14, 1996

As we mentioned last Friday, the storm last week seems to have marked an end to the prolonged spring pattern of below normal temperatures. The jet stream has migrated north and the persistent frontal boundary to our south has left. The rest of the month of June is likely to be at or above normal temperatures. The new monthly and seasonal outlooks by the Climate Prediction Center suggest near normal temperature and precipitation conditions for July, and near normal rainfall for July, August, and September. The seasonal outlook suggests below normal temperatures for the region during the three months of July, August and September, but I disagree based on the current domination of high pressure cells. We'll see who is right!

The warmer temperatures will accelerate crop development, helping to make up for a late planting season. However, the increased evaporative demand and lack of significant rainfall may cause some moisture stress, especially on coarser textured soils (sandy), but these will likely be irrigated anyway. On the home front, don't forget to water lawns and especially trees, some of which appear to be having a difficult time recovering from a harsh winter and spring.

The UV index (ultraviolet) has been quite high lately, in the 7-9 category (high), so I hope people spending time outside are using sun block. Incidentally, the UVI forecast is available on your NOAA Weather Radio each day at 4:30 and 9:30 pm.

Listener question: What has been the longest period in the Twin Cities without measurable rainfall during the growing season when garden and landscape plants need watering?

Most people might think that the answer to this question relates to the severe drought years of 1934, 1936, 1976 and 1988. Actually, no. The longest growing season period without measurable rainfall was 23 consecutive days, from 7/24 to 8/15 in 1947, a moderate drought year. One of 22 consecutive days duration (6/20 to 7/11) occurred in 1980, another moderate drought year. Given that lawns use anywhere from 1.00 to 1.50 inches of water each week during the summer, dry spells of this length necessitate a considerable amount of watering.

Incidentally, the longest period without measurable rainfall that I could find in the state climate records was 79 consecutive days, which occurred in a number of locations from 11/9/43 to 1/26/44. Fortunately plants need little if any water during this period.

Almanac: Average maximum temperature locally for today's date is 75 (plus or minus 9 degrees standard deviation) and the average minimum is 59 (plus or minus 7 degrees standard deviation).

MSP records for today's date include: highest daily maximum temperature of 98 degrees F in 1987, lowest daily maximum temperature of 60 degrees F in 1917; lowest daily minimum temperature of 44 degrees F in 1909, highest daily minimum temperature of 73 degrees F in 1893; record precipitation of 1.68 inches in 1943.

Average dew point on this date is 56 degrees, with a maximum of 74 degrees F and a minimum of 33 degrees F.

Scanning the state climatic data base: the all-time high for today's date is 105 degrees F at Montevideo (Chippewa County) in 1979; all-time low is 29 degrees F at International Falls in 1909 and at Cloquet (Carleton County), Isabella (Lake County) and International Falls (Koochiching County) in 1958.

Community Notes: Austin, MN

This community of over 20,000 citizens lies in western Mower County not far from the Iowa border. Daily climate observations were begun there in 1937 and were the responsibility of the caretaker at the Hormel Country Estate for many years. Since the 1950s daily observations have been reported by radio station KAUS just south of town. These observations have been important for defining the climate of Mower County and the hydrology of the Cedar River in southern MN and northern IA.

Climate records at Austin show the following extremes: a high temperature of 100 degrees 6/21/88; a low of -42 degrees on 1/15/63; 4.55 inches of rainfall on 8/29/47; 13 inches of snow on 1/22/82; after an overnight low of 25 a daytime high of 80 degrees on 10/24/52; 10 consecutive days with measurable rain (twice) 6/7 to 6/16 1967 and 7/4 to 7/13 in 1994; and an almost unbelievable 56 consecutive days with no measurable precipitation (twice) 11/10/43 to 1/4/44 and 9/23 to 11/17 in 1952 (despite being located in one of the wetter regions of the state in terms of annual precipitation).

Word of the Week: Riparian Buffer

This term is from the Latin riparius, meaning the bank of a river. A riparian buffer is a managed vegetative area running parallel to river and stream banks which protects the waters from sediments and from non-point source agricultural runoff. In many cases these riparian buffers are composed of a grass or forb (broadleaf) buffer zone for slowing and spreading runoff and sediment, followed by a forested zone or forest-shrub mixture for taking up nutrients and securing stream banks from erosion. In some cases a mixture of wetland plant species are used along the streambed to further slow and filter runoff of nutrients and sediments.

Various studies have shown that these "living filters" can be effective in slowing runoff, reducing erosion and taking up nutrients such as nitrates, phosphorus, and potassium. More riparian buffers may be proposed to reduce the sediment and

nutrient runoff reaching the Minnesota River depending on the outcome of some studies being done there.

Riparian buffers do work for most conditions, but unusual slopes, and intense rainfall conditions can effectively overcome the buffering capacity of the vegetation in some situations. The course of the Mississippi River running through the Twin Cities does not benefit from enough riparian buffers, and some citizens are proposing the addition of more in the form of parks and green space.

Outlook:

Continued above normal temperatures are expected for the weekend and most of next week, with higher dew points favoring showers and thundershowers for Saturday night and Sunday. Gradual warming early next week, with lower dew points. End of the week may be dominated by low pressure with cooler temperatures and some showers.

To: Bob Potter, Stephanie Curtis, Greg Magnuson and John Bischoff
From: Mark Seeley
Re: Suggestions for MPR's Morning Edition, Friday, June 21, 1996

Topic: Moisture discrepancies

While parts of the SW, including west Texas, Oklahoma and New Mexico continue to dry up, southern MN continues to get wetter. Both the crop moisture index and the Palmer drought index show moisture surplus in western and southern portions of the state and nearly normal conditions in the northern sections. Yet, many northern counties have had little precipitation since they lost snow cover in May. The fire danger has increased in the BWCA, where very little rainfall has occurred since April 1.

The four to nine inch rains in southern MN, brought flood crests to the Cottonwood and Minnesota Rivers. Flooded cropland may see some yield reduction. If crops remain literally under water for two or more days, they may have to be replanted or abandoned.

Forecasts have been difficult to pin down because of variability in atmospheric stability and lack of a definitive jet stream trajectory.

Question: What will the weather be like for Grandma's Marathon?

Actually, the weather looks quite favorable for the running of the 20th edition of Grandma's Marathon. Saturday morning dew points should be in the 40s, with light winds and scattered clouds. Temperatures during the race will range from the mid 50s to mid 60s. Runners may achieve their best times.

Almanac: Average maximum temperature locally for today's date is 78 (plus or minus 8 degrees standard deviation) and the average minimum is 59 (plus or minus 7 degrees standard deviation).

MSP records for today's date include: highest daily maximum temperature of 95 degrees F in 1910, lowest daily maximum temperature of 59 degrees F in 1906; lowest daily minimum temperature of 39 degrees F in 1992, highest daily minimum temperature of 74 degrees F in 1923; record precipitation of 2.29 inches in 1986.

Average dew point on this date is 56 degrees, with a maximum of 75 degrees F and a minimum of 37 degrees F.

Scanning the state climatic data base: the all-time high for today's date is 107 degrees F at Browns Valley (Traverse County) in 1988; all-time low is 25 degrees F at Brimson (St Louis County) in 1992. 1992 you might remember was the year that frost was recorded in many places in Minnesota on the summer solstice. June 20 (Thursday) was the summer solstice this year, with nearly 15 hours and 40 minutes of daylight.

Community Notes: Austin, MN

This community of over 20,000 citizens lies in western Mower County not far from the Iowa border. Daily climate observations were begun there in 1937 and were the responsibility of the caretaker at the Hormel Country Estate for many years. Since the 1950s daily observations have been reported by radio station KAUS just south of town. These observations have been important for defining the climate of Mower County and the hydrology of the Cedar River in southern MN and northern IA.

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Word of the Week: Woolpack

This is an old cloud term that refers to cirrocumulus or altocumulus (puffy) clouds which have a fleecy appearance and resemble flocks of sheep or lambs. The British coined this term and naturally they live in a land of many sheeps. Actually, a woolpack sky was in evidence on Thursday (June 20) around the state as skies were fair with some cirrocumulus clouds strung across the sky like a flock of sheep.

Outlook:

Humid and somewhat unstable air will persist into the weekend. Saturday should be the best day, though there is a chance of showers up north. Then showers and thundershowers statewide later on Sunday. Turning cooler on Monday with temperatures cooler than normal by several degrees until mid week. Then the yoyo effect for late next week, with temperatures bouncing up in the 80s and 90s again going into next weekend.

To: Bob Potter, Greg Magnuson, John Bischoff, and Stephanie Curtis
From: Mark Seeley
Re: Suggestions for MPR's Morning Edition, Friday, June 28, 1996

This morning's low temperatures were the warmest for this date since 1933, and in some locations the warmest ever. Overnight lows in parts of the Red River Valley did not drop below 80 degrees.

Topic: Climatology of the July 4th Holiday

A listener in Roseville called with several questions about the climatology of the July 4th holiday.

"How often has it rained measurably on the 4th?"
Answer: about 45 percent of the time since 1891.

"The past three July 4th holidays at the Taste of Minnesota have been uncomfortably warm, with high dew points. Is this common?"
Answer: You're right, dew points have been in the high 60s each year since 1993. The average dew point locally for July 4th is 59 degrees F. Dew points greater than 65 degrees are generally uncomfortable for most of us. This has been the case 11 times in the past 51 years. On the other hand, in 1990 we had a rather chilly dew point in the 40s.

"The plumes from the fireworks on the State Capitol grounds always seem to drift to the north where we are watching from. Is this always the prevailing wind?"
Answer: The most frequent wind directions on the evening of the 4th of July have been SE to S winds. So if you commonly observe the fireworks from a position N or NW of the Capitol you will most often have the plumes of debris and smoke coming at you.

Incidentally, in answering Mary's questions, I found a couple of interesting footnotes. Six consecutive July 4th holidays had rainfall, from 1900 to 1905. Conversely, the holiday was rain free from 1939 to 1944 and again from 1952 to 1957.

Almanac: The average MSP high temperature for today's 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).

Local Records:

MSP records for today's date include: highest daily maximum temperature of 102 degrees F in 1931, lowest daily maximum temperature of 64 degrees F in 1923; lowest daily minimum temperature of 47 degrees F in 1895 and 1924; highest daily minimum temperature of 82 degrees F in 1931; record rainfall of 2.33 inches in 1920.

Average dew point on this date is 59 degrees, with a maximum of 77 degrees F and a minimum of 40 degrees F.

Scanning the state climatic data base: the all-time high for

today's date is 108 degrees F at Canby (Yellow Medicine County) in 1931; all-time low is 27 degrees F at Cook in 1983 and at Tower in 1993 (both in St Louis County).

Note, too, that this is the anniversary of the all-time warmest night in the state of Minnesota, when the overnight low at Canby only fell to 87 degrees F on this date in 1931.

Community Notes: Rochester, MN

Rochester, MN provides the only source of long term climate records for Olmsted County and one of just a few long term sites in SE MN. Daily observations in the area actually started in St Charles along the Olmsted and Winona County line during the summer of 1889. Later daily observations were taken over by weather service observers in Rochester and published in the Monthly Weather Review beginning in May of 1893, though periodic observations were recorded before that. Daily records are continuous since July of 1908 and have been provided by a number of organizations including the Rochester Post Bulletin, the Libby Canning Company and the National Weather Service Forecast Office located at the airport.

The Birth of the Mayo Clinic:

An unusually destructive and historically important tornado visited this community on August 21, 1883. A large roaring tornado ripped through town about 6 pm that evening, completely destroying 135 buildings and damaging scores of others. Thirty-one people were killed and a hundred or more seriously injured. In addition, a Chicago and Northwestern train, traveling between Rochester and Zumbrota was hit by the tornado and knocked off the tracks, killing a number of passengers and injuring most of the others. This tornado was on the ground for 18 miles, destroying an additional 50 or more farmsteads in the surround countryside. In the aftermath, relief, rescue and medical aid committees were formed to aid the suffering. From this effort the world renowned Mayo Clinic was born.

All-time records at Rochester:

Maximum temperature: 108 degrees F 7/14/36
Minimum temperature: -42 degrees F 1/7/1883
24-hr rainfall: 7.47 inches 7/11/81
24-hr snowfall: 15.4 inches 1/22/82
Greatest snow depth: 29 inches 1/25/82

Largest temperature change in 1 day: An afternoon high of 90 degrees and an a low of 32 degrees F, a drop of 58 degrees following a cold front.

Most consecutive days with measurable rainfall: 11 days (twice)
9/12/65 to 9/22/65 and 6/28/78 to 7/8/78

Longest period without measurable precipitation: 57 days, from
11/9/43 to 1/4/44

Most consecutive days with max temps equal to or greater than 100 F:

9 days from 7/10/36 to 7/18/36

Most consecutive days with min temps equal to or less than -20 F:
6 days from 1/30/96 to 2/4/96. (This is the most recent record)

Words of the Week: Doctor and Harmattan

These are old colloquialisms from West Africa used to describe winds. The harmattan is derived from a Spanish term and refers to the northeast winds that blow in the dry season (November to March). These winds come from the Sahara Desert to the north and bring dry and dusty air, but air that has much lower dew points for the tropical environments of West Africa. Therefore this wind is considered a relief from the steamy heat of the rainy season and restores health to the body and soul.

The doctor is also used in the African tropics to describe a sea breeze which generally brings cool relief from the heat generated in the interior of the continent. We are in that time of year in Minnesota, when high dew points (greater than 65 degrees F) sometimes make the air feel oppressive. This may last for days, until we get a stronger northerly wind which typically ushers in much lower dew points and feels like natural air conditioning. This wind could be called the doctor as well, for it restores our vigor, lifts our spirits and allows us to sleep more comfortably.

Outlook:

Warm and humid Friday, with a chance of showers and thundershowers Friday night and Saturday. Cooler and drier Sunday through Wednesday with a doctor wind bringing lower dew points. Temperatures will probably still remain near seasonal normals, but it will definitely be more comfortable. 4th of July should be pleasant, with highs in the 80s and dew points from the mid 50s to low 60s. Warming for next weekend, with a return to the upper 80s and low 90s.

