

To: Greg Magnuson, Bob Potter, John Bischoff, and Stephanie Curtis  
From: Mark Seeley  
Re: Suggestions for Morning Edition, Friday, January 13, 1995

We have had a fairly cloudy and foggy week, with some rather hazardous walking and driving conditions. Northeastern Minnesota received a fair amount of lake-effect snow. Cascade River State Park in Cook County had received 5 new inches by Wednesday, giving them a total of 14 inches on their snow trails there. Of course 14 inches of snowdepth isn't all that much in that area of the state. The North Shore Ridge in Cook, Lake and St Louis Counties (1200 ft above Lake Superior in some places) has had snow depths of well over 50 inches in past winters. Meadowlands had 88 inches of snow on the ground in February of 1969 while Gunflint Lake had over 70 inches of snow on the ground in February of 1972. Pigeon River Bridge in Cook County reported 147.5 inches of snowfall during the winter of 1936-37, but I don't know what the maximum snow depth was.

Incidentally, each Wednesday afternoon the DNR puts out a weekly snow depth map and trail conditions information for those people who would like to plan their weekend hiking, snowshoeing, or cross-country skiing activity. For Internet users, this information can be found on the University of Minnesota Gopher at the following address:  
"gopher.soils.umn.edu"

Almanac: Normal high in the low 20s and lows in lower single digits

MSP records for today's date include: a maximum temperature of 48 degrees in 1987; a minimum temperature of -34 degrees in 1868 (old Pioneer records) and -30 degrees in 1916; record precipitation of 0.36 inches in 1888 (0.29 inches in 1967); record snowfall of 6.0 inches in 1967; and record snow depth of 19 inches in 1984.

Scanning the state climatic data base: the all-time maximum temperature for today is 60 degrees at Lambertson (SW) in 1987; the all-time low temperature is -50 degrees at Bagley (NW Clearwater County) in 1916. That year (1916) is also noteworthy for producing 35 to 40 inches of total snowfall during the month of January at a number of places in western and northern Minnesota.

Word of the Week: Finger Drifts

This is used as much by people in transportation as well as meteorology. Snow drifts which occur along roadways and railroad tracks are often affected by the subtle features of topography or local vegetation pattern, particularly where the roadbed is below or level with the surrounding landscape. These features modify both the deposition and drift of snow, especially very light snow like we had earlier this week. Sometimes the result is that drifts accumulate in a fingerlike pattern across a roadway or railway, rarely causing an impassable blockage, but creating a considerable nuisance for driving nevertheless. Many northern Minnesota roads were reporting finger drifts earlier this week.

Community and Observer Notes: None this week

Topic: January Thaws

This is almost an annual phenomena in Minnesota despite the fact that January, and especially the third week of the month is generally the coldest time of the year. If you consider two or more days with temperatures above freezing as a criteria for January thaw, it is indeed rare not to have one. Since official National Weather Service records for the Twin Cities started in 1891, there have only been 11 Januarys without such a thaw period (1895, 1912, 1918, 1929, 1937, 1940, 1977-1979, 1982, and 1994), most recently in fact last year.

The high Wednesday (1/11) was 34 degrees, followed by a high on Thursday of 36 degrees here at MSP, the first days so far this month with maximum temperatures in the 30s. A somewhat minor January thaw, but both the medium range guidance and the 6-10 outlook for next week favor much above normal temperatures, perhaps 10-20 degrees warmer than normal.

To: Greg Magnuson, Bob Potter, John Bischoff, and Stephanie Curtis  
From: Mark Seeley  
Re: Suggestions for Morning Edition, Friday, January 20, 1995

So far this winter only 15.5 inches of snowfall. Bob Potter asked if this was quite a bit below normal. Well, yes. Normal snowfall would be about 25-26 inches by now. Since 1948, a period encompassing 47 Minnesota winters, we have had only 15.5 inches of snowfall or less by this date exactly 14 times. The last time was the winter of 1986-1987 when we had received only 9.6 inches by January 20th. The record lowest amount of snowfall by January 20th is 6.0 inches which occurred during the winter of 1980-81.

Almanac: Normal high in the low 20s and lows in lower single digits

MSP records for today's date include: a maximum temperature of 52 degrees in 1908; a minimum temperature of -32 degrees in 1888 (old Pioneer records) and -25 degrees in both 1943 and 1984; record precipitation of 0.80 inches in 1982; record snowfall of 17.1 inches in 1982; and record snow depth of 22 inches in 1967.

Last year on this date it was -18 degrees in the Twin Cities.

Scanning the state climatic data base: the all-time high for today's date is 61 degrees at Montevideo (Chippewa County) in 1944; the all-time low is -43 degrees which occurred at Roseau in 1949 and at Cass Lake (Cass County) last year (1994).

Word of the Week: Barber

Bob being a boating enthusiast, I thought you might appreciate this one, although I understand that you rarely take your boat out in foul weather. This term refers to a severe storm during which the wind driven sea spray and precipitation freeze onto the decks and rigging of boats. More specifically along the Gulf of St Lawrence in eastern Canada the term refers to a local blizzard with wind driven ice particles of such force that they almost cut the skin from the face. Sounds like the kind of weather to avoid.

Community and Observer Notes: Grand Meadow, MN

This small community of about 1000 people is located in Mower County. The climate station there is one of the oldest and most complete in southeastern Minnesota. Daily climate observations were started in July of 1887 by Mr. C.F. Greening. They continue today in the capable hands of Mr. Kenneth Hoefs. Climate records at Grand Meadow show the following extremes: maximum temperature of 107 degrees on May 31, 1934, perhaps the highest ever May temperature in Minnesota; minimum temperature of -38 degrees on January 14, 1912; a rainfall of 6.41 inches on August 13, 1911; and a snowfall of 18 inches on March 19, 1933.

Topic: Winterkill on crops

Though the winter as a whole has been quite mild, the recent freezing drizzle and rain has put a sheet of ice over much of the landscape. This prevents the normal exchange of gases between the soil and the atmosphere and can cause substantial winter injury to grasses and forage crops such as alfalfa. In fact, though the winter in Minnesota has been mild so far, there are some signs that winter injury may be higher than normal this year. Factors to consider are:

- poor fall hardening as crops entered dormancy due to a prolonged warm spell with few frosts.
- saturated soils in some parts of the state
- little protective snow cover, even where considerable stubble was left after the last cutting of alfalfa. Usually 6 or more inches of snow cover is desirable.
- recent ice sheeting as a result of freezing drizzle and rain has formed a continuous layer over some fields and especially low spots

On the brighter side, soil temperatures have not been unusually low yet this winter. They typically do not contribute to winter injury unless they fall below 15 degrees F. Most average temperatures at the 4 inch depth now are in the 20s. I'm sure this topics are being discussed at the Annual Forage Conference in Minnesota which is currently underway in Detroit Lakes.

To: Greg Magnuson, Bob Potter, John Bischoff, and Stephanie Curtis  
From: Mark Seeley  
Re: Suggestions for Morning Edition, Friday, January 27, 1995

A celebration of winter, the St Paul Winter Carnival begins today.

Bob, it occurred to me that each of the last two years we have considered which days of the week are the wettest and the driest. During 1994, Sunday showed the highest frequency of precipitation events with 19, while Wednesday showed the lowest frequency with 13 events. Weekends, considering both Saturday and Sunday, were wet 27 times during 1994.

Looks like Super Bowl weather in Miami will be 78-80 degrees and cloudy with a chance for thunderstorms in the area.

Almanac: Normal high about 20 and normal low about 0 degrees

MSP records for today's date include: a maximum temperature of 47 degrees in 1934; a minimum temperature of -23 degrees in 1950; record precipitation of 0.42 inches in 1916; record snowfall of 3.8 inches in 1916; and record snow depth of 22 inches in 1982.

Scanning the state climatic data base: the all-time high for today's date is 58 degrees at Hovland (off Hwy 61 in Cook County) in 1906; the all-time low is - 47 degrees which occurred at Bagley (Clearwater County) in 1915.

Word of the Week: Nephanalysis

This is derived from the Greek word nepho meaning cloud and analysis meaning to resolve something. Cloud systems are sometimes referred to as nephsystems. Nephanalysis is a type of synoptic weather analysis based on the types and amount of clouds, as well as where precipitation is occurring. These may be the only features of the weather known to the meteorologist, but they can be used to construct approximations of the pressure pattern, winds, and frontal boundaries. For example the presence of cirrus followed by altostratus clouds typically foretell the approach of a warm front, while the presence of cumulus and cumolnimbus clouds usually accompany a cold front.

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Topic: "The Geritol Solution"

This refers to a proposal to combat global warming. Though the

role of oceans is not particularly well understood yet, they do play a key role in the carbon cycle. The Southern Ocean near Antarctica and in the equatorial Pacific are rich in some nutrients, but poor in iron and low in phytoplankton, the minute forms of plants that live in the oceans. When amounts of iron were added to samples of ocean water containing small quantities of phytoplankton, the production of these small plants skyrocketed. Since phytoplankton production is part of the great biological pump which fixes atmospheric carbon dioxide and stores it in the deep ocean, fertilization of the ocean with iron (Geritol) to stimulate more rapid production of phytoplankton has been proposed as a means to reduce the growth of carbon dioxide in the Earth's atmosphere.

It is uncertain how much this would help, since it might change the composition of phytoplankton in the ocean, favoring one species over another, and disrupt the food chain; or it might make the deep ocean too oxygen deficient. (Geritol might be more likely to work better on you and I Bob). Do you have iron poor blood?

To: Greg Magnuson, Bob Potter, John Bischoff, and Stephanie Curtis  
From: Mark Seeley  
Re: Suggestions for Morning Edition, Friday, February 3, 1995

As a result of a Star Tribune article earlier this week, an MPR listener called to ask how often we receive half or more of our winter snowfall after March 1st. In examining the MSP snowfall records since 1948 (47 years) I find that this has been the case only 5 times, most recently in the winter of 1984-85 when nearly 37 inches of snow fell in the month of March. With the paltry amount of snow so far this winter - only 16.9 inches - we could certainly add significantly to it during the month of March which averages about 11.5 inches of snow.

Northwestern Europe has suffered through one of the wettest ever spells during the month of January. Many places in France, Belgium, Germany, and the Netherlands reported monthly rainfall totals of 8 to 11 inches and some individual storm totals of 3 to 5 inches.

Almanac: Normal high about 22 and normal low about 3 degrees

MSP records for today's date include: a maximum temperature of 51 degrees in 1934; a minimum temperature of -31 degrees in 1863 (Old Pioneer Records), and -25 degrees in 1923 in the modern record; record precipitation of 0.42 inches in 1943; record snowfall of 3.4 inches in 1936 and 1976; and record snow depth of 22 inches in 1969.

Scanning the state climatic data base: the all-time high for today's date is 65 degrees at Browns Valley (Big Stone County) in 1991; the all-time low is - 47 degrees at Itasca State Park in 1923.

One of the coldest spells in Minnesota history occurred on February 5-6, 1895 when Leech Lake and Pokegama Dam reported lows of -54 degrees.

Acronym of the Week: OOPS

As is often the case with many government agencies, the National Weather Service uses a number of acronyms to shorten the names of procedures, equipment, staff positions, and operations. This one is interesting because it refers to something which most organizations ought to have - Organized Operational Panic Systems Handbook. Does MPR have one of these? Of course experience is the best teacher, so the MPR employee who has survived the most panic situations this past year should probably write one of these for the organization.

Word of the Week: Canadian hardness gage

This is not related to the fact that many Canadians pride themselves on their hardness. This is a type of disk gage used for measuring snow hardness. The instrument is a spring-loaded rod with a disk attached at the tip. A gage attached on the side is calibrated for pounds per square inch to indicate

resistence of the snow. It has been used most commonly on arctic and glacier expeditions. I presume this is needed to know what kind of load (pedestrian on snowshoes, or skis) the snow could take.

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Topic: "The Geritol Solution"

This refers to a proposal to combat global warming. Though the role of oceans is not particularly well understood yet, they do play a key role in the carbon cycle. The Southern Ocean near Antarctica and in the equatorial Pacific are rich in some nutrients, but poor in iron and low in phytoplankton, the minute forms of plants that live in the oceans. When amounts of iron were added to samples of ocean water containing small quantities of phytoplankton, the production of these small plants skyrocketed. Since phytoplankton production is part of the great biological pump which fixes atmospheric carbon dioxide and stores it in the deep ocean, fertilization of the ocean with iron (Geritol) to stimulate more rapid production of phytoplankton has been proposed as a means to reduce the growth of carbon dioxide in the Earth's atmosphere.

It is uncertain how much this would help, since it might change the composition of phytoplankton in the ocean, favoring one species over another, and disrupt the food chain; or it might make the deep ocean too oxygen deficient. (Geritol might be more likely to work better on you and I Bob). Do you have iron poor blood?

To: Greg Magnuson, Bob Potter, John Bischoff, and Stephanie Curtis  
From: Mark Seeley  
Re: Suggestions for Morning Edition, Friday, February 10, 1995

Some of the coldest temperatures so far this winter occurred earlier this week, with -25 to -30 degrees reported in northern Minnesota. Last year at this time, Fosston in northwestern Minnesota reported a low of -42 degrees.

We better adjust to it because it looks like the coldest air mass of the winter will start descending upon us this Friday and persist for several days while a large storm system winds up in the central Rockies to perhaps affect our weather next week with abundant wind and snow. Temperatures this weekend will be quite cold with lows well below zero (-30 to -40 up north) and highs remaining below zero or only slightly above.

Northwestern Europe has suffered through one of the wettest ever spells during the month of January. Many places in France, Belgium, Germany, and the Netherlands reported monthly rainfall totals of 8 to 11 inches and some individual storm totals of 3 to 5 inches. Total precipitation in some of these areas was 3 to 4 times the normal for January. Parts of Germany and France had an inch or more of precipitation again last week.

Almanac: Normal high mid 20s and normal low about 5 degrees

MSP records for today's date include: a maximum temperature of 47 degrees in 1977; a minimum temperature of -23 degrees in 1899; record precipitation of 0.60 inches in 1898; record snowfall of 4.3 inches in 1953; and record snow depth of 20 inches in 1967 and 1969.

Scanning the state climatic data base: the all-time high for today's date is 57 degrees at Luverne (Rock County) in 1977; the all-time low is -49 degrees at Tower (St Louis County) in 1899.

Word of the Week: Canadian hardness gage

This is not related to the fact that many Canadians pride themselves on their hardness. This is a type of disk gage used for measuring snow hardness. The instrument is a spring-loaded rod with a disk attached at the tip. A gage attached on the side is calibrated for pounds per square inch to indicate resistance of the snow. It has been used most commonly on arctic and glacier expeditions. I presume this is needed to know what kind of load (pedestrian on snowshoes, or skis) the snow could take.

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Topic: El Nino and Submarine Volcanic Activity

A recent article by Daniel Walker (University of Hawaii) in the Transactions of the American Geophysical Union suggests a correlation between seismic activity along the East Pacific Rise (near Easter Island) and El Nino events. The six most significant occurrences of El Nino since 1964 show very close correspondence to increased submarine seismic activity. Speculation is that the hydrothermal plumes from volcanic activity release energy (as magmatic heat) and nutrients to the middle and upper levels of the Southern Pacific Ocean several months prior to an El Nino event. Cause and Effect? Not clear, but scientists are continuing to study the linkage, some using satellite derived measures of the sea surface opacity in hopes of detecting hydrothermal plumes.

Topic alternative: Warm Winter

This has been a topic of conversation in many coffee shops for the past several weeks. The table below shows the relative ranking of the November through January period in terms of historical warmth. The average temperature for the three month period is calculated from preliminary data. Departure from normal is determined from using the 1961-1990 average for the November through January period. Historical ranking for warmth is based on record periods varying from 33 years at Hibbing to 175 years at MSP. To interpret the departure from normal for the three month period, bear in mind that the standard deviation from the historical records is only about 3-4 degrees.

| Location    | Ave Temp<br>Degrees F | Departure from<br>Normal Nov-Jan | Historical ranking<br>(place/no. years) | Last period<br>as warm (yr) |
|-------------|-----------------------|----------------------------------|---|-----------------------------|
| Twin Cities | 27.0                  | +6.0                             | 10th/175yr                              | 1941-42                     |
| Intl Falls  | 19.8                  | +8.8                             | 4th/85yr                                | 1920-21                     |
| Duluth      | 22.8                  | +6.7                             | 1st/47yr                                | -----                       |
| Crookston   | 19.6                  | +7.6                             | 13th/105yr                              | 1957-58                     |
| Hibbing     | 21.7                  | +8.2                             | 1st/33yr                                | -----                       |
| Olivia      | 23.9                  | +5.1                             | 20th/110yr                              | 1980-81                     |
| Willmar     | 23.2                  | +5.5                             | 7th/64yr                                | 1980-81                     |
| Lamberton   | 25.9                  | +5.9                             | 1st/34yr                                | 1960-61                     |
| Waseca      | 25.6                  | +6.2                             | 7th/80yr                                | 1957-58                     |
| Rochester   | 25.5                  | +5.1                             | 1st/47yr                                | -----                       |

To: Greg Magnuson, Bob Potter, John Bischoff, and Stephanie Curtis  
From: Mark Seeley  
Re: Suggestions for Morning Edition, Friday, February 17, 1995

I just confirmed that the new long range predictions will be released at 3 pm EST today, so I should be able to talk about them tomorrow (for whatever it is worth). They were pretty wrong for February so far, although with the expected warmup, the second half of the month may more than compensate for the negative temperature departures during early Feb.

I still think that I will mention temperature variation in some form because it does convey information about how representative the daily mean really is(n't). Maybe something like "today's average maximum is 28 degrees plus or minus 14."

Concerning the nature of the recent storm, air aloft was warmer over southern Minnesota (classic overrunning of warm air over cold), such that liquid droplets formed in clouds aloft rather than snowflakes. As they fell through colder and colder layers the droplets froze to produce freezing rain and drizzle. Over northeastern Minnesota, the jet stream broke down the vertical layers of temperature (by divergence) and produced more uniformly saturated air. This combined with a bit of an easterly flow off Lake Superior produced much heavier snowfalls (8-10 inches in places)

Yes indeed the days are getting longer. We have gained 44 minutes of daylight so far this month and will pick up another 34 minutes by the end of the month.

The warmup to begin this weekend looks like it will persist well into next week, so the snow cover will be shortlived for cross country skiers and the like. We might even see 40s and 50s by next week in the southern part of the state.

We can discuss this if there is time, but I thought by replying now you might be able to work in some of these comments other than in the 2-3 minutes we are likely to have tomorrow.

Mr. Dick Seavey a math teacher from Burnsville and regular listener called to ask why we don't report the variation as well as the average conditions during the almanac segment each Friday. He raises a very good point in that the variation about the average daily max and min temperature changes throughout the year. For example, the variation (expressed as a standard deviation) in wintertime daily max and min temperature is roughly twice that of the summer months. Thus, a daily max or min which is 10 degrees above average is much more unusual in the summer months than during the winter.

In an effort to provide more information and to educate listeners about the variability in Minnesota's climate, I would like to routinely include the extremes, the average high and low and the standard deviations of temperature in the almanac segment each Friday. The standard deviation of daily max and min temperature will define the limits associated with roughly two thirds of all values for that particular day.

Almanac: Average maximum temperature is 28 (plus or minus 13 degrees standard deviation) and the average minimum is 11 (plus or minus 14.5 degrees standard deviation).

MSP records for today's date include: a maximum temperature of 55 degrees in 1981; a minimum temperature of -20 degrees in 1903 and 1936 (-30 degrees in 1849 or Pioneer Records); record precipitation of 0.29 inches in 1972; record snowfall of 3.8 inches in 1972; and record snow depth of 26 inches in 1967.

Scanning the state climatic data base: the all-time high for today's date is 66 degrees at Luverne (Rock County) and Pipestone in 1981; the all-time low is -44 degrees at Baudette (Lake of the Woods County) and Thorhult (Beltrami County) in 1966.

1981 was memorable for being an unusually early spring in Minnesota. Temperatures were so warm in February, that some small grains (wheat and oats) were planted during the last week of February and first part of March in southern counties. Hard to imagine, but true, as there was a general absence of snow cover and shallow soil temperatures shot up into the 40s and 50s during late February.

Word of the Week: Hydrology and Hygrology

These two are sometimes confused. Hydrology is taken literally from the Greek (hydro=water, logy=study) as the study or science of water, including its properties, origins, and distribution. Important components of hydrology are the study of evaporation, precipitation, infiltration, percolation, runoff, and ground water. The hydrologic cycle describes the interchange of water between the land, the atmosphere and the oceans (or lakes). A hydrograph is a graphical depiction of the stage or discharge of a river or stream as a function of time. This is very important to monitor along the major rivers in Minnesota during the early spring.

Hygrology is taken literally from the Greek (hygo=moist, logy=study) as the study of water vapor in the atmosphere. It is really the study of humidity variation. A hygrograph is a graphical depiction of the humidity of the air as a function of time. An instrument which graphically records both the temperature and humidity over time is called a hygrothermograph.

Community and Observer Notes:

Topic: New Monthly and Seasonal Climate Forecasts released this week

I will be prepared to discuss these if I can. Otherwise, perhaps one of the topics below.

Topic: El Nino and Submarine Volcanic Activity

A recent article by Daniel Walker (University of Hawaii) in the Transactions of the American Geophysical Union suggests a correlation between seismic activity along the East Pacific Rise (near Easter Island) and El Nino events. The six most significant

occurrences of El Nino since 1964 show very close correspondence to increased submarine seismic activity. Speculation is that the hydrothermal plumes from volcanic activity release energy (as magmatic heat) and nutrients to the middle and upper levels of the Southern Pacific Ocean several months prior to an El Nino event. Cause and Effect? Not clear, but scientists are continuing to study the linkage, some using satellite derived measures of the sea surface opacity in hopes of detecting hydrothermal plumes.

Topic alternative: Warm Winter

This has been a topic of conversation in many coffee shops for the past several weeks. The table below shows the relative ranking of the November through January period in terms of historical warmth. The average temperature for the three month period is calculated from preliminary data. Departure from normal is determined from using the 1961-1990 average for the November through January period. Historical ranking for warmth is based on record periods varying from 33 years at Hibbing to 175 years at MSP. To interpret the departure from normal for the three month period, bear in mind that the standard deviation from the historical records is only about 3-4 degrees.

