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Climatic Factors to Consider in Planning a Winter Recreation Enterprise in Michigan  
Michigan State University

Cooperative Extension Service

Louis F. Twardzik, Michael W. Skaggs, Department of Park and Recreation Resources

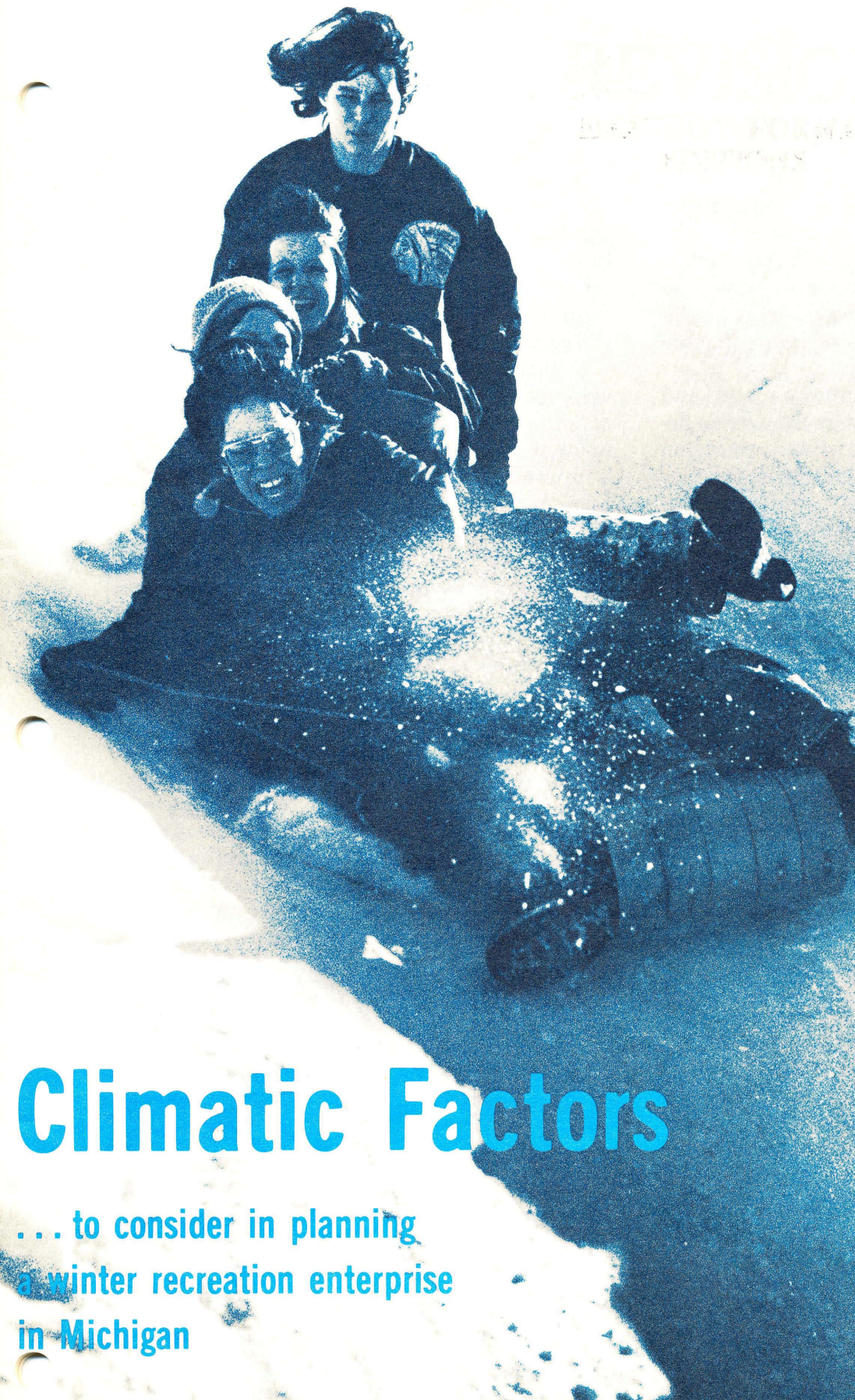
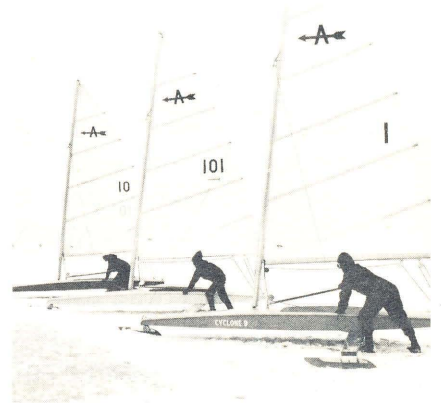
May 1979

20 pages

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# Climatic Factors

... to consider in planning  
a winter recreation enterprise  
in Michigan

## Introduction

Interest in outdoor winter recreation in Michigan continues to increase steadily. This has been due largely to the favorable climate of the state. Land and water resources have been traditionally used for recreation as climate permitted—sleighing behind horses, skiing, tobogganing, skating, and other winter activities. They were all enjoyed by residents living in the colder and snowier areas of the state, but denied, or seldom available, to those in the southern part of Michigan and other states because of unpredictable snowfall and temperatures.

However, a variety of technical, social, and economic changes in recent years have made development of these kinds of winter recreation activities popular public and private enterprises throughout the state. They are available to people in all regions of Michigan and have become the basis for an important tourist economy. A new highway system with improved winter maintenance has greatly increased access to northern Michigan from both southern Michigan and neighboring states. New work patterns, longer vacations and more long weekends resulted in more leisure time and larger discretionary incomes which now provide greater opportunities for outdoor recreation activities.

Private investors were attracted to the potential of ski resorts, and Michigan now claims 78 developed ski areas. Approximately 89% of these areas are privately owned and 11% mostly owned by local units of government. The majority of Michigan's ski areas are, of course, in the northern part of the state.

Refinement of uphill tows and new methods for manufacturing snow have been largely responsible for the increasing supply of downhill skiing. These advances have sparked interest in developing additional private and public ski slopes in the southern counties of the state. Michigan safety regulations have also contributed significantly to public acceptance of ski lifts considering accident rates in other winter recreation regions of the country.

A more recent development has been the mass production, marketing, and sales of snowmobiles. While only in mass production in recent years, hundreds of thousands are now in use in Michigan. Over 225,000 snowmobiles are currently registered in the state. Snowmobiling

activities will likely remain popular because of the development and maintenance of trails by federal and state park and forest agencies and county governments.

Michigan's citizens have always participated in activities like sledding, skating, and snowshoeing. Even though skiing and snowmobiling have dominated the winter recreation scene in recent years, many of the long established activities such as snowshoeing and cross-country skiing are increasing in popularity.

Critical to most winter outdoor recreation developments is adequate snow depths for various activities. Recent technological advances have made it possible to manufacture snow either as a supplement to natural snow or as a snow base. Snow is manufactured by combining water that has been atomized by compressed air or by an airless system and proper atmospheric conditions. The resulting droplets of water are forced into the air and freeze before touching the ground. It is possible to manufacture snow at temperatures slightly above 30°F; however, most snow manufacturing systems work best at temperatures of 28°F or lower.

Not only does the manufacture of snow enhance winter recreation development potentials, but other methods of maintaining adequate snow depths are important. Some of these include proper layout of facilities taking advantage of natural conditions, use of shelter belts and windbreaks, snow grooming, and heavy ground covers that hold the snow in place.

The following information can be used in early decision-making by planners of winter resort and recreation areas. Most of the information covers the months of October through April. Even though October, April and portions of November and March are not normally considered part of the winter season, information for these months is included to show the trends leading to, and ending, the winter months. All of the climatic information is based on a long-range look at the weather and not just short-term trends. Included in this bulletin are the following:

Section 1. Monthly Mean Temperatures

Section 2. Monthly Mean Snowfalls

Section 3. Percentage of Years and Mean

Dates of the First 6- and 12-inch Snow Depths

Section 4. Average Number of Days with Selected Accumulated Snow Depths

Section 5. Additional Climatological Data for Primary Weather Stations

Those who plan winter recreation developments should find this information useful for initial decision-making. Planners should be able to use it to determine the climatological potential for developing a winter outdoor recreation area in Michigan. Both private and public developers should supplement this information with market studies, evaluation of topography, vegetation, water resources, and land use plans before making final decisions.

The authors wish to acknowledge the assistance of the Michigan Weather Service and the U.S. Weather Bureau for information included in this publication. For specific information and analysis of Michigan's climate, contact: National Weather Service, Capital City Airport, Lansing, Michigan 48906, or, Michigan Department of Agriculture, Weather Service, 1407 S. Harrison Road, East Lansing, Michigan 48823.

Special thanks is extended to Bernard Bujnowski, former graduate assistant, who co-authored the original version of this publication in 1971.

In this edition, we also acknowledge the talents of graduate assistant, Richard E.

Photos: Michigan Travel Bureau

Sanders, for the art work, and Professor Gaylan A. Rasmussen for the graphic concepts.

## References:

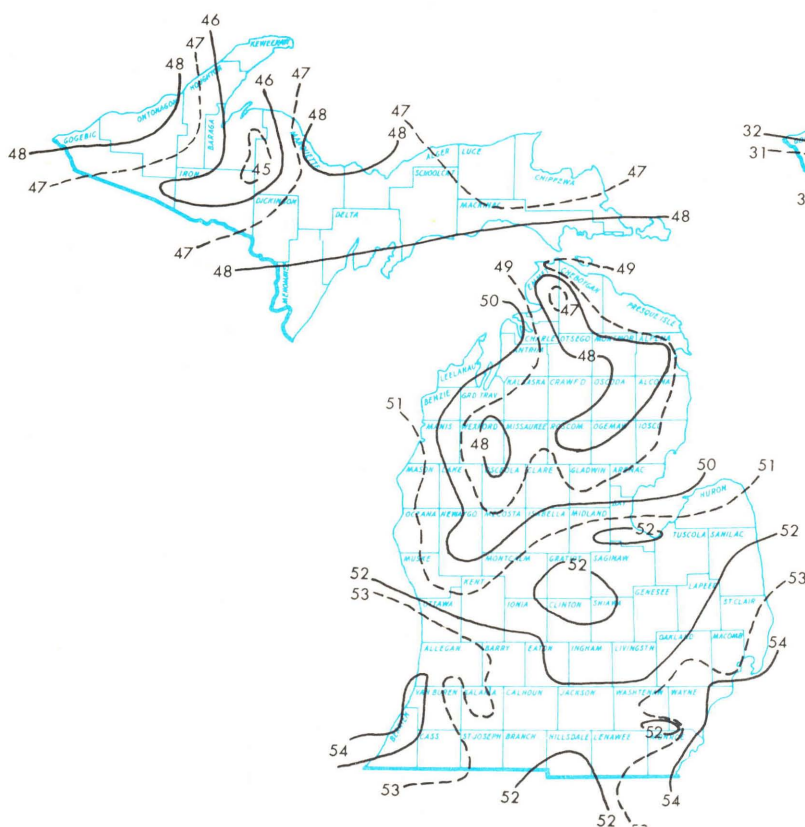
1. Supplement to *The Climate of Michigan by Stations*, Mean Temperature Maps for the period 1940–1969, Michigan Department of Agriculture, Michigan Weather Service, June 1974.
2. Supplement to *The Climate of Michigan by Stations*, Mean Snowfall Maps for the period 1940–1969, Michigan Department of Agriculture, Michigan Department of Agriculture, Michigan Weather Service, March 1975.
3. Michigan Snowfall Statistics: First 1-, 3-, 6-, and 12-inch Depths, Michigan Department of Agriculture, Michigan Weather Service, June 1968.
4. Michigan Snow Depths, Michigan Department of Agriculture, Michigan Weather Service, February 1969.
5. Local Climatological Data, Annual Summary with Comparative Data (Alpena, Detroit, Grand Rapids, Lansing, Houghton Lake, Muskegon, Flint, Sault St. Marie, Marquette), National Oceanic and Atmospheric Administration, National Climatic Center, Asheville, North Carolina, 1977.