To: Bob Potter, Greg Magnuson, John Bischoff, and Stephanie Curtis
From: Mark Seeley
Re: Suggestions for MPR's Morning Edition, Friday, July 5, 1996

Topic: Will weather-related disasters eventually bankrupt the insurance industry?

This question has come up more frequently in recent years as insurance policies and rates have been reconsidered in the aftermath of such disasters as the midwest floods of 1993, 1992's Hurricane Andrew, and the severe drought of 1988. In fact a summary of the weather-related disasters for the six years from 1988 to 1993 compiled by the National Climatic Data Center in conjunction with the insurance industry shows damage and losses of over \$98 billion nation wide. This is staggering!

Severe weather is responsible for 85 percent of all Presidential disaster declarations. It is estimated on an annual basis that the United States is affected by hundreds of tornadoes and thousands of severe thunderstorms, many producing local flooding. In addition, hurricanes, severe winter storms and drought seem to affect parts of the United States each year, ranging from isolated localized areas, to numerous widespread distributions. Costs for emergency and medical aid, temporary shelters, cleanup, repair and reconstruction are not going to get any less. Mitigation in the form of zoning regulations, redesign and engineering of new or replacement structures, and insurance coverages will likely have some ameliorating effects. Nevertheless, as a meteorologist and climatologist I can't help but wonder what limits the federal disaster relief funds and insurance funds can be stretched to should Mother Nature continue her trend of increased climatic variability.

Almanac: The average MSP high temperature for today's 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).

Local Records:

MSP records for today's date include: highest daily maximum temperature of 100 degrees F in 1982, lowest daily maximum temperature of 66 degrees F in 1905; lowest daily minimum temperature of 45 degrees F in 1967; highest daily minimum temperature of 78 degrees F in 1982; record rainfall of 1.65 inches in 1994.

Average dew point on this date is 59 degrees, with a maximum of 77 degrees F and a minimum of 40 degrees F.

Scanning the state climatic data base: the all-time high for today's date is 108 degrees F at Pipestone in 1936; all-time low is 32 degrees F at Tower in 1972 and again in 1979.

Words of the Week: Saffir-Simpson Scale

Like the F-scale for tornado intensity (developed by Theodore T. Fujita of the University of Chicago) depicted recently in the movie "Twister", the Saffir-Simpson Scale is used to rate the intensity of hurricanes. It was derived from the studies and analyses of H.F. Saffir, a consulting engineering and R.H. Simpson, former director of the National Hurricane Center. Like the F-scale, this scale ranges from 1 to 5, with the larger

numbers meaning increased intensity. Hurricane intensity is rated primarily based on four characteristics: how low the central pressure is; the sustained wind speeds; the storm surge potential; and the potential for property damage. A rating of 3 or greater on the Saffir-Simpson scale is considered a major hurricane.

Hurricane season has been somewhat quiet so far, but will last until October. Only activity at the moment is a tropical depression in the western Atlantic and another one in the eastern Pacific, neither of which has been named yet. Tropical storm Cristina recently exhausted herself along the west coast of Mexico.

Community Notes: Rochester, MN

Rochester, MN provides the only source of long term climate records for Olmsted County and one of just a few long term sites in SE MN. Daily observations in the area actually started in St Charles along the Olmsted and Winona County line during the summer of 1889. Later daily observations were taken over by weather service observers in Rochester and published in the Monthly Weather Review beginning in May of 1893, though periodic observations were recorded before that. Daily records are continuous since July of 1908 and have been provided by a number of organizations including the Rochester Post Bulletin, the Libby Canning Company and the National Weather Service Forecast Office located at the airport.

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Most consecutive days with max temps equal to or greater than 100 F:
9 days from 7/10/36 to 7/18/36

Most consecutive days with min temps equal to or less than -20 F:
6 days from 1/30/96 to 2/4/96. (This is the most recent record)

Outlook:

We will feel the return of higher dew points today, but it will be somewhat short-lived. A cold front will move across the state on Saturday, bringing a chance for showers and thunderstorms. Cooler and drier air will follow, lowering daily temperatures into the 70s and low 80s for Sunday and the early part of next week. An increasing chance for shower activity near the end of next week.

To: Bob Potter, Greg Magnuson, John Bischoff, and Stephanie Curtis
From: Mark Seeley
Re: Suggestions for MPR's Morning Edition, Friday, July 19, 1996

Anniversaries:

On this date in 1983, MSP recorded a dew point of 80 degrees F, the highest dew point observed in the Twin Cities record until July 12th of last year, when a dew point of 81 degrees was recorded.

Tomorrow (Saturday, July 20) is the 46th anniversary of the famous Hennepin County tornado of 1951. It struck between 9:00 and 10:00 pm and was not totally visible, but left a destructive path nearly 18 miles long. Sustained 84 mph winds were recorded by the Weather Service at the airport, with a peak gust of 92 mph. Rainfall rates were not possible to measure because the recording rain gage was blown away. But Maple Plain reported 8.5 inches of rainfall in less than 6 hours. The MSP airport suffered extensive damage, with 63 airplanes destroyed and another 37 damaged.

Questions from Christina Koenig in Bemidji:

Where else are tornadoes fairly common?

Tornadoes are most common in the central and southeastern U.S. Only the interior of Australia has somewhat comparable frequencies. Tornadoes do occur in many other countries though, including Canada, India, Bangladesh, Italy, Ireland, the United Kingdom, and Argentina among others.

Do other nations have warning systems?

I believe that other developed countries like Australia have similar systems of watches and warnings, but less developed countries do not. The deployment of spotter networks, radar and satellite technology, and severe weather forecast models is expensive. In Australia, the Meteorology Office issues warnings concerning the possibility of severe weather development with lead times of 3 hours and 6 hours. Germany, France and Switzerland have similar systems of warnings which refer to the possibility of severe weather within a certain number of hours. In New Zealand, the weather service is completely privatized and offers a system of weather warnings for a fee. None of these countries have a system of watches and warnings like the U.S. Canada's Weather Service uses a comparable system of watches and warnings like the U.S..

Almanac: The average MSP high temperature for today's 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).

Local Records:

MSP records for today's date include: highest daily maximum temperature of 100 degrees F in 1940, lowest daily maximum

temperature of 63 degrees F in 1902; lowest daily minimum temperature of 51 degrees F in 1911 and 1947; highest daily minimum temperature of 79 degrees F in 1977; record rainfall of 1.75 inches in 1957.

Average dew point on this date is 61 degrees, with a maximum of 80 degrees F (1983) and a minimum of 41 degrees F.

Scanning the state climatic data base: the all-time high for today's date is 108 degrees F at Canby (Yellow Medicine County) in 1932; all-time low is 31 degrees F at Stephens Mine (St Louis County) in 1911 and matched in 1912 at Roseau and Cloquet.

Words of the Week: Isoceraunic

This is another analysis term used in meteorology to describe a line drawn on a map to depict equal frequency or intensity of thunderstorm activity. Isoceraunic (iso-se-ronik) is from the Greek word ceraun (keraun) meaning thunderbolt.

Outlook:

Somewhat cooler than normal temperatures this weekend with a chance for thunderstorms Saturday and Sunday. Then near seasonal normal temperatures returning by midweek with drier conditions. Dew points will be 8 to 10 degrees less than those of this week.

To: Bob Potter, John Bischoff, and Stephanie Curtis
From: Mark Seeley
Re: Suggestions for MPR's Morning Edition, Friday, July 26, 1996

Getting dry in southern Minnesota now. Crops and grass could use a good rain. At least crops are not experiencing any heat stress as they enter the critical reproductive stage.

Topic: Question and Follow up on Hurricane Discussion

Earlier this month we mentioned the Saffir-Simpson Scale for quantifying the strength of hurricanes. A few days later Hurricane Bertha, a level 3 hurricane, roared into the Carolina coast.

A listener asked me some time ago when gender equity was achieved in the naming of hurricanes. A little history on the naming of hurricanes was provided by friends at the National Weather Service.

A 19th century Australia meteorologist, Clement Wragge was probably the first to assign female names to tropical storms of the Pacific. During WWII, Navy meteorologists also referred to tropical storms in the Pacific by female names. This simplified the task of tracking multiple tropical storms. In 1953 Weather Service meteorologists experimented with a system of naming hurricanes using the international phonetic alphabet (Able, Baker, Charlie, etc) but this was not well received. So from 1953 forward, tropical storms were given female names by the Weather Service.

Gender equity was achieved in the naming of tropical storms in 1978, when a system of alternating male and female names was adopted by forecasters in the eastern Pacific. In 1979, the same system was adopted by the weather service for forecasting tropical storms in the Atlantic and Gulf of Mexico.

The National Hurricane Center (Miami) currently uses alphabetized lists of names on a six year rotation. That is the list used for 1996 will be repeated for the year 2002. If a tropical wave evolves into a tropical storm, with rotary circulation and wind speeds greater than 39 mph, then it becomes a named storm. The names of storms which make landfall and cause significant economic loss are retired from the list. Thus we will not hear of another storm named Andrew, Agnes, Camille, or Bertha among others.

The letters Q, U, X, Y and Z are not used in naming storms because there are so few names which begin with those letters. An international meeting of the World Meteorological Organization usually approves the list of names. Other names on the list for 1996 include: Dolly, Edouard, Fran, Marco, Sally, Wilfred, and Vicky. Bob and Mark are not on the list! On average there are 9 or 10 named tropical storms each year in the Atlantic, Caribbean and Gulf of Mexico areas combined.

Almanac: The average MSP high temperature for today's 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).

Local Records:

MSP records for today's date include: highest daily maximum temperature of 100 degrees F in 1894 and 1955; lowest daily maximum temperature of 68 degrees F in 1903; lowest daily minimum temperature of 45 degrees F in 1962; highest daily minimum temperature of 76 degrees F in 1931; record rainfall of 1.70 inches in 1953.

Average dew point on this date is 60 degrees, with a maximum of 75 degrees F (1983) and a minimum of 37 degrees F.

Scanning the state climatic data base: the all-time high for today's date is 107 degrees F at Beardsley (Big Stone County) in 1931; all-time low is 27 degrees F at Tower (St Louis County) in 1980. In fact on this date just last year it was only 34 degrees in Tower.

Word of the Week: Wetterschmerz

German of course. This term literally means "weather pain" and refers to people with sensitive bones or joints (often arthritics) who can predict storms based on aches and pains attributed to the approach of a low pressure system. In historical Germany, those with wetterschmerz were considered "gifted" people. Today, they are referred to as "amateur meteorologists."

Outlook:

Somewhat below normal temperatures and dry conditions are in the forecast for the weekend. Pleasant enough for people, but our crops could use a little water. We should climb back up to near seasonal temperatures for the first dew days of August next week.

To: Greg Magnuson, John Bischoff, and Stephanie Curtis
From: Mark Seeley
Re: Suggestions for MPR's Morning Edition, Friday, August 9, 1996

The record high dew point temperature of 79 degrees F on Tuesday of this week reminded me of how important it is to stay hydrated with plenty of liquid during such spells of weather. Earlier in the summer I suffered from a kidney stone as a result of letting myself get too dehydrated. Although the Heat Index reached 109 in the Twin Cities on Tuesday, that was well below the 116 we had last July during the oppressive heat wave which killed half a million Minnesota turkeys.

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

Local Records:

MSP records for today's date include: highest daily maximum temperature of 95 degrees F in 1947; lowest daily maximum temperature of 64 degrees F in 1903; lowest daily minimum temperature of 46 degrees F in 1972; highest daily minimum temperature of 75 degrees F in 1936; record rainfall of 2.15 inches in 1948.

Average dew point on this date is 59 degrees, with a maximum of 73 degrees F (1983) and a minimum of 41 degrees F.

Scanning the state climatic data base: the all-time high for today's date is 104 degrees F at Canby (Yellow Medicine County) in 1947; all-time low is 28 degrees F at Tower (St Louis County) in 1994.

Word of the Week: Laurence

This is a term used in meteorology to describe a shimmering or terrestrial scintillation observed over a hot surface on a calm, cloudless summer day. In Minnesota this shimmering may be seen on a hot cloudless summer afternoon over a paved road or a stubble field where small grains have been harvested. The shimmering is caused by the unequal refractions of light produced by numerous convective air columns (some only inches in diameter) which differ in temperature and density.

The term laurence comes from St Laurence, the partron saint of cooks, who lived in Roman times (mid 3rd century AD). Laurence was a deacon in the Church of Rome. Only days after the death of Pope St Sixtus, a Roman magistrate demanded that Laurence bring him the riches of the church. Laurence gathered the poor people of Rome and brought them before the magistrate, claiming that they were the riches of the church. The magistrate was so offended that he order Laurence to be roasted alive on a gridiron (basically barbecued). He was later canonized as a saint. In fact tomorrow (August 10) is the traditional St Laurence Day

or Feast of St Laurence.

The weather proverb associated with St Laurence Day in Europe is

"If the weather is fair
fine autumn and good wine"

New Museum:

Since August is vacation month for many I thought I would mention the relatively new Museum of American Weather located in Haverhill, New Hampshire. Those weather enthusiasts traveling to the NE may find it worth the stop. Opened in 1992, the museum hours are 10 am to 3 pm Friday through Monday. Phone number is 802-439-5601.

There is a nice article about it in the current issue of Weatherwise magazine. Among the exhibits one will find depictions of famous tornadoes and hurricanes, the famous blizzard of 1888 and collections of historical weather records from various parts of the United States. One of the prize collections is a series of hand drawn weather maps for June 6, 1944 which the German military used to assess the likelihood of an invasion of France.

Outlook:

The weather appears to favor near normal temperatures with only widely scattered shower possibilities on the weekend, especially on Sunday. This will be followed by a warmup toward the end of next week with above normal temperatures. Crop producers in southern Minnesota would probably like to see some more rain.