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To: Greg Magnuson, Bob Potter, John Bischoff, and Stephanie Curtis  
From: Mark Seeley  
Re: Suggestions for Morning Edition, Friday, March 3, 1995

Though it has been quite cold this week and not conducive to thinking about Spring, we are gaining a great deal of daylight this month. From the 1st to the 31st 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 precipitation starting on Saturday and carrying over into much of next week. Maybe we will see some additions to the measly 19 inches of seasonal snowfall in the Twin Cities. A warmup is not readily apparent in any of the forecast models until about the 10th or 11th of March.

Almanac: Average maximum temperature is 33 (plus or minus 13 degrees standard deviation) and the average minimum is 17 (plus or minus 14.5 degrees standard deviation).

MSP records for today's date include: a maximum temperature of 65 degrees in 1905; a minimum temperature of -12 degrees in 1943; record precipitation of 1.19 inches in 1970; record snowfall of 12.6 inches in 1985; and record snow depth of 21 inches in 1962.

Scanning the state climatic data base: the all-time high for today's date is 71 degrees at Milan, Montevideo, Winnebago, and St Peter in 1905; the all-time low is -38 degrees at Pokegama Falls (Itasca County) in 1904.

Words of the Week: Blustery

This word is derived from Low German (blustern) and Serbo-Croatian (blizuzgati) words which mean to blow fitfully and violently like in a storm, referring to the wind. Technically, the National Weather Service forecasters have guidelines for using the term in public forecasts. These guidelines are described in a Rule of Thumb (ROT) memo: "With sustained winds of 15 to 25 mph and especially in gusty situations, the term blustery may occasionally be used." Winds of 15 to 25 mph under mild temperature conditions are sometimes described as "breezy", while the same winds under cold temperature conditions are described as "brisk."

It is not surprising to find that these terms (blustery, breezy, and brisk) are most often found in the public forecast statements during the transition seasons, particularly the months of March-May and October-November when wind speeds tend to be higher.

Community and Observer Notes: Bigfork, MN

This little town (pop. approximately 400) in northern Itasca County, lies along the Big Fork River. Mr. William Bischoff began taking weather observations there in December of 1925. Over the years the power plant personnel, municipal hospital personnel and municipal liquor store personnel have taken turns making the daily observations. This community holds the distinction of reporting the lowest ever March minimum

temperature in Minnesota, -47 degrees on March 1, 1962.  
Observations stopped here shortly after 1980.

Topic: Preliminary February Summary

Locally here at MSP February of 1995 proved to be slightly warmer than normal (+1.4 degrees), drier than normal (-0.63 inches) with only 2.1 inches of snow, cloudier than normal and more wind than usual for the month.

Generally around the state, February was drier than normal except for the Arrowhead region (Duluth received 17.6 inches of snowfall). Most locations in the north (St Cloud and north) reported average temperatures for the month which were 1 or 2 degrees colder than normal, while most locations in the south reported average temperatures which were 1 or 2 degrees warmer than normal. This is to be expected, since the northern half of the state had far more consistent snowcover throughout the month than the south, which actually had some snow-free areas.

Some extremes for the month included a high of 52 degrees at Winona and Canby, and a low of -30 degrees at International Falls and Itasca State Park.

Alternative Topic: El Nino and Submarine Volcanic Activity

A recent article by Daniel Walker (University of Hawaii) in the Transactions of the American Geophysical Union suggests a correlation between seismic activity along the East Pacific Rise (near Easter Island) and El Nino events. The six most significant occurrences of El Nino since 1964 show very close correspondence to increased submarine seismic activity. Speculation is that the hydrothermal plumes from volcanic activity release energy (as magmatic heat) and nutrients to the middle and upper levels of the Southern Pacific Ocean several months prior to an El Nino event. Cause and Effect? Not clear, but scientists are continuing to study the linkage, some using satellite derived measures of the sea surface opacity in hopes of detecting hydrothermal plumes.

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From: Mark Seeley  
Re: Suggestions for Morning Edition, Friday, March 10, 1995

Seasonal snowfall accumulations so far:

Rochester 20.3"      St Cloud 37.9"  
MSP 28.9"      Inl Falls 55.8"      Duluth 63.6"

Almanac: Average maximum temperature is 35 (plus or minus 13 degrees standard deviation) and the average minimum is 18 (plus or minus 14.5 degrees standard deviation).

MSP records for today's date include: a maximum temperature of 56 degrees in 1977; a minimum temperature of -17 degrees in 1948; record precipitation of 0.55 inches in 1913; record snowfall of 4.2 inches in 1956; and record snow depth of 22 inches in 1979.

Scanning the state climatic data base: the all-time high for today's date is 67 degrees at Pokegam Falls (Itasca County) in 1902 (no snow on the ground); the all-time low is -44 degrees at Itasca State Park (Clearwater County) in 1948 (with 29 inches of snow on the ground).

Words of the Week: The Seasons in Latin

Hibernal, vernal, aestival and autumnal are the Latin adjectives for the four seasons, winter, spring, summer and fall. Later this month on March 20th we change over from hibernal to vernal with the Vernal Equinox as the sun passes over the equator on its migration north. Interestingly, many Minnesotans choose to hibernate (the verb form for spending the winter) in Arizona, Texas or Florida, then turnaround and aestivate (the verb form for spending the summer) in places like Detroit Lakes, Gull Lake, Pelican Lake and Lake of the Woods. That's what I call hibernating and aestivating in style.

Community and Observer Notes: Bigfork, MN

The coldest place ever in March.

This little town (pop. approximately 400) in northern Itasca County, lies along the Big Fork River. Mr. William Bischoff began taking weather observations there in December of 1925. Over the years the power plant personnel, municipal hospital personnel and municipal liquor store personnel have taken turns making the daily observations. This community holds the distinction of reporting the lowest ever March minimum temperature in Minnesota, -47 degrees on March 1, 1962. Observations stopped here shortly after 1980.

Topic: Ice Jams

The spring snowmelt flood outlook update is being released today by the National Weather Service. Though the risk of spring snowmelt flooding is not particularly high for most river basins in Minnesota, a big unknown is whether or not significant ice

jams might develop along the rivers. Sometimes these ice jams occur along areas where the ice is relatively thicker or where the river makes a sharp turn. Ice jams can cause dramatic rises in the basin flow and be difficult to break up. They are also hard to forecast. In the case of the Red River of the North, ice jams can occur because the basin first thaws in the southern region and begins to drain to the north where it is still frozen. This is the only one of our major basins which actually drains to the north. The others drain to the south, and therefore to a warmer climatic regime.

The warmer temperatures this weekend and into next week, will certainly contribute to more rapid snowmelt and drainage along our river basins. In the absence of any ice jams this drainage in March will help alleviate any flood potential for later in the spring. Look for a high frequency of fog in the mornings though as water vapor produced by melting during the day will remain in the lower layers of the atmosphere over night and condense into fog.

To: Greg Magnuson, Bob Potter, John Bischoff, and  
Stephanie Curtis  
From: Mark Seeley  
Re: Suggestions for Morning Edition, Friday, March 17, 1995

A remarkable run of above normal temperatures has occurred since our last visit. Since last Friday, temperatures have averaged 18-20 degrees above normal, resulting in a rapid loss of snowcover over a period of 3 days and subsequently a loss of over 10 inches of soil frost. Southern Minnesota locations may indeed lose all of their soil frost over the next week or so as warmer temperatures from both above (surface heating) and below work to reduce the remaining frost layer.

Almanac: Average maximum temperature is 38 (plus or minus 11 degrees standard deviation) and the average minimum is 21 (plus or minus 11 degrees standard deviation).

MSP records for today's date include: a maximum temperature of 76 degrees in 1894; a minimum temperature of -8 degrees in 1941; record precipitation of 0.89 inches in 1965; record snowfall of 11.2 inches in 1965; and record snow depth of 21 inches in 1962.

Scanning the state climatic data base: the all-time high for today's date is 81 degrees at Granite Falls (Chippewa County) in 1894 (no snow on the ground); the all-time low is -30 degrees at Baudette (Lake of the Woods County) in 1967 and at Tower (St Louis County) in 1989.

Word of the Week: Isanthesic line

From the Greek iso for equal and anthesis for blooming, this term refers to a line drawn on a map to indicate geographical locations where the blooming of a given plant occurs on the same date. The lines are usually date labeled with text about which plant species have been analyzed.

Should we maintain this pattern of above normal temperatures, we may start to see some premature budding of many plants across the state.

Community and Observer Notes: None this week

Topic: Diurnal (daily) temperature ranges

We are now at the time of year, March and April, when some of the largest daily temperature ranges can occur, especially under a dry weather pattern. This is the result of two factors: the rapidly increasing daylength and sun angle which bring about greater heating of the surface; and secondly substantial differences in temperature among the air masses which pass over us (tropical air from the south and polar air from the north).

The average daily temperature range in March is about 15 to 20 degrees, however there are some remarkable examples in the climate records of much larger changes which have occurred in one day. For example, on March 30, 1963 the morning low temperature in the Twin Cities was 30 degrees, but with sunny skies and strong southerly winds the afternoon high shot up to 77 degrees. Even more astounding, on April 3, 1982 Lamberton (SW Minnesota) reported a high of 78 degrees and a low of 7 degrees.

Alternative Topic: Climate Predictions

The new long range forecasts from the Climate Prediction Center came out Thursday afternoon, March 16. For April in Minnesota, the CPC calls for above normal temperatures to continue to dominate. No significant departures in April precipitation are expected. The new Seasonal Outlook for April-May-June shows a trend toward below normal precipitation in the southern part of state state, and near normal precipitation and temperature expected for the balance of the area.

To: Greg Magnuson, Bob Potter, John Bischoff, and  
Stephanie Curtis  
From: Mark Seeley  
Re: Suggestions for Morning Edition, Friday, March 31, 1995

Well March ends today leaving us a bit exasperated. The month started out like winter, then teased us with notions of springtime conditions during the middle part of the month, and departed with reminders of winter again this week.

10.4 inches of snow during March brought the seasonal total to 29.4 inches, still awfully wimpy for Minnesota.

Average temperatures for March will be from 4 to 6 degrees above normal. MSP averaged about 35 degrees F. The local extremes were 66 degrees on the 16th and -4 on the second and the ninth. Most places in the state lost ground frost during the month and many lakes lost their ice covering as well. Tulips and other bulbs started to sneak a peak at the sky, but have been rather timid lately.

Almanac: Average maximum temperature is 46 (plus or minus 12 degrees standard deviation) and the average minimum is 29 (plus or minus 9 degrees standard deviation).

MSP records for today's date include: a maximum temperature of 82 degrees in 1986; a minimum temperature of -1 degrees in 1969; record precipitation of 1.25 inches in 1985; record snowfall of 14.7 inches in 1985; and record snow depth of 12 inches in 1965.

Scanning the state climatic data base: the all-time high for today's date is 84 degrees at New Ulm and St Peter in 1968 and at St James in 1986; the all-time low is -32 degrees at Tower (St Louis County) in 1975.

Word of the Week: Spirit Thermometer

Not for taking the temperature of a spirit or ghost, neither of which would probably have a temperature anyway.

This is a type of liquid in glass thermometer for measuring very low minimum temperatures. Spirit is used here in the same sense as a bartender would use the word, referring to a form of liquor derived from the distillation process. In Minnesota where the wintertime minimum temperatures are frequently below zero degrees F, alcohol is often used for the minimum thermometers because it has a very low freezing point and a relatively high coefficient of expansion.

Community and Observer Notes: None this week

Topic: April Weather

The medium range guidance suggests that the first week of April will be cooler than normal. But what if I told you that we might see 100 degrees during the month, or that we might also get as frigid as -22 degrees. April Fools! Not really. It is possible. On April 21, 1980 the Fargo-Moorhead area reported an afternoon maximum of 100 degrees F. On the other hand, on April 6, 1982 Tower (St Louis County) reported a morning low of -22 degrees. Would any meteorologists in their right mind forecast either of these temperatures in April?

Probably not. But Mother Nature sure likes to surprise us  
in Minnesota.

To: Greg Magnuson, Bob Potter, John Bischoff, and  
Stephanie Curtis  
From: Mark Seeley  
Re: Suggestions for Morning Edition, Friday, March 31, 1995

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Community and Observer Notes: None this week

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To: John Bischoff, Perry Finelli, and Stephanie Curtis  
From: Mark Seeley  
Re: Suggestions for Morning Edition, Friday, April 7, 1995

I neglected to mention that March was the 7th consecutive month in Minnesota with above normal average temperatures. We are long overdue for a correction, which may perhaps occur this month. With ice out on many southern lakes and no more ground frost, farmers are anxious to start field work, especially for small grains.

It sure felt like a correction on Tuesday (April 4th). The table below summarizes record setting minimum temperatures and low maximum temperatures which occurred on that day around the region:

| Location        | Max Temp (F) | Min Temp (F) |
|-----------------|--------------|--------------|
| Waseca          | 29           | 7*           |
| Rosemount       | 27*          | 6            |
| La Crosse (WI)  | 28*          | 11*          |
| Eau Claire (WI) | 24*          | 6*           |
| Decorah (IA)    | 29*          | 10 (t)       |
| Dubuque (IA)    | 30*          | 13*          |
| Rochester       | 25*          | 6*           |
| Duluth          | 18*          | -3           |
| St Cloud        | 27*          | 3            |
| Becker          | 27*          | 2*           |
| MSP             | 27*          | 5*           |
| Rice            | 26*          | 2            |
| Princeton       | 26*          | 2            |
| Perham          | 22*          | 1*           |
| Park Rapids     | 19*          | -2 (t)       |
| Grand Rapids    | 20*          | -1           |
| Cloquet         | 21*          | -2           |
| Roseau          | 18*          | 1            |
| Cedar           | 26*          | 3            |

Note \* indicates record (low max or low min) (t)=tied record

Almanac: Average maximum temperature is 50 (plus or minus 12 degrees standard deviation) and the average minimum is 32 (plus or minus 8 degrees standard deviation).

MSP records for today's date include: a maximum temperature of 83 degrees in 1991; a minimum temperature of 6 degrees in 1936; record precipitation of 1.72 inches in 1919; record snowfall of 8.9 inches in 1923; and record snow depth of 6 inches in 1975.

Scanning the state climatic data base: the all-time high for today's date is 91 degrees at Canby (Yellow Medicine County) in 1991; the all-time low is -16 degrees at Tower (St Louis County) in 1982.

Word of the Week: Ringelmann chart

In the past we have discussed the use of the Linke scale to describe the blueness of the sky and the use of Munsell soil color charts to describe the color of soils. In a similar manner, Ringelmann charts are used to make estimates of the amount of solid (or particulate) matter being emitted from smoke stacks. An observer compares the grayness of smoke

to a series of standard shaded diagrams mounted on a white background. The estimates are subjective and can be confounded by whether the sky is clear or overcast.

Community and Observer Notes: None this week

Topic: April Winds

April is on average the windiest month in Minnesota, with mean wind speeds ranging from 11 to 15 mph. This has implications for both the farmer and the home gardener as exposed soils and vegetation can dry out very rapidly in the absence of adequate rainfall. On April 5, 1958 Duluth Airport measured one of the strongest winds ever, 70 mph from the NE off of Lake Superior.

The outlook for the early part of April appears to favor storminess and therefore strong winds and perhaps above normal precipitation. Temperatures appear to be staying on the cool side and so soils will be slow to warm up. Looks like those farmers anxious to get started with small grain plantings will have to be patient at least until the middle part of the month.

To: Bruce MacDonald, Bob Potter, John Bischoff, and Stephanie Curtis  
From: Mark Seeley  
Re: Suggestions for Morning Edition, Friday, April 14, 1995

I will be working at the university Cloquet Forestry Center on Thursday afternoon and Friday, April 13-14. But plan to speak with you by phone at the usual time, if that is OK.

Last time I checked this week, our Twin Cities seasonal snowfall accumulations was still resting at 29.5 inches. If that is where it stays, then we will mark only the 7th winter since 1948 in which we have received less than 30 inches of snowfall. The record low amount over that time is 17.4 inches during the winter of 1986-87.

Looks like farmers in the midwest will have to be patient about starting field work. Much of the agricultural landscape in a number of midwest states has been saturated by rain, sleet and snow since last weekend. Portions of Missouri have had 3 to 4 inch rains, with parts of Iowa and Illinois receiving 2 to 3 inch rains as well. In Minnesota, southern counties have received the most precipitation, ranging from 2 to 3 inches in southwestern sections to 1 to 2 inches in south-central and southeastern sections. The western edge of the state received considerable amounts of snowfall as well, 6-10 inches in some areas. The Minnesota River and Red River of the North will continue to run high for awhile as the basins drain. Small grain producers will have to wait for a prolonged spell of good drying conditions before starting any field work. This may be awhile in coming, as the outlook shows a series of weather disturbances crossing our region on Saturday and again Tuesday and Wednesday of next week.

Almanac: Average maximum temperature is 55 (plus or minus 11 degrees standard deviation) and the average minimum is 35 (plus or minus 8 degrees standard deviation).

MSP records for today's date include: a maximum temperature of 85 degrees in 1954; a minimum temperature of 18 degrees in 1926 and 1928; record precipitation of 1.56 inches in 1983; record snowfall of 13.6 inches also in 1983; and record snow depth of 5 inches in 1949. 1983 also saw the highest monthly snowfall for April measured in the Twin Cities at 21.8 inches.

Scanning the state climatic data base: the all-time high for today's date is 90 degrees at Tracy (Lyon County) in 1954: the all-time low still below zero at -5 degrees up at Roseau in 1950.

Word of the Week: Vectopluviometer

This is a special type of raingage whose characteristics can be inferred from the name: vecto referring to speed and direction, pluvio is the Latin for rain, and meter meaning to measure. Thus this type of gage measures the inclination and direction of falling rain. Two types have been used: one type is a recording gage mounted to a windvane such that it always faces into the wind and catches rainfall coming from that direction. Another type is a series of four gages each oriented to a cardinal compass

direction, such that the gage oriented most parallel to the trajectory of falling rain drops will capture the most.

In case you are interested rain drops in April most commonly come from northwesterly, northeasterly or southeasterly directions.

Community and Observer Notes: Wright, MN

This small community of approximately 170 people began daily climate observations in 1961 (not so long ago compared to most others). Located along Hwy 210 near the border of Aitkin and Carlton Counties, the surrounding landscape is forested and dotted with small lakes. This area has one of the shortest growing seasons in the state, averaging only 98 days frost free each year (June 1 to Sep. 8), compared to an average 165 day growing season in the Twin Cities area.

Their measured climatic extremes include: 100 degrees on August 18, 1976 and on July 27, 1988; -52 degrees on January 15, 1972; 3.80 inches of rainfall on August 31, 1989; 19.2 inches of snowfall on November 11, 1991 (Halloween Blizzard); and 41 inches of snowcover on March 18-19, 1965.

Topic: How fast does spring move northward?

This question came up recently among friends in the Minnesota climatology group (Jim Zandlo, Greg Spoden and Don Baker). Three separate measures of the migration of spring were described: Historically the dates for "ice-out" on Minnesota lakes (that is the date that lakes are free of any ice cover) ranges from early April in the south to early May in the north. This equates to a migration of about 15 miles per day.

A second method is based on the movement of the 45 degree isotherm for average air temperature (that is the average historical date for when daily air temperature starts to average 45 degrees or greater in the spring). By the date sequence for the migration of this isotherm, spring moves northward at 22 miles per day.

Lastly, the migration of spring can be calculated by the apparent movement of the sun between March 21 (the vernal equinox when it lies over the equator) to June 21 (the summer solstice when it lies over 23.5 degrees north latitude). Over that time period the overhead sun moves a total of 23.5 degrees (from 0 degrees at the equator to 23.5 degrees N at the Tropic of Cancer) for a total of 1567 miles. This equates to an average of 17 miles per day.

To: Greg Magnuson, John Bischoff, and Stephanie Curtis  
From: Mark Seeley  
Re: Suggestions for Morning Edition, Friday, April 21, 1995

Definitely looks like April temperatures will break the string of seven consecutive months of above normal conditions.

This week marks the 30th anniversary of the highest recorded river stage along the Mississippi River between Anoka, MN and Dubuque, IA. During April of 1965, flood stage was exceeded by 6 to 12 foot crests along the river. Not even the flood of 1993 approached this level. High levels of stored soil moisture, heavy winter snow cover and above normal April rainfall contributed to the flooding, some of which lasted for a period of 43 days.

Almanac: Average maximum temperature is 59 (plus or minus 11 degrees standard deviation) and the average minimum is 38 (plus or minus 7 degrees standard deviation).

MSP records for today's date include: a maximum temperature of 95 degrees in 1980; a minimum temperature of 22 degrees in 1966; record precipitation of 0.74 inches in 1912; record snowfall of 4.8 inches in 1972.

Scanning the state climatic data base: the all-time high for today's date is 100 degrees at Campbell (Wilkin County), Montevideo (Chippewa County), Ada (Norman County), Georgetown and Moorhead (Clay County) in 1980; the all-time low is 0 degrees up at Hallock (Kittson County) in 1945.

Word of the Week: Goldbeater's skin hygrometer

A hygrometer measures water vapor or humidity. There are several types, some of which we have discussed previously.

A goldbeater's skin hygrometer is rare, but may still be found on occasion. Goldbeaters hammer pieces of gold into gold leaves. These leaves are then separated from each other using goldbeater's skin which is prepared membrane of the large intestine from an ox. This material changes dimension as the humidity of the atmosphere varies. Therefore, it is sometimes used as the sensitive element in a hygrometer which translates minute changes (shrinkage and swelling) in the dimensions of the skin to a measure of atmospheric humidity.

Community and Observer Notes: Wright, MN

This small community of approximately 170 people began daily climate observations in 1961 (not so long ago compared to most others). Located along Hwy 210 near the border of Aitkin and Carlton Counties, the surrounding landscape is forested and dotted with small lakes. This area has one of the shortest growing seasons in the state, averaging only 98 days frost free each year (June 1 to Sep. 8), compared to an average 165 day growing season in the Twin Cities area.

Their measured climatic extremes include: 100 degrees on August 18, 1976 and on July 27, 1988; -52 degrees on January 15, 1972; 3.80 inches of rainfall on August 31, 1989; 19.2 inches of snowfall on November 11, 1991 (Halloween Blizzard); and 41 inches of snowcover on March 18-19, 1965.

Topic: Tornadoes and "tornado awareness week"

Next week is "tornado awareness week" in Minnesota. In addition to the new technologies such as Doppler radar and Wind Profilers deployed by the National Weather Service, severe weather spotters trained through the Skywarn program help to protect us from tornadoes and other severe weather events.