**Louis F. Twardzik, Professor & Chairman**  
**Michael W. Skaggs, Graduate Assistant**

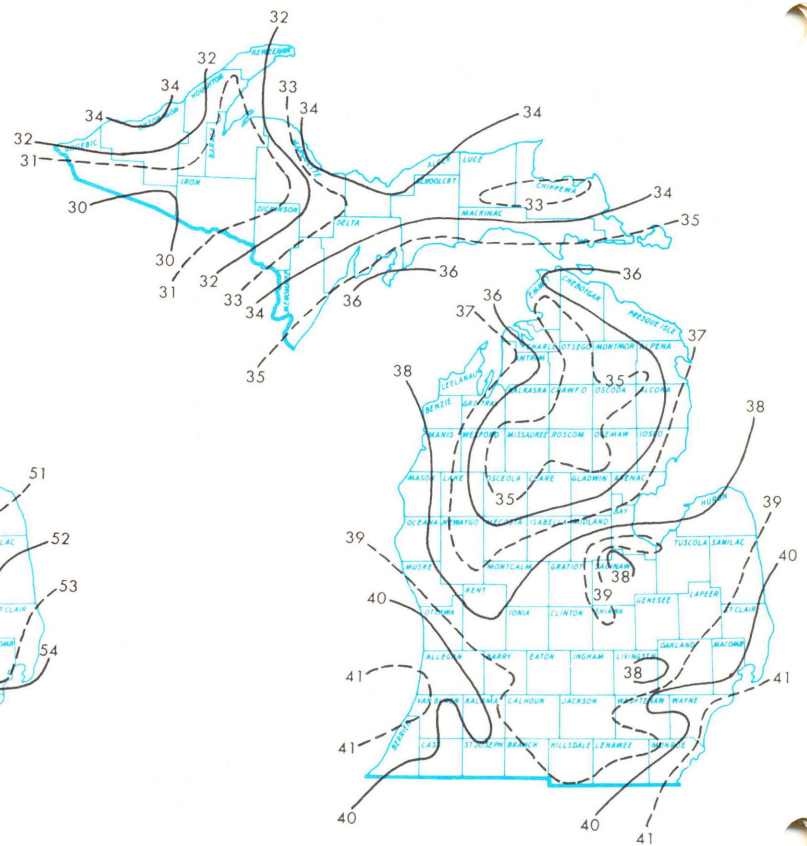
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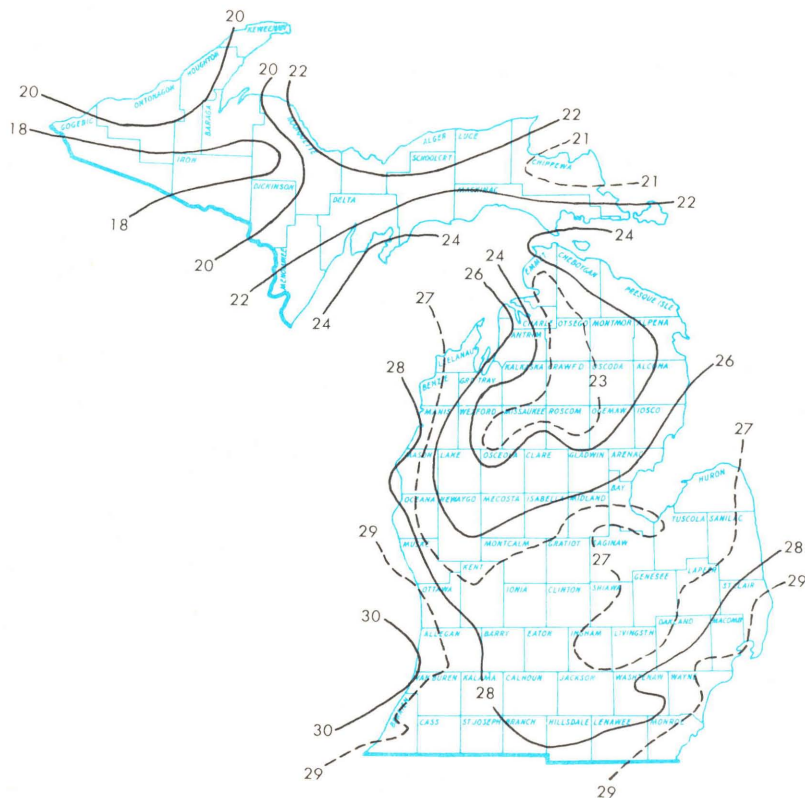
## Section 1—Monthly Mean Temperatures.



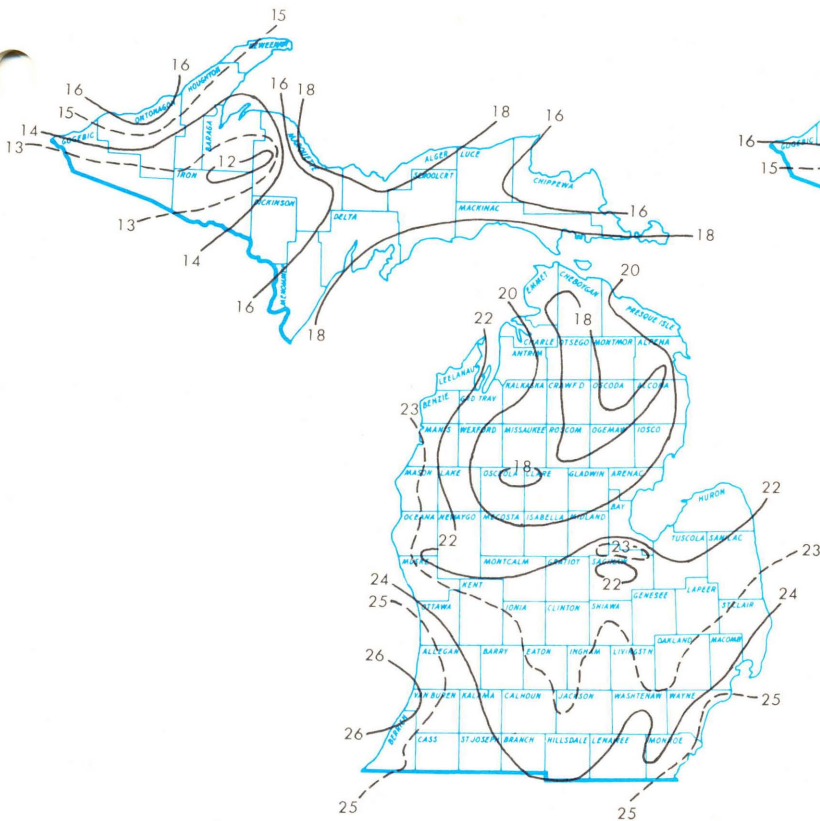
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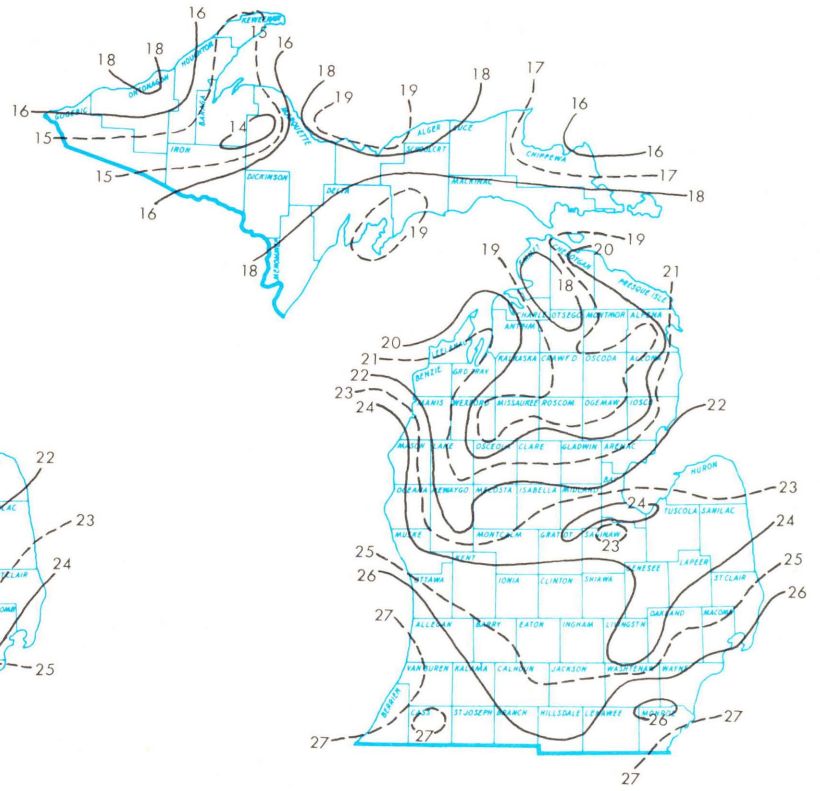
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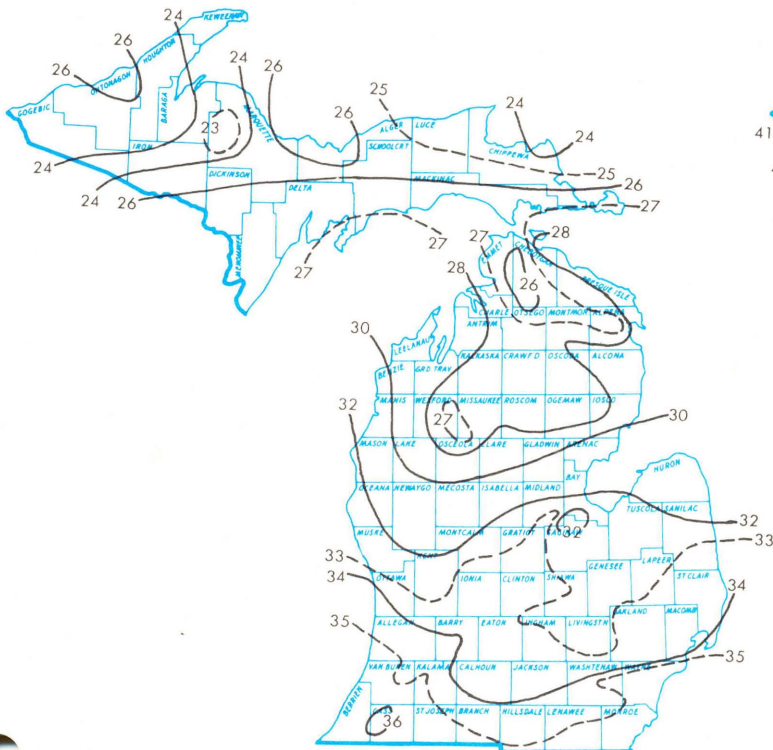
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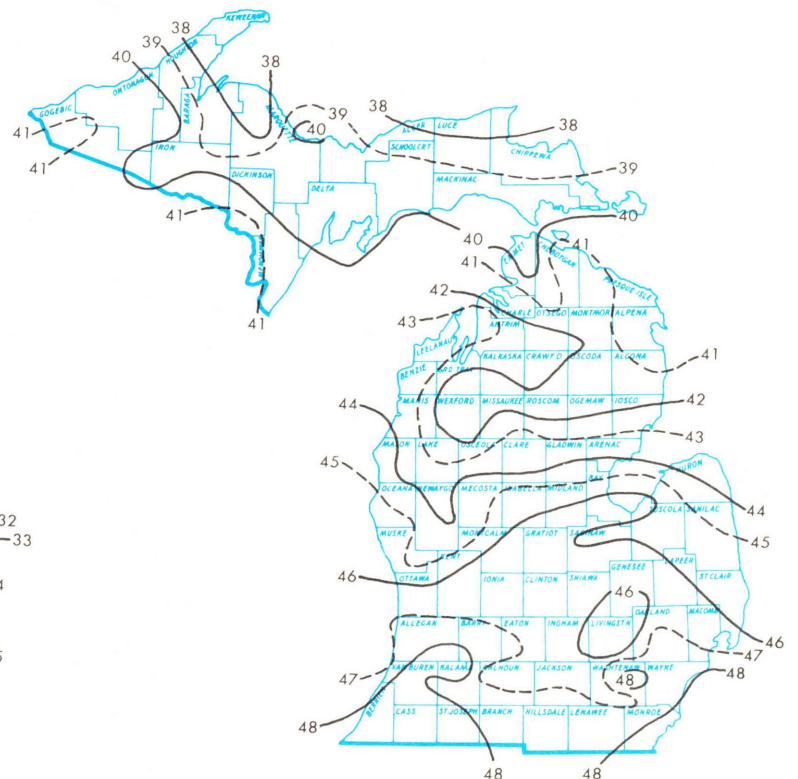
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February Mean Temperature (F°)