To: Bob Potter, John Bischoff, and Stephanie Curtis
From: Mark Seeley
Re: Suggestions for MPR's Morning Edition, Friday, August 16, 1996

Daylength is getting noticeably shorter. We started August with 14 hrs and 40 minutes of daylight and we will end up with just 13 hrs and 17 minutes. Each day we are losing close to 3 minutes of daylight. This is probably hard on those golfers who used to be able to get in 9 holes after work.

State Fair Coming Up:

This year our State Fair runs from August 22 to September 2. Over this interval, the date showing the fewest measurable rainfalls historically (since 1891) is September 1st, on which it has rained only 26 percent of the time. August 30th shows the most rainfalls over the same period of time at 36 percent frequency.

How often is a sweater or light jacket appropriate during the Fair, other than occasionally in the early morning when the gates open? Not very often. When I looked at the frequency of afternoon temperatures that didn't reach 65 degrees F, I found that this only occurs less than 7 percent of the time (again since 1891).

All-time extremes during the State Fair (according to National Weather Service MSP records since 1891) include: a high of 99 degrees F on the afternoon of August 27, 1926; a morning low of 36 degrees F on September 1, 1974; a sticky night with a 75 degree dew point and overnight low of 80 degrees F on August 22, 1968; a chilly afternoon with overcast skies, strong northwesterly wind and a high of only 58 degrees F on August 31, 1958.

One of the most unsettling evenings during the State Fair was probably, August 30, 1977, when one of the heaviest thunderstorms to ever hit the Twin Cities occurred, dropping 7.28 inches at the airport between 8:30 pm and midnight. This obviously caused severe flooding, but primarily in the south Metro area. The State Fair Grounds actually recorded a mere 4.5 inches of rain. Still I wonder how many fairgoers brought their poncho and umbrella and I wonder who was playing in the Grand Stand that night.

Almanac: The average MSP high temperature for today's 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).

Local Records:

MSP records for today's date include: highest daily maximum temperature of 99 degrees F in 1988; lowest daily maximum temperature of 64 degrees F in 1943; lowest daily minimum temperature of 47 degrees F in 1962; highest daily minimum temperature of 77 degrees F in 1913; record rainfall of 1.60 inches in 1986.

Average dew point on this date is 59 degrees, with a maximum of 74 degrees F (1983) and a minimum of 42 degrees F.

Scanning the state climatic data base: the all-time high for today's date is 106 degrees F at Canby (Yellow Medicine County) in 1988; all-time low is 27 degrees F at Tower (St Louis County) in 1976. Same two record locations as last week.

Word of the Week: Heat Lightning

This term was derived from observations of lightning under clear skies during warm summer evenings. It was misconstrued that the lightning was produced by an excessively heated atmosphere.

Heat lightning is really the luminosity of the sky overhead produced by distant lightning flashes off the horizon and too far away to be seen. There was some heat lightning in the Twin Cities area on Tuesday evening of this week.

Technically all lightning produces heat, since a single stroke can heat the surrounding air to over 50,000 degrees F, causing sound waves due to the rapid expansion of air, which we later hear as thunder. Sound travels approximately a mile every 5 seconds, so you can gage the distance of the lightning flashes by counting how many seconds pass between the flash and the resulting thunder (approximately 1/5 of a mile for every second). Thus a 15 second interval between observed lightning and the sound of thunder indicates that the flash occurred about 3 miles away. Lightning strokes from over 10 miles away are rarely heard as thunder.

New Museum:

Since August is vacation month for many I thought I would mention the relatively new Museum of American Weather located in Haverhill, New Hampshire. Those weather enthusiasts traveling to the NE may find it worth the stop. Opened in 1992, the museum hours are 10 am to 3 pm Friday through Monday. Phone number is 802-439-5601.

There is a nice article about it in the current issue of Weatherwise magazine. Among the exhibits one will find depictions of famous tornadoes and hurricanes, the famous blizzard of 1888 and collections of historical weather records from various parts of the United States. One of the prize collections is a series of hand drawn weather maps for June 6, 1944 which the German military used to assess the likelihood of an invasion of France.

Outlook:

Nice weekend coming up, then chance of thunderstorms Monday through Wednesday, but mainly in northern areas. It should be warm and dry for the first few days of the State Fair with afternoon temperatures well into the 80s.

Latest outlook for the month of September favors somewhat below normal temperatures in southeastern MN. Near normal temperatures elsewhere.

To: Bob Potter, John Bischoff, and Stephanie Curtis
From: Mark Seeley
Re: Suggestions for MPR's Morning Edition, Friday, August 23, 1996

Odds and Ends in the Weather:

Dolly and Edouard are the 4th and 5th named storms of the Atlantic hurricane season. The forecast for the 1996 season is for 11 named storms (that would get us down to the name Josephine in the list of storm names) and seven hurricanes, considerably less than the twentysome named storms of last season but close to the historical averages for number of storms and hurricanes each year (9.3 and 5.7, respectively). The most active part of the hurricane season is yet to be, from now into early October. On the other hand, much of our own severe weather season is behind us and it wasn't so bad. The frequency of severe thunderstorms tapers off significantly after the end of this month.

Yesterday was "Buttered Corn Day" in Sleepy Eye Minnesota, celebrating two of our primary state commodities, butter and sweet corn. Field corn growers are a bit concerned about early frost affecting the corn maturation this year, since the crop is on the order of a week to 10 days behind normal development. There is no evidence to indicate an earlier than normal frost will occur this year, but growers might watch what the hurricane season is doing. There have been cases in the past when strong hurricanes in the Gulf have altered the weather pattern enough to draw down cold Arctic air masses early in the fall.

Almanac: The average MSP high temperature for today's date is 79 degrees F (plus or minus 8 degrees standard deviation), while the average low is 60 degrees F (plus or minus 7 degrees standard deviation).

Local Records:

MSP records for today's date include: highest daily maximum temperature of 97 degrees F in 1948; lowest daily maximum temperature of 60 degrees F in 1940; lowest daily minimum temperature of 42 degrees F in 1891; highest daily minimum temperature of 77 degrees F in 1948; record rainfall of 1.43 inches in 1899.

Average dew point on this date is 58 degrees, with a maximum of 77 degrees F and a minimum of 40 degrees F.

Scanning the state climatic data base: the all-time high for today's date is 104 degrees F at Beardsley (Big Stone County) in 1922; all-time low is 25 degrees F at Tower (St Louis County) in 1977. The next day at Tower the thermometer showed a low of only 22 degrees F, one of the coldest temperatures ever in August. The all-time record low for August in Minnesota is 21 degrees F at Tower on August 28, 1986.

Word of the Week: Anhyetism

This is not a disease, but in many parts of Minnesota people are suffering from this. Hyetos is the Greek term for rain, so the meaning is deductive - lack of rainfall. The term is rarely used anymore, but was used at one time by academics who loathed the use of the term drought to describe short periods without rainfall.

Community Notes: Northfield, MN

Northfield has the distinction of not only being one of the oldest climate observing stations in southern Minnesota, but also being the location of the first State Weather Service Office thanks to the work of the faculty at Carleton College.

Professor William Payne, founder of the astronomy program at Carleton College, became the first weather observer in Northfield in 1881 for the old Army Signal Corps. He made daily observations of max/min temperature, precipitation, barometric pressure, sky conditions and wind speed/direction at the Carleton College Goodsell Observatory. Later in 1883 when state weather services were formed to coordinate the collection of climate observations, provide agricultural and river assessments, and release forecasts and warnings, Professor Payne became the Director of the Minnesota State Weather Service. This preceded the formation of the U.S. Weather Bureau by several years. The State Weather Office shifted to St Paul in 1886, and then the Federal Weather Bureau Office was established in 1891 in Minneapolis. But Professor Payne and the staff at Carleton continued to make daily observations for many decades. Today, daily precipitation observations are made by the staff of the Water Treatment Plant in Northfield.

Some of the all-time climate records at Northfield, MN include: 6.70 inches of rainfall on April 20, 1893, one of the heaviest April rainfalls ever measured in Minnesota; and -47 degrees F on January 21, 1888, one of the coldest temperatures ever measured in southern Minnesota.

Outlook:

Pleasant in the south and a chance for thunderstorms in the north this weekend. Should be nice for Sound Money at the State Fair on Saturday. Actually dry and pleasant most of next week, with an increasing chance for thunderstorms and a warm up toward Thursday and Friday.

Re: Suggestions for MPR's Morning Edition, Friday, August 30, 1996

I saw Bob Potter's namesake over in the Swine Barn at the State Fair on Tuesday. "Bob" is the state champion boar at nearly 1200 pounds. He was lying on his side asleep and we couldn't get him to wake up.

Historical Act: Today is the 107th anniversary of Congressional Statutes 371 and 398 which were enacted by Congress on this date in 1890 to help create the volunteer climate observation network in the United States. Under these acts the Secretary of Agriculture was given the authority to issue up to \$15 in instrumentation to one unpaid volunteer observer in each county for the purpose of providing the government with daily meteorological observations. Many volunteers came forward, as in those days, keeping the local weather records was perhaps regarded as more prestigious than it is today. After all, many famous Americans such as Professor John Winthrop of Harvard, statesman Benjamin Franklin, President Thomas Jefferson, writer Henry Thoreau, and explorers Lewis and Clark were at some time engaged as daily weather observers.

The legacy of this act is the detailed climatology available today for most places in the United States.

Topic: Preliminary August Climate Summary

For most parts of the state, August is ending up to be near normal with respect to temperature conditions. The mean temperature for August of 1996 is going to be plus or minus a degree or two from normal. With respect to rainfall, August has been drier than normal for many of the northern and central counties. In fact parts of the northwest have had less than an inch of rain. Parts of south central Minnesota have seen a recent surplus of rainfall. Fairmont in Martin County has reported nearly 10 inches. The lack of moisture has kept some plant diseases a bay, but has not helped crop yields.

I could find no record of frost in northern Minnesota this August, but it did get down to 34 degrees F at Embarrass and Tower earlier this week (Aug. 27).

Almanac: The average MSP high temperature for today's date is 77 degrees F (plus or minus 8 degrees standard deviation), while the average low is 58 degrees F (plus or minus 6 degrees standard deviation).

Local Records:

MSP records for today's date include: highest daily maximum temperature of 96 degrees F in 1941; lowest daily maximum temperature of 60 degrees F in 1965; lowest daily minimum temperature of 45 degrees F in 1935; highest daily minimum temperature of 75 degrees F in 1932; record rainfall of 7.28 inches in 1977.

Average dew point on this date is 58 degrees, with a maximum of 75 degrees F and a minimum of 41 degrees F.

Scanning the state climatic data base: the all-time high for today's date is 101 degrees F at Beardsley (Big Stone County) in 1921; all-time low is 28 degrees F at Tower (St Louis County) in 1976. The all-time record low for August in Minnesota is 21 degrees F at Tower on August 28, 1986.

Word of the Week: contrails and distrails

These terms are abbreviated forms for condensation trails and dissipation trails left by high flying aircraft.

Contrails result from the addition of water vapor and other exhaust products left in the swept path of aircraft. The humidifying effects in the cold air aloft produces almost instant condensation. Sometimes the aerodynamic pressure reduction which occurs around wing tips can produce condensation if the air aloft is near the saturation point anyway.

Dissipation trails are far less frequently observed than contrails. They result from an aircraft flying through a thin cloud layer of relatively low water content and high temperature. The heat from the exhaust plume in the swept path of the aircraft overcomes the humidifying effects of water vapor, and essentially evaporates the thin cloud layer along the flight path.

Outlook:

Continued beautiful weather through the weekend, with lows in the 50s to low 60s and highs in the 70s and 80s. Little chance of rain until Tuesday or Wednesday of next week, when dew points may rise and we'll have an increasing chance for thundershower activity.

To: Bob Potter, John Bischoff, and Stephanie Curtis
From: Mark Seeley
Re: Suggestions for MPR's Morning Edition, Friday, Sept 6, 1996

Hurricane Fran and Tropical Weather Update:

Fran was a category 3 hurricane, not a category 4 like Hugo in 1989. Large in areal extent, Fran produced wind gusts approaching 120 mph, heavy rainfalls of 6 to 10 inches and a storm surge along the coast of up to 16 ft. Hugo produced damages between 7 and 9 billion dollars in 1989. Fran should not produce damages of that magnitude, but additional flooding over the weekend may still put damages into the billions of dollars.

This morning's cloud shield from Fran extends all the way west to Ohio and Michigan and north into Ontario and NY state. Flooding may cause the most damage from Fran, as heavy rains are expected in several states through the weekend. Flood watches and warnings are out for Virginia, West Virginia, Pennsylvania, New York, Maryland, and Washington D.C. in addition to North Carolina. Large volumes of runoff are expected because much of this area already has saturated soils, incapable of holding more moisture.

As Fran slowly moves north and east over the weekend, other weather systems moving across the midwest from west to east will likely move more slowly. In the Atlantic, Tropical Depression number 8, now east of the lesser Antilles may evolve into tropical storm Hortense over the weekend.

Topic: Hot humid weather

Back to high dew points this week (mid to upper 60s), but thankfully temperatures were not in the 90s, only the 80s. A recent study by the University of Delaware using the National Center for Health Statistics data on mortality found that the persistence of a hot humid air mass over a major metropolitan area is associated with significantly higher mortality rates, due to increases in cardiac arrest, stroke, and respiratory distress. The study also found that the occurrence of such conditions in the late spring or early summer had a more pronounced effect than later in the season when we have had time to acclimatize to the summer season.

Following the July 1995 heat wave which increased mortality in several major cities, Philadelphia's Department of Public Health now employs National Weather Service short and medium range forecasts for the purpose of providing health advisories to survive heat wave conditions.

Interestingly enough, the same University of Delaware study, written up in Weatherwise magazine, found that winter weather had much less impact on daily mortality rates. I guess that

this is not surprising since they were studying persistence of air mass types and not how much snow John Q. Public was shoveling.

Almanac: The average MSP high temperature for today's date is 75 degrees F (plus or minus 10 degrees standard deviation), while the average low is 57 degrees F (plus or minus 8 degrees standard deviation).