#### History:

The first reported Minnesota tornado was in 1820. Sporadic records of tornado activity in the state were kept up until the 1950s. Since that time National Oceanic and Atmospheric Administration reports have summarized tornado activity around the state each year. The average number of tornadoes in Minnesota each year is 18. In some years (1968 and 1994 for example) well over 30 tornadoes have been reported, while in other years none have been reported.

#### Frequency:

They are more common in the southern half of the state than the northern half. The frequency of tornado reports peaks in the months of June and July. Nearly 75 percent of all tornadoes occur between the hours of 3 pm and 8 pm.

#### 1994:

There were 1,076 tornadoes reported in the United States last year, the fewest in 5 years. Minnesota reported 34, ranking 13th among states (Texas reported 188). But there were 69 deaths nation-wide due to tornadoes and this was the most since 1984. Forty of those deaths occurred as a result of the Palm Sunday (March 27) outbreak in the southeastern United States (Alabama, Georgia, South Carolina, and North Carolina) which saw 27 confirmed tornadoes touch down. One of the strongest tornadoes touched down in Alabama late in the morning and destroyed two churches while worship services were going on. Members at one of these churches (Goshen United Methodist) received no warning, because no system was in place to provide one. VP Gore visited some of the worst hit areas and pledged to deploy better warning systems by expanding NOAA Weather Radio coverage.

#### Trends:

Historical statistics show that deaths have been reduced due to better forecasting and the watch and warning system deployed by the National Weather Service. However, property damage continues to increase with population growth and the ever-increasing replacement costs, particularly for buildings. Nearly 1/2 billion dollars in property damage was chalked up to tornadoes in 1994. New technologies such as Doppler radar are being tested in the midwest and show promise to increase the lead time for warnings to the public. Even increases of five to ten minutes in lead time could help prevent many deaths and injuries.

#### Alternative Topic: How fast does spring move northward?

This question came up recently among friends in the Minnesota climatology group (Jim Zandlo, Greg Spoden and Don Baker). Three separate measures of the migration of spring were described: Historically the dates for "ice-out" on Minnesota lakes (that is the date that lakes are free of any ice cover) ranges from early April in the south to early May in the north. This equates to a migration of about 15 miles per day.

A second method is based on the movement of the 45 degree isotherm for average air temperature (that is the average historical date for when daily air temperature starts to average 45 degrees or greater in the spring). By the date sequence for the migration of this isotherm, spring moves northward at 22 miles per day.

Lastly, the migration of spring can be calculated by the apparent movement of the sun between March 21 (the vernal equinox when it lies over the equator) to June 21 (the summer solstice when it lies over 23.5 degrees north latitude). Over that time period the overhead sun moves a total of 23.5 degrees (from 0 degrees at the equator to 23.5 degrees N at the Tropic of Cancer) for a total of 1567 miles. This equates to an average of 17 miles per day.

To: Greg Magnuson, John Bischoff, and Stephanie Curtis  
From: Mark Seeley  
Re: Suggestions for Morning Edition, Friday, April 28, 1995

Looks like a marked warming trend for the first week of May and perhaps our first look at 70 degree temperatures by next weekend.

A listener called to remark that this has been one of the coldest Aprils in her memory. Indeed she is right.

Preliminary summary for April shows that temperatures around the state have averaged from 4 to 7 degrees cooler than normal, with precipitation generally below normal in the northern and eastern counties, and above normal in the southern and western counties. The temperature departures are significant given that the standard deviation of monthly temperature for April is only 4 degrees. For many locations this has been the coldest April since 1975. No 70 degree temperatures were recorded during the month, while on average 3 to 6 days reach 70 degrees or more during the month of April. Soil temperatures are only recently warming to levels that are sufficient for crop germination, and on soils which are reasonably well drained or have not received a lot of precipitation this month, some planting progress has been made this week.

Almanac: Average maximum temperature is 62 (plus or minus 11 degrees standard deviation) and the average minimum is 42 (plus or minus 8 degrees standard deviation).

MSP records for today's date include: a maximum temperature of 87 degrees in 1934 and 1952; a minimum temperature of 26 degrees in 1907, 1958, and 1965; record precipitation of 0.80 inches in 1896; record snowfall of 4.5 inches in 1907 and 1994. Snow on this date last year at MSP, with temperatures hovering in the low 30s all day long.

Scanning the state climatic data base: the all-time high for today's date is 94 degrees at Argyle (Marshall County) in 1952; the all-time low is -2 degrees up at St Vincent (Kittson County near the borders with North Dakota and Manitoba) in 1892. By the way, according to the Minnesota Climate Data Base, this latter record is the latest in the spring that a below zero temperature has ever been recorded in the state.

Word of the Week: Hazemeter or Transmissometer

With the agricultural season upon us, this is the time of year we sometimes see low level haze develop across the landscape as a result of soils being disturbed by tillage. There are also many other sources of haze such as smoke, exhaust from motor vehicles or from factories. With atmospheric inversions these small particles are prevented from rapid dispersion and held in the air layer nearest the ground. For reporting on visibility, such as required at airports, observers may use a hazemeter or transmissometer to examine the extinction of a light beam of known initial intensity as it travels

horizontally through the atmosphere from point A to point B.

Community and Observer Notes: Wright, MN

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To: Bob Potter, Greg Magnuson, John Bischoff, and Stephanie Curtis  
From: Mark Seeley  
Re: Suggestions for Morning Edition, Friday, May 5, 1995

Huge progress in spring field work this week which was hoped for, didn't quite materialize, though significant progress has been made on sandier and well-drained soils. Actually soil temperatures have only recently been adequate for normal germination of crops. In the context of recent memory, this is a very slow starting spring and the grain trade is showing some response to this reflected in higher prices.

Yesterday, Thursday, May 4 was National Weather Observer's Day, a time to acknowledge the thousands of volunteers who have documented the nation's climatic resources in their daily ritual of measuring temperature, precipitation and other elements of the environment. For the most part, I have found that weather observers are God-Fearing, down to earth, honest folk, who are reverent about the environment and keen observers of nature as well. All in all a very nice lot of people to associate with.

I suppose next week the questions will really start up about weather for the Fishing Opener. It is interesting that in recent years, with the Fishing Opener and Mother's Day falling on the same weekend, I always get more requests for the weather forecast from fishermen than I do from families who are hoping to celebrate Mother's Day outdoors, picnicing, biking, or hiking for example. Of course this is the land of 10,000 lakes (over 16,000 actually) and a million anglers.

Almanac: Average maximum temperature locally for today's date is 67 (plus or minus 11 degrees standard deviation) and the average minimum is 45 (plus or minus 8 degrees standard deviation).

MSP records for today's date include: a maximum temperature of 88 degrees in 1909 and 1939; a minimum temperature of 27 degrees in 1989; record precipitation of 1.84 inches in 1991; and record snowfall of 0.3 inches in 1991.

Scanning the state climatic data base: the all-time high for today's date is 97 degrees at Argyle (Marshall County), Angus and Crookston (Polk County) in 1926; the all-time low is 12 degrees at Cass Lake (Cass County) in 1967 and at Isabella (Lake County) in 1989, the latter being one of the few places in Minnesota with an elevation over 2000 feet.

Words of the Week: Mackerel sky and mackerel breeze

Well, why not a fishy word. We've got the Minnesota fishing opener coming up soon, again coinciding with Mother's Day weekend (I wonder who takes credit or blame for that one). Mackerel is an edible ocean fish with a greenish, blue striped back and a silvery belly. I remember as a boy using small mackerel as bait for sharks when I was fishing with my Dad

and uncle in California. One time we even caught a shark with one.

Anyway, on occasion a weather observer may note the appearance of a mackerel sky, when high level or medium level broken cumulus clouds are aligned such that in combination with the blue sky they present an image not unlike the scales on the side of a mackerel. In another context, fishermen may occasionally refer to a mackerel breeze, which is a wind strong enough to ruffle the water surface and favoring the catching of mackerel.

Community and Observer Notes: Wright, MN

This small community of approximately 170 people began daily climate observations in 1961 (not so long ago compared to most others). Located along Hwy 210 near the border of Aitkin and Carlton Counties, the surrounding landscape is forested and dotted with small lakes. This area has one of the shortest growing seasons in the state, averaging only 98 days frost free each year (June 1 to Sep. 8), compared to an average 165 day growing season in the Twin Cities area.

To: Bob Potter, Greg Magnuson, John Bischoff, and Stephanie Curtis  
From: Mark Seeley  
Re: Suggestions for Morning Edition, Friday, May 12, 1995

Record snowfall for the month of May in the Twin Cities is 3 inches, which occurred in 1892, 1935, and 1946. Interestingly enough in all three cases it was a single storm that was the culprit. The 1935 storm occurred on May 1, a Wednesday and was accompanied by ice which knocked down a number of telephone and powerlines. The 1946 storm occurred overnight during May 11-12, but the snow and associated record-breaking low temperatures were very short-lived as temperatures rebounded into the 70s the next day. The 1892 storm also occurred overnight, from 10:30 pm on the 19th to 6:30 am on the 20th, the latest such storm recorded in the modern Twin Cities record. 1892 is also noteworthy for producing one of the wettest months of May ever in Minnesota. The associated cloudy conditions held the temperatures in check too, since 70 degrees was not reached that year until May 17th - a record.

Almanac: Average maximum temperature locally for today's date is 67 (plus or minus 10 degrees standard deviation) and the average minimum is 46 (plus or minus 8 degrees standard deviation).

MSP records for today's date include: a maximum temperature of 90 degrees in 1900 and 1961; a minimum temperature of 28 degrees in 1946; record precipitation of 1.52 inches in 1906; and record snowfall of 0.2 inches in 1946.

Scanning the state climatic data base: the all-time high for today's date is 98 degrees at Hallock (Kittson County) in 1900; while the all-time low is 11 degrees also at Hallock in 1946. This is unusual to find that one community holds both state temperature records for a given date.

Word of the Week: Zephyr

This is of course the train that goes to California! Actually it derives from the ancient Greek name for the gentle west wind called Zephyros which is depicted on the Tower of Winds in Athens as a youth wearing a flowered mantle. More commonly this term is used to describe a gentle breeze or wind. There are many derivatives such as zephyr cloth, zephyr shirt, zephyr shawl all of which are worn for comfort when the zephyr blows.

Community and Observer Notes: Hallock, MN

This town in the heart of Kittson County (NW MN) has kept daily climate observations since January of 1899, for one of the oldest records in the northern Red River Valley area. Small grains, sugarbeets and potatoes are grown in the area. All-time records at Hallock include: 109 degrees on July 11-12, 1936; -48 degrees on January 13, 1916; 5.36 inches of rainfall on August 31, 1956; and 12 inches of snow on March 28, 1956.

Being located on the flat prairie lands of the Red River Valley, Hallock is subject to some very large swings in daily temperature conditions, particularly when it is dry. For example, on October 9, 1933 after a morning low of 22 degrees, the afternoon high reached 82 degrees under sunny skies and southerly winds.

Topic: Rapid Spring Planting Progress

Some observers in recent years have marveled at the increased speed with which farmers are able to sow a crop in the spring. For example, last week in roughly a three day period, over 30 percent of the field corn acreage in the state was planted. I think that there are at least three factors contributing to this. One is certainly larger and more efficient field equipment (tractors, planters and grain drills), but this has been a trend for a good number of years. A second reason is the move toward less tillage. Many fields now are planted in no tillage or reduced tillage situations (light disking or cultivating). Not so many years ago more time was spent doing spring tillage before even sowing a crop. Lastly, farmers are both ready and willing to spend longer days in the field to achieve timely planting. This attitude is based on the knowledge that maximum yields and optimal weed control are heavily based on timely seeding of the crop. The evidence to support this is overwhelming and producers are thus willing to give planting a top priority.

Alternative Topic: World Meteorological Organization Meeting  
on May 31

One of the contentious issues to be discussed at this meeting in Geneva later this month is the debate over access to meteorological data. Historically, the weather services of most countries have a history of sharing meteorological data sources (e.g. satellite imagery, radar, surface observations, upper air data (balloons), aircraft and ship observations, and general forecasts) in order to benefit their own operational forecasts and services. In addition to the operational needs of various weather services, the academic research needs in meteorology and climatology have benefitted greatly from this policy of freely sharing data sources.

However, in recent years, many national weather services (particularly those of European countries) have developed commercial services which generate substantial revenues in support of their annual operating costs. These commercial services provided to transportation and communication industries (TV and radio), as well as agriculture, shipping, and private forecasting companies (among others) are a source of revenue which most governments want to protect. In light of this, there are proposals to be discussed at this meeting which would restrict the availability and commercial use of some data sources by non-academic institutions and businesses.

The United States representatives to the WMO are concerned that data sources available to all researchers be maintained. A new restrictive policy on data flow may have ramifications for the transfer of large data sets and images which are already freely shared using the Internet. This topic will likely take some time to sort out.

To: Bob Potter, Greg Magnuson, John Bischoff, and Stephanie Curtis  
From: Mark Seeley  
Re: Suggestions for Morning Edition, Friday, May 19, 1995

A listener pointed me to a recent article in the magazine Weatherwise which referred to a study of the "Rainy Weekend Myth." The pattern of daily rainfall for five midwestern cities was studied over a 7 year period. The cities were Peoria, IL; Carbondale, IL; Memphis, TN; Kansas City, MO; and Cincinnati, OH. The percentage of weekends with rainy days ranged from only 26 percent at Carbondale to 36 percent at Cincinnati.

How about MSP in 1995? So far this year there have been 20 weekends and the National Weather Service has measured precipitation on 12 of them. That's 60 percent by my calculation. I certainly hope that trend doesn't continue throughout the summer.

By the way, the early signs for Memorial Weekend look like the weather will be warm and humid. We'll see.

Almanac: Average maximum temperature locally for today's date is 69 (plus or minus 11 degrees standard deviation) and the average minimum is 49 (plus or minus 8 degrees standard deviation).

MSP records for today's date include: a maximum temperature of 89 degrees in 1977 and 1978; a minimum temperature of 33 degrees in 1961; and record precipitation of 0.99 inches in 1925.

Scanning the state climatic data base: the all-time high for today's date is 104 degrees at Redwood Falls in 1934 (the warmest month of May on record with 112 degrees at Maple Plain on May 31); while the all-time low is 17 degrees also at Roseau in 1924.

Words of the Week: VORTEX and TOTO

These are acronyms which I came across this week. A vortex in the usual sense refers to a whirlpool or circular eddy. In this case VORTEX refers to a research project being conducted by the National Severe Storms Laboratory in Oklahoma and stands for Verification of the Origins of Rotation in Tornadoes Experiment. They are the storm chasers we have heard about who use a variety of technology such as Doppler radar, video, satellite imagery, and mobile electronic instrumentation to study tornadoes. One of the well instrumented vehicles deployed in the chase is called TOTO for Totable Tornado Observatory.

Community and Observer Notes: Redwood Falls, MN

This community began making daily climate observations in 1892. This location has the reputation for reporting some of the warmest temperatures in the state. All-time records there include: a maximum of 110 degrees on July 13-14, 1936; an all-time low of -36 degrees on January 12, 1912; a rainfall of 4.31 inches on June 16, 1993; and a snowfall of 14 inches on March 4, 1984. The FAA located at the airport currently reports climate observations for this community.

Topic: The new 30 day and 90 day seasonal outlooks.

My interpretation of the new National Weather Service 30 and 90 day weather outlooks released earlier on Thursday afternoon is shown below:

The 30 day outlook for the month of June suggests near normal temperatures and near normal precipitation for the state, as well as the entire upper midwest. To the west of the state above normal temperatures are predicted, however this pattern is not predicted for the Dakotas and Minnesota because of the excessive soil moisture conditions which presently exist. Should soils dry substantially during the balance of May and early June, then above normal temperature probabilities for the balance of June would certainly increase.

On the precipitation side, the primary jet stream and frontal boundary this spring continues to reside south of Minnesota. This prevents strong moisture advection into the northern most counties and may limit thunderstorm activity in that area of the state, even though total precipitation for June is expected to be about normal.

The 90 day outlook for June, July and August also favors near normal temperature conditions (except possibly in southwestern Minnesota where it may be cooler) and near normal precipitation. This suggests that the staff of the Climate Prediction Center see little indication of a serious climate anomaly developing (wetness or dryness) during the crop season. Regionally, the eastern corn belt is seen to have warmer than normal conditions, while much of Nebraska and Kansas are expected to be cooler than normal during these three months.

For what it is worth.....

Alternative Topic: World Meteorological Organization Meeting  
on May 31

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However, in recent years, many national weather services (particularly those of European countries) have developed commercial services which generate substantial revenues in support of their annual operating costs. These commercial services provided to transportation and communication industries (TV and radio), as well as agriculture, shipping, and private forecasting companies (among others) are a source of revenue which most governments want to protect. In light of this, there are proposals to be discussed at this meeting which would restrict the availability and commercial use of some data sources by non-academic institutions and businesses.

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To: Bob Potter, Greg Magnuson, John Bischoff, and Stephanie Curtis  
From: Mark Seeley  
Re: Suggestions for Morning Edition, Friday, May 26, 1995

As with so many other misfortunes, the late planting season should be evaluated in relative terms. Minnesota farmers have made very good gains in planting progress over the past week to ten days (corn over 75% done; soybeans over 50% done; and spring wheat over 50% done), yet bemoaning the late planting season and its potential detrimental effects on this year's production remains a popular topic in coffee shops. Well, let's consider our neighbors: Southern Iowa, Eastern Nebraska, Missouri and Illinois are even more behind and facing the prospect of some prolonged drying before they can get into their fields. They produce crops which require even longer growing seasons than ours. In addition, crop producers in the eastern Dakotas and southern Manitoba are looking at fields that are wetter than they have ever been for this time of year. So, in the relative scheme of things, let's count ourselves lucky to be where we are.

This week (May 20-26) in 1906, the Twin Cities received nearly 7.5 inches of rainfall, somewhat similar to what has been happening in parts of Missouri this past week.

Almanac: Average maximum temperature locally for today's date is 71 (plus or minus 10 degrees standard deviation) and the average minimum is 52 (plus or minus 8 degrees standard deviation).

MSP records for today's date include: a maximum temperature of 96 degrees in 1978; a minimum temperature of 34 degrees in 1992; and record precipitation of 1.31 inches in 1906.

Scanning the state climatic data base: the all-time high for today's date is 99 degrees at Alexandria in 1934 (the warmest month of May on record with 112 degrees at Maple Plain on May 31) tied at Pipestone in 1967; while the all-time low is 20 degrees at Cook (St Louis County) in 1961.

Words of the Week: Duty of Water

This is an old term, rarely used anymore. Duty refers here to the inherent obligation of water to nourish plants. In irrigated agriculture, the duty of water refers to the total volume of water needed to bring a crop stand from germination to maturation. This may be expressed as acre-inches (total inches applied per acre). Water applied by irrigation is intended for plant root uptake (something called consumptive use), but its fate may be otherwise: it may be evaporated before infiltrating the soil; it may percolate through a highly porous soil before roots can use it; or it may runoff into ditches and streams before it infiltrates into the soil (particularly if the soil is saturated or the application rate is too fast). Thus the duty of water is always greater than the amount of water actually used in crop growth.

Community and Observer Notes: Cook, MN

This small community of 800 or so is located in northern St Louis County (west of Lake Vermillion), near Sturgeon River State Forest. They have been making daily climate observations since September

of 1959. Cook is one of the few places in Minnesota which has reported frost in each month of the year. The average frost-free growing season there is only 97 days. All-time extremes at Cook include a maximum of 99 degrees (8/19/76); a minimum of -50 degrees (1/14/65 and 1/17/82); 3.85 inches of rain (8/16/72) in one storm; 29 inches of snow in one day (11/1/91); and 69 inches of snow on the ground (nearly 6 feet) on 1/31/69.

Topics: Memorial Weekend Outlook

Looks like showers and thunderstorms are a probability for Saturday and early Sunday this weekend, with temperatures in the 60s during the day. But Monday looks like quite a nice day, so the holiday picnic or barbecue should be save. In fact it looks like Monday through Wednesday will be quite nice around the state with afternoon temperatures actually making it up to seasonal normals for a change.

Alternative Topic: World Meteorological Organization Meeting on May 31

One of the contentious issues to be discussed at this meeting in Geneva later this month is the debate over access to meteorological data. Historically, the weather services of most countries have a history of sharing meteorological data sources (e.g. satellite imagery, radar, surface observations, upper air data (balloons), aircraft and ship observations, and general forecasts) in order to benefit their own operational forecasts and services. In addition to the operational needs of various weather services, the academic research needs in meteorology and climatology have benefitted greatly from this policy of freely sharing data sources.

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To: Bob Potter, Greg Magnuson, John Bischoff, and Stephanie Curtis  
From: Mark Seeley  
Re: Suggestions for Morning Edition, Friday, June 2, 1995

Snow on this date at Cloquet, MN in 1945, if you can believe that!  
Also on this date in 1990, strong thunderstorms and damaging winds  
went through several southern Minnesota counties, with a tornado  
damaging 4 farms in Goodhue County.

Almanac: Average maximum temperature locally for today's date is  
74 (plus or minus 9 degrees standard deviation) and the average  
minimum is 53 (plus or minus 7 degrees standard deviation).

MSP records for today's date include: a maximum temperature of  
93 degrees in 1940; a minimum temperature of 34 degrees  
in 1946; and record precipitation of 2.00 inches in 1897.

Scanning the state climatic data base: the all-time high for  
today's date is 105 degrees at both New Ulm and Fairmont in  
1934; while the all-time low is 24 degrees at Angus (Polk County)  
in 1910 and at Tower (St Louis County) in 1986 and 1993.

Words of the Week: Plow Wind (or Plough Wind)

This is a midwestern term, though not used as much as it used to  
be. It is another name for straight line winds or wind gusts  
associated with thunderstorms and squall lines. These winds  
often cause damage which is confined to a straight and narrow  
path where the winds were concentrated in one direction. They  
are usually of relatively short duration but can be quite  
strong, ranging from 40 to 80 mph. The name plow wind is derived  
from the characteristic damage path which looks like a large  
plow has passed over the landscape.

Community and Observer Notes: Angus, MN

This small town of less than 100 people is located in northern  
Polk County along Hwy 75 between Euclid and Warren. They started  
making daily climate observations in April of 1902. The rich  
soil is noted for small grain, sunflower and sugarbeet production,  
yet surprisingly, Angus is perhaps the driest place in the state,  
with an average annual precipitation of only 18.64 inches (in  
contrast, the average annual precipitation for MSP is about 28.5  
inches). The silty clay loam soil there, however has a great  
capacity to store water, something like 11 to 13 inches in the top  
5 ft of soil. It is this storage, combined with proper crop  
rotation which usually helps make the production profitable in  
the area.