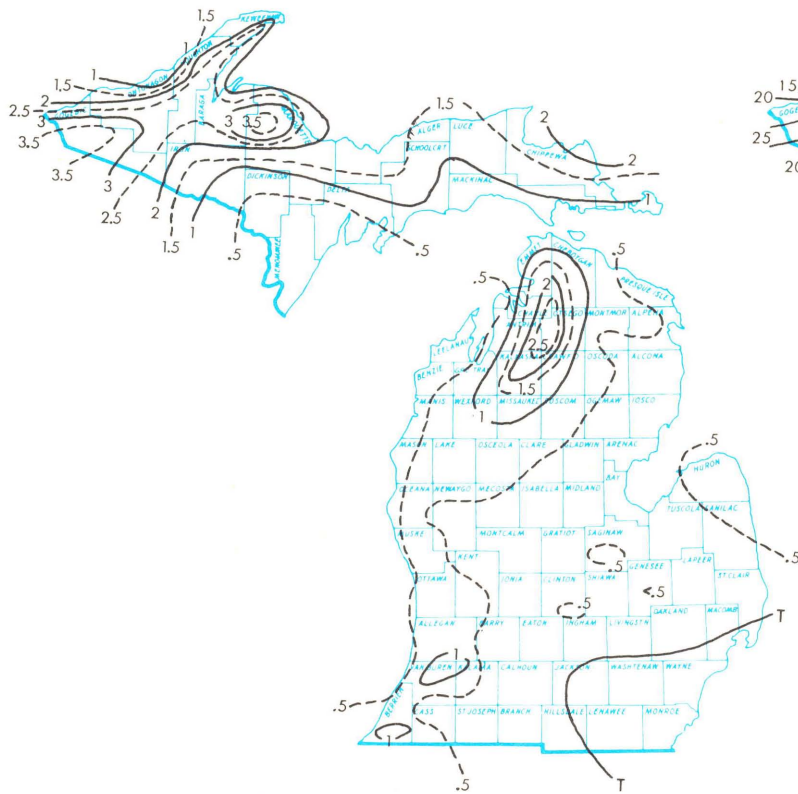


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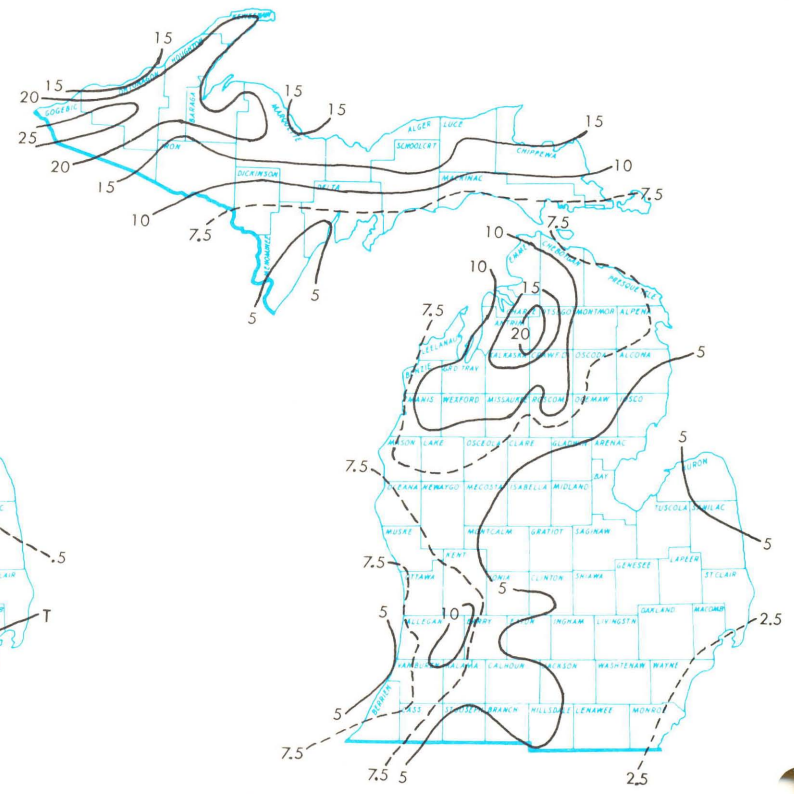


April Mean Temperature (F°)

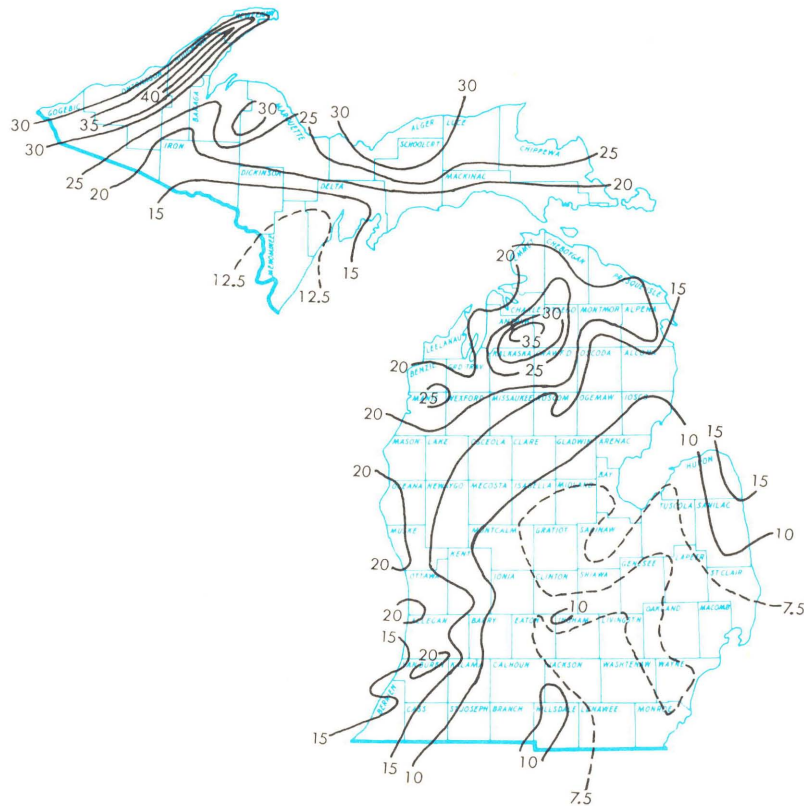
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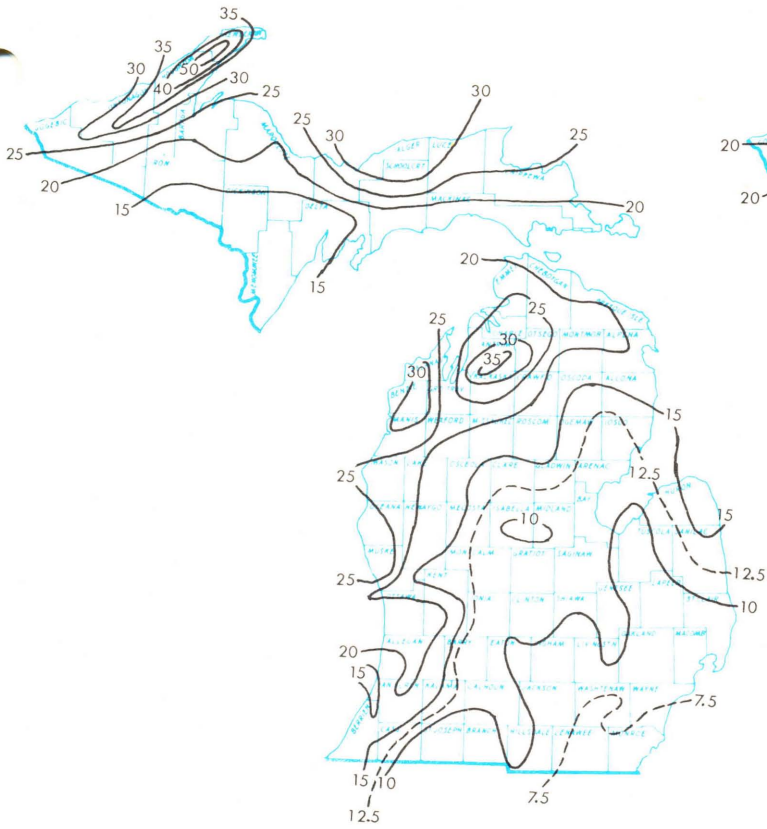
October Mean Snowfall (Inches)