Local Records:

MSP records for today's date include: highest daily maximum temperature of 98 degrees F in 1922; lowest daily maximum temperature of 55 degrees F in 1911; lowest daily minimum temperature of 41 degrees F in 1962; highest daily minimum temperature of 75 degrees F in 1913; record rainfall of 0.74 inches in 1938.

Average dew point on this date is 55 degrees, with a maximum of 75 degrees F and a minimum of 33 degrees F.

Scanning the state climatic data base: the all-time high for today's date is 105 degrees F at New Ulm (Brown County) in 1922; all-time low is 23 degrees F at Park Rapids (Hubbard County) in 1885.

Word of the Week: GPS dropwindsonde

This is a new weather sensor used by NOAA to study hurricanes. GPS stands for Global Positioning System which gives latitude, longitude and elevation of the instrument package with greater precision than was previously possible. The dropwindsonde, or instrument package transmits pressure, temperature, humidity, and wind speed information as it falls through the tropical cyclone or hurricane.

This type of instrumentation should help in the study of hurricanes and perhaps lead to improved forecasting. It is being used by the new NOAA aircraft, a Gulfstream IV jet which can fly up to 45,000 ft. There is a nice article about this in the new Weatherwise magazine.

Outlook:

Warmer than normal into the weekend, with a chance for showers and thunderstorms, then cooling down a bit. Might see our first overnight minimum temperature in the 40s since July 10. Haven't seen 30s since the 39 on June 8th. This is the month when overnight minimum temperatures in the 30s will accelerate the fall leaf color change.

To: Bob Potter, John Bischoff, and Stephanie Curtis
From: Mark Seeley
Re: Suggestions for MPR's Morning Edition, Friday, Sept 13, 1996

Topic: Fall temperature decline

Temperatures this morning in the 30s around much of the state, with some scattered frost reported. It was 30 degrees F at Aitkin about 6 am. Another night in the 30s tonight, but probably not a hard enough freeze to end the agricultural season.

The recent cool down is the second such spell of weather in the last three weeks. Of course we normally start to see a more rapid temperature decline this time of year, losing about 3-4 degrees off the daily mean each week of September.

There was an article in the Pioneer Press about the early fall of leaves as a result of winter stress and very dry late summer conditions. This may diminish the effect of the normal color change and leaf drop that occurs later this month. On average leaf color change begins in the far north about September 19-21, but not in the south until the end of the month or 1st of October.

Though leaf color changes are triggered primarily by the shorter days of fall, the process is accelerated by low temperatures, particularly overnight minimums in the 30s. Northern Minnesota experienced 1 or 2 nights of such temperatures during the week of August 27th and now again this week. In most years 7 to 10 nights of minimum temperatures in the 30s approximates the the peak of fall colors.

Many people are concerned about the first fall frost. Those suffering from the high pollen (asthma) would prefer to see a frost soon, while those gardeners and crop producers hope that a frost holds off until the end of the month or later. Average first frost dates in the state range from the 7th to the 14th of September in the NE to the first week of October in the far south. Though frost may have already occurred in parts of northern Minnesota, there is not indication yet of when it might occur in the central and southern sections.

Almanac: The average MSP high temperature for today's date is 70 degrees F (plus or minus 9 degrees standard deviation), while the average low is 53 degrees F (plus or minus 8 degrees standard deviation).

Local Records:

MSP records for today's date include: highest daily maximum temperature of 95 degrees F in 1939; lowest daily maximum temperature of 52 degrees F in 1903; lowest daily minimum temperature of 34 degrees F in 1923; highest daily minimum temperature of 72 degrees F in 1939; record rainfall of 1.01 inches in 1994.

Average dew point on this date is 49 degrees, with a maximum of 68 degrees F and a minimum of 31 degrees F.

Scanning the state climatic data base: the all-time high for today's date is 100 degrees F at Redwood Falls in 1939; all-time low is 17 degrees F at Roseau in 1975.

Word of the Week: Pogonip

Most of the time we discuss words derived from Latin, Greek, German, French, or Arabic, but this is actually an American Indian word used to describe a mountain valley fog composed of tiny ice crystals. This frost or freezing fog, observed by native Americans in the mountains of the western states is most common in late fall and early winter and can produce some spectacular scenery of white tinted meadows, pastures, and forests. The special name given to this fog by the American Indian was because of so-called harmful health effects. In Indian lore it was injurious to your lungs to breathe the air of the pogonip, especially at higher elevation. It caused wheezing and coughing.

Outlook:

Temperatures remaining near to slightly below normal, with an increasing chance for shower activity toward the end of next week. We might finally get some good soaking rains.

To: Bob Potter, John Bischoff, and Stephanie Curtis
From: Mark Seeley
Re: Suggestions for MPR's Morning Edition, Friday, Sept 20, 1996

Topic 1: Assessing last week's frost

The frosts (temp less than or equal to 32 degrees F) reported around the state last Saturday morning (Sept 14) were earlier than normal but not a record for earliness. Many agricultural counties have historically experienced years with earlier frosts, some as early as the 2nd and 3rd of September (1974). Record low temperatures were reported for Rochester(34), St Cloud (31) and the MSP airport (33) on the morning of September 14. In addition, Red Wing (37), Rosemount (36), Faribault (32), Olivia (33), Worthington (32), Cambridge (31), Aitkin (29), Lamberton (34), and Hutchinson (33) reported record lows that morning. It will be difficult to sort out what effects the frost might have on yields of row crops since it was not a widespread killing frost, but very spotty.

Topic: "How dry we are" (at least in some places)

Row crops, trees, grass and other vegetation has perhaps been more affected in many counties by dryness rather than by frost. Dave Ruschy of our climate group points out that MSP has recorded only 3.63 inches of rainfall from June 22 to September 18th of this year. This is drier than all like periods in the historical record back to 1891 (including the Dust Bowl years of 1934 and 1936), with the exception of 1894 when only 2.06 inches of rain fell in the same period. Fortunately, the stored soil moisture from last year and the absence of any prolonged heat stress have combined to somewhat reduce the wear and tear on trees and plants.

MSP is by no means alone in this rainfall deficiency. Bob Weisman of St Cloud State University's Meteorology Program reports that St Cloud has had the driest summer since 1950. In addition, Hutchinson, Red Wing, Caledonia, Winona and Rosemount all report rainfall deficiencies of 7 to 9 inches since April 1st. Itasca State Park trying to recover from the wind damage of last summer to thousands of trees is suffering from its driest growing season since the drought year of 1976.

Almanac: The average MSP high temperature for today's date is 69 degrees F (plus or minus 10 degrees standard deviation), while the average low is 50 degrees F (plus or minus 9 degrees standard deviation).

Local Records:

MSP records for today's date include: highest daily maximum temperature of 91 degrees F in 1895; lowest daily maximum temperature of 50 degrees F in 1927; lowest daily minimum temperature of 28 degrees F in 1962; highest daily minimum temperature of 75 degrees F in 1895; record rainfall of 0.73 inches in 1964.

Average dew point on this date is 48 degrees, with a maximum

of 72 degrees F and a minimum of 27 degrees F.

Scanning the state climatic data base: the all-time high for today's date is 99 degrees F at Montevideo (Chippewa County) in 1984; the all-time low is 14 degrees F at Karlstad (Kittson County) in 1973.

Words of the Week: Seistan (Sistan) or Wind of 120 Days

In the Seistan (Sistan) Basin of southeastern Iran and southwestern Afghanistan, there is a strong and persistent summer wind of monsoon origin which blows from the north-northwest from May through September. It is also called the wind of 120 days.

The deep summer low over northwest India provides the pressure gradient for this wind, which may blow up to speeds of 70 mph and carries a good deal of sand and dust. It is an irritating and highly erosive type of wind which can produce a sandblasting effect. Buildings are eaten away and undercut during the summer. For this reason, the north-facing sides of buildings are often left blank, with no windows, frescos or other designs. Wandering sand dune deposits sometimes crowd buildings and choke surface water supplies. Because of the persistent wind, much of the vegetation that survives there can be used as a compass because the stems and shoots are often oriented north to south.

The Seistan is coming to an end this month as the Indian monsoon weakens with the southerly migration of the sun.

Outlook:

Good chance for some rain statwide through Saturday night. Then cooler with some overnight lows in the 30s up north early next week and a gradual return to near seasonal normal temperatures.

To: Bob Potter, John Bischoff, and Stephanie Curtis
From: Mark Seeley
Re: Suggestions for MPR's Morning Edition, Friday, Sept 27, 1996

Listener question: Is there a correlation between frost and the full moon during the fall in Minnesota? Is there any cause and effect relationship? (From Tom Hoverstad, Waseca, MN)

Clear nights tend to be colder and of course the moon phase is more obvious on clear nights. Historically speaking, frost occurs nearly simultaneously with the September full moon less than 1 year in 4 (probably closer to 1 year in 5). But if we examine the correlation between frosts and the full moon for the second half of September (9/16 and beyond) and the month of October, the relationship is somewhat greater than 1 year in 2. Average minimum temperatures are declining rapidly in late September and early October anyway. Several counties typically report minimum temperatures in the 30s and most have better than a 50 percent frequency of overnight minimums below 32 degrees F during this calendar period. I would stress that though there appears to be some association between frost and the full moon phase in the fall, it is not cause and effect. It has never been proven that the properties of the lower atmosphere which directly effect the chances for frost to occur are to any degree affected by the phases of the moon.

Topic: The Harvest Moon

An event occurred last night (Sept 26) which many Minnesotans may have witnessed: the Harvest Moon being eclipsed by the Earth's shadow between 8:30 and 11:00 pm CDT.

The full moon phase closest to the autumnal equinox (Sept 22 this year) is called the Harvest Moon. It rises in the east near sunset for several nights and casts enough light for farmers to extend their harvesting operations well into the evening. Last night it was partially or completely blocked out for a period of over 2.5 hours. The next eclipse of the Harvest Moon will not occur until the year 2015.

Minnesota farmers were probably not terribly encumbered by the eclipse of the Harvest Moon last night, because the lateness of the crop this year has postponed the harvest season for row crops until October.

Almanac: The average MSP high temperature for today's date is 66 degrees F (plus or minus 11 degrees standard deviation), while the average low is 46 degrees F (plus or minus 8 degrees standard deviation).

Local Records:

MSP records for today's date include: highest daily maximum temperature of 88 degrees F in 1987; lowest daily maximum temperature of 40 degrees F in 1942; lowest daily minimum temperature of 29 degrees F in 1942 and 1991; highest daily minimum temperature of 64 degrees F in 1891; record rainfall of 0.54 inches in 1947.

Average dew point on this date is 45 degrees, with a maximum of 66 degrees F and a minimum of 24 degrees F.

Scanning the state climatic data base: the all-time high for

today's date is 97 degrees F at Hallock (Kittson County) in 1952 and at Canby (Yellow Medicine County) in 1956; the all-time low is 16 degrees F at Wannaska (Roseau County) in 1967.

Words of the Week: Oriented Roughness and Random Roughness

These are terms used in soil science to describe the results of soil disturbance, such as the common practice of fall tillage. In Minnesota, the fall season is the time of year for soil moisture recharge, that is when the stored moisture consumed by vegetation during the growing season is replaced in the soil. Recharge efficiency is highest in the fall for a number of reasons: rainfall rates more closely correspond to soil infiltration rates; daylength, solar radiation intensity and average daily temperature are declining so there is less evaporation; vegetation is dying or going dormant and therefore consuming less moisture through the root system. Storage efficiency for any given rainfall event in the fall can be as high as 70 to 90 percent, that is for every inch of rain, as much as 0.7 to 0.9 inches might be stored in the soil.

Tillage, whether it be spading up the home garden or running a disk across the residue left in a corn field, disturbs or roughs up the soil surface. In some cases, ridges and depressions are left in an oriented manner (oriented roughness), or in some cases random roughness is left (undulations in soil relief are left in a random manner, often as a result of turning over clods of different sizes). In either case, the total soil surface area exposed to the atmosphere is increased greatly. This allows the soil to capture a greater amount of rainfall, particularly as depressional storage. This is noticeable later in the fall in looking at a tilled field following a rain storm. It is also often evident following the first snowfall of the season, as the soil depressional areas are the first to fill up with snow. One of the first scientists to study the effects of microscale soil relief (oriented and random roughness) was Ray Allmaras, a USDA soil physicist with our department of Soil, Water, and Climate. Capturing and storing fall rainfall is a prerequisite to having good crop production potential for the following year.

Outlook:

Low pressure passing over the Great Lakes will affect us through Friday night, causing cloudiness and scattered rain showers in many places around the state. Should be relatively dry for the rest of the weekend until Sunday evening, then a chance for showers again until Tuesday of next week. Temperatures should remain close to or below seasonal normals.

To: Bob Potter, John Bischoff, and Stephanie Curtis
From: Mark Seeley
Re: Suggestions for MPR's Morning Edition, Friday, Oct. 4, 1996

September Climate Summary for Minnesota:

For most of Minnesota the average September 1996 temperature was close to the 30 year normal, deviating only 1 or 2 degrees positive or negative. Extremes for the month were 92 degrees F at Browns Valley on the 5th and 23 degrees F at Embarrass on the 13th and 19th.

Rainfall for September was generally short of normal for most counties. St Cloud, Litchfield, Amboy and Redwood Falls barely recorded 1 inch, while Duluth recorded nearly 5 inches. The absence of a widespread killing frost was a blessing for crop producers, waiting for late planted row crops to reach maturity.

Topic: Change in observational practices at MSP Airport

The change to automated measurements for monitoring the environment at the MSP airport this summer has prompted some criticism from various users. There was an article in the Pioneer Press this week about this matter.

The chief purpose of the automated systems being deployed by the National Weather Service is to improve the intelligence gathering capability of forecasters and pilots. Though there is an effort to document these improvements and their impact on operations, in the process a long history of observational climatology is being discarded much to the distress of the climatology community and other users of the data.