Records at Angus include: 108 degrees on July 11-12, 1936; a low  
of -49 degrees on January 11, 1912; rainfall of 3.76 inches on  
June 26, 1915; snowfall of 9 inches on November 18, 1958; and  
snowdepth of 36 inches on January 10, 1958.

Angus is also known for recording perhaps the driest year ever in Minnesota. In 1936, this community reported an annual total of only 7.81 inches of precipitation, a figure close to the average annual precipitation at Albuquerque, NM, where irrigation is mandatory for crop production.

Topics: May Weather Summary

May was the second month in a row with below normal temperatures in Minnesota. Temperatures averaged 2 to 4 degrees colder than normal. May precipitation was also less than normal, except for some western counties. Redwood Falls, Worthington, Lamberton, Winnebago, and Rosemount all recorded over 4 inches of rainfall, while Canby, Fairmont, and Albert Lea all reported over 5 inches.

MSP reported only one day with a temperature of 80 degrees or higher (May 31), while on average there are six such days during the month.

Announcement:

On behalf of the National Weather Service, I would like to announce that there will be a public open house at the new forecast office in Chanhassen on Saturday, June 3, from 10 am to 2 pm. Tours and displays will inform visitors about the new technologies and techniques being deployed by the National Weather Service to improve forecasts and warnings. The new forecast office is located at 1733 Lake Drive West in Chanhassen. Turn left onto Audubon Rd off Hwy 5 and go south to Lake Dr. West, then turn right.

Weather Outlook:

After Saturday morning, looks like relatively dry weather in southern Minnesota, with a chance of scattered shower activity in the north by Monday, spreading into southern Minnesota counties by Monday night and Tuesday. Dew point temperatures which have only recently reached the upper 50s and 60s will probably stay there, and afternoon high temperatures will approach or exceed the average values for the first week of June. Chance for showers and thunderstorms as we approach next weekend (June 9-10), with a low pressure system passing through the central plains. Temperatures reaching the 80 to 85 degree mark by next weekend.

To: Perry Finelli, Greg Magnuson, John Bischoff, and Stephanie Curtis  
From: Mark Seeley  
Re: Suggestions for Morning Edition, Friday, June 9, 1995

Snow showers in Two Harbors on Wednesday, June 7th! You must be kidding. Strong northeasterly winds allowed cool polar air to spill into the state Wednesday..with a chance for frost to occur in some northern counties. In the meantime, how would you like to be twice as warm as we were on Thursday (58 degree high). All you have to do is fly to India and Pakistan, parts of which reported 117 to 120 degree high temperatures earlier this week.

First high dew points of the season this week too, ranging from 63 to 66 degrees in many southern counties. No wonder we got all the rainfall, that's a lot of water vapor. Our Minnesota crops, however, love high dew points.

Speaking of crops, in many fields of Missouri, southern Iowa and southern Illinois there still aren't any. They continue to get heavy rainfall in that region this week, with 1 to 2 inch amounts as recently as yesterday (Thursday, June 8). And there is a system of stacked low pressure centers waiting to cross the central plains today and Saturday which will see more rain in the area and across Minnesota.

Almanac: Average maximum temperature locally for today's date is 75 (plus or minus 8 degrees standard deviation) and the average minimum is 56 (plus or minus 6 degrees standard deviation).

MSP records for today's date include: a maximum temperature of 95 degrees in 1911, 1973 and 1976; a minimum temperature of 39 degrees in 1915; and record precipitation of 2.33 inches in 1927.

Scanning the state climatic data base: the all-time high for today's date is 102 degrees at Albert Lea, Faribault, Mankato, Owatonna, Waseca, and Zumbrota in 1985; while the all-time low is 24 degrees at Roseau in 1915.

Words of the Week: Cotton Region Shelter

For many years this has been the standard shelter for housing instruments, particularly maximum and minimum thermometers. It has been used extensively at second order and cooperative observer stations. It can be described as a white louvered box to allow ventilation, with a flat double roof (for insulation), mounted on four legs about 4 feet above the ground. It is always painted white to reflect some of the energy from the sun.

The name is derived from a climatological network established in 1881 to monitor the climate for cotton production in the southeastern U.S. The cotton region climatological network encompassed the Carolinas and most of the southeastern states

all the way west to Texas. Cotton region observers were generally telegraph or railroad employees who could easily send their observations along to other communities. This network was one of the first to use the louvered wooden shelter to shield the maximum and minimum thermometers from the direct effects of the sun. This instrument shelter was widely adopted for use at cooperative observer locations throughout the country in 1910 at the insistence of Willis Moore, then Chief of the Weather Bureau.

Today, liquid in glass thermometers are being replaced by smaller thermistors to measure maximum and minimum temperatures. These smaller instruments can be housed in a different type of shelter, usually a white plastic one which looks like an inverted stack of dishes. And so ends over 100 years of service from the cotton region instrument shelter.

Topic: Weather Information on the Web

We have discussed sources of weather and climate information available via the Internet before, primarily as Gopher sites.

For Internet users, some of the better home pages to find on the Web include:

The Weather Processor at Purdue University  
<http://thunder.atms.purdue.edu>

The Daily Planet at the University of Illinois  
<http://wx.atmos.uiuc.edu>

The Weathernet Intellicast Services of Weather Services Inc.  
<http://cirrus.spril.umich.edu/wxnet/wsi.html>

The last one offers total precipitation estimates from the network of new National Weather Service radars which is being deployed around the country. These estimates may need some fine tuning to agree with rain gage reports, but they provide an interesting picture of the spatial pattern of the storms we have been having in the midwest.

Weather Outlook:

For once the models agree on the weather outlook, so I suppose we can put more confidence in the forecast.....

The weather outlook for the weekend and next week....cloudy and rainy Friday through early Sunday. Then clearing, with a warming trend and generally fair weather settling in. In fact both temperatures and humidity will climb throughout the week next week, perhaps peaking with thunderstorms on Thursday or Friday. It could get pretty sticky again like we had early this week with dew points in the mid 60s. Watch for more mosquitos

next week as well.

To: Bob Potter, Greg Magnuson, John Bischoff, and Stephanie Curtis  
From: Mark Seeley  
Re: Suggestions for MPR's Morning Edition, Friday, June 16, 1995

Getting to that time of year when people start to pay more attention to dew point temperature since it relates closely to comfort. Today's average dew point historically is 54 degrees F in the Twin Cities, fairly high but not uncomfortable. The highest dew point for today's date is 73 degrees F which is down right uncomfortable. The lowest dew point for today is only 32 degrees.

Speaking about uncomfortable, parts of India and Pakistan have seen daily maximum temperatures ranging from 117 to 122 degrees for over two weeks now. There are serious water shortages in some areas because of increased usage by agriculture to prevent drought stress on some crops.

Almanac: Average maximum temperature locally for today's date is 78 (plus or minus 8 degrees standard deviation) and the average minimum is 58 (plus or minus 7 degrees standard deviation).

MSP records for today's date include: a maximum temperature of 97 degrees in 1933; a minimum temperature of 43 degrees in 1961; and record precipitation of 2.16 inches in 1935.

Scanning the state climatic data base: the all-time high for today's date is 106 degrees at Beardsley (Big Stone County) in 1933; while the all-time low is 25 degrees at north central Minnesota at Bigfork (Itasca County) in 1964.

Words of the Week: Advection

This is a meteorological term more commonly used in the summer months. It refers to the transport of an atmospheric property, say heat or water vapor, solely by the mass motion of the air, that is the wind field. Typically in the summer, when we have higher than normal temperatures in Minnesota, it is at least partially due to the advection of heat on westerly or south-westerly winds, in other words heat derived from a drier warmer air mass to the west or southwest. When we have persistent southerly or southeasterly winds in the summer months, we usually see the dew points go up as greater amounts of water vapor are advected into Minnesota.

Advection of water vapor is now directly monitored via satellite using the water vapor detection bands which show the concentration of water vapor in the atmosphere and its movement over time.

Topic: 90 degree heat

Many people are wary of the 90 degree heat expected this weekend,

especially so since we have had such cool temperatures this spring so far. In fact on a statewide basis, weekly temperatures have averaged above normal only once in the past ten weeks. This has given us little opportunity to adjust for the expected heat.

On the average MSP records 3 days in June with temperatures of 90 degree F or greater. June of 1933 brought 17 such days. There have been 25 Junes since 1891 when we have recorded no 90 degree temperatures in the month, including a string of 5 years in a row (1914-1918) when no such temperatures were recorded in June.

Grandma's Marathon this weekend on the northshore may be run in the warmest temperature conditions ever. The forecast shows temperatures in the mid 60s at the start of the race, rising to the mid 70s by the finish. However, dew points will be in the 60s with light winds. Under these conditions it will be harder to dissipate body heat during the race, and of course water will be in great demand along the way.

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For Internet users, some of the better home pages to find on the Web include:

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<http://cirrus.spril.umich.edu/wxnet/wsi.html>

The last one offers total precipitation estimates from the network of new National Weather Service radars which is being deployed around the country. These estimates may need some fine tuning to agree with rain gage reports, but they provide an interesting picture of the spatial pattern of the storms we have been having in the midwest.

To: Bob Potter, Greg Magnuson, John Bischoff, and Stephanie Curtis  
From: Mark Seeley  
Re: Suggestions for MPR's Morning Edition, Friday, June 23, 1995

Quite a heat wave. The last time an equivalent heat wave occurred in Minnesota during June was 1933, a mere 62 years ago.

Actually the combination of dryness and heat has really hurt the state's small grains crop (wheat, barley and oats), especially in northwestern Minnesota, where late planting was widespread this year due to wet fields.

The prolonged dry period has depleted the near surface layer of soil. Even though stored moisture in the lower rootzone (below 2 ft) is adequate, many plants have not established root systems that deep. The heat has caused more than just usual wilting. Under temperature stress, many plants like small grains accelerate development toward the reproductive phase in order to produce some seed. This is an inherent survival mechanism and results in fewer tillers, shorter plants, fewer grain heads and fewer seeds of grain. Many counties are considering filing for disaster declarations unless rain comes very soon.

The forests of northern Minnesota are drying out as well, especially Superior National Forest where the fire danger has been increasing. Daily water use has been very high the past week and drastically reduced soil moisture levels.

Almanac: Average maximum temperature locally for today's date is 80 (plus or minus 8 degrees standard deviation) and the average minimum is 60 (plus or minus 6 degrees standard deviation).

MSP records for today's date include: a maximum temperature of 99 degrees in 1937 and 1922; a minimum temperature of 44 degrees in 1972; and record precipitation of 1.81 inches in 1919.

Scanning the state climatic data base: the all-time high for today's date is 103 degrees at Pipestone in 1937; while the all-time low is 28 degrees at Tower (St Louis County) in 1979.

Word of the Week: Monsoon

This term is used in a number of countries to describe seasonal changes in wind patterns over ocean-continent boundaries. High pressure builds over the land mass in winter causing winds to blow off the land toward the ocean, while in the summer low pressure prevails over the land mass as it is heated more rapidly than the bordering ocean, causing winds to blow off the ocean onto the land bringing large quantities of water vapor into highland areas where precipitation is produced.

The best known and most striking example of a monsoon is in southern Asia along the Arabian Sea and Bay of Bengal. This year, parts of India and Pakistan have suffered from over three weeks of apparent temperatures ranging from 115 to 120 degrees. This caused a great deal of suffering and contention over water which had to be appropriated for agriculture. Only this week have the monsoon rains kicked in over the region, bringing 10 to 13 inches rains within a few days.

Local residents in southern India, call the late summer south-easterly monsoon "the elephant", I suppose because of the heavy and noisy thundersqualls produced by it.

Topic: Apparent Temperatures

This has been used more commonly since about 1980 to refer to what various temperature and humidity combinations feel like based on human physiology and clothing science and the need for the body to maintain a thermal equilibrium. It particularly applies to the summer months, because relative humidity is much less important to human comfort when air temperatures are below 40 degrees F.

When relative humidities are very low, as in arid conditions, say below 30 percent, the air can actual feel cooler than indicated by a thermometer, because of evaporative cooling effects on the skin. On the other hand, when relative humidities are high, say above 60 percent, then we can feel warmer than the air temperature indicated by a thermometer because of the increased resistance to moisture and heat loss by our bodies (particularly if there is little air movement).

For the past seven days temperatures have consistently been above 90 degrees in many places around the state. Fortunately the relative humidity has remained rather low most of the time, ranging from 25 to 45 percent during the afternoons. If it had been in the 60 to 70 percent range then apparent temperatures from 99 to 112 degrees would have resulted in even higher risk of heat cramps or heat exhaustion. The seven straight days of temperatures in the 90s tied the record for consecutive days dating back to 1910 and 1933, but the record for 90 degree days in June is 17 set in 1933 and we'll probably not achieve that thankfully.

The record dew point temperature for June 23 is 72 degrees, but we should reach the mid 60s today. Thunderstorms are possible now each day for the next week or so and should bring some relief to dry areas in the state.

To: Bruce MacDonald, Perry Finelli, and Stephanie Curtis  
From: Mark Seeley  
Re: Suggestions for MPR's Morning Edition, Friday, July 7, 1995

The warm temperatures of June were detrimental to small grains, but they did push along row crop development. Both field corn and soybean growth stages are near normal now and some corn fields should tassel by the third week of the month. Growing degree days which were behind normal during the cool spell in April and May are ahead of normal now.

The July outlook released last month by the National Weather Service, favored below normal temperatures and above normal rainfall in Minnesota. It has sure been right on the money for the first full week of the month. Parts of Big Stone, Chippewa, Swift, Koochiching, Cass, Itasca, and Stearns Counties have already reported over 4 inches of rainfall this week. Milan in Chippewa County reported 9.78 inches overnight from the 3rd to the 4th of July, shattering the old single day rainfall record of 4.33 inches (6/29/71). Benson in Swift County almost set a new single day rainfall record as well, recording 5.27 inches over the same period (their record is 5.57 inches set on 8/18/90).

Temperatures so far in July have averaged 4 to 7 degrees cooler than normal.

Almanac: Average maximum temperature locally for today's date is 83 (plus or minus 7 degrees standard deviation) and the average minimum is 63 (plus or minus 7 degrees standard deviation).

MSP records for today's date include: a maximum temperature of 101 degrees in 1936; a minimum temperature of 44 degrees in 1891; and record precipitation of 3.0 inches in 1955.

Scanning the state climatic data base: the all-time high for today's date is 108 degrees at Browns Valley in 1988; while the all-time low is 31 degrees at Tower (St Louis County) in 1984.

Average dew point temperature for today is 61 degrees F. The highest dew point on this date is 79 degrees, while the lowest is 43 degrees.

Word of the Week: Crotovinas or Krotovinas

These are not meteorological terms but soil science terms. Studies have shown that the transport of water from the soil surface to deeper layers of the soil can be greatly affected by macropore flow, that is larger pore spaces or channels left in the soil by earthworms, ants and termites. Even larger animals such as gophers, prairie dogs, mice and snakes leave abandoned burrows in the soil which sometimes are quite deep. These are called crotovina. The rapid movement of nitrates and herbicide residues near the soil surface to deeper layers of the soil is sometimes rainfall event driven as when a 2, 3, or 4 inch thundershower occurs shortly after a field operation to apply fertilizer or spray for weeds. Abandoned channels and furrows in the soil (crotovina) provide a mechanism for soluble material to move very rapidly (leach) to deep soil layers or sometimes even to the ground water table. This mechanism of

ground water pollution is particularly difficult to prevent.

Topic: National Weather Service Agricultural and Fire Weather Programs

Budget cuts within the National Oceanic and Atmospheric Administration will lead to the closure of these programs as of October 1 of this year. Government officials anticipate that private meteorological services will develop to replace these programs. I certainly hope. Both programs are seasonal in nature, but provide more specific forecast detail needed by agricultural and forest managers. Wind, humidity, sunshine and quantified precipitation forecasts (expected amounts) are some of the elements included in these forecast products which are not normally included in other forecasts routinely released by the National Weather Service.

The U.S. Forest Service and the Bureau of Reclamation are two of the primary users of the Fire Weather Program. These agencies may have to contract with private firms to obtain the forecast guidance they need at certain times of the year. Agricultural interest groups such as elevators, commodity associations, dealers, suppliers, custom applicators, crop consultants, packagers and processors may have to contract for forecast services as well.

Other countries (particularly in Europe) have already made this transition to privatization. It will be interesting to see how the commercial meteorological sector responds to this challenge in the next few years.

Outlook: Chance of showers in southern Minnesota early on Saturday, otherwise, partly cloudy with a warming trend. Chance of showers later next week, Thursday into Saturday.

To: Bruce MacDonald, Perry Finelli, and Stephanie Curtis  
From: Mark Seeley  
Re: Suggestions for MPR's Morning Edition, Friday, July 14, 1995

The return of warm weather this week brought even higher dew points than we had during the warm spell in June. In recent summers we have not had to bear such weather. The overnight low on Wednesday was 74 degrees, on Thursday it was 75 degrees and this morning it was 78 degrees F. These high values have not been seen here since August 26, 1991. In fact this morning's 78 was the second warmest minimum ever for this date (behind 79 which occurred in 1980). We also tied the all-time high dew point temperature with 80 degrees F reported by the National Weather Service on Wednesday afternoon and evening (for ten consecutive hours). More on these subjects later.

Almanac: Average maximum temperature locally for today's date is 83 (plus or minus 7 degrees standard deviation) and the average minimum is 63 (plus or minus 6 degrees standard deviation).

MSP records for today's date include: a maximum temperature of 108 degrees in 1936; a minimum temperature of 50 degrees in 1930; and record precipitation of 3.17 inches in 1915.

Scanning the state climatic data base: the all-time high for today's date is 111 degrees at New Ulm in 1936; while the all-time low is 30 degrees at Tower (St Louis County) in 1987.

Average dew point temperature for today is 60 degrees F. The highest dew point on this date is 75 degrees, while the lowest is 48 degrees.

Word of the Week: Fresh

This adjective has been used in meteorology for centuries, originally and perhaps most commonly by the Scottish, Welsh and English. It is primarily associated with the nature or character of the wind, though sometimes refers to the air quality as well. A wind that is vigorous as a gust or a squall is sometimes called a fresh wind. A wind that is cool and invigorating, especially following a hot muggy period is said to be a fresh wind. And a breeze following a morning frost is sometimes referred to as a fresh wind. On the Beaufort wind scale, a fresh breeze is a wind of 19 to 24 mph while a fresh gale is a wind of 39 to 46 mph.

The complete absence of odours, a clear visual horizon, moisture laden sea breezes or lake breezes or sometimes even the fragrant calm around a garden or forest produce a condition that is often described as fresh air. This can also be thought of as air that is crisp, clear and free of foul or stale odours. Fresh air is usually associated with the early morning or evening hours when there is typically little wind to stir things up.

Topic: Sleeping Weather (Comfort Zones)

Our 74 degree F overnight minimum earlier this week (Wednesday morning) got my attention. We had not experienced an overnight minimum that high since August 26 of 1991 in the Twin Cities.

In fact based on the 104 year climate record for MSP, overnight minimums that high or greater occur on average about three times each year, though there have been 24 years when none have occurred (most recently 1992 and 1993). Thankfully the frequency of such weather is so low. It seems rather silly to have to run your air conditioner overnight in Minnesota.

Comfort zones are used to describe the conditions of temperature, humidity and air movement under which most people function without mental or physical stress (in other words in relative comfort). The limiting conditions vary with the prevailing climate and seasons. For example in the United States the comfort zone ranges from 63 to 75 degrees F at 70 percent relative humidity (with adequate ventilation), more typical of summertime indoor conditions in Minnesota. When indoor humidity is less, say 30 percent, the comfort zone goes up to 67 to 80 degrees F. In England the relative comfort zone is centered on about 60 degrees F (because they are generally cooler and wetter), while in the tropics the comfort zone is centered on about 78 degrees F (being very much warmer and less variable than our climate).

Historically, MSP shows that overnight minimum temperatures of 75 degrees or greater (outside our summertime comfort zone) have occurred in about 40 percent of the summers, with the highest frequency in July. There has been only one occurrence of this condition in May and only nine in September. In total there have been 185 days (1891-1994) with overnight minimums of 75 degrees or greater, with 175 of these coming in June, July or August.

I think that there are primarily three factors which contribute to maintaining these high overnight minimums:

One is daytime heating, that is the reservoir of heat that is stored at the surface during the day (in the soil, the pavement, the buildings and other things around us). This is substantiated by the fact that only 9 of the 185 occurrences of minimum temperatures equal to or greater than 75 degrees are associated with daytime maximums that did not reach 90 degrees F.

Secondly, dew point temperatures remain high all day and night. The moisture laden air tends to prevent long wave radiation from escaping more rapidly overnight. Often times the overnight dew point is in the high 60s to low 70s.

Thirdly, the short nights of summer in the northern hemisphere reduce the amount of time for the earth to cool by giving up long wave radiation. The length of night ranges from 8 to 9 hours during the primary summer months

Outlook:

Increasing clouds Friday and Saturday as low pressure passes through the area. Chance for showers and thunderstorms through Saturday morning. Then freshening air with much lower dew points. Drier and more pleasant Sunday and Monday, with a slight chance for showers in the north on Monday. Generally near normal temperatures for the balance of next week, with another chance for precipitation approaching the weekend. Dew points should stay in the upper 50s or low 60s.



To: Greg Magnuson, Bob Potter, and Stephanie Curtis  
From: Mark Seeley  
Re: Suggestions for MPR's Morning Edition, Friday, July 21, 1995

Sure has been a nice week compared to last. Much cooler and less humidity. Last Thursday (7/13) both Winona, MN and LaCrosse, WI tied their all-time high temperature records (dating back to 1936) with a maximum of 108 degrees F. Overnight lows were warm too, 80 degrees F at Winona and 81 degrees F at LaCrosse. Must have been a bit uncomfortable for boaters anchored along the Mississippi that day.

Got wind of another, more unusual weather record that was tied recently, in fact on Monday July 17. The National Weather Service Forecast Office in Sacramento, CA reported a trace of rainfall at 2:30 pm on Monday. That whopping rainfall event tied the record for the most received on that the date, going back all the way to 1912. Goes to show how dry it usually is in Sacramento during the summer months.

Almanac: Average maximum temperature locally for today's date is 84 (plus or minus 7 degrees standard deviation) and the average minimum is 64 (plus or minus 6 degrees standard deviation).

MSP records for today's date include: a maximum temperature of 105 degrees in 1934; a minimum temperature of 49 degrees in 1947; and record precipitation of 1.36 inches in 1951.