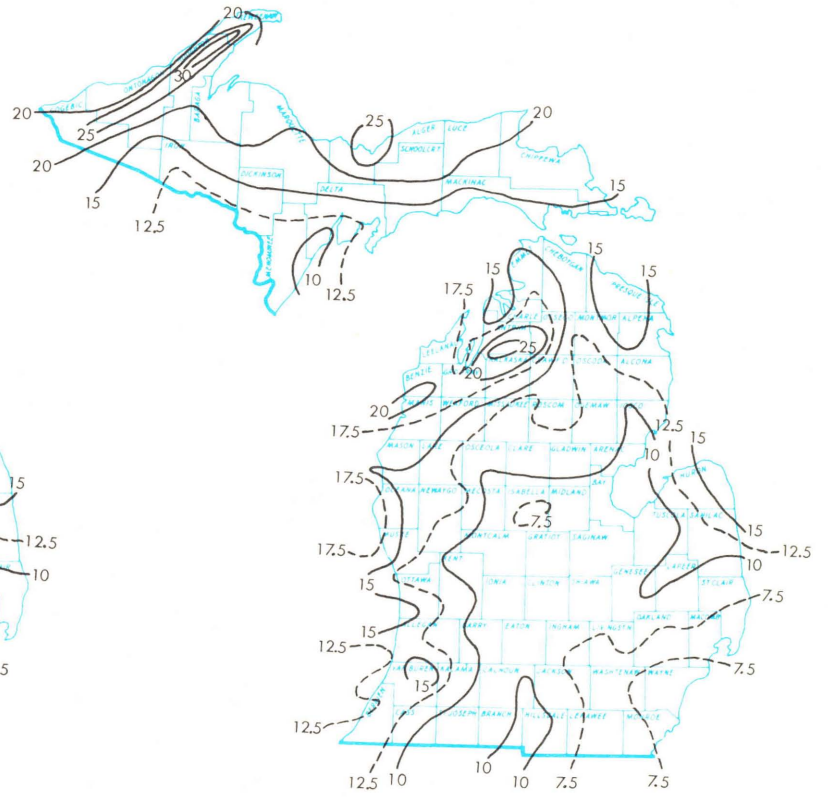
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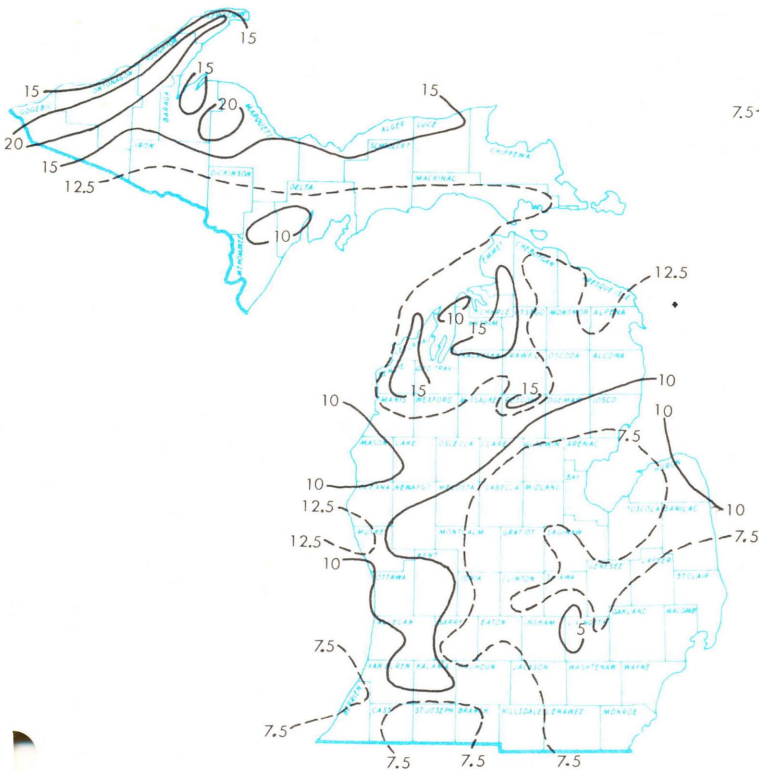
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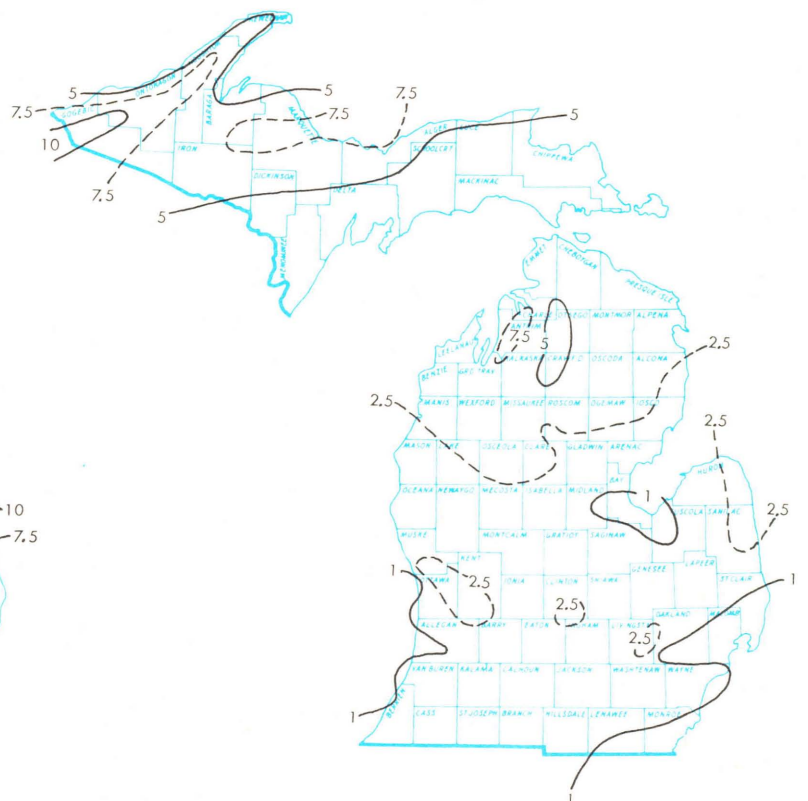
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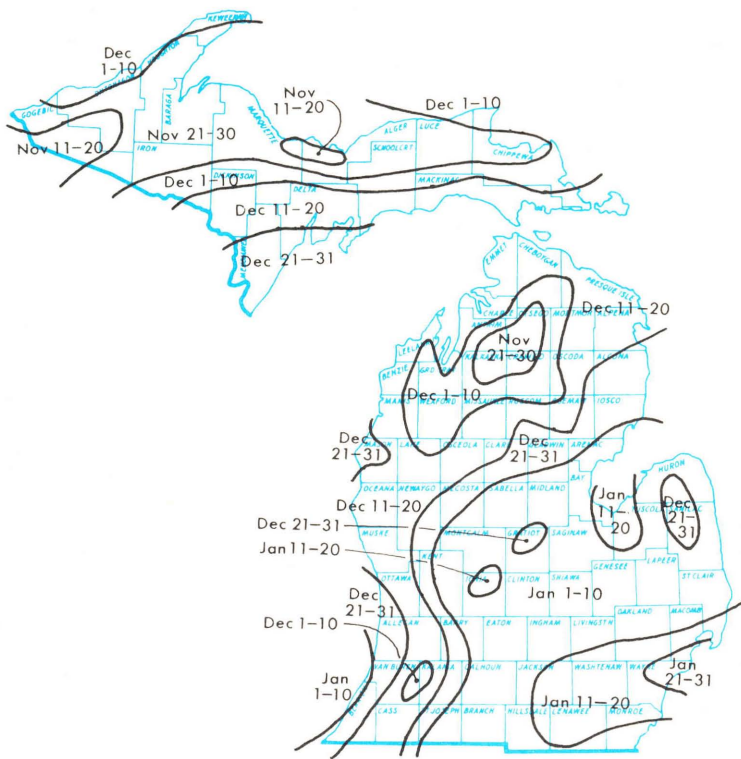


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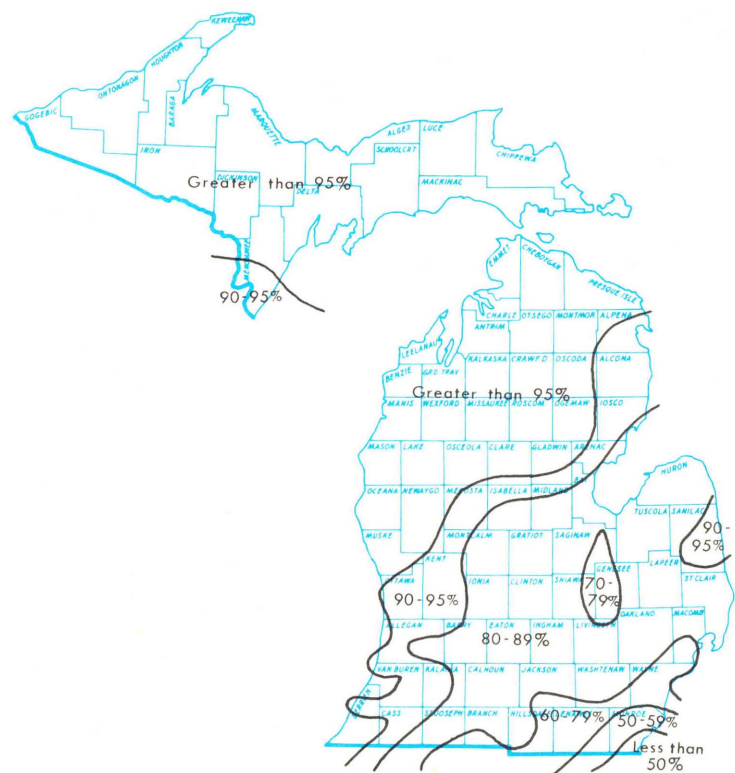


April Mean Snowfall (Inches)

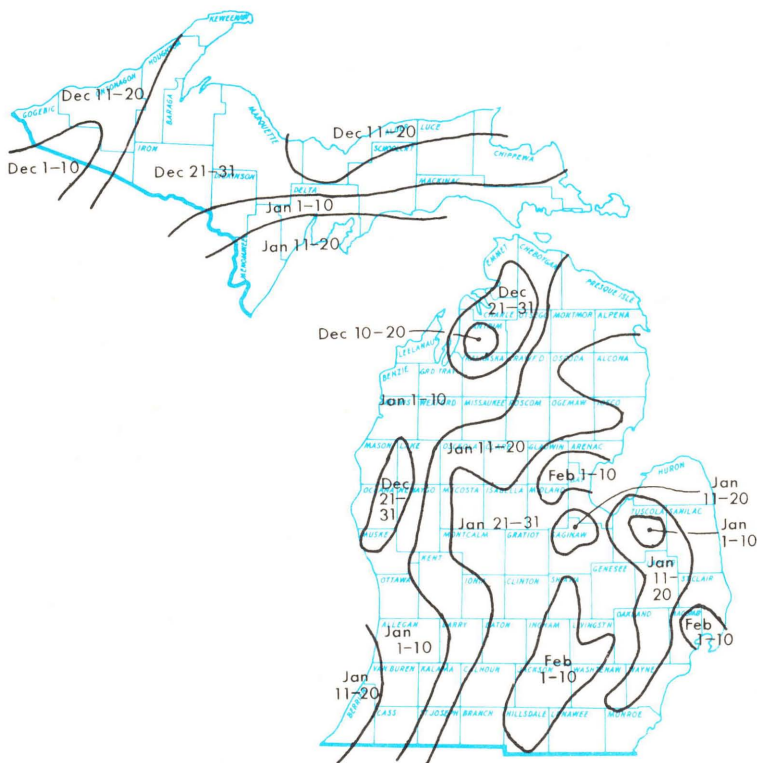
## Section 3—Percentage of Years and Mean Dates of First 6- and 12-inch Snow Depths.