No snowfall, snow depth, or snow water equivalence measurements will be taken by these systems. In addition, there will be no observations of severe weather elements such as tornadoes, hail, thunderstorms, and other significant weather features such as drizzle, freezing drizzle, blowing dust, smoke, distant clouds, or clouds above 12,000 ft. These observations are useful to many people.

Locally, the National Weather Service Forecast Office is having the MSP airport automated system augmented by manual observations made under contract. This certainly helps for the time being, but may end after another year. In addition some sites will be equipped in the future with sensors for detecting freezing rain and lightning, but the reliability of these sensors must be proven first.

Even the automated sensors which are being used to transmit data are not without problems. The heated tipping bucket gages which record liquid precipitation have been shown to underestimate light amounts and snowfall equivalence (due in part to evaporation loss), as well as intense rainfall events when the tipping mechanism fails to keep up with the rainfall rate. The temperature sensor, known as a 1088 thermistor may be overly influenced by terrestrial radiation when snow cover is present, and may therefore record a lower overnight minimum than a different type of sensor (liquid in

glass, thermocouple or other thermistor). These matters are of concern to climatologists since they will influence the future accumulation of historical records for examining frequencies of events, climate means and climate trends.

Almanac: The average MSP high temperature for today's date is 65 degrees F (plus or minus 10 degrees standard deviation), while the average low is 45 degrees F (plus or minus 8 degrees standard deviation).

Local Records:

MSP records for today's date include: highest daily maximum temperature of 89 degrees F in 1922; lowest daily maximum temperature of 44 degrees F in 1932; lowest daily minimum temperature of 24 degrees F in 1935; highest daily minimum temperature of 68 degrees F in 1922; record rainfall of 1.83 inches in 1985.

Average dew point on this date is 42 degrees, with a maximum of 64 degrees F and a minimum of 13 degrees F.

Scanning the state climatic data base: the all-time high for today's date is 91 degrees F at Bird Island (Renville County) and Tracy (Lyon County) in 1922; the all-time low is 10 degrees F at Argyle (Marshall County) in 1989.

Word of the Week: ASOS

This is a National Weather Service acronym for Automated Surface Observing System. It is a system of weather sensors, data collection hardware, acquisition control modules, communications devices, and peripherals and displays for monitoring local environmental conditions, primarily at airports. Over 1700 such units are being deployed around the country to replace manual observations. There is now one operating at the MSP airport, reporting air temperature, cloud ceiling, visibility, dew point, and wind among other things. Forecasters use the frequent ASOS reports to refine and update forecasts. In addition, for some locations computer generated voice reports are available for pilots to dial in and get airport conditions. ASOS systems are being evaluated, but have thus far been subjected to a number of criticisms as expressed in the discussion above.

Outlook:

Looks like a warm up on the way, with above normal temperatures lingering into most of next week. Drier than normal too because of the relative dominance of high pressure. Twin Cities Marathon Forecast shows that morning temperatures will be around 50 F for the start of the race, with south to southwesterly winds at 8-10 mph, partly cloudy skies, and low humidity. Good for most runners.

To: Perry Finelli, John Bischoff, and Stephanie Curtis
From: Mark Seeley
Re: Suggestions for MPR's Morning Edition, Friday, Oct. 11, 1996

Topic: Temperature Control

This time of year the daily course of the sun has less and less to do with controlling the air temperature, as increased cloudiness and advection of large air masses begin to take control. We are losing 18 to 20 minutes of daylight each week and the midday sun angle is declining. In addition, the frequency and extent of cloudiness begins to increase. In fact by the end of the month, the average number of clear days is half of what it is at the beginning of the month, with a corresponding increase in the number of partly cloudy and cloudy days.

Advection begins to take more control of the temperature across Minnesota. Advection in a traditional usage refers to the transport of atmospheric properties horizontally through large scale wind fields. Winds from the northwest bring polar air masses which have been conditioned in high latitudes and are thus cooler and drier. Wind shifts to the southeast or southwest bring warmer and more moist air into the region, often with cloudiness which helps prevent overnight minimum temperatures from going very low. The propagation of these air masses often has a two to three day life cycle which creates the so-called rollercoaster effect in our autumn temperatures, giving us alternating periods of warm Indian Summer like conditions and cold blustery November like conditions.

Advection takes even tighter control of the temperature conditions as snow cover is established in higher latitudes, greatly modifying (cooling) the air in those regions. Northwesterly winds then bring even colder air across Minnesota. But this does not typically start to occur until November.

Almanac: The average MSP high temperature for today's date is 61 degrees F (plus or minus 11 degrees standard deviation), while the average low is 42 degrees F (plus or minus 8 degrees standard deviation).

Local Records:

MSP records for today's date include: highest daily maximum temperature of 84 degrees F in 1930; lowest daily maximum temperature of 39 degrees F in 1959; lowest daily minimum temperature of 23 degrees F in 1987; highest daily minimum temperature of 62 degrees F in 1930; record rainfall of 1.13 inches in 1912; and record snowfall of 0.5 inches in 1917 and 1977.

Average dew point on this date is 41 degrees, with a maximum of 67 degrees F and a minimum of 18 degrees F.

Scanning the state climatic data base: the all-time high for today's date is 91 degrees F at Pipestone (Pipestone County) in 1910; the all-time low is 12 degrees Brimson (St Louis County) in 1987.

Word of the Week: Nephoscope

This term is derived from the Greek words nepho meaning cloud and scope meaning to view. This is an instrument for viewing clouds and determining their motion. There are two types: a direct view and mirror view of the sky, each equipped to allow the observer to determine the compass direction in which clouds are moving. Cloud motions may vary with elevation, that is low clouds may be moving in one direction and high clouds moving in another.

Of course today, many meteorologists rely on satellite and radar imagery to provide information on cloud motions.

Outlook:

Looks like the temperature rollercoaster will continue over the weekend and into next week a bit, with a chance for scattered shower activity late Saturday into Sunday, but generally a dry pattern. Daytime temperatures will range from the 50s to 60s.

To: Bob Potter, John Bischoff, and Stephanie Curtis
From: Mark Seeley
Re: Suggestions for MPR's Morning Edition, Friday, Oct. 18, 1996

The twelfth named tropical storm of the Atlantic hurricane season, Hurricane Lili, is located over Cuba this morning and moving north to northeast. It may weaken somewhat but still remain a tropical storm and affect parts of Florida and the Bahamas over the weekend. Central pressure in Hurricane Lili yesterday was very close to the central pressure of the strong low pressure center that passed over Minnesota on Thursday causing wind gusts to exceed 50 mph.

Topic: Minnesota's mid October Snow Storms

Snowfall was reported this morning from Hibbing, International Falls and Baudette. Up to 3 inches fell in some counties. It is unusual to have mid October snows in Minnesota, but there have been some significant ones in the recent past. Just last year, from October 20 to 24 north central and northeastern counties in Minnesota received from 6 to 12 inches. During October 14 to 20 of 1992, parts of northern Minnesota recorded 3 to 5 inches of snow, and from 18 to 24 October in 1976 southwestern counties recorded up to 8 inches.

The two worst October snow storms (aside from the Halloween Blizzard of 1991, most of which occurred on November 1st), in the state records were in 1916 and 1880. Following beautiful harvesting conditions during the first two weeks of October in 1916, a blizzard struck the western counties in the state from the 18th to the 20th. Snowfalls of 10 to 19 inches were recorded in northwestern Minnesota. Temperatures in the 50s and 60s before the storm plummeted to the single digits by the 20th, with Roseau recording a low of 0 degrees F.

The 1880 blizzard was even worse, reputed to be the most severe ever in the month of October. Centered near the South Dakota, Minnesota and Iowa border, the storm lasted from the 15th to the 21st, with wind gusts as high as 70 mph. Gales did extensive damage to shipping traffic on the Great Lakes. Snow drifts accumulated to a depth of 15 feet in places and blocked roads and railroad tracks. Many of the snow drifts persisted throughout the winter.

Almanac: The average MSP high temperature for today's date is 58 degrees F (plus or minus 11 degrees standard deviation), while the average low is 40 degrees F (plus or minus 9 degrees standard deviation).

Local Records:

MSP records for today's date include: highest daily maximum temperature of 87 degrees F in 1950; lowest daily maximum temperature of 30 degrees F in 1930; lowest daily minimum temperature of 18 degrees F in 1972; highest daily minimum temperature of 61 degrees F in 1950; record rainfall of 2.75 inches in 1924; and record snowfall of 1.3 inches in 1916 and 1976.

Average dew point on this date is 37 degrees, with a maximum of 65 degrees F and a minimum of 9 degrees F.

Scanning the state climatic data base: the all-time high for today's date is 87 degrees F at Minneapolis, St Paul's Holman Field, and St Peter in 1950; the all-time low is 5 degrees at Crookston (Polk County) in 1992.

Words of the Week: Plimsoll's Mark or Plimsoll's Line

This is the name given to the conspicuous marks painted on the sides of merchant ships that indicate the limit of submergence allowed by law. It is named for Samuel Plimsoll who championed the law before the British Parliament to prevent captains from overloading their merchant ships. The British merchant ships used this system for years (since at least 1899) before the United States adopted a similar system in 1930.

Load limits or lines were designated as FW for fresh water, S for summer, W for winter and WNA for winter in the North Atlantic. For merchants carrying goods to and from India, there was an additional Plimsoll Mark, IS which stood for Indian Summer, but this actually a misnomer. It was meant for the October to April period in the Indian Ocean when the summer monsoon season had ended and seas were relatively calm. Loads could be greater during this time.

In fact expected or prevailing weather is an important factor in designating load limits on merchant ships both on inland waters and in open seas. Since its inception, the Plimsoll Mark has been partially based upon the seas traveled, the time of year and the prevailing weather. Where the weather historically produced rougher seas with larger swells, Plimsoll Marks designated lighter load limits for ships. If these lines or marks were not rigidly observed, shipping companies could be fined and their insurance policies cancelled.

Outlook:

Looks to be cold, cloudy and somewhat windy over the weekend, with a chance for showers. Remaining colder than normal much of next week with a chance for some precipitation Monday and Tuesday, including possible snow showers up north. There is definitely cold air building at the higher latitudes, as Barrow (AK) and Dead Horse reported minimums of -19 degrees F earlier this week. In fact Barrow had a windchill factor of -45 degrees as well. Fairbanks, Alaska reported the coldest first half of October in 76 years.

The new monthly outlook for November favors near normal to below normal temperatures and above normal precipitation. Further the seasonal outlook for November through January favors below normal temperatures for Minnesota, with above normal moisture in southern counties.

To: Bob Potter, John Bischoff, and Stephanie Curtis
From: Mark Seeley
Re: Suggestions for MPR's Morning Edition, Friday, Oct. 25, 1996

Don't forget to set clocks back one hour on Saturday night. The Hunter's Full Moon will probably not be visible through the clouds on Saturday across most of the state.

Listener question: How often does it snow on Halloween in the Twin Cities? I suppose that this question was prompted by the recent past, in that it snowed on Halloween in 1991 (8.2 inches, over 28 inches in total) and again last year (0.5 inches, over 2 inches in total). Anyway, checking the historical MSP records back to 1891, measurable snowfalls, snow showers or snow flurries have been observed on Halloween just 15 times in the past 105 years of Twin Cities weather. Incidentally, the MSP records show measurable precipitation of some form on 34 Halloweens of the past. The most common early evening temperature is in the 40s, but it has ranged from 77 degrees F to 21 degrees F.

Topic: Importance of fall moisture

Since October 15th, many areas of the state have received well over 2 inches of precipitation, the most for any such period since mid June. Though disruptive to farmers trying to finish corn harvesting and to the rest of us trying to finish outdoor fall chores (like leaf raking, pruning, painting, etc), the moisture is much needed in many places.

Storage efficiency in Minnesota soils is maximum this time of year for several reasons. Most vegetation has died or is in the process of going dormant and using little soil moisture; surface evaporation is reduced because of the lower air temperatures, sun angle and declining daylength; and rainfall rates more closely match the infiltration rates of our soils, meaning that less is lost to runoff. For individual storms, storage efficiency can be as high as 80 percent, that is to say for every inch of rainfall, approximately 0.80 inches can be stored in the soil.

Good fall moisture recharge helps to ensure that our soils will not freeze too deeply this winter and that farmers will have adequate soil moisture to start the 1997 growing season.

Almanac: The average MSP high temperature for today's date is 55 degrees F (plus or minus 12 degrees standard deviation), while the average low is 37 degrees F (plus or minus 8 degrees standard deviation).

Local Records:

MSP records for today's date include: highest daily maximum temperature of 82 degrees F in 1989; lowest daily maximum temperature of 31 degrees F in 1919; lowest daily minimum temperature of 18 degrees F in 1962; highest daily minimum temperature of 56 degrees F in 1897; record rainfall of 0.53 inches in 1902; and record snowfall of 0.2 inches in 1942.

Average dew point on this date is 35 degrees, with a maximum of 59 degrees F and a minimum of 8 degrees F.

Scanning the state climatic data base: the all-time high for today's date is 87 degrees F at New Ulm (Brown County) in 1927; the all-time low is -10 degrees F at St Vincent (Kittson County) in 1887.

Words of the Week: Tablecloth, Sansan, Cap Cloud, Crest Cloud, or Banner Cloud

These are either local or generic names for the same cloud form. Crest, cap or banner is used to describe the standing cloud which forms across the peak of a mountain ridge. Uplifted air on the windward side reaches saturation forming a cloud over the mountain crest, while on the leeward side, subsiding or downslope winds warm and dry out the air, causing sufficient evaporation to abruptly terminate the cloud form. Strong winds over a mountain peak may lead to a banner form, that is a cloud that looks like a white flag.

In the Canadian Rockies such a cloud is called a sansan, while in Cape Town, South Africa this type of cloud form is frequently seen (and photographed) over Table Mountain and is called the Tablecloth.