Scanning the state climatic data base: the all-time high for today's date is 113 degrees at Milan (Chippewa County) in 1934; while the all-time low is 36 degrees at Tower (St Louis County) in 1973 and 1993.

Average dew point temperature for today is 61 degrees F. The highest dew point on this date is 78 degrees, while the lowest is 40 degrees.

Words of the Week: Deasil and Withershins

These terms are derived from ancient Gaelic words and though rare are still occasionally used in Wales and Scotland. Deasil, also deiseal or dessil (pronounced dezil or des-hal) means righthanded or clockwise, but climatologically it means sunwise - in the same direction as the sun. When facing south towards the equator the sun moves left to right or clockwise. The Celts thought this was a natural procession and that moving in this direction was a charm or good omen. Before marriage ceremonies, participants would process around the church three times in a clockwise manner to bring good luck. Similarly before a battle, people might process or walk the deasil carrying a lighted torch around the soldier(s) before their engagement in combat.

Even today, roundabouts in England run in a clockwise direction and some attribute this to the heritage of the deasil, or the charm of moving with the sun.

Withershins or widdershins is a term of similar age, which means counterclockwise or contrary to the sun's movement. To move widdershins from place to place is considered unlucky or disastrous. In old England, fishermen would not approach a favorite fishing

spot by moving withershins (against the sun), but would circle around to approach in a clockwise manner.

Topic: Minnesota Sunflowers

This is the time of summer when driving or flying across western portions of the state, you will sometimes see a sea of yellow blanketing the landscape. Sunflowers are blooming. This is one of the few heliotropic crops, the flowers point toward the sun, tracking it across the sky during the day, often pointing east in the morning and west at sunset. They make quite a sight. (You could also say their movement is deasil).

This is a significant crop in Minnesota agriculture but we rarely hear about it. Minnesota Agricultural Statistics has kept production figures for sunflowers back to at least 1964. This year about 460,000 acres were planted to sunflowers, mostly in western and northwestern counties, in some instances it was used as an alternative to planting wheat late due to excessively wet conditions.

Sunflowers are native to North America. American Indians used them for food, dye, medicine, and oil (mostly for painting). They also used them as a phenological calendar for buffalo hunting. It was known that when the sunflowers were tall and blooming the buffalo herds were fat and loaded with good meat.

Sunflowers are raised for two purposes: some hybrids are raised for oilseed production; other varieties are raised for birdfeed and for confectionary markets. The development of high oil content hybrids fueled a large increase in acreage planted beginning in the mid 1960s. In Minnesota sunflower acreage peaked in 1979 when nearly 1.5 million acres were planted.

Since that time sunflower acreage has declined to generally less than 0.5 million acres. Part of the reason is relatively lower prices for sunflower oil, and part is because of pest management. Since the sunflower produces a very large flower which is exposed at the top of the canopy, it is susceptible to many plant diseases, insects and birds. Red winged blackbirds in particular can cause great losses. Sunflower producers try to frighten them off with noise makers such as rifles, firecrackers, automatic cannons, and electronic devices that mimic the distress call of blackbirds. So if you are driving through western Minnesota in the summer and hear shots being fired, perhaps it is just your local sunflower producer managing the bird population.

Outlook: Chance of thunderstorms in northern Minnesota this weekend, sunny and pleasant elsewhere with highs mostly from the 70s in the north to low to mid 80s in the south. Looks like temperatures will remain at or slightly below seasonal normals well into next week, with chances for precipitation late Tuesday through early Thursday.

To: Greg Magnuson, Bob Potter, and Stephanie Curtis  
From: Mark Seeley  
Re: Suggestions for MPR's Morning Edition, Friday, July 28, 1995

Almanac: Average maximum temperature locally for today's date is 83 (plus or minus 7 degrees standard deviation) and the average minimum is 63 (plus or minus 6 degrees standard deviation).

MSP records for today's date include: a maximum temperature of 100 degrees in 1955; a minimum temperature of 50 degrees in 1981; and record precipitation of 1.36 inches in 1951.

Scanning the state climatic data base: the all-time high for today's date is 113 degrees F at Beardsley (Big Stone County) in 1917 (after a morning low of 51 degrees F!); the all-time low is 33 degrees at Tower (St Louis County) in 1979. The interesting thing about Beardsley is that this town holds the all-time high temperature record for Minnesota, 114.5 degrees F on July 29, 1917, yet earlier that same month (July 2 and 3) they reported overnight lows in the upper 30s with ground frosts throughout the countryside.

Average dew point temperature for today is 61 degrees F. The highest dew point on this date is 76 degrees, while the lowest is 42 degrees. Mean dew point temperatures start to decline now as we move into August.

Words of the Week: Sunshine Recorder

This is an instrument used by weather services throughout the world to record the duration of sunshine (hours and minutes) without regard to intensity. European countries typically use a Campbell-Stokes sunshine recorder which is composed of a spherical lens mounted on an exposed mast. The lens burns an image of the sun onto a specially prepared card which has a time scale on it. The Marvin sunshine recorder has been used more commonly in the United States. It consists of two bulbs, one blackened and one clear, which are connected by a glass tube filled with mercury. When exposed to sunlight, the blackened bulb warms more readily than the clear one, as the air expands it forces the mercury to move through the glass connecting tube and to trip electrical contact points which start a pen trace on a chronograph (paper graph with time increments on it).

Many National Weather Service Forecast Offices continue to measure the hours and minutes of sunshine each day, along with percent possible sunshine when evaluated in the context of daylength.

Community Notes: Beardsley and Browns Valley

These two communities in combination form one of the best climate records in far western Minnesota. Beardsley in Big Stone County is a small town on the prairie of just over 300 people. They began making daily climate observations there in May of 1893. Though many citizens of the town contributed to taking the daily climate observations for over 80 years there, the police station in town had the responsibility for a number of years. Beardsley measured the highest temperature ever recorded in Minnesota on

July 29, 1917 with 114.5 degrees F. Daily observations stopped in 1973, but since that time have been taken by observers in Browns Valley (Traverse County), a town of about 900 people which is located 10 miles west of Beardsley on the South Dakota border. Thus a total of over 102 years of daily climate records are available from this area of the state. Incidentally, the all-time low temperature measured in this area of the state is -41 degrees F recorded at Beardsley on February 16, 1936 and again at Browns Valley on February 9, 1994.

Topic: Better Summer in 1995?

Sasha Aslanian, producer of "Mid Morning" at MPR observes that this summer's weather seems to be nicer and perhaps brighter than recent summers. I looked at two weather parameters to see if this observation was true: percent possible sunshine and the frequency of measurable rainfalls on weekends. The tables below summarize my findings in comparing the summer months of May, June and July for 1992 through 1995.

Comparison of May, June and July Percent Possible Sunshine at MSP for the period 1992-1995 along with the Long-Term Average for each Month.

| Year           | May | Jun | Jul |
|----------------|-----|-----|-----|
| 1992           | 78  | 68  | 68  |
| 1993           | 52  | 58  | 60  |
| 1994           | 86  | 69  | 73  |
| 1995           | 67  | 74  | 77  |
| Long Term Ave. | 59  | 63  | 71  |

Comparison of number of days in May, June and July with 100 percent possible sunshine, 1992-1995 at MSP

| Year | May | Jun | Jul | Total |
|------|-----|-----|-----|-------|
| 1992 | 3   | 1   | 0   | 4     |
| 1993 | 1   | 0   | 0   | 1     |
| 1994 | 5   | 0   | 0   | 5     |
| 1995 | 3   | 7   | 1   | 11    |

Comparison of the frequency of measurable precipitation events (greater than trace) occurring on Saturdays and Sundays during May, June, and July, 1992-1995 at MSP. Total possible Saturdays and Sundays in ().

| Year | May | Jun | Jul | Total   |
|------|-----|-----|-----|---------|
| 1992 | 2   | 4   | 3   | 9 (26)  |
| 1993 | 6   | 4   | 6   | 16 (27) |
| 1994 | 6   | 5   | 3   | 14 (27) |
| 1995 | 4   | 2   | 2   | 8 (24)* |

\*through July 23 in 1995

Certainly looks like Sasha's observations are correct based on greater percent possible sunshine in June and July this summer over the past three; higher incidence of perfectly clear days this summer (days with 100 percent possible sunshine); and a much lower occurrence of measurable precipitation on weekends this summer, especially versus 1994 and 1993. It is perhaps the weekend weather in summer that we remember most vividly.

Alternative Topic: The Urban Heat Island

(via a question from Kate Smith)

How is the so-called urban heat island in evidence around the Twin Cities?

The noted climatologist Helmut Landsberg was one of the first to use this term and describe how the development of an urban area modifies the local environment. Urban areas host a higher concentration of atmospheric pollutants, present rougher surface terrain which affects wind fields, and are composed of different surface materials which affect heat storage and convection. The following table summarizes some of the observed effects of urban heat islands.

| Elements                         | Comparison with Rural Environment |
|----------------------------------|-----------------------------------|
| Cloud cover                      | 5 to 10 percent greater           |
| Fog, winter                      | 100 percent more                  |
| Fog, summer                      | 30 percent more                   |
| Precipitation                    | 5 to 10 percent more              |
| Snowfall                         | 5 percent less                    |
| Rain days with less than .02 in. | 10 percent more                   |
| Relative humidity, winter        | 2 percent less                    |
| Relative humidity, summer        | 8 percent less                    |
| Solar radiation                  | 15 to 20 percent less             |
| Ultraviolet radiation, winter    | 30 percent less                   |
| Ultraviolet radiation, summer    | 5 percent less                    |
| Duration of sunshine             | 5 to 15 percent less              |
| Pollutants                       |                                   |
| Solid particles                  | 10 times more                     |
| Gases                            | 5 to 25 times more                |
| Mean annual temperature          | 0.5 to 1.0 degrees C              |
| Annual heating degree days       | 10 percent fewer                  |
| Annual mean wind speed           | 20 to 30 percent less             |
| Frequency of calms               | 5 to 20 percent more              |

Some local effects related to the urban heat island of the Twin Cities are: Longer frost free growing season, 15 to 25 days longer than in the surrounding rural areas of Anoka, Scott, Carver and Dakota counties. Earlier green-up of lawns and gardens in the spring. Later freeze up in the fall of local area lakes than in surrounding rural counties. Average wind speeds that are 10 to 20 percent less than in surrounding rural areas. Generally higher average temperatures and less heating degree days are evident in the Twin Cities when compared with surrounding rural areas. Average precipitation is peculiar because MSP airport values appear to be less than those of the suburban communities surrounding the Twin Cities downtown areas. This was first noted in a 1973 study by Don Baker of the Department of Soil, Water, and Climate and then State Climatologist Earl Kuehnast who reported on the spatial distribution of rainfall in the Metro area. Of course using a single rain gage to report the precipitation climatology of an urban area is not wise, since it will likely underestimate the total precipitation in the area.

Outlook: Beautiful summer weather today and Saturday, with high pressure, sunny skies and temperatures in the 80s to

near 90. Increasing dew points and sticky on Sunday, with a chance for showers and thunderstorms, especially in northern Minnesota. Dry and pleasant Monday and Tuesday, then increasing clouds for Wednesday and Thursday with a chance for showers.

To: Greg Magnuson, Bob Potter, and Stephanie Curtis  
From: Mark Seeley  
Re: Suggestions for MPR's Morning Edition, Friday, August 11, 1995

High dew points and associated discomfort again earlier this week. The dew point of 75 degrees F on Tuesday reported by MSP was a record for the date, while the early morning dew point of 76 degrees F on Wednesday was also a record for the date. That's a lot of water vapor.

Almanac: Average maximum temperature locally for today's date is 80 (plus or minus 7 degrees standard deviation) and the average minimum is 60 (plus or minus 6 degrees standard deviation).

MSP records for today's date include: a maximum temperature of 97 degrees in 1947; a minimum temperature of 47 degrees in 1968; and record precipitation of 1.19 inches in 1900.

Scanning the state climatic data base: the all-time high for today's date is 104 degrees F at Montevideo (Chippewa County) in 1988; the all-time low is 28 degrees at Tower (St Louis County) in 1902.

Average dew point temperature for today is 57 degrees F. The highest dew point on this date is 73 degrees, while the lowest is 33 degrees.

Words of the Week: Zonal Flow

Sometimes meteorologists will use this term in describing a relatively quiet or benign period of weather, with little frontal system activity. The term really refers to the regional wind pattern and means that the wind field is parallel to the latitude bands around the Earth, running west to east. While zonal flow is often associated with pleasant quiet weather, most Minnesotans know, storminess is often associated with stronger polar or equatorial wind components, and in some cases with easterly winds off of Lake Superior.

Community Notes: Tower, MN

This small community (pop. 640) is located on the south end of Lake Vermillion in northern St Louis County. The Minnesota State Forest Service began taking weather observations there in January of 1895 at the Ranger Station.

Listeners may have noted on the almanac segment that six of the last seven weeks, the all-time low temperature record has come from Tower, MN. This location is perhaps most consistently the coldest place in Minnesota during the summer months. The average frost-free growing season there is only 58 days, with median frost dates of June 25 and August 19. Frost has occurred with some frequency in every summer month.

All-time records for this location include: 27 inches of snowfall on April 17, 1961 (kinda late in the winter for that much snow!); a maximum snow depth of 71 inches on March 13, 1989; a rainfall of 4.64 inches on September 11, 1947; a

maximum temperature of -33 degrees F on January 31, 1899; a minimum temperature of -52 degrees F on January 17, 1982 and again on December 19, 1983; and a maximum temperature of 101 degrees F on July 14, 1901.

Topic: Minnesota Sunflowers

This is the time of summer when driving or flying across western portions of the state, you will sometimes see a sea of yellow blanketing the landscape. Sunflowers are blooming. This is one of the few heliotropic crops, the flowers point toward the sun, tracking it across the sky during the day, often pointing east in the morning and west at sunset. They make quite a sight. (You could also say their movement is deasil).

This is a significant crop in Minnesota agriculture but we rarely hear about it. Minnesota Agricultural Statistics has kept production figures for sunflowers back to at least 1964. This year about 460,000 acres were planted to sunflowers, mostly in western and northwestern counties, in some instances it was used as an alternative to planting wheat late due to excessively wet conditions.

Sunflowers are native to North America. American Indians used them for food, dye, medicine, and oil (mostly for painting). They also used them as a phenological calendar for buffalo hunting. It was known that when the sunflowers were tall and blooming the buffalo herds were fat and loaded with good meat.

Sunflowers are raised for two purposes: some hybrids are raised for oilseed production; other varieties are raised for birdfeed and for confectionary markets. The development of high oil content hybrids fueled a large increase in acreage planted beginning in the mid 1960s. In Minnesota sunflower acreage peaked in 1979 when nearly 1.5 million acres were planted.

Since that time sunflower acreage has declined to generally less than 0.5 million acres. Part of the reason is relatively lower prices for sunflower oil, and part is because of pest management. Since the sunflower produces a very large flower which is exposed at the top of the canopy, it is susceptible to many plant diseases, insects and birds. Red winged blackbirds in particular can cause great losses. Sunflower producers try to frighten them off with noise makers such as rifles, firecrackers, automatic cannons, and electronic devices that mimic the distress call of blackbirds. So if you are driving through western Minnesota in the summer and hear shots being fired, perhaps it is just your local sunflower producer managing the bird population.

Outlook:

Looks like warming into the weekend, then a chance for showers and thundershowers late Saturday into early Tuesday. Temperatures should stay near seasonal normals next week. Quite pleasant for Tuesday through Thursday of next week, with lower dew points and more comfortable temperatures.

To: Greg Magnuson, Bob Potter, John Bischoff, and Stephanie Curtis  
From: Mark Seeley  
Re: Suggestions for MPR's Morning Edition, Friday, August 18, 1995

Topic: Heat and Humidity of the Summer of 1995

High dew points and associated discomfort continued this week, particularly so in the southern region of the state. Data from the St Paul Campus Climate Observatory show that since June 1 (and through August 14) we have recorded 225 hours with dew points of 71 degrees F or higher and 56 hours with dew point temperatures above 75 degrees F. The National Weather Service records for MSP since 1945 show that on average we have only 10 such hours during this period. Remember that the energy needed to alter the dew point from 75 degrees to 76 degrees is greater than that needed to change it from 45 to 46 degrees. This makes us more sensitive to changes in dew point at the upper end of the scale (we feel it more). Though it can only be confirmed with further study, I would speculate that we have set a number of high dew point temperature records this summer and probably also set records for the frequency and duration of high dew points.

A listener asked if the hot humid conditions experienced this summer is a sign that winter will be equally colder and have greater snowfall. Well, first of all, as stated above, this summer has certainly been wetter and more humid. But as to the warmth, remember that humidity makes warm temperatures feel even warmer. From purely a temperature standpoint, average May temperatures were cooler than normal, average June temperatures were warmer than normal, and average July temperatures were near normal. So, overall, summer temperatures have not drastically departed from average. But from a comfort standpoint, yes indeed it has felt warm and sticky. In fact so far in August we have recorded remarkably few hourly R.H. readings of less than 55 percent and an extraordinary number of hours above 80 percent.

As to whether this correlates to an equally colder and snowy winter, the answer is NO not to any significant degree. The conditions of summer cannot be used to predict what the conditions of winter might be.

Dew point temperatures reported this morning include:  
Lamberton 76      Waseca 73      MSP 73      Rosemount 71  
Sioux Falls 74      Crookston 75      Morris 77  
Roseau 71      Park Rapids 72

Almanac: Average maximum temperature locally for today's date is 81 (plus or minus 7 degrees standard deviation) and the average minimum is 61 (plus or minus 7 degrees standard deviation).

MSP records for today's date include: a maximum temperature of 98 degrees in 1976; a minimum temperature of degrees 41 degrees F in 1977; and record precipitation of 2.26 inches in 1907.

Scanning the state climatic data base: the all-time high for today's date is 107 degrees F at Browns Valley (Traverse County) in 1976; the all-time low is 24 degrees at Tower (St Louis County) in 1975.

Average dew point temperature for today is 59 degrees F. The highest dew point on this date is 75 degrees, while the lowest is 37 degrees.

Words of the Week: Zonal Flow

Sometimes meteorologist will use this term in describing a relatively quiet or benign period of weather, with little frontal system activity. The term really refers to the regional wind pattern and means that the wind field is parallel to the latitude bands around the Earth, running west to east. While zonal flow is often associated with pleasant quiet weather, most Minnesotans know, storminess is often associated with stronger polar or equatorial wind components, and in some cases with easterly winds off of Lake Superior

Community Notes: Park Rapids, MN

This community in SW Hubbard County began making daily weather observations in January of 1885. The first observer there was Dr. P.A. Walling who made observations until 1929. Perhaps his most famous observation was recorded on January 31, 1893 when during a blizzard he noted one of the most extreme temperature changes ever recorded in the state, a 41 degree temperature drop from 4 pm to 9 pm on that date (13 degrees F to -28 degrees F). Several observers now make daily readings in and around Park Rapids, and there is an automated weather station which reports from the airport.

Park Rapids is noted for the nearby beautiful lakes and forests, with good fishing and biking trails for vacationers, but it is also a hub of agricultural activity. Potatoes, dry beans and corn are raised there mostly under irrigation since the soil is sandy. In fact some of the potato chips and french fries we eat in Minnesota are likely to have been grown in fields around Park Rapids.

All-time climatic extremes measured at Park Rapids include: a maximum temperature of 107 degrees F on July 10 and July 12, 1936; a low of -51 degrees F on February 9, 1899; a rainfall of 6.75 inches on August 1, 1906; and a snowfall of 14 inches on March 4, 1985. Cold temperatures of -40 degrees or lower occur with some regularity in the area. Just last January (1/15/94) Park Rapids reported a low of -42 degrees.

Outlook:

The early part of the weekend through early Saturday morning looks like high humidity, cloudiness and a chance for thunderstorms. Then, somewhat drier air for Sunday through Tuesday with warmer than normal temperatures. Returning to warm and humid conditions Wednesday through Friday for the opening of the State Fair. Of course those State Fair food

vendors probably prefer warm and humid conditions, especially those selling drinks and ice cream.

To: Greg Magnuson, Bob Potter, John Bischoff, and Stephanie Curtis  
From: Mark Seeley  
Re: Suggestions for MPR's Morning Edition, Friday, August 25, 1995

Almanac: Average maximum temperature locally for today's date is 79 (plus or minus 8 degrees standard deviation) and the average minimum is 59 (plus or minus 6 degrees standard deviation).

MSP records for today's date include: a maximum temperature of 94 degrees in 1948; a minimum temperature of degrees 46 degrees F in 1958; and record precipitation of 1.51 inches in 1960.

Scanning the state climatic data base: the all-time high for today's date is 100 degrees F at Beardsley in 1912, at Winona in 1949 and at Hallock in 1976; the all-time low is 22 degrees F at Tracy (Lyon County) in 1887.

Average dew point temperature for today is 58 degrees F. The highest dew point on this date is 74 degrees, while the lowest is 41 degrees.

Topic: State Fair Weather

A listener called earlier this week to ask a climate question related to the State Fair. She goes every year, and recalls getting rained on the majority of the time. So, her question is what date historically has it rained the fewest times during the Fair? Well, first of all since the last day of the Fair always coincides with Labor Day, it does not always take place over the same 12 dates. This year it runs from August 24 to September 4. Over this interval, the date showing the fewest measurable rainfalls is September 1st, on which it has rained only 26 percent of the time since 1891. Incidentally, August 30th shows the most rainfalls over the same period of time at 36 percent frequency. It would appear that this listener just suffers from the misfortune of choosing dates when it rains!

Another listener recalls hardly ever having to wear a sweater or a jacket during the Fair, other than occasionally in the early morning when the gates open. This observation verified when I looked at the frequency of afternoon temperatures that didn't reach 65 degrees F. The frequency of occurrence of this condition during the Fair dates ranged from only 5 to 8 percent for the most part (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; and a sultry, dark and menacing evening on August 30,

1977 when over 4 inches of rain fell in 4 hours during an evening thunderstorms (7.28 inches fell at the airport).

Words of the Week: Emissary Sky

Emissary derives from the Latin word emissarius which means to send out to scout, to explore, or to spy. So what does this have to do with the sky. This term refers to cirrus clouds, the high clouds composed of ice crystals, which appear as single clouds or groups of clouds out ahead of the approach of weather fronts. Thus their appearance is like that of scouts leading the cavalry across the frontier landscape. Storms typically follow these high cirrus clouds within 24 hours.