Mean Date of First 6-Inch Snow Depth



Percentage of Years During Which a 6-Inch or Greater Snow Depth Occurred



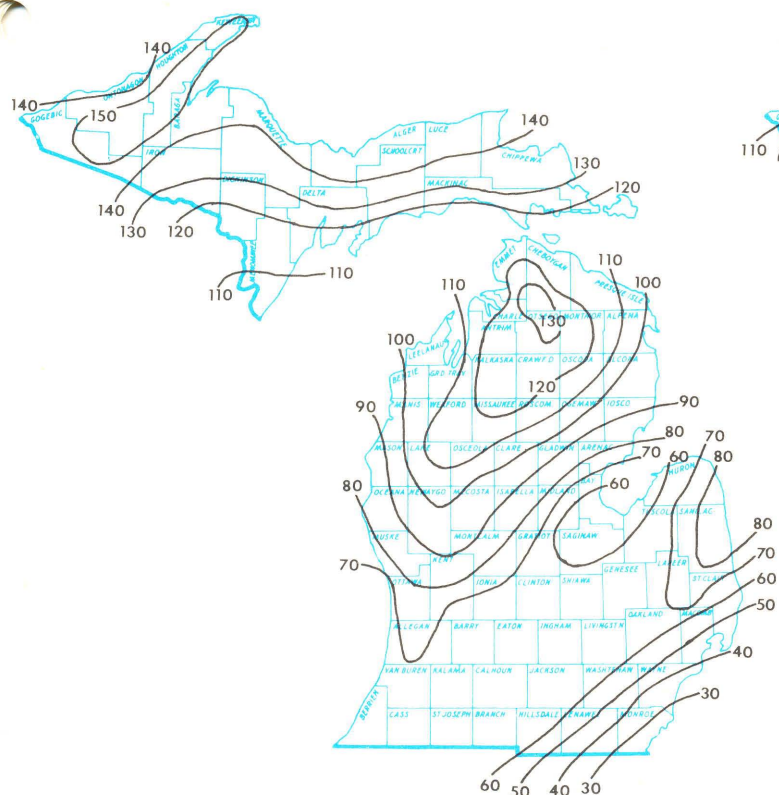
Mean Date of First 12-Inch Snow Depth



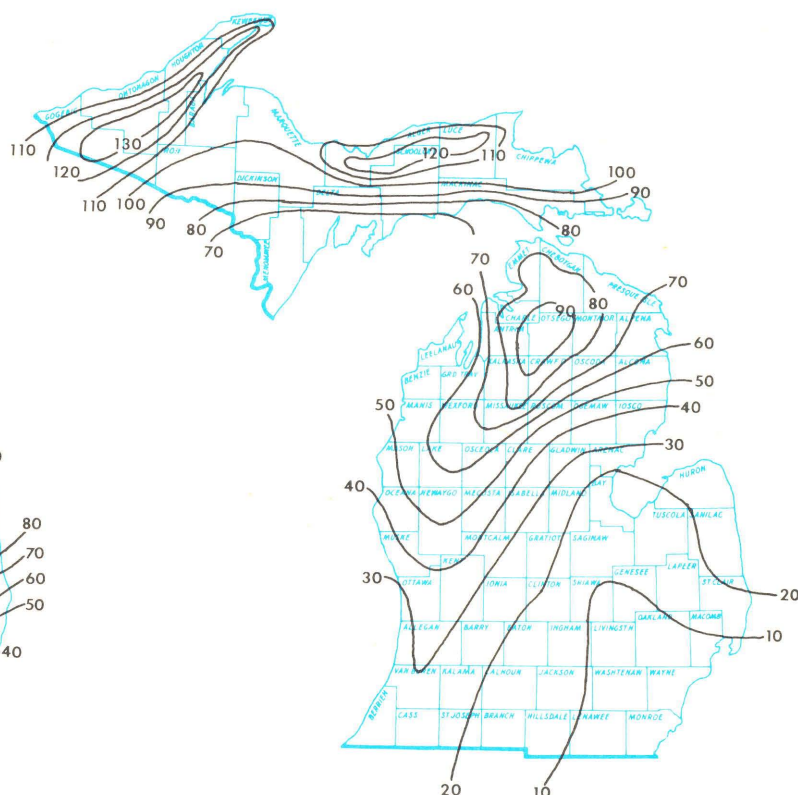
Percentage of Years During Which a 12-Inch or Greater Snow Depth Occurred

## Section 4—Average Number of Days with Selected Accumulated Snow Depths.

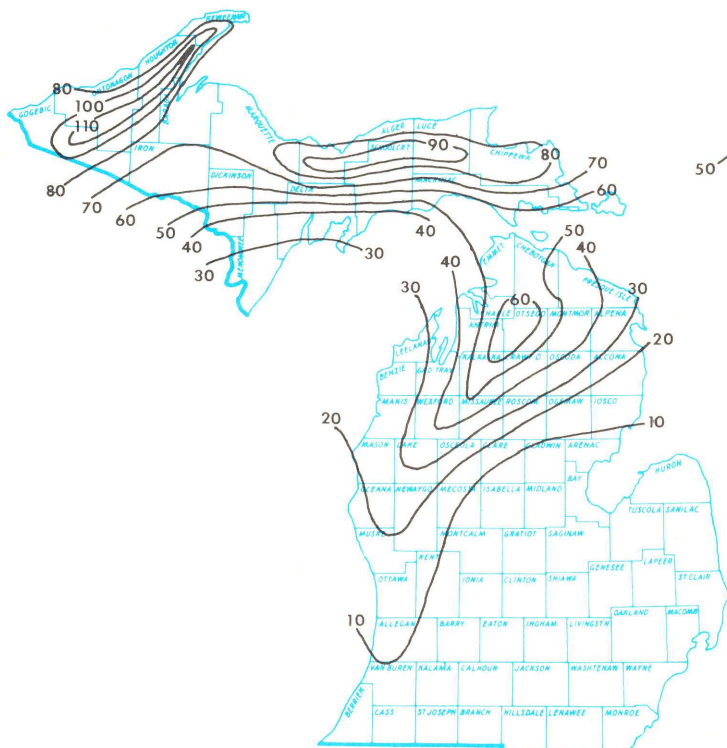
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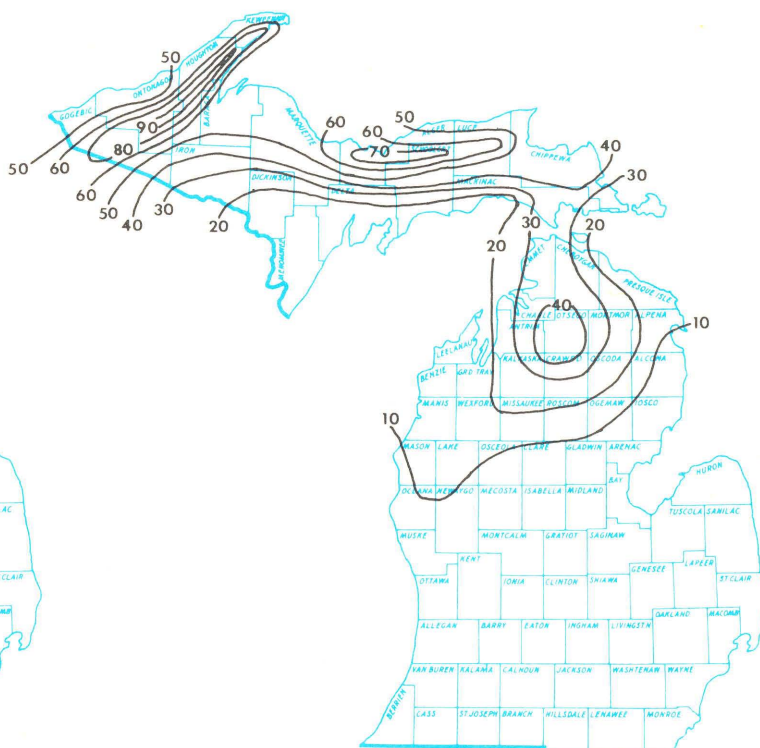
Average Number of Days Per Season with Accumulated Snow Depth on the Ground of 1 Inch or More



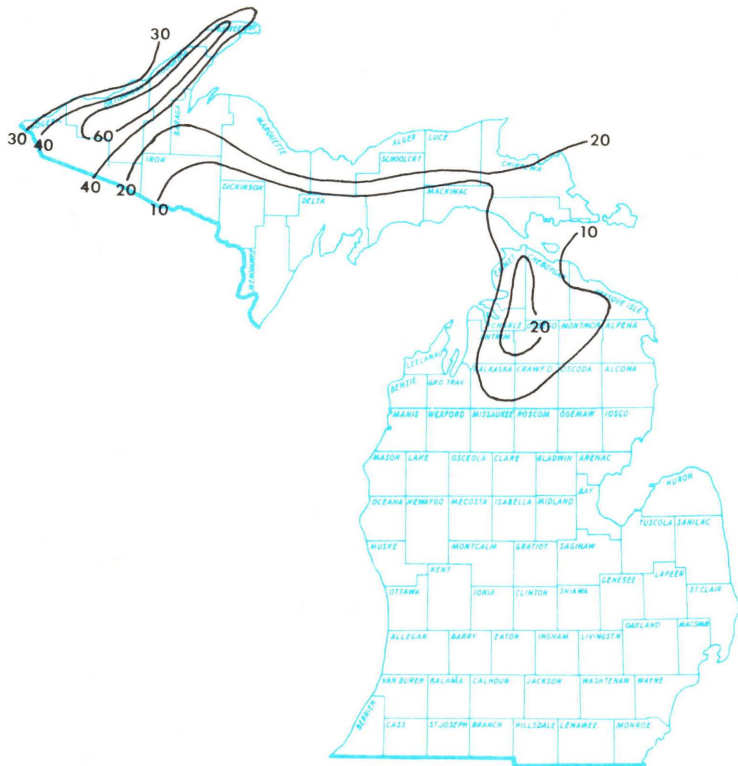
Average Number of Days Per Season with Accumulated Snow Depth on the Ground of 6 Inches or More



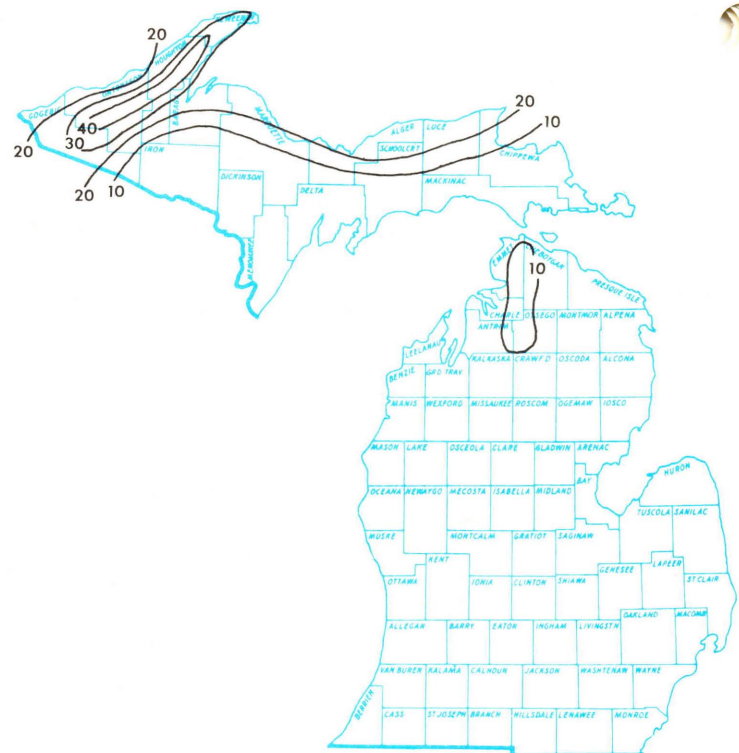
Average Number of Days Per Season with Accumulated Snow Depth on the Ground of 11 Inches or More



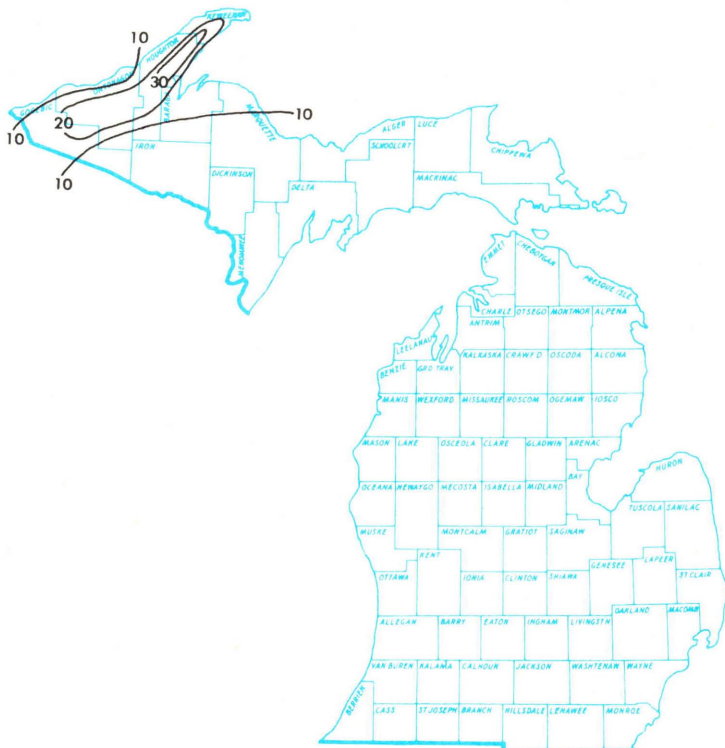
Average Number of Days Per Season with Accumulated Snow Depth on the Ground of 16 Inches or More