Outlook:

Cloudy, rainy and windy for much of the weekend, with some clearing during the day Sunday. Below normal temperature trend continuing for Monday and Tuesday, with some warming to near normal temperatures by Wednesday. Halloween looks to be cloudy with a chance for showers and temperatures in the 40s.

To: Bob Potter, John Bischoff, and Stephanie Curtis
From: Mark Seeley
Re: Suggestions for MPR's Morning Edition, Friday, Nov.1, 1996

It's hard to believe that as recently as last Saturday, several places in Minnesota were recording temperatures in the 70s. Tornado warnings were issued for some parts of Minnesota as well, highly unusual for October. The strong storm on Tuesday and Wednesday of this week (Oct. 29-30) set a new low pressure record for October at the MSP airport, with a barometer reading of 28.90 inches. This broke the record of 28.98 inches set in October of 1949.

Almanac: The average MSP high temperature for today's date is 50 degrees F (plus or minus 11 degrees standard deviation), while the average low is 33 degrees F (plus or minus 9 degrees standard deviation).

Local Records:

MSP records for today's date include: highest daily maximum temperature of 77 degrees F in 1933; lowest daily maximum temperature of 25 degrees F in 1951; lowest daily minimum temperature of 10 degrees F in 1951; highest daily minimum temperature of 56 degrees F in 1938; record rainfall of 1.85 inches in 1991; and record snowfall of 18.5 inches in 1991. Maximum snow depth has been 14 inches in 1991 and there have been five measurable snows since 1948.

Average dew point on this date is 33 degrees, with a maximum of 58 degrees F and a minimum of -4 degrees F.

Scanning the state climatic data base: the all-time high for today's date is 84 degrees F at Winona in 1950; the all-time low is -10 degrees F at Campbell (Wilkin County) in 1919.

Word of the Week: Twilight (including civil, nautical, and astronomical)

An enquiry from my adult evening class at the university prompted this selection. In simple terms twilight is the term used to describe the period of incomplete darkness that occurs after sunset and before sunrise. It is derived from Saxon or Middle English terms, which imply that it occurs twice daily. The British have also used the term crepuscule which means a dim or faint light. With the sun below the horizon the multiple scattering of light produced by constituents in the upper atmosphere may commonly produce a purple, red or yellow glow.

Three somewhat arbitrary subdivisions of twilight have been used historically to define outdoor visibility.

Civil twilight refers to the interval of incomplete darkness that occurs when the sun's center is approximately 6 degrees below the horizon. The amount of light is still sufficient to carry on outdoor work without the aid of artificial light.

Nautical twilight refers to the interval of incomplete darkness that occurs when the sun's center is approximately 12 degrees below the horizon. The amount of light is still sufficient to navigate using visible features on the surface of water or land.

Astronomical twilight refers to the interval of incomplete darkness that occurs when the sun's center is approximately 18 degrees below the horizon. There is no discernible horizon glow left over the sun's azimuth. Stars (sixth magnitude) directly overhead.

The duration of twilight varies considerably with latitude and season. The daily path of the sun across an observer's celestial sphere will be significantly different near the equator versus the poles for example. The rotational speed of the Earth and changing angles of the sun make it so. At the equator civil twilight may last only 21 minutes and vary little from season to season. At our latitude civil twilight may vary from 30 to 40 minutes, while at high latitudes civil twilight in the summer can literally last all night.

Topic: Weather during November election week in Minnesota

How many times have we heard the weather take the blame for an undesirable outcome....."housing starts were down this quarter due to bad weather in the east"....."food prices will be higher due to poor growing season weather"... "the space shuttle landing was postponed due to foul weather"...."construction costs were higher because of weather delays." But the one I can't stand is "voter turnout was low due to poor weather conditions." This is the case more often in other states rather than in Minnesota, where in relative voter turnout we nearly always look pretty good in national statistics.

With the possible exception of parenting our children, what's more important than using our right to vote? Albeit if weather conditions are dangerous, such as a blizzard, then voters may be justified in staying home, but I can't buy uncomfortable or inclement weather as an excuse.

Historically, election day has varied from the 2nd of November to the 8th of November. In Minnesota, high temperatures are typically in the 40s with lows in the 20s and 30s. There is frequently little or no precipitation, but there have been some notable exceptions of rather harsh weather in terms of both precipitation and temperature. 1901, 1910, 1911, 1933, 1936, 1951, 1959, and 1991 were all notable for being quite cold and/or snowy during election week. 1936 was the only case of a major national and local election in Minnesota taking place in the face of some pretty cold and icy weather. Heavy snows and glaze occurred in northern, western, and central counties during the first three days of November and near record setting cold temperatures accompanied the storms. Election morning lows (Nov 3) were in the single digits to teens. The streets and sidewalks were pretty icy from recent snows and the windchill index was well below

zero all day and in the dangerous category (colder than -25) in some places. Yet, the voter turnout was over 1.1 million in Minnesota, probably over 70 percent of those eligible. Way to go Minnesota!

Interestingly enough, we have had measurable snowfalls just preceding or on election day each year since 1988, with the most pronounced being 1991, which was not only the snowiest but the coldest, surpassing 1951 in terms of weather misery.

Outlook:

The outlook for next week looks to be colder than normal with chances for precipitation somewhat lower than normal. Specifically on election day (Tuesday) lows will be in the 20s and highs in the 30s to low 40s. It will likely be cloudy and windy, with a chance for rain or snow showers around the state. I would like to think that inclement weather would have little effect on the turnout of stout-hearted Minnesotans who cherish their voting privileges.

To: Bob Potter, John Bischoff, and Stephanie Curtis
From: Mark Seeley
Re: Suggestions for MPR's Morning Edition, Friday, Nov.15, 1996

A Plug:

In the current issue of The Minnesota Volunteer, the magazine of the Minnesota DNR, there is an excellent article by Stan Tekiela entitled, "Stuff That Falls From the Sky." In this article he describes wintertime weather phenomena and suggests some activities for children to learn more about winter weather.

Anniversary today and tomorrow of the famous 1911 cold wave and snow storm in northwestern Minnesota, which saw 1 to 2 foot snowfalls and almost unbearable windchill readings (-60 to -70). For comparison, our statewide windchill values yesterday (Thursday) morning were negative single digit to teens, and that felt plenty cold enough!

Topic: Freezing Rain in Minnesota

As it appears that freezing rain may be affecting parts of the state this week, I want to comment on a couple of characteristics regarding this type of storm: the frequency of occurrence and the formation process.

November to late December is the period of time when we most frequently record freezing rainfall. Historically, the frequency of occurrence for freezing rain during this period is nearly equal to the total frequency of these events observed for the balance of the calendar year. In other words about half of the annual observations of freezing rain fall within this period. 1996 has already produced one of the heaviest freezing rainfall events in recent memory as a result of the storm on January 17-18 last winter.

The process which produces freezing rain is almost always overrunning, that is warm, moist air running over the top of cold air near the surface. Water droplets formed in relatively warmer clouds aloft become supercooled falling through colder and colder layers toward the ground. When these droplets hit surfaces (pavement, trees, wires, etc) which are at subfreezing temperatures, they freeze, forming a glaze.

Almanac: The average MSP high temperature for today's date is 41 degrees F (plus or minus 11 degrees standard deviation), while the average low is 27 degrees F (plus or minus 11 degrees standard deviation).

Local Records:

MSP records for today's date include: highest daily maximum temperature of 69 degrees F in 1953; lowest daily maximum temperature of 13 degree F in 1932; lowest daily minimum temperature of 1 degree F in 1911, 1932, and 1940; highest daily minimum temperature of 55 degrees F in 1930; record rainfall of 0.67 inches in 1944; and record snowfall of 5.1 inches in 1956. Maximum snow depth has been 5 inches in 1991 and there have been five measurable snows since 1948.

Average dew point on this date is 29 degrees, with a maximum of 52 degrees F and a minimum of 1 degrees F.

Scanning the state climatic data base: the all-time high for today's date is 76 degrees F at Madison (Lac Qui Parle County) in 1953 (see community notes section); the all-time low is -36 degrees F at Angus (7 inches snow cover) in northern Polk County in 1911. This is probably the coldest temperature ever recorded in the state so early in November.

Community Notes: Madison, MN

Mr. S. M. Heinzen was the first observer in Madison, starting daily weather observations in May of 1940. This town of about 2000 people, along with Dawson to the south provide the only climate records available for Lac Qui Parle County. Located near the South Dakota border, Madison is generally drier and warmer than most other communities in the state. During the drought year of 1976, they recorded 68 days with high temperatures of 90s degrees F or greater, and during the 1988 drought they recorded 59 such days, including two consecutive days with 110 degrees F.

Many state high temperature records, including the 76 degrees recorded on November 15, 1956 (today's date) are claimed by this community. In fact, it can be speculated that had daily weather observations been established earlier this century in Madison, they would probably have recorded a majority of the state's all-time high temperatures, including surpassing the state record high of 114.5 degrees F recorded at Beardsley on July 29, 1917.

Some additional records for Madison, MN include:

Rainfall of 4.47 inches on June 17, 1992

A minimum temperature of -36 degrees F on February 9, 1994

12 inch snowfall on March 3, 1985

49 inches of snow cover on February 21-22, 1969

Word of the Week: Brickfielder

No, this is not the guy who hands the bricks to the bricklayer.

Like Cock-eyed Bob and Willy-Willies, this is a colorful Australian term for winds. While we are transitioning to winter, downunder they are approaching summer. Sometimes in summer a hot, dry and dusty wind from the interior deserts blows south and affects the south coastal areas of Australia, making the people who live there uncomfortable and irritable. This wind is called the brickfielder, presumably because it picks up the red dusty brick-like soil of the interior and deposits it over the coastal areas.

Outlook:

Unsettled throughout most of the weekend. Temperatures will remain cooler than normal, with precipitation for most areas. Snow in the north, and mixed precipitation in the south. Somewhat drier on Monday, but then another weather system will bring precipitation to the state on Tuesday and Wednesday. The cooler than normal temperature trend will continue well into next week.

To: Bob Potter, John Bischoff, and Stephanie Curtis
From: Mark Seeley
Re: Suggestions for MPR's Morning Edition, Friday, Nov.22, 1996

Topic: Luke Howard, the Father of Meteorology

This name is still not known well outside meteorological circles. Luke Howard was an English chemist (pharmacist) who proposed in 1803 a system of cloud classification based on his own observations and sketches. This classification system is for the most part still used today, nearly 200 years later!

Using the botanical Linnean conventions (after Linnaeus the Swedish naturalist of the 18th century) to classify his observations of the "face of the sky" based on genera, species and varieties (or classes, orders, and suborders), Howard published his "Essay on the Modification of Clouds" in 1804. His scheme for classifying clouds was based on their appearance and the process of formation. There were three distinct types all derived from Latin words: cirrus (wispy hair or thread-like high clouds); cumulus (a heap or puffy cloud); and stratus (spreaded or blanket-like cloud). He also employed a Latin derived word for the rain cloud, nimbus. There were additional combination forms which he proposed as well including cirrocumulus, cirrostratus, and cumulostratus.

With some modifications, Howard's scheme of cloud classification was adopted as a standard in 1891 by the International Meteorological Organization, a non-governmental scientific group. Later, during the 1950s with some additional modification the government based World Meteorological Organization adopted it as a standard for making cloud observations.

Howard was a chemist, a naturalist, an artist, and a devout Christian. Despite being one of the most respected scientists of his time, he maintained a humble attitude which is depicted in his writings. He later authored "The Climate of London," and the first meteorological text book entitled "Seven Lectures in Meteorology." But, he is best remembered for his studies of clouds. It has been speculated by historians, that his contemporary, the poet Percy Shelley, wrote "The Ode to the West Wind" (1819) and "The Cloud" (1820) based on an understanding of the water cycle obtained through reading Howard's works. This Thanksgiving, November 28th, 224 years will have passed since the birth of Luke Howard, the Godfather of the Clouds.

Alternative Topic: Dissecting the climatology of the
Thanksgiving Holiday

With Thanksgiving coming up next week, I have already had several enquiries about what it might be like weatherwise.

Wednesday and Sunday either side of the holiday have evolved to become two of the heaviest travel days of the year. The Twin Cities climate records since 1891 show that 37 percent of

the Wednesdays preceding Thanksgiving have recorded measurable precipitation of some form, suggesting better than a 1 in 3 chance of encountering some storminess. Twenty seven percent of these Wednesdays also show a measurable snowfall, the greatest being 11.4 inches in 1983.

On the other hand, 26 percent of the Sundays following Thanksgiving show measurable precipitation of some form. 21 percent of the Sundays had measurable snowfall, with the greatest being 8.4 inches in 1985. In 1939, it wasn't snowfall which created travel problems, but very dense fog that lasted much of the day on the Sunday after the holiday and created numerous traffic accidents. Despite this incident, statistics suggest a higher probability of having reasonable travel weather on the Sunday after Thanksgiving than on the Wednesday before.

Regarding the Thursdays when Thanksgiving is observed, some rather extreme conditions have occurred. For example the afternoon high was only 4 degrees F in 1930 with a windchill factor ranging between -30 and -33 degrees, while in 1914 the afternoon high reached 62 degrees F under sunny skies.

The most snowfall on Thanksgiving was 4.6 inches in 1940 (the year of the Armistice Day Blizzard). One of the more recent pleasant Thanksgivings was 1988 when the mercury hit 52 degrees and several families enjoyed a bit of the outdoors playing and picnicing in city parks. But don't get your hopes up too much, historically, there is a 36 percent chance of having snow cover on Thanksgiving Day.

The Friday and Saturday after the holiday have become two of the busiest shopping days of the year. Based on history, there is less than a 1 in 4 chance of having snowfall on Friday, and less than a 1 in 5 chance of having snowfall on Saturday following the holiday. So in relative terms, Mother Nature has been kind to shoppers. However, Friday, November 29, 1991 was not a pleasant shopping day, with 12.6 inches of snow falling. Neither was Friday, November 29, 1929 which produced a high temperature of only 4 degrees F with daytime windchills of -35 to -40 degrees. Blowing snow drastically reduced visibility that day and cars had to try to negotiate icy streets nearly everywhere. But then 1929 was probably before shopping became such a popular activity following the holiday.