Community Notes: Bemidji, MN

Home to MPR station KCRB 88.5 FM, and Bemidji State University, this community in southern Beltrami County near the headwaters of the Mississippi River began making daily weather observations in January of 1896. Since that time, numerous volunteers and staff at the Bemidji Airport have contributed to the daily observation record there. The Bemidji climate record is the second longest in Beltrami County (second to Red Lake which began daily obs in November of 1893).

All-time weather records at Bemidji include: a maximum of 107 degrees F on July 11, 12, and 13, 1936; -50 degrees F on January 30, 1950; a 74 degree temperature rise on March 19, 1939 (from -32 degrees F to 42 degrees F); a rainfall of 4.15 inches on July 22, 1914.

Outlook:

Looks to be cloudy and humid with a chance for thundershowers during the first two days of the State Fair as a low pressure system will affect the state. Starting sometime early on Saturday, dew points should drop and high pressure settle in for through the rest of Saturday and most of Sunday. Then increasing clouds and humidity again with a chance for thunder showers, drying out for Tuesday, but then warm and moist again most of next week.

To: Greg Magnuson, Bob Potter, John Bischoff, and Stephanie Curtis  
From: Mark Seeley  
Re: Suggestions for MPR's Morning Edition, Friday, Sep 1, 1995  
Topic: Review of Summer of '95

The summer of 1995 in Minnesota started out cooler than normal in May. May was also wetter than normal in western sections of the state (delaying field activity for some time), but drier than normal in northern and southeastern areas.

June was warmer than normal and drier than normal. Temperatures climbed to 100 degrees in the western sections of the state during mid month, but fortunately humidities remained low, so livestock stress was avoided. The drier weather allowed many fields to drain enough to be planted.

Despite some unbearably hot and humid weather at mid month, July temperature averaged out near normal. It was also wetter than normal, except for a few areas in the far north and the southeast. High dew points were the most striking feature, causing livestock stress, high energy usage for air conditioning, infection of plant diseases (leaf diseases, e.g. fungi and bacteria), heat stress, auto stress, dehumidifier stress, refrigerator stress, etc.

August was generally warmer and wetter than normal for most places in the state, with some very high dew points as well. Some of the heaviest thunderstorms also occurred in August.

The dew point temperature climatology for the summer is striking when one examines the hourly data from the National Weather Service at MSP: the number of hours with dew points above 70 degrees is the second highest total for summer since 1945 (second to 1983). Observations of extreme dew points are even more striking. Since 1945, an 80 degree F dew point has been observed at MSP only 13 times. Ten of those observations occurred just this past July!

Almanac: Average maximum temperature locally for today's date is 78 (plus or minus 9 degrees standard deviation) and the average minimum is 58 (plus or minus 8 degrees standard deviation).

MSP records for today's date include: a maximum temperature of 97 degrees in 1913; a minimum temperature of degrees 36 degrees F in 1974; and record precipitation of 1.05 inches in 1926.

Scanning the state climatic data base: the all-time high for today's date is 101 degrees F at Beardsley and Winona in 1913, and then at Tracy in 1922; the all-time low is 23 degrees F at Tower in 1974, and again just last year south of Tower they reported 23 degrees F on this date.

Average dew point temperature for today is 56 degrees F. The highest dew point on this date is 75 degrees, while the lowest is 30 degrees.

Word of the Week: Pannus

This term comes from the Latin meaning web. It is a type of accessory cloud associated primarily with larger nibostratus or cumulonimbus clouds. These clouds often appear as shreds or web shapes lying under the base of the larger, main cloud. Their formation is dependent on water vapor and air circulation derived from the parent cloud. Often times you will see them associated with relatively large thunderstorm clouds in mid to late summer in Minnesota.

Outlook: Mild and sunny

Looks like a wonderful weekend for Fair goers and others who want to enjoy the proverbial last weekend of summer. Warm temperatures, with pleasant dew points, light winds and sunny skies. Temperatures should warm up for the full-fledged return of school next week, but it should remain on the dry side in terms of rainfall.

To: Greg Magnuson, Bob Potter, John Bischoff, and Stephanie Curtis

From: Mark Seeley

Re: Suggestions for MPR's Morning Edition, Friday, Sep 8, 1995

You might be interested to know that the central valley of California is having some fine "raisin drying weather" this week. Now I know why some of those farmers from California have a raisin like complexion.

Looks like relief from our high dew point depression will settle in this week. Maybe we have seen the last of the 70 plus dew points for 1995. Let's hope so.

If we actually get overnight minimums below 45 degrees F, it will be the first time since June 8th, and should we drop below 40 degrees F, that would be a first since May 2nd.

Topic: Fall Colors

Even though the primary trigger for fall leaf color change is the declining daylength (we are presently losing 3-4 minutes per day), former State Climatologist Earl Kuehnast found that the pace of color change was also governed by overnight low temperatures. He studied the effects of low temperatures on both the onset and rate of leaf color change around Minnesota. He found that three nights with lows in the 30s were sufficient to start leaf color change, and that peak fall colors were associated with 7 to 10 nights of such temperatures.

Exceptionally warm August temperatures with relatively high dew points, which have carried over into the first week of September are finally giving way to cool dry Canadian high pressure which will bring the first string of 30 degree F minimum temperatures to the northern parts of the state. Thus the onset of fall color change in the north should begin in earnest this weekend. If sunny and cool weather prevails for awhile, the brighter plant pigments may put on quite a nice display this fall, starting in northeastern sections by mid month.

Almanac: Average maximum temperature locally for today's date is 76 (plus or minus 10 degrees standard deviation) and the average minimum is 56 (plus or minus 7 degrees standard deviation).

MSP records for today's date include: a maximum temperature of 99 degrees in 1931; a minimum temperature of degrees 41 degrees F in 1965 and again in 1992; and record precipitation of 0.99 inches in 1961.

Scanning the state climatic data base: the all-time high for today's date is 105 degrees F at New Ulm in 1931; the all-time low is 24 degrees F at Meadowlands (southern St Louis County) in 1956 and at Tower (northern St Louis County) in 1975.

Average dew point temperature for today is 55 degrees F. The highest dew point on this date is 73 degrees, while the lowest is 32 degrees.

Word of the Week: Serein

This term comes from a French word meaning clear or bright. It is the name of an unusual phenomenon of fine rain falling from an apparently clear sky. This most often occurs due to rain drops being blown out of cloud formations in the windward direction from where the observer is standing, where it may be absolutely clear overhead. This occurred for a brief time at the State Fair this year (Saturday, Sept 2) when clouds in the southwestern sky produced a few rain drops which were deposited by winds over the sunny Fair Grounds.

Long ago, the wet vegetation found in the early morning was thought to be the result of a fine light rain from cloudless overnight skies. Later, scientists discovered that the moisture comes from the condensation of water vapor on the vegetative surfaces that drop below the dew point temperature.

Outlook: Cool and Dry

Can you believe that the forecast calls for a 40 degree drop in dew point temperatures? Dew points on Wednesday reached the 70s again in southern Minnesota, but by Friday and Saturday they should be in the low to mid 30s. That will feel like refrigeration! Highs should climb from the 60s to the 70s over the weekend and into next week. We'll probably see an end to some of the mosquito activity, but I'm sure that the yellow jackets will continue to be a nuisance.

I wouldn't yet put away the window fans or cover the air conditioners. There is still one chance in four that we'll see another 90 degree day, and a return of higher dew points. We have had 70 degree F dew points as late as October 14.

To: Greg Magnuson, Bob Potter, John Bischoff, and Stephanie Curtis  
From: Mark Seeley  
Re: Suggestions for MPR's Morning Edition, Friday, Sep 15, 1995

Yes, those area lawns need some moisture, especially after fall nitrogen is applied. Dave Ruschy notes that for the period of August 14 through September 14, MSP National Weather Service reports only 0.79 inches of rainfall. This is the 3rd driest such period in the MSP records back to 1891.

Comment on daylight loss noted by Bob Potter:

You are right about the very perceptible loss in daylight. We are losing over 3 minutes per day now, which translates to a loss of 1 hour and 30 minutes in September. We will lose another 1 hour and 30 minutes in October as well, before going off daylight savings time.

The lower sun angle also magnifies the problems with glare and reflection when driving a car this time of year (or trying to follow the flight of a golf ball). Need to start wearing those sun glasses again.

Topic: Rainy Days in 1995

To check up on the frequency of measurable rains across each day of the week during 1995, I did a frequency distribution since January 1st from the MSP data: The following are the percent frequencies of measurable rain for each day of the week..

|          |     |        |     |          |     |           |     |
|----------|-----|--------|-----|----------|-----|-----------|-----|
| Sunday   | 35% | Monday | 51% | Tuesday  | 32% | Wednesday | 30% |
| Thursday | 27% | Friday | 30% | Saturday | 41% |           |     |

Note that the first day of the work week has not been especially good at 51 percent wet, while Thursdays (traditional 1/2 days for doctors and dentists) has been rather kind with only a 27 percent frequency of rains. On weekends, Sundays have been better than Saturdays so far this year.

Topic 2: A Change in the Wind

Fall brings a change in prevailing winds across the state. As we have discussed before, the dominant wind directions in Minnesota are northwesterly and south to southeasterly, except for Duluth and northshore areas which sees a significant frequency of easterly winds during the summer months (cooler and heavier air moving off Lake Superior towards the warmer land). September and October are transition months, when the southerly wind components diminish in frequency and the northwesterly components increase in frequency until they become fully dominant for the November through March period.

This has been occurring already this month and will continue.

Sharp contrasts in overnight minimums are in evidence as a result. Overnight minimums have ranged from the mid 60s with warm moist and moderate southerly winds to the 30s with light dry northwesterly winds. The southerly winds awaken our memory to those balmy days of summer, while the northwesterly winds sometimes create anxiety attacks about the impending season of "layered clothing."

Almanac: Average maximum temperature locally for today's date is 70 (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: a maximum temperature of 98 degrees in 1939; a minimum temperature of degrees 36 degrees F in 1964; and record precipitation of 2.59 inches in 1992.

Scanning the state climatic data base: the all-time high for today's date is 100 degrees F at St Peter (Nicollet County) in 1939 and at Tracy (Lyon County) in 1955; the all-time low is a very nippy 17 degrees F at Bigfork (northern Itasca County) in 1964.

Average dew point temperature for today is 48 degrees F. The highest dew point on this date is 66 degrees, while the lowest is 30 degrees.

Word of the Week: Prevailing Wind

Many people think that this is some kind of an average of wind direction, but it is really the most frequently observed direction over a given period of time, such as a day, a week, or a month. For many locations, prevailing winds are figured from a series of hourly observations. For MSP, prevailing winds by month are...

|     |     |     |     |     |     |     |     |     |     |     |     |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
| NW  | NW  | NW  | NW  | SE  | SE  | SE  | SE  | S   | SE  | NW  | NW  |

Outlook:

Looks like the yo-yo effect settling in. Near seasonal average temperature with a chance for precipitation going into the weekend, then declining temperatures starting on Sunday and into next week, with westerly to northwesterly winds. Chance of shower activity toward the end of the week, between Wednesday and Friday.

To: Greg Magnuson, Bob Potter, John Bischoff, and Stephanie Curtis  
From: Mark Seeley  
Re: Suggestions for MPR's Morning Edition, Friday, Sep 22, 1995

Bob's question on frost and winds reminds me of why some Minnesotans run their ceiling fans on low speed during the winter. It mixes the air, spreading the warm air which accumulates near the ceiling both horizontally and vertically. Thus this can help keep the temperature of a room or a building warmer and more uniform throughout.

Similarly in the outside environment overnight winds provide enough mixing of air to prevent cold air drainage and accumulation around low spots at the surface. This can prevent frost from occurring, since the air temperature tends to remain more uniform rather than becoming too stratified and developing a sharp overnight inversion layer.

Topic: Snows in September

Observed snow showers and flurries in northern Minnesota this week, prompted a listener to call and ask "how often does this occur?" The answer is more often than you think. The last relatively widespread observation of September snows occurred in 1974, when 33 National Weather Service observers (from 14 different counties) reported snow. Hoyt Lakes and Crane Lake Ranger Station in St Louis County, as well as International Falls (Koochiching County) reported 1 inch of snow on the ground at least for a brief period of time. And Big Falls in Koochiching County actually reported a trace of snow on August 28th of that year, an extremely rare event indeed.

Even more recently, the Reserve Mining Company at Babbitt, MN reported 1.5 inches of snow on September 30, 1985. But this was a more isolated event geographically. The heaviest September snowfall I could find through a cursory scan of the state data base was 2.0 inches which occurred at Tower, MN on September 27, 1899 and again at Babbitt, MN on September 25, 1927. A more thorough search of the state climatic data base would probably reveal even greater September snowfalls.

In a 67 year climate record from Babbitt in St Louis County, September snows are reported in 25 of those years. That's better than one year in three. In addition, three separate September snowfall events were observed there in both 1942 and 1972. So at least for parts of northern Minnesota, reports of snow in September should not cause too many mouths to fall open with shock or create panic about the premature onset of winter.

Topic 2: Freezes and the freeze-free season

With a freeze forecasted for most of the state on Thursday and Friday mornings, Jim Zandlo, our State Climatologist reminded me of the earliest fall freezing temperatures found in the MSP records:

Sept 3, 1974      Sept 18, 1929      Sept 20, 1962 (and 1991)  
and Sept 22, 1913

But, actually freezes during the third week of September in rural Minnesota (even southern counties) are not uncommon. The median freeze date at Pipestone is 9/23, at Preston it is 9/21 and even for Sibley, IA it is 9/24.

A freeze this early in the heat island of the Twin Cities is quite unusual. The growing season, often defined as the number of days between the last spring freeze and first fall freeze is remarkably longer in the Twin Cities area than in surrounding communities. The average length of the growing season for MSP (based on National Weather Service records) is 164 days. This is longer than nearly all the surrounding communities with significant climatic records, including Maple Plain, Rosemount, Forest Lake, Farmington, Chaska, Jordan, Buffalo, and Delano. Only communities along the Mississippi River Valley in SE Minnesota have growing seasons as long as MSP. In fact with respect to latitudinal position, you have to go south to Cedar Rapids, IA to find a growing season as long.

The last spring freeze for MSP has occurred as early as 4/7 (1955) and 4/8 (1899), while the first fall freeze has been delayed as late as November in three years: November 1, 1931; November 6, 1958; and November 7, 1900. This results in a temporal range in the freeze free season of 120 days to 208 days.

In terms of the long term temporal variability of the growing season, the MSP record is a bit puzzling. Given the tremendous growth through urbanization over the past 100 years, and the evidence showing that the mean annual temperature in the MSP records has increased better than 1.5 degrees F since the beginning of this century, one might expect to see an increase in the growing season length. Not so! In fact growing seasons throughout the first 50 plus years of the MSP record (1891-1940) were typically longer than those of the most recent 50 years, up to 14 days or more longer. The explanation for this is likely a complex one, but one contributing factor may be the reduced surface moisture storage in urban areas (due to greater runoff), causing a reduction in water vapor released from the surface. This would tend to accentuate the diurnal heating and cooling cycle.

Almanac: Average maximum temperature locally for today's date is 68 (plus or minus 10 degrees standard deviation) and the average minimum is 48 (plus or minus 8 degrees standard deviation).

MSP records for today's date include: a maximum temperature of 95 degrees in 1936; a minimum temperature of degrees 26 degrees F in 1974; and record precipitation of 2.80 inches in 1895.

Scanning the state climatic data base: the all-time high for today's date is 101 degrees F at Beardsley (Big Stone County) and at Moorhead (Clay County) in 1936; the all-time low is a 10 degrees F at Thorhult (Beltrami County) in 1974.

Average dew point temperature for today is 45 degrees F. The highest dew point on this date is 68 degrees, while the lowest is 20 degrees.

Words of the Week: Freezing Level Chart

We have talked about the atmospheric freezing level in the past. This is defined as the height of the 32 degree F isotherm over a particular point on the Earth's surface. It is determined twice daily over many points around the world from soundings that are made by radiosondes (balloon launched instruments). A freezing level chart is a synoptic depiction (map) of the height of this freezing level at a given point in time, but shown over a large geographic area (using isoheights or contour lines-lines of constant height). Thus a forecaster can compare the height of the freezing level over Minnesota against that over Illinois for example. He or she may use this as guidance in forecasting the type of precipitation expected from a frontal system or upper air disturbance. It is also used very commonly in pilot briefings.

The freezing level over Minnesota has dropped many thousands of feet this week (it was at 8500 ft on Tuesday, 4000 ft on Wednesday, and only 290 ft on Thursday night). The lowering of the freezing level has been a factor in the observation of snow showers and snow flurries around the state (including MSP suburbs and Rochester), even though many of the official surface observations of temperature have been in the 40s. This is due to the somewhat shallow depth of the atmosphere near the ground where temperatures are above freezing, thus snow flakes and crystals formed in clouds, can fall through this layer without totally losing their structure and melting.

Outlook:

Tied the MSP record for lowest maximum temperature on Thursday (Sept. 21) and may also break or tie the record for today, Friday, Sept. 22 (49 degrees F in 1983). Improving weather on Saturday, with south winds, mostly clear skies and temperatures reaching the 50s. Increasing clouds Saturday night and into Sunday, with a chance for showers, especially in southern parts of the state. Then clearing with a warming trend beginning on Monday and running through most of next week. High temperatures will return to the mid to upper 60s.

To: Greg Magnuson, Bob Potter, John Bischoff, and Stephanie Curtis  
From: Mark Seeley  
Re: Suggestions for MPR's Morning Edition, Friday, Sep 29, 1995

This morning's low of 63 degrees at MSP ties the record for the warmest overnight low on this date (1982 and 1922).

September is a month of very perceptible changes in climate, for example daylength is now 1 hr and 26 min shorter than the first of the month. The altitude angle of the sun above the horizon at midday is noticeably less having declined by over 10 degrees during the month. (Today it is about 43 degrees above the horizon at midday). This increasingly acute angle causes alot of squinting. In terms of daylength and sun angle, today's equivalent spring date is March 14 (MSP reported a high of 56 and a low of 33 degrees F last March 14, with frozen soil).

Mother Nature has been kind to Minnesota's farmers this week. We have often referred to a timely precipitation event in July as a million dollar rain, because moisture provided during the critical reproductive stages of most crops can boost yields by several bushels/acre. A similar statement can be made about nice field drying weather during late September and early October. The warm temperatures and lower humidities this week have helped to reduce the kernel moisture content of field corn by 4 to 8 percentage points. This translates to a savings of several dollars per acre in terms of drying costs (depending on yield, corn price, and LP price among other factors). So given the nearly 7 million acres of land planted to corn this year, the state has just benefitted from Mother Nature's natural air drying to the tune of several millions of dollars.

Topic 2: Freezes and the freeze-free season

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the growing season for MSP (based on National Weather Service records) is 164 days. This is longer than nearly all the surrounding communities with significant climatic records, including Maple Plain, Rosemount, Forest Lake, Farmington, Chaska, Jordan, Buffalo, and Delano. Only communities along the Mississippi River Valley in SE Minnesota have growing seasons as long as MSP. In fact with respect to latitudinal position, you have to go south to Cedar Rapids, IA to find a growing season as long.

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Almanac: Average maximum temperature locally for today's date is 65 (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: a maximum temperature of 89 degrees in 1897; a minimum temperature of degrees 27 degrees F in 1945; and record precipitation of 0.92 inches in 1971.

Scanning the state climatic data base: the all-time high for today's date is 96 degrees F at Moorhead (Clay County) in 1897; and the all-time low is a 13 degrees F at Hallock (Kittson County) in 1899 and at Mora (Kanabec County) in 1984.

Average dew point temperature for today is 45 degrees F. The highest dew point on this date is 68 degrees, while the lowest is 24 degrees.

Words of the Week: Fog Horizon

This is the term used to describe the top of a fog layer which

is confined by a low level temperature inversion. This inversion puts a semi-uniform lid on the fog layer, giving the appearance of a horizon when viewed from above.

These were in evidence in many city parks in the Twin Cities on both Tuesday and Wednesday mornings this week. Many grassy areas located away from traffic patterns showed a low level fog horizon in the early morning hours. Near roadways through the parks, where motor vehicles passed and mixed the air, the low level inversion was broken and the fog was not present.

Community Notes: Fairmont, MN

This community located in central Martin County, not far from the Iowa border has one of the longest climate records in the upper midwest. Daily observations of temperature and precip were begun in January of 1886. The Wherland Family made observations at their farm, Rolling Green, from that time until 1914. The current daily observations are made at the city water filtration plant.

Extreme climatic events at Fairmont include: 109 degrees on August 3, 1930; -35 degrees on January 12, 1912 and again on February 2, 1917; 4.79 inches of rain on July 19, 1963; and 17 inches of snow on February 12, 1965.

Fairmont has a median freeze free season of 156 days, less than that of the Twin Cities, even though it lies along the Iowa border. What was thought to be an all-time precipitation record was set there in 1991 with nearly 44 inches, only to be shattered in 1993 by over 52 inches (with nearly 15 inches coming in June the peak of the flooding). This precipitation level is more like Florida than Minnesota.

Outlook:

Relatively large double-barreled low pressure system will bring widespread shower activity and moderate to strong winds for Friday through Sunday. Some heavy rain may occur in places. This will be followed by some cooler air with decreasing temperatures for the first half of next week.

To: Greg Magnuson, Bob Potter, John Bischoff, and Stephanie Curtis  
From: Mark Seeley  
Re: Suggestions for MPR's Morning Edition, Friday, Oct 6, 1995

Hurricane Opal will probably make quite a bit of news by the time we talk on Friday. It appears to be quite strong and getting stronger. This could affect our weather for the weekend and next week as well. Sometimes these strong hurricanes in the Gulf act like a giant vacuum cleaner and draw down a great deal of cold air out of northern Canada. It may disrupt the overall Jet Stream flow across the eastern U.S. as well. I will try to keep up with its position and effects over the next few days.

I will be in Illinois at the regional research meetings on Climate and Agriculture. Issues discussed on Thursday will likely include the dismantling of the National Weather Service Agricultural Weather Services due to budget cuts. There will be other issues discussed as well.

Almanac: Average maximum temperature locally for today's date is 63 (plus or minus 10 degrees standard deviation) and the average minimum is 43 (plus or minus 7 degrees standard deviation).

MSP records for today's date include: a maximum temperature of 85 degrees in 1961; a minimum temperature of degrees 26 degrees F in 1976; record precipitation of 1.69 inches in 1941; and a trace of snow in 1952.