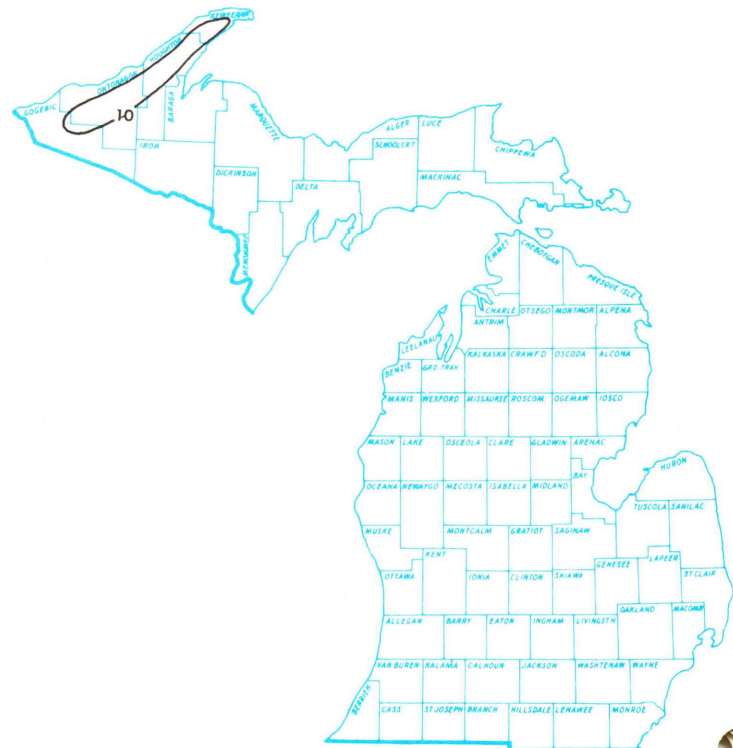
**Average Number of Days Per Season  
with Accumulated Snow Depth on  
the Ground of 21 Inches or More**



**Average Number of Days Per Season  
with Accumulated Snow Depth on  
the Ground of 26 Inches or More**



**Average Number of Days Per Season  
with Accumulated Snow Depth on  
the Ground of 31 Inches or More**

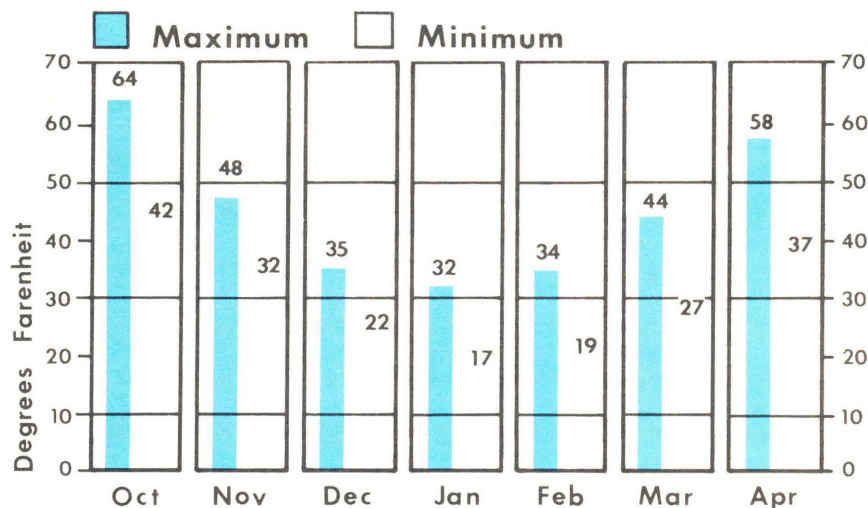


**Average Number of Days Per Season  
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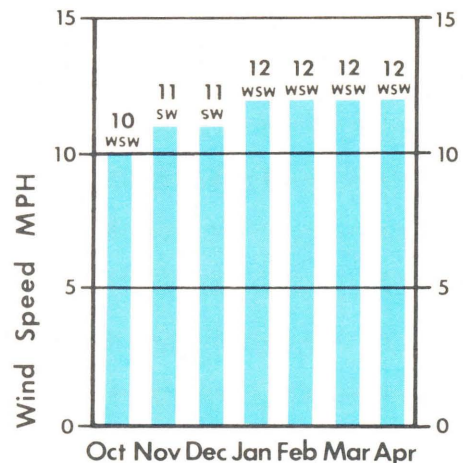
## Section 5—Additional Climatological Data for Primary Weather Stations.