Taken as a whole (Wed.-Sun.), the holiday period covering Thanksgiving shows a 57 percent occurrence of snowfall on at least one day and a 50 percent occurrence of snow covering the ground. From 1944 to 1958 there was measurable snowfall over every Thanksgiving holiday period, while from 1963 to 1974, no significant snowfalls were measured over the holiday period. Talk about streaky weather! Of the last ten Thanksgiving holiday periods, seven have shown measurable snowfall, including last year.

Almanac: The average MSP high temperature for today's date is 35 degrees F (plus or minus 10 degrees standard deviation), while the average low is 21 degrees F (plus or minus 9 degrees standard deviation).

MSP Local Records:

MSP records for today's date include: highest daily maximum temperature of 58 degrees F in 1980; lowest daily maximum temperature of 12 degree F in 1921; lowest daily minimum temperature of -3 degree F in 1896; highest daily minimum temperature of 42 degrees F in 1908; record rainfall of 0.58 inches in 1898; and record snowfall of 5.5 inches also in 1898. Maximum snow depth has been 8 inches in 1981 and there have been twelve measurable snows since 1948.

Average dew point on this date is 20 degrees, with a maximum of 53 degrees F and a minimum of -7 degrees F.

Scanning the state climatic data base: the all-time high for today's date is 71 degrees F at Red Wing (Goodhue County) in 1990; the all-time low is -25 degrees F at Pokegama Dam in 1896 and at Itasca State Park in 1938.

Word of the Week: Nimbostratus

This is a type of cloud which we have already seen several times this month. This term is derived from the original Latin based cloud classification system proposed by Englishman Luke Howard in 1803. The cloud form is gray, with a low ill-defined ceiling. It generally totally obscures the sun. Nimbostratus clouds bring rain, snow or sleet. On satellite imagery, they show up as darker clouds when compared to the higher colder cloud tops.

Outlook:

Mostly cloudy and somewhat windy in southern Minnesota with a chance for snow this Saturday and Sunday, while it remains partly cloudy up north. Somewhat drier with less clouds for Monday through Wednesday. Temperatures look to remain below normal for the weekend and most of next week. A storm could affect the Thanksgiving weekend in Minnesota by next Friday or Saturday, with snow and increasing wind.

To: Bob Potter, John Bischoff, Perry Finelli, and
Stephanie Curtis
From: Mark Seeley
Re: Suggestions for MPR's Morning Edition, Friday, Nov.29, 1996

Topic: Preliminary Climate Summary for November 1996

Earlier this week a number of low temperature records were set around the state, with overnight minimums well below zero and daytime highs only in the single digits.

With just a few days left in the month, we can summarize some of the most distinguishing climate characteristics for November 1996: Cold and snow are the keywords. The average daily November temperature for most Minnesota communities is the coldest since 1985, and one of the coldest ever historically. In western Minnesota, Alexandria reports the coldest November since 1911. For many other locations, the mean temperature this month falls within the coldest 10 percent of the past 100 Novembers.

Many communities have reported 10 to 20 inches of snowfall so far this month. Current snow depths of 8 to 14 inches are common in many counties, ranking in the 80th to 90th percentile historically for this time of year.

Precipitation for November has ranged from 1 to 2 inches in western Minnesota to 3 to 4 inches elsewhere. In fact, many communities have reported twice the normal November precipitation. Heavy damage was reported in southwestern Minnesota as a result of two heavy ice storms.

Topic: Ice Making Weather

How does weather affects the formation of lake ice? With the current trend of below normal temperatures, many ice fishermen must be getting anxious out there. But it is still too early!

This is the time of year that the frost layer in the soil begins to deepen and lake ice begins to thicken. Ice on the Mississippi River begins to develop more extensively as well, as the Army Corps of Engineers usually close the river for navigation early in December.

Soil frost depths currently range from 4 to 6 inches depending on surface cover. Lake ice thickness is highly variable and still dangerous in many places, as usual for this time of year. There will typically be great variability in ice thickness in and around bays and shorelines with variable shading and snow cover, or areas where currents keep the water moving. The very low temperatures for this week have accelerated the penetration of ground frost and formation of lake ice where snow cover is somewhat limited. But where snow cover is 8 inches or greater, the freezing process is slow due to the insulating effects.

At mean daily temperatures of 20 degrees F or less ice formation begins in previously open water in a matter of 2 to 3 days. Successively lower daily mean temperatures will accelerate the process, along with the decreasing daylength this time of year. For example, 9-11 inches of lake ice will develop on previously open water in approximately 6 days at a daily mean of 10 degrees F, but will take over 11 days at a daily mean temperature of 20 degrees F.

Mean daily temperatures even colder than 10 degrees further accelerate the ice forming process but not as much (at a daily mean temperature of 0 degrees F, 9-11 inches of ice still requires 4-5 days to form).

Bear in mind that there is no reliable method to estimate the rate of ice formation on individual lakes. Several factors such as lake depth, vegetation, water currents, exposure to wind and snow cover all influence the rate of ice formation. Fishermen should use ice chisels or augers to check thickness of lake ice. A thickness of 12 inches or greater is enough to support vehicles according to DNR guidelines, and 4 inches or greater is needed for foot traffic. Be safe and where a life jacket when out on the ice. Also carry a pair of ice claws in your coat pocket

Almanac: The average MSP high temperature for today's date is 31 degrees F (plus or minus 11 degrees standard deviation), while the average low is 17 degrees F (plus or minus 12 degrees standard deviation).

MSP Local Records:

MSP records for today's date include: highest daily maximum temperature of 52 degrees F in 1932; lowest daily maximum temperature of 3 degree F in 1896; lowest daily minimum temperature of -13 degree F in 1891; highest daily minimum temperature of 40 degrees F in 1899; record rainfall of 1.38 inches in 1991; and record snowfall of 12.6 inches also in 1991. Maximum snow depth has been 15 inches in 1983 and there have been twelve measurable snows since 1948.

Average dew point on this date is 18 degrees, with a maximum of 43 degrees F and a minimum of -24 degrees F.

Scanning the state climatic data base: the all-time high for today's date is 64 degrees F at Beardsley (Big Stone County) in 1933; the all-time low is -39 degrees F at Tower (St Louis County) in 1896.

Words of the Week: Portmanteau words

This term is derived from two french words (porter and manteau), meaning to carry a cloak or mantle. Portmanteau words are formed from partial combinations of two or more words, with parts of each word suppressed.

These are common in meteorological jargon: for example, in upper air measurements and observations "rabals" (radiosonde balloons), "pibals" (pilot balloons), and "pireps" (pilot reports) are used to determine the strength and direction of winds aloft. In air quality terminology, smog is a portmanteau word formed from smoke and fog.

Outlook:

A somewhat stormy period coming up for the weekend and unsettled into next week as well. Temperatures will moderate from the extreme cold a bit, but still remain below normal for this time of year.

To: Bob Potter, John Bischoff, and Stephanie Curtis
From: Mark Seeley
Re: Suggestions for MPR's Morning Edition, Friday, Nov.8, 1996

Anniversary on Sunday November 10 of one of the most famous Great Lakes ship disasters, the sinking of the Edmund Fitzgerald in gale force winds near Crisp Point on Lake Superior. This happened back in 1975. Winds exceeded 70 mph on the lake during that strong November storm.

Almanac: The average MSP high temperature for today's date is 44 degrees F (plus or minus 10 degrees standard deviation), while the average low is 29 degrees F (plus or minus 9 degrees standard deviation).

Local Records:

MSP records for today's date include: highest daily maximum temperature of 68 degrees F in 1931; lowest daily maximum temperature of 25 degrees F in 1991; lowest daily minimum temperature of 1 degrees F in 1991; highest daily minimum temperature of 53 degrees F in 1977; record rainfall of 1.51 inches in 1932; and record snowfall of 8.5 inches in 1943. Maximum snow depth has been 14 inches in 1991 and there have been six measurable snows since 1948.

Average dew point on this date is 28 degrees, with a maximum of 54 degrees F and a minimum of 1 degrees F.

Scanning the state climatic data base: the all-time high for today's date is 81 degrees F at Canby (Yellow Medicine County) in 1931; the all-time low is -13 degrees F at Wannaska (4 inches snow cover) Roseau (5 inches snow cover) in 1979 and again in 1991 at Waseca (12 inches snow cover) and Isabella (24 inches of snow cover) in 1991. This time of year, nearly all of the low temperature records are set in the presence of snow cover.

Words of the Week: Socked In

This is a term derived from the early days of aviation and refers to very low values of cloud ceiling or visibility, most often due to fog. Visibility is so poor that airports used to be closed under such conditions. Improved technologies for instrument flying, airport illumination and fog dissipation have greatly reduced the frequencies of major airports being socked in.

The term was derived from reference to the wind sock, a cloth tube mounted on a mast to indicate wind direction along the runway. When the cloud ceiling was low or visibility so bad that the sock was obscured from view, the airport was said to be "socked in," that is the sock was in the clouds.

Listener Question:

Lee in Anoka left a question on my answering machine: "You have often mentioned that November is the month with the most cloud cover in Minnesota. Does that also lead to a smaller difference between daytime and nighttime temperatures?"

Good observation Lee! Historically speaking, there are more days with cloud cover during November than any other month. This condition tends to reduce heating of the air near the ground during the day and also prevents too much heat loss at night. The daily range of temperature, called diurnal fluctuation by climatologists, is from 20 to 30 F degrees much of the year in Minnesota. But in November it is typically only 14 to 16 degrees F. This is due to increased cloud cover as Lee points out, but it is also due to the combined effects of shorter daylength, declining sun angle, increased atmospheric humidity, and generally greater wind speeds (keeping the air mixed).

In fact the average difference between the overnight lows and daytime high temperatures so far this month is only about 10 to 14 degrees F. We have seen some days already this week with a daily temperature spread of only 4 or 5 degrees F. These kinds of conditions tend to aggravate those who suffer from "seasonal affected disorder" (SAD) which is sometimes treated with light therapy.

Outlook:

Mostly cloudy and cold weather is in store for the weekend. A chance for some snow flurries but nothing significant. Becoming partly cloudy and windy for Monday through Wednesday. This will warm the temperatures up a bit, putting us 6 to 8 degrees above normal for mid to late week. Then it appears that a storm is brewing for next weekend and may affect much of Minnesota. Wrap up those outdoor fall chores this week.

To: Bob Potter, John Bischoff, and Stephanie Curtis
From: Mark Seeley
Re: Suggestions for MPR's Morning Edition, Friday, Dec 6, 1996

I will post the following under WEATHERTALK at the MNONLINE site: www.mnonline.org

Question from an MPR listener: Did soils freeze up earlier than usual this year?

Yes. The first reports of soils freezing around the state occurred the week of October 29. This was two to three weeks earlier than normal. Since that time we have recorded a number of snowfalls and freezing rain events which have placed a blanket of snow and ice over the soil surface. This has prevented soil frost from penetrating too deeply. Most soils in southern Minnesota are frozen to a depth of 2 to 5 inches. Northwestern Minnesota reports that soils are frozen to a depth of 10 to 12 inches. Snow cover currently ranges from 4-5 inches in the south and 10 to 15 inches in the north. This blanket of snow will help stall the penetration of soil frost to greater depths.

Topic: Errors in measuring snow and liquid equivalence

With the passage of each winter storm, most true-blue Minnesotans are interested in how much snow fell. We rely on the National Weather Service and its network of cooperative observers to tell us. But snow measurement is quite difficult and prone to errors.

Most of the measurements are made with snow gages, which are really rain gages that have the funnel and inner cylinder removed. Snow accumulates to some depth in the graduated larger diameter outside cylinder. The depth is noted by the observer every 24 hours and then the cylinder emptied or thawed to collect a liquid measurement of the snowfall.

There are several sources of error in measuring a snowfall. Wind can carry much of the snow over the gage opening, allowing less to collect in the gage itself. In addition, after a snowfall event ends, there is frequently blowing and drifting, especially significant with light, fluffy snow. Some of the wind blown snow may get deposited as spindrift in the gage before an observer makes an official measurement.

Another source of error occurs when a liquid measurement is attempted. If the cylinder is heated to melt the snowfall, then some evaporation occurs. This may represent a significant fraction of the precipitation if the snowfall amount is small. One of the better methods for determining the liquid water content is to melt the snow in the gage with a known quantity of tap water, then measure the total liquid in the cylinder and subtract out the quantity that was used for thawing.

Snow boards or snow mats are sometimes used as alternatives to the snow gage. These are essentially platforms for collecting snow which can be wiped clean after each new snowfall. They too, however are subject to wind effects.

Almanac: The average MSP high temperature for today's date is 29 degrees F (plus or minus 11 degrees standard deviation), while the average low is 14 degrees F (plus or minus 12 degrees standard deviation).

MSP Local Records:

MSP records for today's date include: highest daily maximum temperature of 63 degrees F in 1939; lowest daily maximum temperature of -2 degree F in 1972; lowest daily minimum temperature of -19 degree F in 1972; highest daily minimum temperature of 37 degrees F in 1951; record rainfall of 0.53 inches in 1935; and record snowfall of 4.4 inches in 1969. Maximum snow depth has been 21 inches in 1991 and there have been eleven measurable snows since 1948.

Average dew point on this date is 13 degrees, with a maximum of 42 degrees F and a minimum of -28 degrees F.

Scanning the state climatic data base: the all-time high for today's date is 73 degrees F at Beardsley (Big Stone County) in 1939; the all-time low is -32 degrees F at Rothsay (Wilkin County) in 1972. December 9, 1939 is noteworthy as Wheaton recorded a temperature of 74 degrees F, the highest ever noted in the month of December in the history of the state.

Words of the Week: Portmanteau words

This term is derived from two french words (porter and manteau), meaning to carry a cloak or mantle. Portmanteau words are formed from partial combinations of two or more words, with parts of each word suppressed.