Scanning the state climatic data base: the all-time high for today's date is 94 degrees F at Madison (Lac Qui Parle County) in 1993 (after a morning low of 42 degrees); and the all-time low is 11 degrees F at Pokegama Falls (Itasca County) in 1904 and at Detroit Lakes (Becker County) in 1976.

Average dew point temperature for today is 45 degrees F. The highest dew point on this date is 68 degrees, while the lowest is 24 degrees.

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This is the term used to describe the top of a fog layer which is confined by a low level temperature inversion. This inversion puts a semi-uniform lid on the fog layer, giving the appearance of a horizon when viewed from above.

These are in evidence sometimes in the fall around many city parks in the Twin Cities. Grassy areas located away from traffic patterns will show a low level fog horizon in the early morning hours. Near roadways through the parks, where motor vehicles pass and mix the air, the low level inversion will be broken and the fog cannot form.

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Outlook:

Most people will be interested in the weather for the Twin Cities Marathon. Looks to be cool, possibly 30s to low 40s in the morning. May have some heavy dew or fog with light winds. Dry with partly cloudy skies for most of the morning as well. We'll check the update on Friday.

Runners dissipate the heat they generate by conduction, convection (from the skin), evaporation (sweat), warming the inhaled air in the lungs, and by evaporation into the inhaled air. Clothing style and color has a greater impact on heat storage and dissipation when the sun is out. Some studies have shown that dark colored clothing may keep the runner 3 to 7 degrees F warmer than light colored clothing of the same material.

To: Greg Magnuson, Bob Potter, John Bischoff, and Stephanie Curtis  
From: Mark Seeley  
Re: Suggestions for MPR's Morning Edition, Friday, Oct 13, 1995

Though perfectly clear, cloudless days are somewhat rare across the region, the peak occurrence falls between September 27 and October 24, when the mean frequency is 17 to 23 percent (e.g. two days in every 10 are cloudless). This was demonstrated in a regional study by Dr. Donald Baker of the Department of Soil, Water, and Climate. These dates correspond closely with a period known as "Indian Summer." This is definitely what we have been enjoying this week, with some of the clearest days of the fall season, and near peak solar radiation values.

The term "Indian Summer" dates back to at least 1778 and probably originated from the way native American Indians used the last spells of good weather in the autumn to increase their winter stores of supplies and food. The corresponding period in Europe is sometimes referred to as "Old Wives Summer."

Almanac: Average maximum temperature locally for today's date is 61 (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: a maximum temperature of 84 degrees in 1956; a minimum temperature of degrees 22 degrees F in 1917; record precipitation of 1.12 inches in 1956; and 0.4 inches of snow in 1969.

Scanning the state climatic data base: the all-time high for today's date is 89 degrees F at Canby (Yellow Medicine County) in 1958 and at Fairmont (Martin County) and Luverne (Rock County) in 1975; the all-time low is 8 degrees F at Tower (St Louis County) in 1993.

Average dew point temperature for today is 41 degrees F. The highest dew point on this date is 67 degrees, while the lowest is 21 degrees.

Word of the Week: Pennant

This is the championship flag which will be awarded to the winner of the Braves-Reds series and the Indians-Mariners series. It is also a nautical term used for various flag signals which are hoisted on ships.

In meteorology it is a term applied to the plotting of wind speed on a synoptic chart. Listeners who view the weather locally on Channel 17 or use the Internet to access weather information may have noticed the appearance of pennants on the upper air (Jet Stream) charts or the surface observations. It is a triangular flag pointing towards lower pressure and designates a wind speed of 50 knots (approx 58 mph). Lower wind speeds are denoted by the use of barbs (10 knots) and half-barbs (5 knots).

Community Notes: Fairmont, MN

This community located in central Martin County, not far from the Iowa border has one of the longest climate records in the

upper midwest. Daily observations of temperature and precip were begun in January of 1886. The Wherland Family made observations at their farm, Rolling Green, from that time until 1914. The current daily observations are made at the city water filtration plant.

Extreme climatic events at Fairmont include: 109 degrees on August 3, 1930; -35 degrees on January 12, 1912 and again on February 2, 1917; 4.79 inches of rain on July 19, 1963; and 17 inches of snow on February 12, 1965.

Fairmont has a median freeze free season of 156 days, less than that of the Twin Cities, even though it lies along the Iowa border. What was thought to be an all-time precipitation record was set there in 1991 with nearly 44 inches, only to be shattered in 1993 by over 52 inches (with nearly 15 inches coming in June the peak of the flooding). This precipitation level is more like Florida than Minnesota.

#### Outlook:

Mild weather has been the order this week. MSP's 59 degree F overnight low on October 12 tied the record for highest minimum temperature on that date set in 1920.

The mild spell comes to an end on Friday with a frontal passage folowed by cooler Candaian air. Somewhat unsettled weather for Saturday through Monday, as we cool down to temperatures that are below normal. Chance of precipitation Friday night through Monday as well, with a chance for snow showers in the north. Dry and cool Tuesday through Thursday, then increasing cloudiness with a chance for precipitation.

To: Greg Magnuson, Perry Finelli, John Bischoff, and Stephanie Curtis  
From: Mark Seeley  
Re: Suggestions for MPR's Morning Edition, Friday, Oct 20, 1995

In anticipation of winter, a listener called with a question about maximum temperature distribution during winter. She asked how often the MSP maximum temperature has reached 60 degrees F or greater during the winter months. Since 1891, a maximum temperature of 60 degrees F or greater has occurred 3 times in December and 3 times in February. It has never occurred in January for MSP, although 60 degree January temperatures have been recorded at other locations in Minnesota. As recently as January 24, 1981 a high temperature of 69 degrees F was recorded at Montevideo in Chippewa County. That's almost high enough to break out the summer wardrobe!

Topic: Soil Frost

One of the most distinguishing features of Minnesota's climate is soil freezing. Unlike our neighboring states to the south and to the east, our soils freeze for longer periods of time and to greater depths during the winter. But even within the state, there is a good deal of variability in soil freezing characteristics.

For example, the prairie clay soils of the Red River Valley usually begin to freeze about the last week of November, while the loess soils in southeastern Minnesota often do not freeze until near Christmas time. Average maximum frost depths range from less than 20 inches in some southern counties and in some heavily forested northern counties, to 4 feet or deeper in parts of western Minnesota where soils are often not well insulated by persistent winter snow cover.

The maximum penetration of soil frost usually occurs in late February or during March. This is followed by a gradual thawing both from the surface and from below the frost layer where the soil temperature is nearly constant between 45 and 50 degrees F.

Almanac: Average maximum temperature locally for today's date is 56 (plus or minus 11 degrees standard deviation) and the average minimum is 39 (plus or minus 9 degrees standard deviation).

MSP records for today's date include: a maximum temperature of 83 degrees in 1953; a minimum temperature of 18 degrees F in 1960; record precipitation of 2.64 inches in 1924; and 3.0 inches of snow in 1916.

Last snowfall on this date locally was 0.5 inches in 1982. We have twice reached 80 degrees F or better on this date: 1947 when the temperature rose to 80 degrees; and 1953 when a record 83 degrees was recorded.

Scanning the state climatic data base: the all-time high for today's date is 91 degrees F at Canby (Yellow Medicine County) in 1947; the all-time low is 0 degrees F at Roseau in 1916. This low temperature record by the way represents the earliest recorded temperature of 0 degrees F in the state and occurred

in the aftermath of a 9 inch snowstorm. Roseau is also the site of the earliest below zero temperature reading, a -2 degrees F minimum recorded on October 21, 1913.

Average dew point temperature for today is 37 degrees F. The highest dew point on this date is 62 degrees, while the lowest is 8 degrees.

Words of the Week: Stevenson Screen

In a previous program we talked about the use of the Cotton Region Shelter in the United States, dating back to 1881. It was adopted by the National Weather Service in 1910 as the standard instrument shelter for observers who recorded daily maximum and minimum temperatures.

Preceding this type of shelter was the Stevenson Screen designed in the 1860s by Scottish engineer Thomas Stevenson. It was adopted by the British as a standard instrument shelter in the United Kingdom and was used throughout the old British Empire as well, particularly in India. The Stevenson Screen consists of a wooden box (generally smaller than the Cotton Region Shelter) with double louvered sides. This box is mounted on four legs about four feet above the ground, most often over a grass surface. It is usually painted white with the thermometers mounted on brackets in the middle of the box.

Because of the trend away from the use of liquid in glass thermometers to thermistor-based measurements (electrical), both the Stevenson Screen and the Cotton Region Shelter are disappearing from the world's climate observation networks. They are being replaced by the smaller Gill-type shield which is composed of stacked plates and concentric tubes (usually made of plastic) mounted on a single post.

Incidentally, the designer of the Stevenson Screen, Thomas Stevenson, was better known as the father of the great Scottish novelist and poet, Robert Louis Stevenson, who exhibited a sound knowledge of climate and climatic effects in his writings.

Outlook:

Somewhat unsettled weather over the weekend and into Monday, with cooler than normal temperatures, mostly cloudy skies and a chance for rain in the south and snow showers in the north. Remaining cooler than normal most of next week with a chance for showers again as we approach the end of the week.

To: Greg Magnuson, Bob Potter, John Bischoff, and Stephanie Curtis  
From: Mark Seeley  
Re: Suggestions for MPR's Morning Edition, Friday, Oct 27, 1995  
Topic: Fall Chores

The time for outdoor chores is rapidly coming to an end. I have had people ask me about the chances of having suitable weather yet to finish up outside painting, to rake and mulch leaves, fertilize lawns, prune trees, caulk windows and doors, finish autobody patching and painting, cover golf course greens, dry-dock boats and any number of other activities.

Some of these concerns are framed in questions such as: "Do you think it will reach 70 degrees again this month?" (only a 6-7 percent chance); or "Surely we'll have more daytime highs in the 50s so I can paint, won't we? (about a 55 percent chance); or "I need two or three consecutive dry days to finish up the yard, do you think it will happen?" (60 to 70 percent chance); or "This putty only sets up if the air temperature is 60 degrees or warmer, any chance of that?" (about a 30 percent chance).

Without climatology, how would I ever address these questions.

Almanac: Average maximum temperature locally for today's date is 54 (plus or minus 11 degrees standard deviation) and the average minimum is 35 (plus or minus 7 degrees standard deviation).

MSP records for today's date include: a maximum temperature of 74 degrees in 1922 and again in 1948; a minimum temperature of 16 degrees F in 1976; record precipitation of 2.22 inches in 1971; and 2.6 inches of snow in 1919.

Last snowfall on this date locally was 0.1 inches in 1967.

Scanning the state climatic data base: the all-time high for today's date is 86 degrees F at Montevideo (Chippewa County) in 1955; the all-time low is -10 degrees F at Itasca State Park in 1919. This was one of the lowest October temperatures in Minnesota and followed a 13 inch snowfall which occurred on the 24th and 25th. The coldest October temperature I could find was -16 degrees at Roseau on Oct. 26, 1936. That record occurred after a 6 inch snow storm as well.

Average dew point temperature for today is 35 degrees F. The highest dew point on this date is 60 degrees, while the lowest is 12 degrees.

Word of the Week: LIDAR

Like the term RADAR (for Radio Detection And Ranging), LIDAR is also an acronym. It stands for LIght Detection And Ranging. LIDAR instruments provide valuable information about the structure of the atmosphere.

Light is transmitted from a source to a target. The transmitted light interacts with and is changed by the target, some of the light being absorbed, reflected or scattered. The changes in the

properties of the light are a measurement of the properties of the target. The time for the light to travel out to the target and return back to the instrument indicates the range of the target. The returned light signal is detected by special types of mirrors.

LIDAR can be used to measure distance, direction and speed of movement, as well as density of various atmospheric constituents such as water vapor, ozone, pollutants and other aerosols. Temperature and density profiles of the atmosphere are commonly determined by LIDAR measurements, many using differential absorption of two laser beams. Different LIDAR systems are being deployed in orbit to measure properties of the Earth's atmosphere.

Community Notes: Canby, Minnesota

Canby, a community of about 2000 people in Yellow Medicine County has a climate record which began in August of 1887. The first observer was Mr. P.C. Scott. There have been over a dozen observers since that time. The current observer, Mr. Darold Snortum has been recording daily temperatures and precipitation since 1948 (over 47 years).

Canby is one of the warmest places in Minnesota. The average July maximum temperature is 87 degrees F. On the mornings of June 28 and 29 of 1931, the overnight low temperature was 87 degrees F in Canby, the warmest nights in the Minnesota State Climate Record. Located just 9 miles from the SD border, Canby can be very dry, with exceedingly low relative humidity. This leads to some rather large daily temperature ranges. For example, on March 7, 1950 after a morning low of 3 degrees F, the afternoon temperature climbed to 60 degrees F.

All-time records at Canby include: 111 degrees F on July 12, 1936; -33 degrees F on January 22, 1936; 5.35 inches of rainfall on August 19, 1926; and 16 inches of snow on November 20, 1975.

Outlook:

Chance of precipitation (rain or snow) on Friday, then cloudy with cool temperatures Saturday, Sunday and Monday. Chance of rain or snow Tuesday, then cooler and drier weather settling in for the rest of next week with highs in the 30s and lows in the teens and 20s.

To: Greg Magnuson, Bob Potter, John Bischoff, and Stephanie Curtis  
From: Mark Seeley  
Re: Suggestions for MPR's Morning Edition, Friday, Nov 10, 1995

Topic 1: FROM THE "IT ALL DEPENDS" FILE:

The use of the adverb "possibly" depends on the context. For example, when asking a politician about prospects for a tax cut, the answer may be, "possibly", used as a three syllable "NO"; however, when asking a meteorologist about prospects for snow cover at Thanksgiving time, the answer may be, "possibly", used as a three syllable "YES". (since 1891 snowfalls have occurred over the Thanksgiving holiday weekend 57 percent of the time).

Yes, it has been a cold and wintry November so far, but it depends on your frame of reference. The all-time low temperature record for November is -45 degrees F at Pokegama Dam on November 30, 1896. Although some below zero readings have already been reported around the state and some are expected again this weekend, none have approached that record!

The onset of winter in November is following a recent climatic trend: seven of the past ten Novembers have been colder than normal; while six of the past ten have seen more than normal snowfall (including the 46.9 inches in 1991).

Topic 2: Alternative names for Winter

Winter is the coldest season of the year, especially in the mid and high latitudes. Astronomically winter is the period when the sun is over the opposite hemisphere (between the winter solstice, Dec. 22, and the vernal equinox, Mar. 20 for the northern hemisphere). In ancient classical Mediterranean civilizations it was known as the hibernal season or the stormy season.

But countries and cultures around the world often describe or refer to winter based on observed effects.....

It is known as the wet season in places with dry summers.

It is the white season where snow covers the landscape.

It is the season of frozen soil, where the ground freezes hard and deep.

It is the season of fire and smoke for many nomadic tribes whose only source of warmth is a campfire.

To the Plains Indians of North America it was known as the season when the thunder sleeps (lack of thunderstorm activity).

It is the season when King Boreas (the north wind) reigns in some European countries.

And perhaps in the more modern context it is the season for home videos, or outdoor activities such as skiing or snowmobiling.

Almanac: Average maximum temperature locally for today's date is

44 (plus or minus 10 degrees standard deviation) and the average minimum is 28 (plus or minus 9 degrees standard deviation).

MSP records for today's date include: a maximum temperature of 67 degrees in 1930; a minimum temperature of 3 degrees F in 1986; record precipitation of 1.36 inches in 1915; and 5.0 inches of snow in 1896.

Last snowfall on this date locally was 1.3 inches in 1991. We have recorded four measurable snowfalls on this date since 1948.

Scanning the state climatic data base: the all-time high for today's date is 78 degrees F at Fosston (Polk County) in 1909; the all-time low is -15 degrees F at Big Falls (Koochiching County) in 1933.

Average dew point temperature for today is 26 degrees F. The highest dew point on this date is 51 degrees, while the lowest is -3 degrees.

Word of the Week: Snow Garland

This is a very rare and particularly beautiful feature which sometimes occurs with snowfalls when the temperature hovers near 32 degrees F. Snow becomes festooned from trees, shrubs, and even fences. It takes the form of a rope or garland made of snow, and may be several feet long and an inch or more in diameter. This shape is retained by the surface tension provided by the thin films of water bonding individual snow crystals and aggregates together. Temperatures right around the freezing point are necessary to preserve the crystals and the thin films of water which bond them. Winds must be calm so that the garlands are undisturbed during accumulation.

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All-time records at Canby include: 111 degrees F on July 12, 1936; -33 degrees F on January 22, 1936; 5.35 inches of rainfall on August 19, 1926; and 16 inches of snow on November 20, 1975.

Outlook:

Some flurries around the state on Friday, then cold and sunny and Saturday and Sunday, with some overnight lows below zero in

the north. Highs should be in the 20s. Chance for light snow later on Sunday and on Monday. Tuesday will be dry with moderating temperatures. Highs may approach the 40s by Wednesday and Thursday with a low pressure system bringing precipitation across the region on Friday and Saturday.

To: Greg Magnuson, Bob Potter, John Bischoff, and Stephanie Curtis  
From: Mark Seeley  
Re: Suggestions for MPR's Morning Edition, Friday, Nov 17, 1995

Climate Trivia: Have we ever had a November without measurable snowfall in the Twin Cities?

Answer: Yes, three times. 1928 and 1939 only a trace of snow was recorded, and in November of 1963 not even a trace was observed.

Topic 1: 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. Jim Zandlo, Minnesota State Climatologist helped me look at the historical weather in the Twin Cities associated with the Thanksgiving Holiday period (Wed-Sun) each year since 1891.

Wednesday and Sunday either side of the holiday have evolved to become two of the heaviest travel days of the year. 37 percent of the Wednesdays preceding Thanksgiving have recorded measurable precipitation of some form, suggesting better than a 1 in 3 chance of encountering some form of storminess. 27 percent of these Wednesdays also show a measurable snowfall, the greatest being 11.4 inches in 1983. On the other hand, 26 percent of the Sundays following Thanksgiving show measurable precipitation of some form. 21 percent of the Sundays had measurable snowfall, with the greatest being 8.4 inches in 1985. In 1939, it wasn't snowfall which created travel problems, but very dense fog which 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 the ground 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. 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 reducing visibility and cars trying to negotiate icy streets. But then 1929 was probably before shopping became such a popular activity following the holiday.

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

## Topic 2: Planting fall bulbs

A question came in this week about whether or not there would still be suitable weather for planting bulbs. Well, the soil is already frozen to a depth of 6 to 8 inches or more where there is no surface cover. Where there is mulch, leaves or plant residue left on the surface, the soil has not frozen as deeply and might still be workable.

One listener asked if the warm spell this week (and weekend) would at least temporarily thaw the soil. The answer is probably not. Even if the temperature reaches the 40s or 50 degrees F, it will not have the assistance of an effective high sun and increasing daylength, two factors which contribute to a more rapid thawing out of the soil in the spring. So if your soil in your garden is already frozen it is likely to stay that way.

I asked Deb Brown, Extension Horticulturalist about this and she advised to either send the bulbs back to the supplier or pot them and place them in an old refrigerator or cellar, then place them in a window box in February to force them to grow and bloom.

Almanac: Average maximum temperature locally for today's date is 42 (plus or minus 12 degrees standard deviation) and the average minimum is 26 (plus or minus 10 degrees standard deviation).

MSP records for today's date include: a maximum temperature of 71 degrees in 1953; a minimum temperature of -2 degrees F in 1959; record precipitation of 0.72 inches in 1971; and 8.3 inches of snow in 1978.

There have been seven snowfalls locally on this date since 1948, the last one occurring in 1989 when 1.0 inches fell.

Scanning the state climatic data base: the all-time high for today's date is 74 degrees F at Morris and Ada in 1953; the all-time low is -19 degrees F at Hallock in 1914.

Average dew point temperature for today is 26 degrees F. The highest dew point on this date is 58 degrees, while the lowest is -14 degrees.

Word of the Week: Gale

This word is popularly used to describe an unusually strong wind (i.e. anything greater than 25 mph but less than hurricane strength of 75 mph). In nautical terminology it has more specific meaning: a moderate gale is a wind of 32 to 38 mph; a fresh gale is 39 to 46 mph; a strong gale is 47 to 54 mph; and a whole gale is greater than 55 mph. It first came into use in the nineteenth century with the British adoption of the Beaufort scale to estimate wind speeds at sea based upon observed effects (such as size of the swells).

Community Notes: None this week

Outlook:

Looks like a bit of a course correction coming up for November temperatures. Mild spell Saturday through Monday, then falling temperatures Tuesday through Saturday of next week. Chance of snow Tuesday and Wednesday and again next Saturday. Temperatures over the Thanksgiving holdiday will generally remain below normal.

To: Greg Magnuson, Bob Potter, and John Bischoff  
From: Mark Seeley  
Re: Suggestions for MPR's Morning Edition, Friday, Nov 24 1995

Listener question: How often do we have winter snow cover by the end of November?

Answer: About half the time. Since 1948, MSP has recorded one inch or greater of measured snow cover on the 30th of November 23 times (years).

Locally, current frost depths are 6 to 10 inches in bare soil, but only about 2 to 3 inches deep under sod (grass).

Almanac: Average maximum temperature locally for today's date is 35 (plus or minus 10 degrees standard deviation) and the average minimum is 20 (plus or minus 11 degrees standard deviation).

MSP records for today's date include: a maximum temperature of 59 degrees in 1990; a minimum temperature of -10 degrees F in 1893; record precipitation of 0.42 inches in 1908; and 1.7 inches of snow in 1977.

Last measurable snowfall on this date was 0.3 inches in 1993.

Scanning the state climatic data base: the all-time high for today's date is 68 degrees F at Wheaton (Traverse County) in 1984; the all-time low is -31 degrees F at Pokegama Dam (Itasca County) in 1898.

Average dew point temperature for today is 18 degrees F. The highest dew point on this date is 40 degrees, while the lowest is -12 degrees.

Words of the Week: Mathematical Climate

This term relates to one of the earliest attempts by the ancient Greeks to classify the Earth's climate into zones. It is based entirely on the annual cycle in the sun's inclination. The Torrid Zone (winterless) lies between the Tropic of Cancer (23.5 degrees N latitude) and the Tropic of Capricorn (23.5 degrees S latitude) centered on the equator. The Temperate (intermediate) Zone lies between 23.5 degrees and 66.5 degrees latitude. The Frigid Zone (summerless) lies within the Arctic and Antarctic Circles, poleward from 66.5 degrees latitude. Mathematical climate is a generalization based on the positional characteristics of the sun with the changing seasons. It is not useful for describing important climate characteristics such as wet and dry seasons, growing season length, temperature variability, etc.