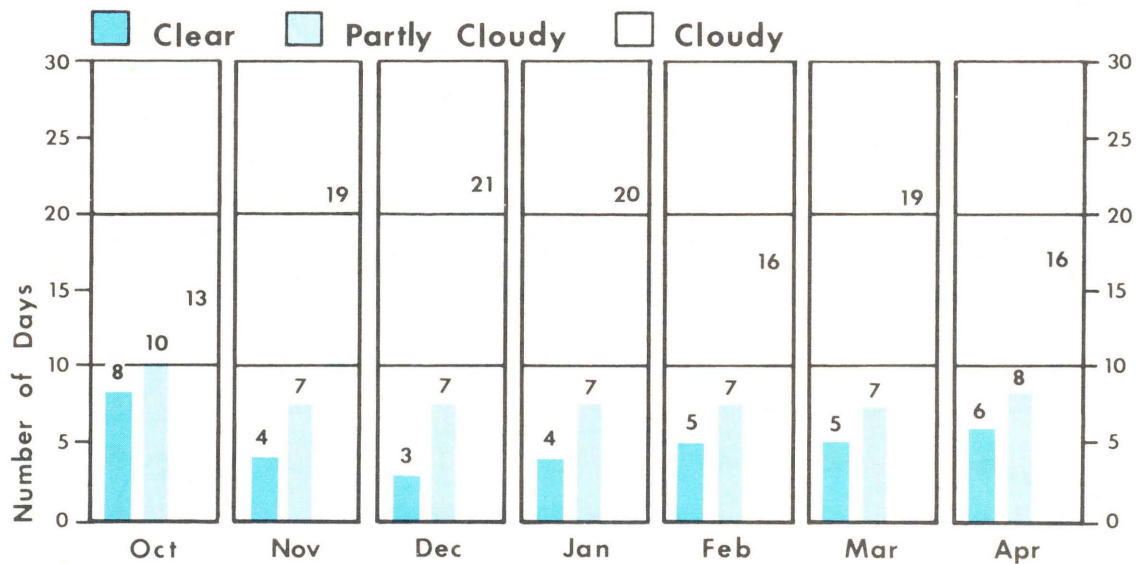
## Primary Weather Stations in Michigan



**NORMAL DAILY MAXIMUM  
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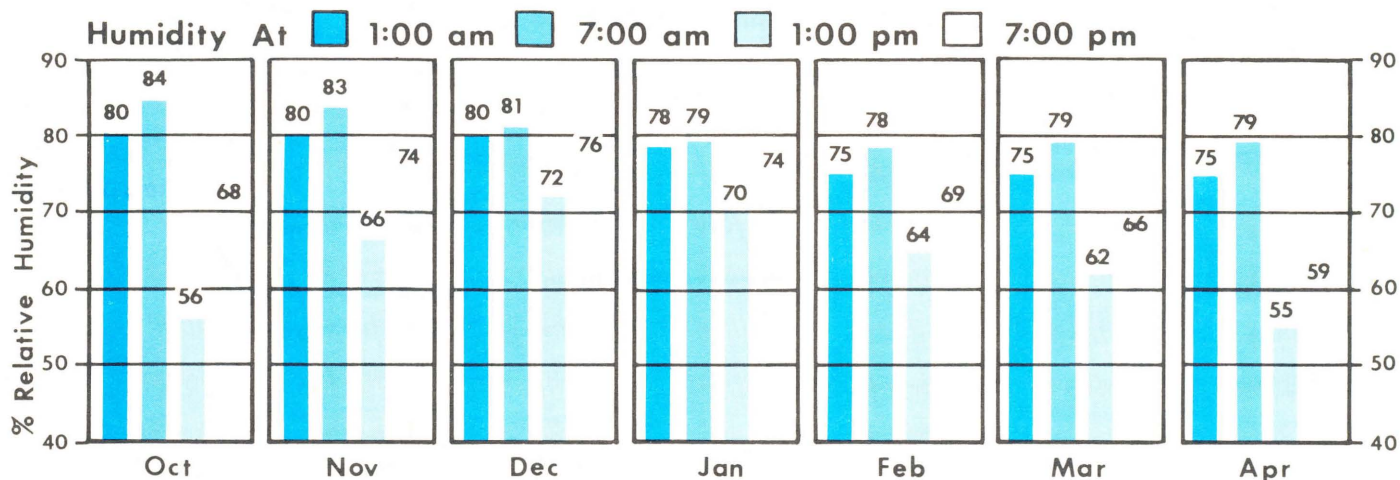


**MEAN WIND SPEED &  
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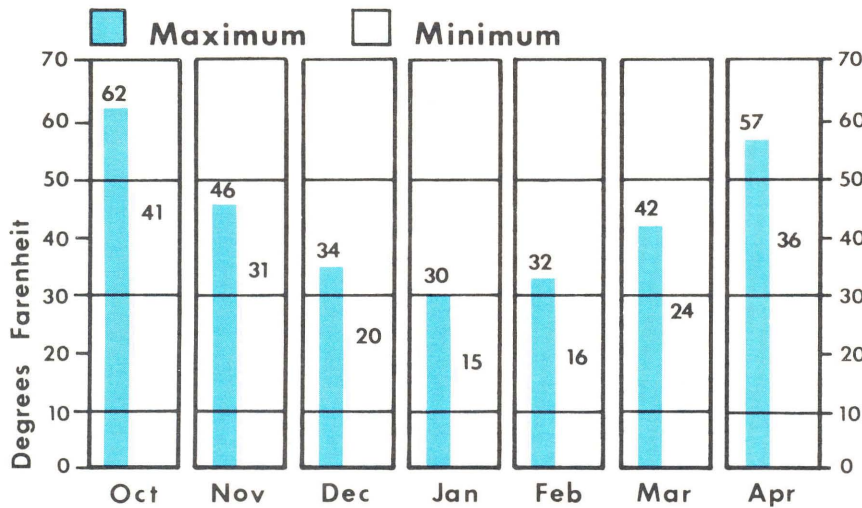


**CLOUD COVER DAYS—SUNRISE TO SUNSET**

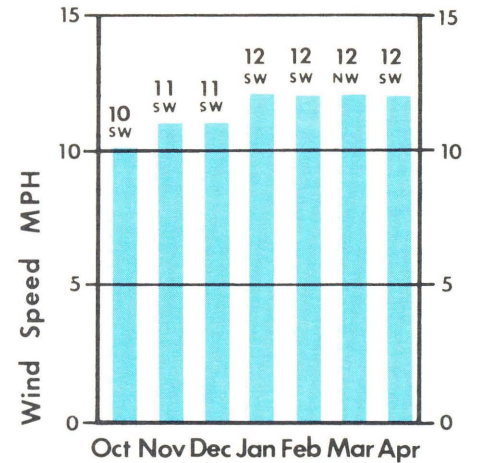
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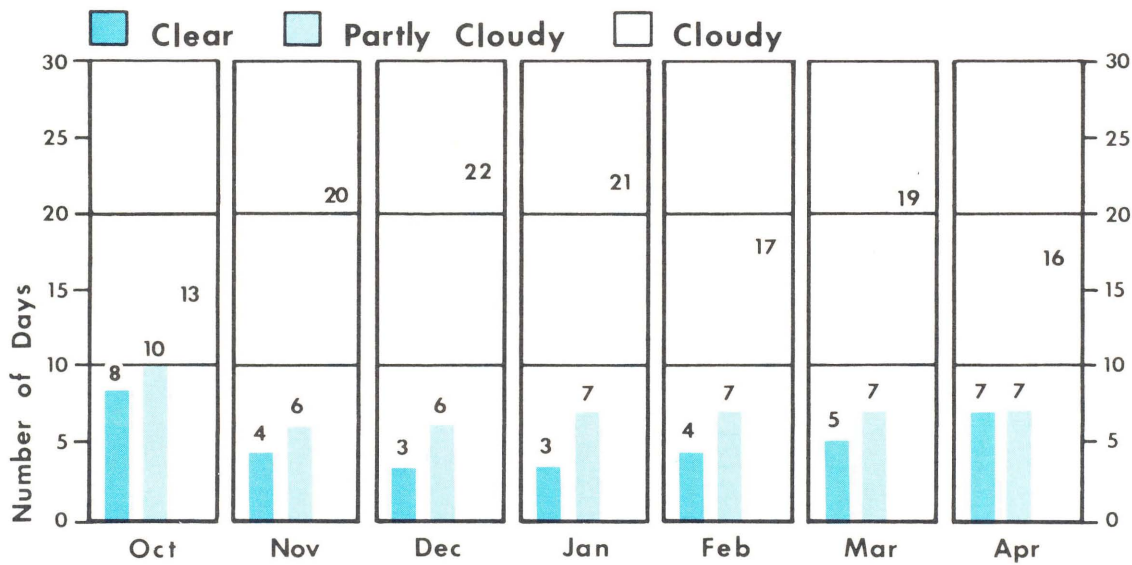
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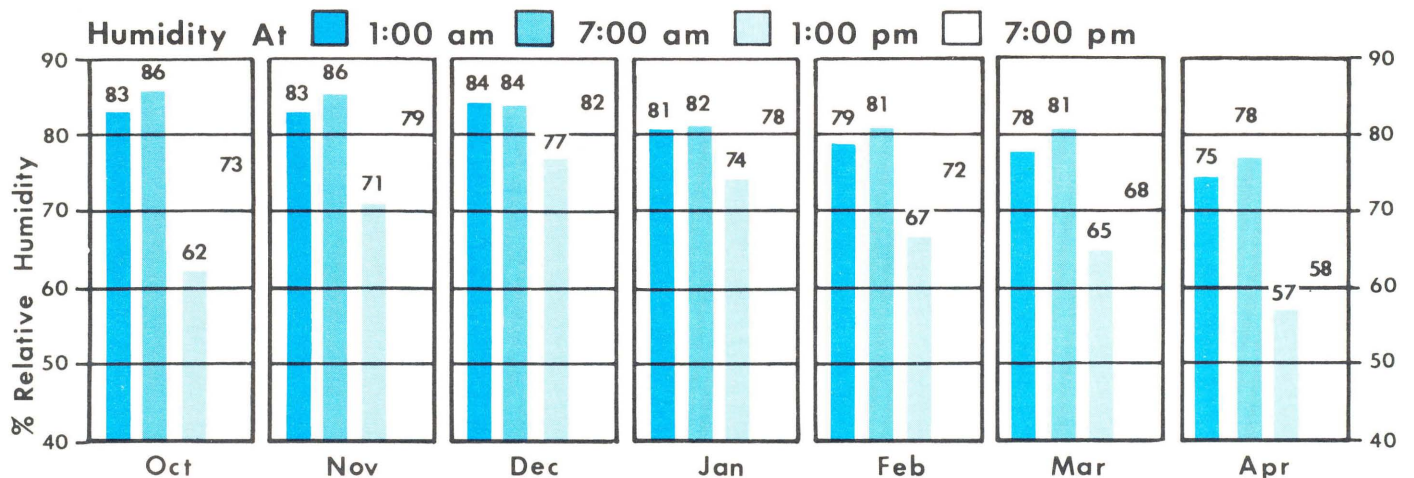


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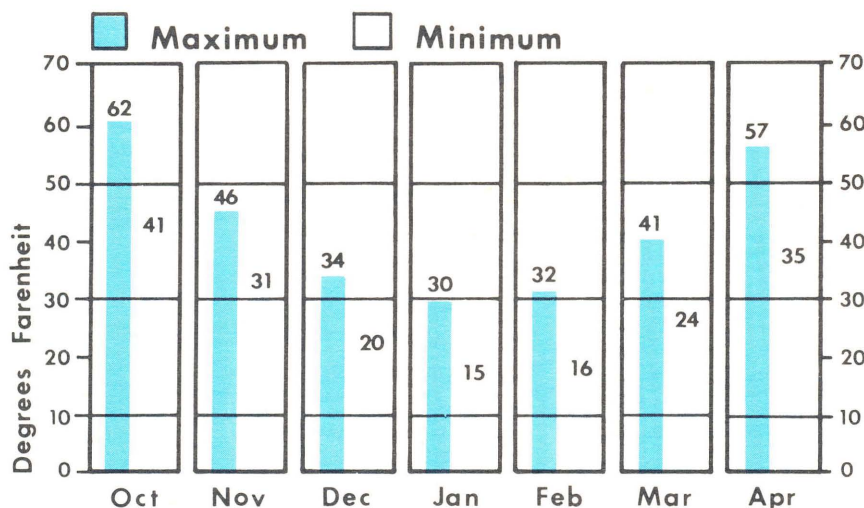


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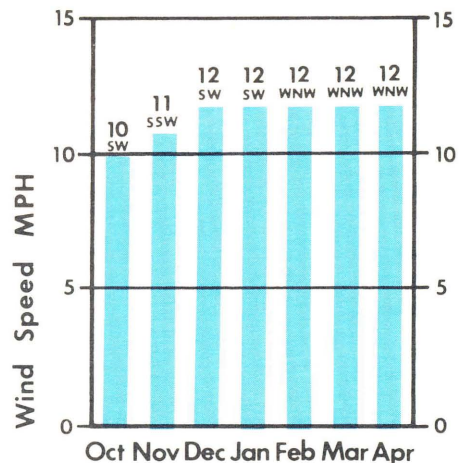
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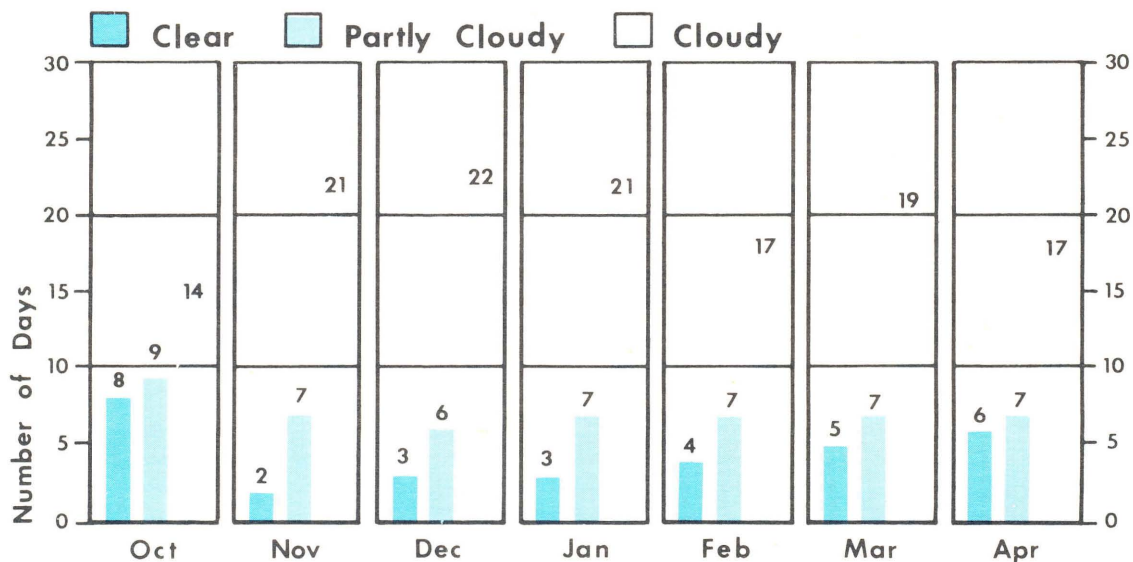
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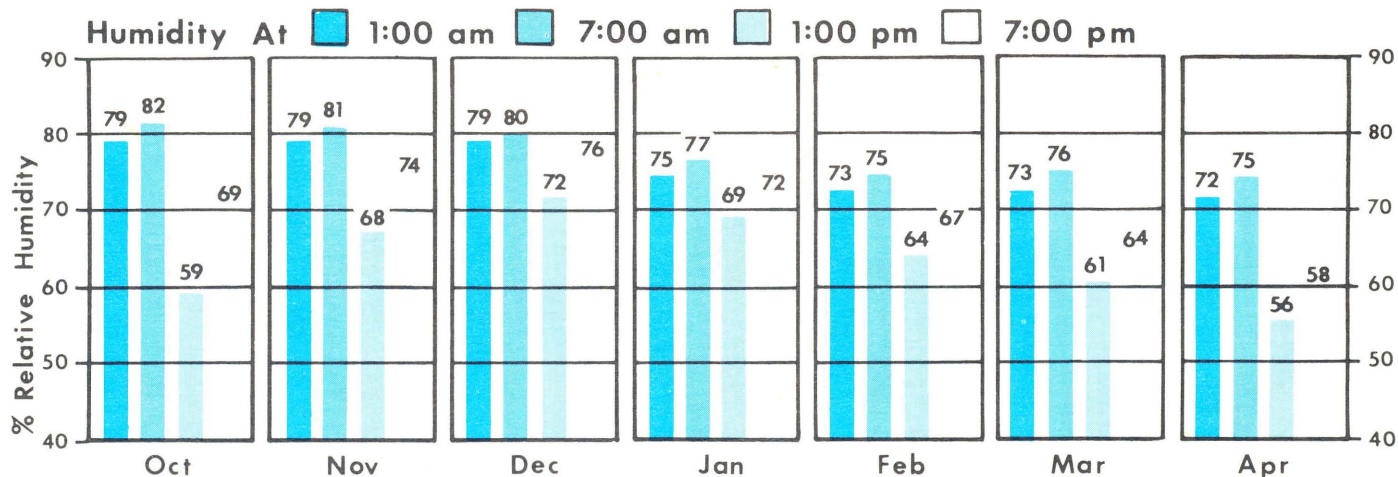


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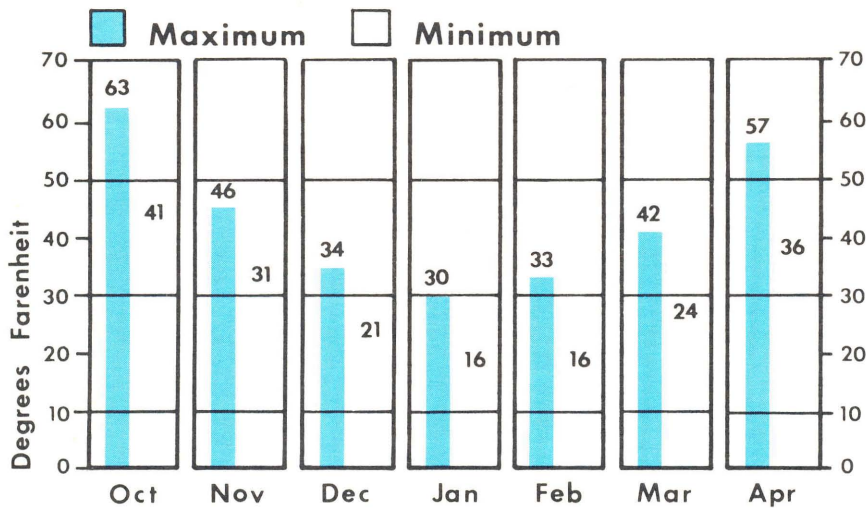