These are common in meteorological jargon: for example, in upper air measurements and observations "rabals" (radiosonde balloons), "pibals" (pilot balloons), and "pireps" (pilot reports), are used to determine the strength and direction of winds aloft. In some weather messages, the header "rarep" indicates that what follows is a radar report. In air quality terminology, smog is a portmanteau word formed from smoke and fog.

Outlook:

Looks to be some snowfall around the state ending on Saturday, then dry for Monday, Tuesday and Wednesday. Temperatures will moderate at or above seasonal normals, but another storm forming in the plains could affect us toward the end of next week, bringing more snow to most of Minnesota.

To: Bob Potter, John Bischoff, and Stephanie Curtis
Re: Suggestions for MPR's Morning Edition, Friday, Dec 13, 1996

Question from an MPR listener: What's the difference between freezing rain and freezing drizzle?

Good question. Seems that we are having our fair share of both this winter. The distinction between freezing rain and freezing drizzle is technically the droplet size. Drizzle consists of droplets which are 0.2 to 0.5 millimeters (.01 to .02 inches) in diameter. Rain droplets are larger diameters. Another important characteristic difference is that being of such a small size drizzle tends to be more uniformly dispersed and often appears to float around among air currents before it finally lands on the surface. It is most often very light and of little significance, generally recorded as only a trace in a rain gage for example. On the other hand, the larger rain droplets tend to fall in shafts of varying density. In the freezing form, both kinds of precipitation fall as liquid, but freeze on contact with subfreezing surfaces.

Odds and Ends in the Weather:

- This week marks the anniversary of a very unusual occurrence in west coast weather. On December 11, 1932 a very strong cold front swept across northern California, bringing nearly 1 inch of snow and a 20 degree F minimum temperature to San Francisco, one of only a handful of times that snowfall has ever been reported in that city. Can you imagine driving the hills of San Francisco in snow! This cold front also established an all-time low temperature reading for the state Capitol at Sacramento, which reported only 17 degrees F.

- This fall, the National Weather Service Storm Prediction Center moved from Kansas City, MO to Norman, OK. Thus it is now co-located with the National Severe Storms Laboratory (the group featured in the recent movie "Twister"). The operational side of severe storm forecasting is now side by side with the major research center for studying severe storms. This should facilitate better communications and more rapid deployment of new techniques and products for warning the public about severe weather.

- For Minnesota citizens who like to cross country ski or snowmobile, the Minnesota Climatology Working Group Web Site provides a weekly assessment of ski and snowmobile trail conditions around the state along with a map of the current snow depth. These products are updated by the DNR-State Climatology Office every Thursday afternoon for those planning their weekend activity. The URL is the following..

<http://www.soils.agri.umn.edu/research/climatology>

Almanac: The average MSP high temperature for today's date is 26 degrees F (plus or minus 12 degrees standard deviation), while the average low is 11 degrees F (plus or minus 15 degrees standard deviation).

MSP Local Records:

MSP records for today's date include: highest daily maximum temperature of 53 degrees F in 1891; lowest daily maximum temperature of -5 degree F in 1917; lowest daily minimum temperature of -21 degree F in 1917 (with -55 to -60 degree F windchill readings); highest daily minimum temperature of 36 degrees F in 1928; record rainfall of 0.41 inches in 1983; and record snowfall of 6.3 inches also in 1983. Maximum snow depth has been 15 inches in 1950 and there have been 14 measurable snows since 1948, including 3.4 inches only last year.

Average dew point on this date is 10 degrees, with a maximum of 34 degrees F and a minimum of -26 degrees F.

Scanning the state climatic data base: the all-time high for today's date is 62 degrees F at Lynd (Lyon County) in 1921 (no snow on the ground); the all-time low is -42 degrees F at Ada (Norman County) in 1901 (10 inches of snow on the ground). The record at Ada is another example of a strong cold wave, since the afternoon high on December 11th had been 29 degrees F. The temperature dropped 71 degrees by the morning of the 13th.

Word of the Week: GOOS

Another acronym that's kind of fun to pronounce. This one stands for Global Ocean Observing System, which is part of a global climate monitoring system initiated by the World Meteorological Organization, the International Oceanographic Commission, the United Nations Environment Programme and the International Council of Scientific Unions. Besides monitoring winds, temperature and moisture for climate assessment and prediction, this program will monitor and assess marine living resources, coastal zone environmental changes, carbon fluxes, sea ice and the general health of the oceans. Research in recent years has consistently pointed to the oceanic-atmospheric coupled processes that regulate the climate of Earth. Most historical climate data and research has been associated with land-based studies, but through this program much greater attention will be given to ocean processes in future years.

Outlook:

A generally dry weekend for most of the state, with some chances for snow up north on Sunday. Temperatures will be declining from seasonal normals proceeding into next week, with a good size storm developing in the central plains affecting Minnesota late Monday through early Thursday. Some significant snow accumulations could occur over this interval. Temperatures through the week are expected to average below normal.

To: Bob Potter, John Bischoff, and Stephanie Curtis
Re: Suggestions for MPR's Morning Edition, Friday, Dec 20, 1996

The winter solstice is tomorrow (Dec. 21st) with 8 hr 46 min of daylight. Chin up, the days are getting longer for the next 6 months.

Topic: Happy Holidays to Friends We Appreciate

Since this is a heavily traveled holiday placed right on the threshold of winter, we are all very dependent on our friends at the National Weather Service for continuous reports and forecasts. Their offices operate 24 hours a day and they are always good about updating forecasts as weather systems develop. Updated forecasts can be heard on NOAA weather radio or accessed over the Internet at several Web sites, including.....

<http://www.crhnwscr.noaa.gov/mpx/mpxnew.html>
<http://iwin.nws.noaa.gov/iwin/main.html>

I think we should take a moment to wish National Weather Service employees and the many volunteer cooperative observers who check the weather around the state "HAPPY HOLIDAYS AND THANKS FOR YOUR HARD WORK." In particular, I would especially like to thank Bill Harrison, a forecaster at the NWS Chanhassen office who will be working Christmas Day for the nineteenth year in a row.

Twin Cities Almanac for December 20th:

The average MSP high temperature for December 20 is 27 degrees F (plus or minus 13 degrees standard deviation), while the average low is 10 degrees F (plus or minus 14 degrees standard deviation).

MSP Local Records for December 20th:

MSP weather records for December 20 include: highest daily maximum temperature of 51 degrees F in 1967; lowest daily maximum temperature of -11 degree F in 1916; lowest daily minimum temperature of -24 degree F in 1916; highest daily minimum temperature of 39 degrees F in 1923; record rainfall of 0.74 inches in 1902; and record snowfall of 4.4 inches in 1978. Maximum snow depth has been 18 inches in 1983 and there have been 15 measurable snowfalls since 1948.

Coldest windchill conditions reported in the Twin Cites on December 20 have been: -60 F WC in 1916, -61 F WC in 1983, and -64 F WC in 1989.

Average dew point for December 20th is 9 degrees, with a maximum of 44 degrees F and a minimum of -30 degrees F.

All-time state records for December 20th:

Scanning the state climatic data base: the all-time high for December 20th is 69 degrees F at Faribault (Rice County) in 1923 (no snow on the ground); the all-time low is -49 degrees F at Tower (St Louis County) in 1983 (20 plus inches of snow on the ground).

Topic: Little Need for Minnesotans to Dream of a White Christmas

How often do we have a white Christmas in the Twin Cities area (snow on the ground)? As a Christmas present, our friends at the National Climatic Data Center in Ashville, NC have recently published Technical Report 95-03, entitled "Will we have a white Christmas?" This is available on their Internet site.....

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under the "what's new section." This report details the frequency of a white Christmas for most major cities in the United States based on the historical occurrence of at least 1 inch of snow on the ground.

It is interesting reading. Aproximately 3/4 of all Christmas holidays are white in the Twin Cities. But, did you know that there is virtually a 100 percent chance of a white Christmas in International Falls and Hibbing, MN? You can't get much higher than that. At Redwood Falls, MN there is a 62 percent chance. Even places like Savannah, GA and Tucson, AZ have a 3 percent chance for a white Christmas. Guess that's better than no chance at all. The last white Christmas in Tucson was 1987 when 4 inches of snow blanketed the landscape and that was their first white Christmas in 47 years! For the first time in several years, parts of Florida, Georgia, and Alabama have received some snow (just this week), but it likely will not last until Christmas.

Since 1948, the Twin Cities climate record shows that Christmas day in '49, '57, '58, '65, '67, '76, '77, '79, '82, and '88 occurred without snow on the ground. In addition, over the past 48 years, it has actually snowed measurably on either Christmas Eve or Christmas Day 50 percent of the time (24 years).

These statistics make me realize that the new sleds, skis, snowshoes, snowmobiles, snowboots, caps, gloves, etc. being given for Christmas have a high probability for use on Christmas Day.

Incidentally, the climatology for Christmas Day in the Twin Cities shows an average high of 24 degrees, an average low of 8 degrees, and an average snowdepth of 4 inches. Temperature records are a maximum of 51 degrees F in 1922 and a minimum -39 degrees F in 1879. The record snowfall is 9.6 inches in 1945.

State Record Temperatures for Christmas Eve and Christmas Day:

All-time state records for Christmas Eve are: a high of 52 degrees F at Montevideo in 1922 and a low of -41 degrees F at Pokegama Falls in 1921. Records for Christmas Day are: a high of 56 degrees F at Winona in 1936 and a record low of -50 degrees F at Big Falls (Koochiching County) in 1933.

Other memorable Minnesota Christmas holidays noted for somewhat intolerable or unusual weather were: life threatening -40 to -60

degree F windchill temperatures on Christmas Eve and Christmas Day in 1903, 1933 and 1934; twenty hours of snowfall, totaling between 15 and 20 inches in south central and southeastern Minnesota on Christmas Eve and Christmas Day of 1945 making travel almost impossible; and lightning, thunder and heavy rain in southern Minnesota on Christmas Day 1916, with many communities reporting over 1 inch of rainfall from thunderstorms.

Word of the Week: Blizzard

This is a timely word since western Minnesota and the eastern Dakotas experienced this type of storm earlier this week. The operational use of this term by our National Weather Service in winter weather warning statements specifies wind gusts of 35 mph or higher, low temperatures (generally less than 20 degrees F) and sufficient snow in the air (either from snow bearing clouds or from blowing snow) to reduce visibility to 0.25 miles or less. These conditions must be expected to last 3 hours or more.

The origin of this word is not entirely known. There are two speculations about the first use of it. Early American settlers in Virginia used the term "blizz" to refer to a wind driven rain or snow which reduced visibility. Thus, blizzard may have derived from this term during the 18th century. On the other hand, real blizzard-like conditions are somewhat rare in Virginia and far more common in the Dakotas. Early German settlers in the Dakotas borrowed from the German word "blitzartig" (lightning like) to name sudden and severe winter storms blizzards. This may be the more plausible explanation. In fact, at one time South Dakota was known as the "Blizzard State", but I suppose that did not prove to be a very marketable nickname, so I think it is little used anymore.

Several regions have storms analogous to blizzards, but they refer to them by other names. The "buran" of Russia, the "purga" of northern Siberia, and the "boulbie" of southern France are of a similar nature to the American blizzard and can be life threatening.

Outlook:

A large pool of cold arctic air has formed to the north and will maintain the trend of below normal temperatures for quite sometime. Chance of snow Saturday, Sunday, and Monday as another low pressure system passes through. Continuing chances for snow, particularly in southern Minnesota next week for Wednesday through Friday. So it may indeed be a snowy Christmas for most of us.

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Re: Suggestions for MPR's Morning Edition, Friday, Dec 20, 1996

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All-time state records for Christmas Eve are: a high of 52 degrees F at Montevideo in 1922 and a low of -41 degrees F at Pokegama Falls in 1921. Records for Christmas Day are: a high of 56 degrees F at Winona in 1936 and a record low of -50 degrees F at Big Falls (Koochiching County) in 1933.

Other memorable Minnesota Christmas holidays noted for somewhat intolerable or unusual weather were: life threatening -40 to -60

degree F windchill temperatures on Christmas Eve and Christmas Day in 1903, 1933 and 1934; twenty hours of snowfall, totaling between 15 and 20 inches in south central and southeastern Minnesota on Christmas Eve and Christmas Day of 1945 making travel almost impossible; and lightning, thunder and heavy rain in southern Minnesota on Christmas Day 1916, with many communities reporting over 1 inch of rainfall from thunderstorms.

Word of the Week: Blizzard

This is a timely word since western Minnesota and the eastern Dakotas experienced this type of storm earlier this week. The operational use of this term by our National Weather Service in winter weather warning statements specifies wind gusts of 35 mph or higher, low temperatures (generally less than 20 degrees F) and sufficient snow in the air (either from snow bearing clouds or from blowing snow) to reduce visibility to 0.25 miles or less. These conditions must be expected to last 3 hours or more.

The origin of this word is not entirely known. There are two speculations about the first use of it. Early American settlers in Virginia used the term "blizz" to refer to a wind driven rain or snow which reduced visibility. Thus, blizzard may have derived from this term during the 18th century. On the other hand, real blizzard-like conditions are somewhat rare in Virginia and far more common in the Dakotas. Early German settlers in the Dakotas borrowed from the German word "blitzartig" (lightning like) to name sudden and severe winter storms blizzards. This may be the more plausible explanation. In fact, at one time South Dakota was known as the "Blizzard State", but I suppose that did not prove to be a very marketable nickname, so I think it is little used anymore.

Several regions have storms analogous to blizzards, but they refer to them by other names. The "buran" of Russia, the "purga" of northern Siberia, and the "boulbie" of southern France are of a similar nature to the American blizzard and can be life threatening.

Outlook:

A large pool of cold arctic air has formed to the north and will maintain the trend of below normal temperatures for quite sometime. Chance of snow Saturday, Sunday, and Monday as another low pressure system passes through. Continuing chances for snow, particularly in southern Minnesota next week for Wednesday through Friday. So it may indeed be a snowy Christmas for most of us.