Community Notes: Wheaton, MN

Since Wheaton holds the state high temperature record for today, I thought it would be worth mentioning that it also represents one of the best climatic records in western Minnesota.

Wheaton is a community of about 2000 people located in Traverse County just east of Lake Traverse along the South Dakota border. Daily climate observations were started there in May of 1914 by G. Kristensen. For a number of years observations were made at

the Wheaton Fire Station in town.

Records at Wheaton include: a high temperature of 106 degrees F on 6/25/88; a low temperature of -33 degrees F on 1/9/77; rainfall of 5.55 inches on 6/27/59; and snowfall of 15 inches on 3/3/51.

Wheaton is one of the few places in the state where temperatures greater than 60 degrees have been recorded during the heart of winter. For example, the high was 61 degrees F on 1/24/81 and 66 degrees F on 2/2/91. These high temperatures are a mere 45 degrees warmer than normal for that time of winter!

Outlook:

Looks like an unsettled period for Saturday through Monday, with some snow and rain showers around the state, possibly mixed with sleet and freezing rain. Then continuing cooler than normal for the balance of next week, with lows below zero or in single digits and highs in the teens and 20s.

To: Greg Magnuson, Bob Potter, and John Bischoff  
From: Mark Seeley  
Re: Suggestions for MPR's Morning Edition, Friday, Nov 24 1995

Listener question: How often do we have winter snow cover by the end of November?

Answer: About half the time. Since 1948, MSP has recorded one inch or greater of measured snow cover on the 30th of November 23 times (years).

Locally, current frost depths are 6 to 10 inches in bare soil, but only about 2 to 3 inches deep under sod (grass).

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Records at Wheaton include: a high temperature of 106 degrees F on 6/25/88; a low temperature of -33 degrees F on 1/9/77; rainfall of 5.55 inches on 6/27/59; and snowfall of 15 inches on 3/3/51.

Wheaton is one of the few places in the state where temperatures greater than 60 degrees have been recorded during the heart of winter. For example, the high was 61 degrees F on 1/24/81 and 66 degrees F on 2/2/91. These high temperatures are a mere 45 degrees warmer than normal for that time of winter!

Outlook:

Looks like an unsettled period for Saturday through Monday, with some snow and rain showers around the state, possibly mixed with sleet and freezing rain. Then continuing cooler than normal for the balance of next week, with lows below zero or in single digits and highs in the teens and 20s.

To: Greg Magnuson, Bob Potter, John Bischoff, and Stephanie Curtis  
From: Mark Seeley  
Re: Suggestions for MPR's Morning Edition, Friday, Nov 3, 1995

The new National Weather Service Radar (WSR-88D) was fully commissioned on Wednesday (Nov. 1). It will now be the operational radar of the Twin Cities Forecast Office, replacing the old WSR-57 which had served forecasters since Sept. 1960. The new radar will provide much more information, at finer resolutions. One improvement will be the detection of snowfall intensity levels.

Topic 1:

Recently, this fall I hosted a group of boy scouts at the St Paul Climatological Observatory. We had a question and answer session during which one boy brought to my attention that we always talk about daily climate records on Friday's Morning Edition, but rarely do we talk about unusual or record-breaking streaks of weather. This prompted me to look up some unusual streaks of weather in the MSP records (1891-1995).

1. Longest period with temperatures always below 0 degrees F:  
7 days, January 1-7, 1912
2. Longest period with temperatures always below freezing (32 F):  
66 days, December 19, 1977 to February 22, 1978
3. Driest period longer than one month: Precip=0.02 inches  
79 days, November 9, 1943 to January 26, 1944
4. Most consecutive days with measurable snowfall:  
13 days, December 18-30, 1968
5. Most consecutive days with measurable rainfall:  
10 days, June 18-27, 1951
6. Longest period of continuous snow cover (1 inch or greater):  
136 days, November 27, 1964 to April 10, 1965
7. Longest period of snow cover greater than 4 inches:  
124 days, November 18, 1978 to March 21, 1979

It is interesting to note, that dry periods of no measurable precipitation for 30 days or longer appear 13 times in the MSP historical record (1891-1995). Eleven of these have occurred during the October-February period, only one in the spring and one in the summer (1936).

Topic 2: Snow emergencies in the month of November

A listener left a question on my voice mail this week asking about how many times snow emergencies have been declared in November locally in the Twin Cities. Well, the exact answer probably can be found with the St Paul or Minneapolis Public Works Departments. A climatologically based estimate is possible by examining the frequency of daily 4 inch snowfalls in the Twin Cities (since this remains a threshold for declaring

a snow emergency).

Since 1948, there have been 28 daily snowfalls of 4 inches or greater during the month of November. This equates to a daily frequency of only 2 percent. Of the most recent 48 years of MSP records, 20 years have shown at least one snow storm of 4 inches or greater during November. This equates to a monthly frequency of about 42 percent. Snow storms of 4 inches or greater have occurred more than once in some Novembers: two in 1952, 1981 and 1985; three in 1991 (monthly total 46.9 in.); and four in 1983 (monthly total 30.4 in.).

Almanac: Average maximum temperature locally for today's date is 49 (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: a maximum temperature of 74 degrees in 1978; a minimum temperature of 8 degrees F in 1991; record precipitation of 0.53 inches in 1970; and 4.2 inches of snow in 1951.

Last snowfall on this date locally was 1.2 inches in 1992.

Scanning the state climatic data base: the all-time high for today's date is 82 degrees F at Montevideo (Chippewa County) in 1909; the all-time low is -8 degrees F at Beardsley and Park Rapids in 1951, and at Detroit Lakes in 1991. All these minimum temperature records followed snow storms.

Average dew point temperature for today is 30 degrees F. The highest dew point on this date is 60 degrees, while the lowest is 3 degrees.

Word of the Week: Snow Garland

This is a very rare and particularly beautiful feature which sometimes occurs with snowfalls when the temperature hovers near 32 degrees F. Snow becomes festooned from trees, shrubs, and even fences. It takes the form of a rope or garland made of snow, and may be several feet long and an inch or more in diameter. This shape is retained by the surface tension provided by the thin films of water bonding individual snow crystals and aggregates together. Temperatures right around the freezing point are necessary to preserve the crystals and the thin films of water which bond them. Winds must be calm so that the garlands are undisturbed during accumulation.

Community Notes: Canby, Minnesota

Canby, a community of about 2000 people in Yellow Medicine County has a climate record which began in August of 1887. The first observer was Mr. P.C. Scott. There have been over a dozen observers since that time. The current observer, Mr. Darold Snortum has been recording daily temperatures and precipitation since 1948 (over 47 years).

Canby is one of the warmest places in Minnesota. The average July maximum temperature is 87 degrees F. On the mornings of June 28 and 29 of 1931, the overnight low temperature was 87 degrees F in Canby, the warmest nights in the Minnesota State Climate Record. Located just 9 miles from the SD border, Canby can be very dry,

with exceedingly low relative humidity. This leads to some rather large daily temperature ranges. For example, on March 7, 1950 after a morning low of 3 degrees F, the afternoon temperature climbed to 60 degrees F.

All-time records at Canby include: 111 degrees F on July 12, 1936; -33 degrees F on January 22, 1936; 5.35 inches of rainfall on August 19, 1926; and 16 inches of snow on November 20, 1975.

Outlook:

Quite cool and dry this weekend, with highs in the 20s and 30s. Perhaps the first overnight lows in single digits for Saturday morning. Remaining cooler than normal most of next week, with a chance for snow and/or rain Monday and Tuesday. Primarily dry and cool Tuesday through Friday, with temperatures averaging 7-10 degrees colder than normal.

To: Greg Magnuson, Bob Potter, and John Bischoff  
From: Mark Seeley  
Re: Suggestions for MPR's Morning Edition, Friday, Dec. 1, 1995

As we enter the winter storm season, I would like to remind listeners about some of the forecasters terminology used by the National Weather Service: "A winter weather advisory is issued if a snowfall of 3 inches or greater is expected over a 12 hour period. A winter storm warning is issued if expected snowfall is 3 to 6 inches within a 12 hour period, or 8 or more inches in a 24 hour period."

December is typically the month when permanent winter snow cover is established across the state, lakes continue to freeze up enough to support ice fishing, barge navigation on the upper Mississippi comes to an end and we experience at least a few severe windchill conditions.

In fact windchills of -40 degrees F or colder have been recorded on this date (Dec. 1st) at least four times: 1893, 1908, 1927 and 1930. In 1908 a cold wave settled in over the state, dropping temperatures by 40 to 45 degrees over a 24 hour period.

Historically, the average December snowfall total since the winter of 1884-1885 has been 8.4 inches. Fourteen Decembers have produced more than 15 inches of snowfall, with the maximum monthly total of 33.2 inches in 1969. Decembers of 1913 and 1943 saw only traces of snowfall in the Twin Cities.

Almanac: Average maximum temperature locally for today's date is 31 (plus or minus 12 degrees standard deviation) and the average minimum is 17 (plus or minus 13 degrees standard deviation).

MSP records for today's date include: a maximum temperature of 57 degrees in 1962; a minimum temperature of -15 degrees F in 1893; record precipitation of 0.83 inches in 1985; and 8.4 inches of snow in 1985.

Last measurable snowfall on this date was 0.2 inches in 1992. Since 1948 we have had 16 measurable snowfalls on December 1st.

Scanning the state climatic data base: the all-time high for today's date is 62 degrees F at Canby (Yellow Medicine County) and at Preston (Fillmore County) in 1962; the all-time low is -51 degrees F at Pokegama Falls (Itasca County) in 1896.

Average dew point temperature for today is 18 degrees F. The highest dew point on this date is 49 degrees, while the lowest is -16 degrees.

Words of the Week: Snow Shed

This might be misconstrued in a number of ways. It is not analogous to a watershed which refers to the drainage basin associated with a river system. Nor is it analogous to a tool shed which is a place to store tools.

A snow shed is a protective structure which covers railroad tracks for the purpose of preventing snow accumulation. These

sheds are most commonly used where plowing the tracks is difficult, as along steep mountain side cuts, or along routes that are subject to frequent snow slides. They can be found in the Sierra Nevada Range, the American and Canadian Rockies and the Alps of Europe.

Topic: November Climate Summary

Despite the relative lack of snow cover all month, this November may end up as cold or colder than November 1991 when we received over 40 inches of snowfall. We have been dominated by NW flow and cloud cover holding our temperatures down. It has been much colder in the northern latitudes as well. The standard deviation of November temperature is about 3.5 to 4.5 degrees F. Looks like this November's temperatures will average out to be about 6 to 8 degrees colder than normal in southern counties. This degree of departure puts it in the coldest 10 percent historically. It was relatively colder in the north, where temperatures were 8 to 12 degrees colder than normal.

Outlook:

Looks like a relative warm spell is in store for the weekend, with some areas reaching the 40s. Some snow or freezing drizzle may occur in northern Minnesota Saturday night. Unsettled weather for next Tuesday through Thursday, then a sharp cold front with some very cold weather returning for next weekend.

To: Greg Magnuson, Bob Potter, and John Bischoff  
From: Mark Seeley  
Re: Suggestions for MPR's Morning Edition, Friday, Dec.8, 1995

Topic: Ice Making Weather

A listener called and left a question on my answering machine about how weather affects the formation of lake ice. He must be an anxious ice fisherman!.

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. The Army Corps of Engineers closed the river for navigation on Monday of this week.

Soil frost depths currently range from 6 to 12 inches depending on surface cover. Lake ice thickness is highly variable and still dangerous in many places, as usual for this time of year. Earlier this week, resort operators on Mille Lacs reported 8-10 inches of ice on east bays but only 4-5 inches in western portions of the lake. Projected very low temperatures for the weekend will accelerate the penetration of ground frost and formation of lake ice.

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. Ice chisels or augers should be used to check thickness of lake ice. A thickness of 12 inches or greater is enough to support vehicles according to DNR guidelines.

Anniversary:

If you think that the windchill values have been severe this week, consider what our ancestors had to put up with back in 1927. This is the anniversary of one of the most dangerous December blizzards to ever strike the Twin Cities area. December 7-8, 1927 brought 8.5 inches of snowfall, accompanied by 35 to 45 mph winds and bitter cold. The windchill index remained in the -60 to -70 degree F category for a full 24 hours, from midday on the 7th to midday on the 8th. Visibility was just a block or two within the cities. Fortunately warnings were heeded and many businesses and schools closed. Milk deliveries were suspended because the trucks got stuck, or the milk froze in the cans. So there was a milk shortage for a brief time following the storm.

Almanac: Average maximum temperature locally for today's date is 27 (plus or minus 13 degrees standard deviation) and the average

minimum is 14 (plus or minus 13 degrees standard deviation).

MSP records for today's date include: a maximum temperature of 50 degrees in 1939 and again in 1990; a minimum temperature of -15 degrees F in 1927; record precipitation of 0.44 inches in 1963 and again in 1987; and 4.7 inches of snow in 1924.

Last measurable snowfall on this date was just last year (1994) when 1.8 inches of snow fell. Since 1948, 14 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 Madison (Lac Qui Parle County) in 1990; the all-time low is -38 degrees F at Big Falls (Koochiching County) in 1932.

Average dew point temperature for today is 13 degrees F. The highest dew point on this date is 46 degrees, while the lowest is -20 degrees.

Words of the Week: Mustard Winds

The English have several interesting expressions for weather conditions and this is one of them. When we have a cold front or cold wave move through the midwest, as we did earlier this week, our meteorologists sometimes refer to the wind as a "biting wind", a "penetrating wind", or a "bitter wind." The English will sometimes refer to a wind that brings on severe windchill conditions as a "mustard wind." This is most commonly a cold and damp northeasterly wind off the North Sea.

In fact mustard used as a adjective generally has a negative connotation: mustard gas was an irritating and blistering gas used in WWI; mustard oil has a very unpleasant odour; mustard beetle is a destructive insect pest; mustard plaster or mustard paper is a counter-irritant used in medicine; and anybody who has done laundry knows that a mustard stain is one of the most difficult to remove (just look at my tie collection!).

We will certainly have winds "as keen as mustard" today, with windchills ranging from -30 to -50 degrees F.

Alternative Topic: Weather Ships in WWII

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:

Very cold temperatures in store for the weekend, with below zero readings extending into southern Minnesota for the first time this season. Winds will keep the windchill factor rather penetrating and for a time on Friday night and Saturday visibility will be very limited by blowing snow. Some moderation in temperature next week with the likelihood of snow increasing toward Tuesday and again on Friday.

For the Twin Cities area today, we may break the snowfall record of 4.7 inches set in 1924.

To: Greg Magnuson, Bob Potter, and John Bischoff  
From: Mark Seeley  
Re: Suggestions for MPR's Morning Edition, Friday, Dec.15, 1995

A question from Greg Magnuson and Bob Potter. It seems winter storms more often start during the night or early morning rather than the middle part of the day. Is this true?

That's a complex question and cannot be answered simply yes or no. Jim Zandlo, our state climatologist was kind enough to put together some frequencies of hourly precipitation from the MSP Airport for about a 30 year period. Patterns in the hourly frequencies of precipitation seem to vary by month, although it is true that in the winter months, December through February, the afternoon hours from noon to 4 pm show the lowest relative frequency of measured precipitation. Overnight frequencies of hourly precipitation are relatively higher, particularly from 1 am to 6 am. This could be due to the relationship between air temperature and the saturation of the air. Low temperatures usually occur during these hours and probably remain closer to the dew point temperature, preserving the structure and continuity of precipitation, whether droplets, sleet or snow crystals. The other feature of winter storm systems to remember is that they are usually large and take some time to move across the area. Precipitation may last for several hours and since most of our 24 hour calendar day is in darkness during the winter, we associate the storminess with the night.

Almanac: Average maximum temperature locally for today's date is 26 (plus or minus 13 degrees standard deviation) and the average minimum is 12 (plus or minus 14 degrees standard deviation).

MSP records for today's date include: a maximum temperature of 49 degrees in 1923; a minimum temperature of -21 degrees F in 1901; record precipitation of 0.71 inches in 1902; and and 7.0 inches of snow in the same storm of 1902.

Last measurable snowfall on this date was just last year (1994) when 2.3 inches of snow fell. Since 1948, 18 measurable snowfalls have been recorded at the MSP airport on this date. Over the same period (47 years) 30 years show the presence of snow cover on this date.

Scanning the state climatic data base: the all-time high for today's date is 60 degrees F at Tracy (Lyon County) in 1939; the all-time low is -47 degrees F at Pokegama Falls (Itasca County) in 1901.

Average dew point temperature for today is 10 degrees F. The highest dew point on this date is 36 degrees, while the lowest is -22 degrees.

Words of the Week: Snow Stake

Sometimes called a snow scale, this is usually a wooden scale much like a yard stick, mounted to a post or piece of angle iron and set into the ground to measure snow depth, especially in regions that are subject to large amounts of snow. In some areas around the Great Lakes, these are mounted near government

or city offices and visible to the public.

This may be a good winter to mount a snow stake in your backyard, especially our good neighbors in the Upper Michigan. Many areas in the UP have already received over 50 inches. Sault St Marie reported 62 inches of snow from the last storm and nearly 90 inches so far in the month of December. For the season so far Sault St Marie has received over 127 inches of snowfall and the long term average for the entire winter is 116 inches. Winter of 1976-77 was the heaviest snowfall in Sault St Marie at nearly 179 inches but they may be on track to break that record.

Similarly, Buffalo, NY is having an old fashioned snowy season with over 60 inches so far.

Some of these communities may need 10 ft high snow stakes this winter to keep track of the snow depth.

Topic: Weather Ships in WWII

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 precipitation will be with us on Sunday and Monday, adding to our snow depth. At least temperatures will be near seasonal normals. Then a cooling trend on Tuesday through Thursday will take temperatures back down below normal, but it should be drier. Another snowstorm and further drop in temperature appears likely for next Friday and Saturday.



To: Greg Magnuson, Bob Potter, and John Bischoff  
From: Mark Seeley  
Re: Suggestions for MPR's Morning Edition, Friday, Dec.29, 1995

Topic: Review of 1995

Based purely on monthly climate statistics, 1995 does not stand out as a particularly unusual year. In relative terms, January was the most unusually warm month, with an average temperature nearly 7 degrees F above normal. November was the most unusually cold month, with an average temperature nearly 6 degrees F below normal.

Despite the lack of evidence in monthly statistics, there were some rather significant weather events and episodes in Minnesota during 1995.

1. March, April, May and June were extremely dry in northeastern Minnesota. Compounded by very low humidity and record setting high temperatures in June (approaching 100 degrees F from June 17-23), the fire danger rose in Voyageurs National Park and the Boundary Waters Canoe area.
2. A very wet spring in southwestern Minnesota, delayed planting of row crops to near the end of May.
3. Several high temperature records were set during June. The Twin Cities surpassed the record for consecutive days with high temperatures of 90 degrees F or greater with eight straight from June 16-23, breaking the old record dating back to 1933 and 1910. Fortunately, dew point temperatures remained in the 50s and 60s so that the temperature conditions did not become unbearable. Several Minnesota communities recorded high temperatures of 100 degrees F or greater. At International Falls, Tower and Winton in northern Minnesota, all-time high temperature records were set or tied.
4. July brought real weather extremes to the state, with perhaps the greatest economic consequences. The week of the July 4th holiday, thunderstorms brought heavy rain and hail to many areas, especially western Minnesota, which has remained wetter than normal since that time. Milan in Chippewa County recorded nearly 10.5 inches of rainfall that week, while Benson in Swift County had nearly 6.5 inches. Many other areas of the state received 5 or more inches. The large amount of rainfall which started the month, kept dew point temperatures quite high, so when a heat wave struck from July 12-14, the combined effects were dramatic. Power consumption records were set in many communities as air conditioners worked overtime. Poultry buildings could not be kept cool enough, and over 250,000 turkeys died from heat stress in southern Minnesota. Rushford in Fillmore County hit 105 degrees F on July 14, the warmest since 1936. The overnight low in Hokah (Houston County) on the 14th was 82 degrees F. The Twin Cities recorded a number of hours with 80 degree dew points. While the heat wave was occurring in southern Minnesota, northern counties experienced severe thunderstorms with winds of 60-80 mph. The winds downed hundreds of thousands of trees and forced the closing of Itasca State Park.

5. August brought a continuation of high dew point temperatures, with many readings in the Twin Cities of 70 degrees F or higher, the most since 1983. The high water vapor content allowed mosquitos to fly nearly all day and become a real nuisance.

6. The 7.1 inches of snowfall received on December 8 became the largest snowfall event of 1995. Since October MSP has recorded approximately 23 inches of snowfall, compared with just under 17 inches recorded for the January through April period.

Almanac: Average maximum temperature locally for today's date is 24 (plus or minus 11 degrees standard deviation) and the average minimum is 9 (plus or minus 14 degrees standard deviation).

MSP records for today's date include: a maximum temperature of 44 degrees in 1908; a minimum temperature of -24 degrees F in 1917; record precipitation of 0.80 inches in 1972; and 3.7 inches of snow in the same storm of 1972.

Greatest snowdepth on this date locally, 20 inches in 1968.

Last measurable snowfall on this date was 1993 when 0.1 inches was measured. 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 58 degrees F at Le Sueur in 1897; the all-time low is -47 degrees F at Itasca State Park in 1917.

Average dew point temperature for today is 7 degrees F. The highest dew point on this date is 38 degrees, while the lowest is -24 degrees.

Word of the Week: Barometer

Ambrose Bierce joked that "the barometer is an ingenious instrument which indicates what kind of weather we are having." In reality, it is an important instrument for measuring atmospheric pressure used at airports and weather forecast offices throughout the world.

Most often the instrument is called an aneroid barometer, which contains a small hollow vacuum tube restrained from collapsing by a spring. A measure of the deflection of the spring is proportional to atmospheric pressure. Usually, a dial or column scale indicates pressure in inches, millibars, or millimeters, units that were used when mercury barometers were most common. Standard atmospheric pressure at sea level is 760 mm, 29.92 inches, or 1013.2 mb.

If you received a barometer for Christmas, set it according to the station pressure from the nearest National Weather Service Forecast Office. You can obtain this value from NOAA weather radio, Cable TV, using some of the Internet weather pages or by calling the nearest office of the National Weather Service.

It is not important to be precise with respect to your own elevation or temperature conditions, because the main use of the barometer as a home instrument is to observe pressure changes over periods of several hours in order to infer if

low pressure or high pressure and associated weather features are approaching.

Outlook:

Looks like seasonal temperatures through the weekend, then snow on New Year's Day and again on Thursday, with a decline in temperatures towards the end of the week.