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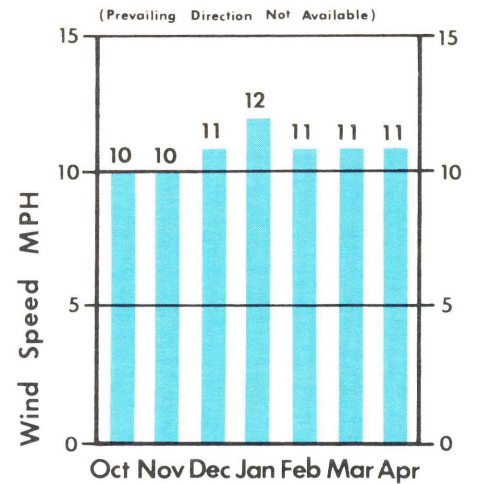
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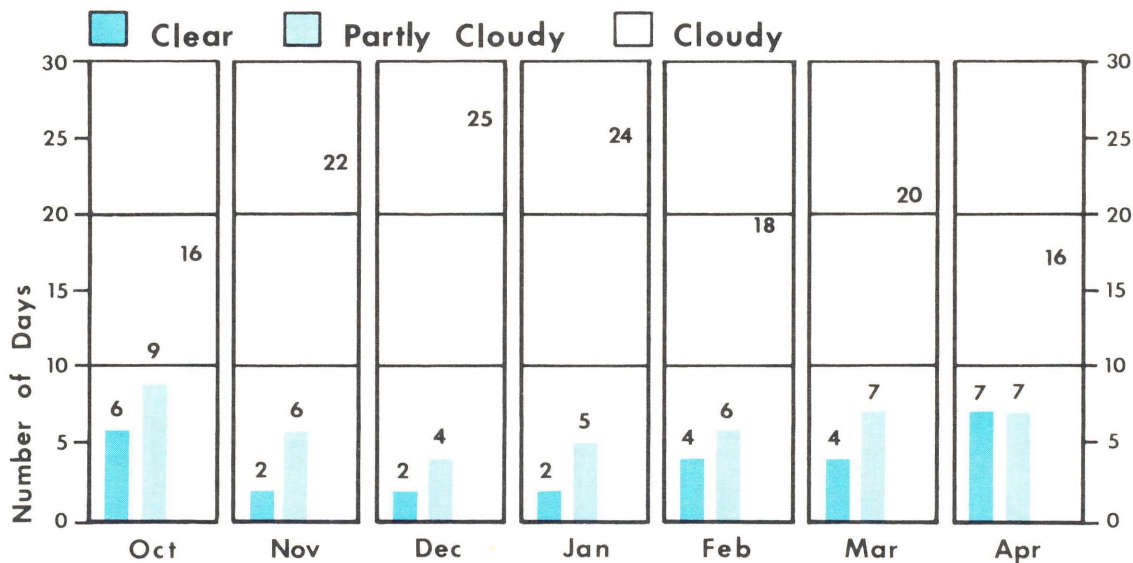
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**NORMAL DAILY MAXIMUM  
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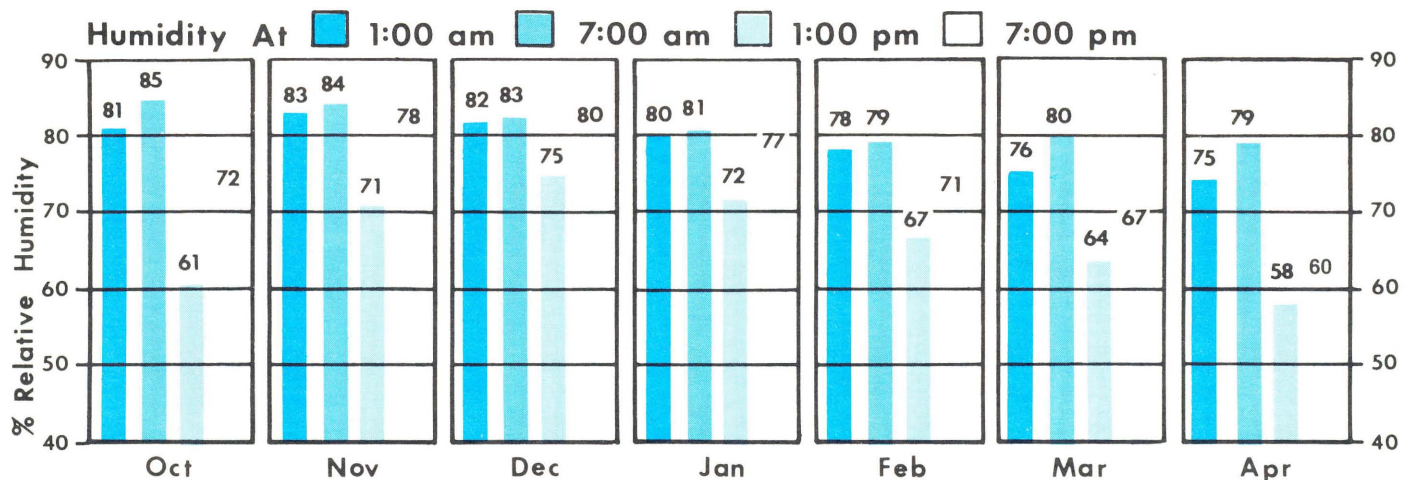


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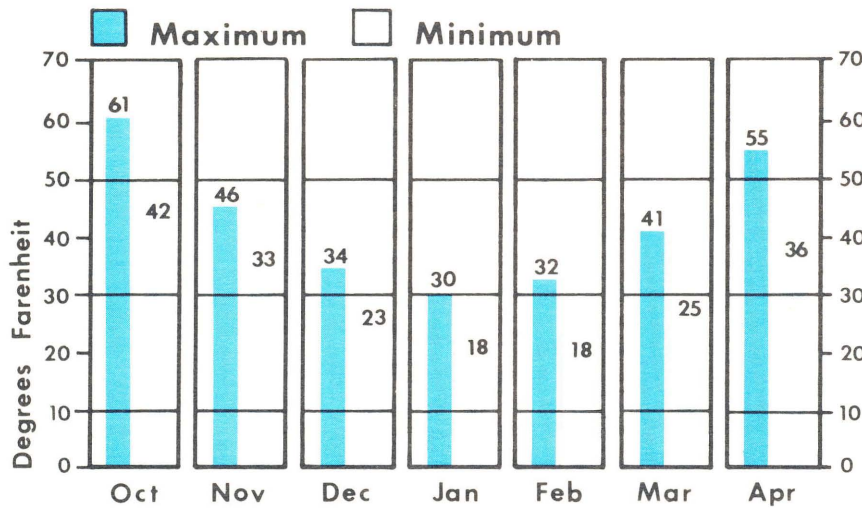


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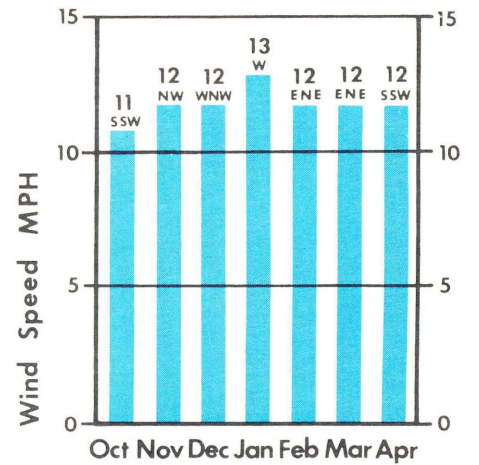
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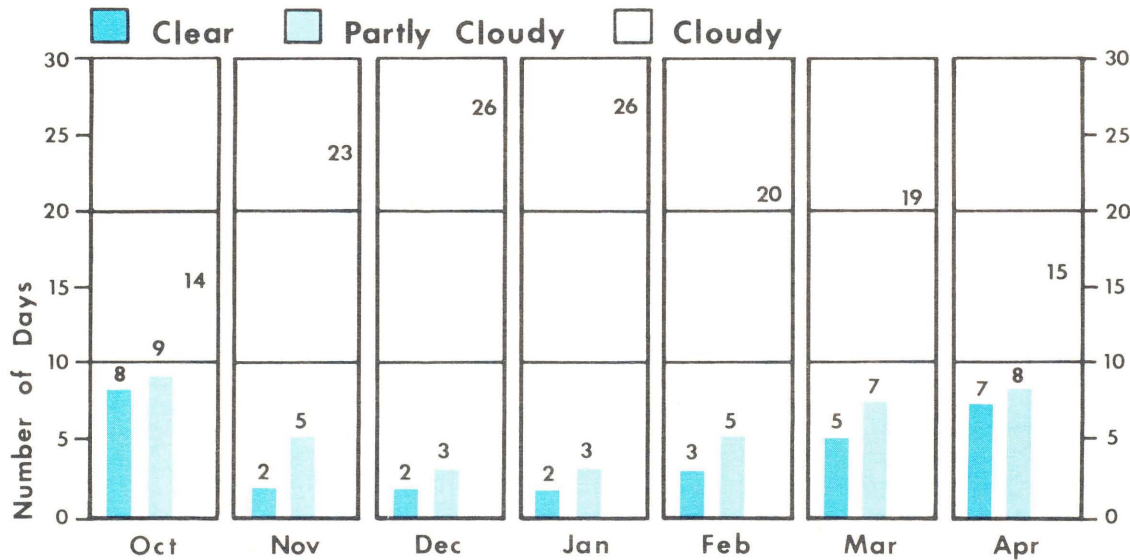
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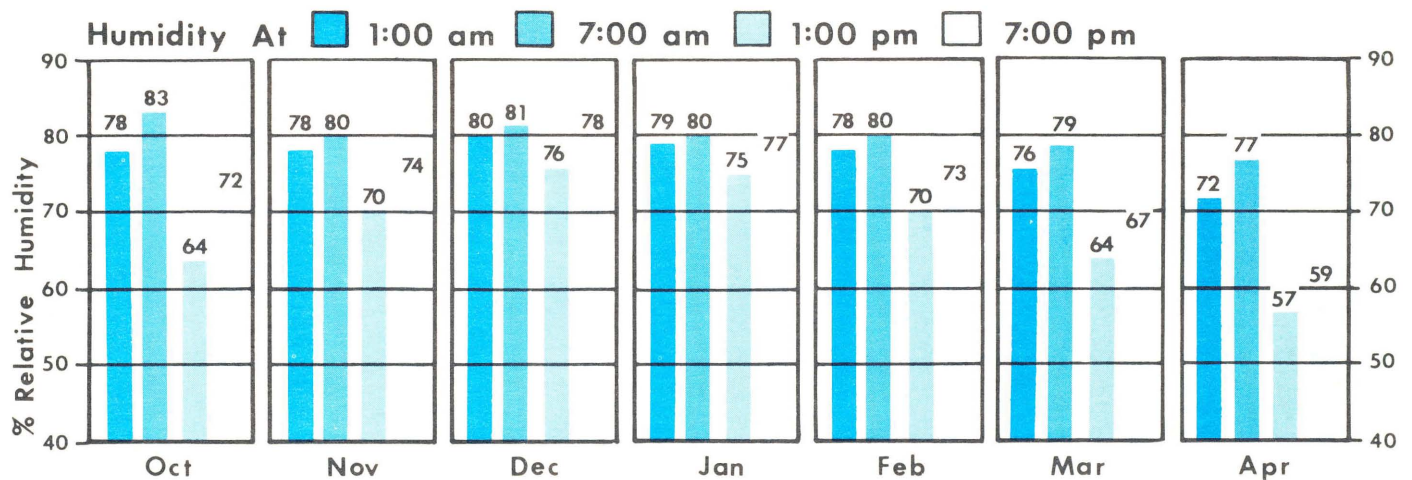
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**MEAN WIND SPEED &  
PREVAILING DIRECTION**

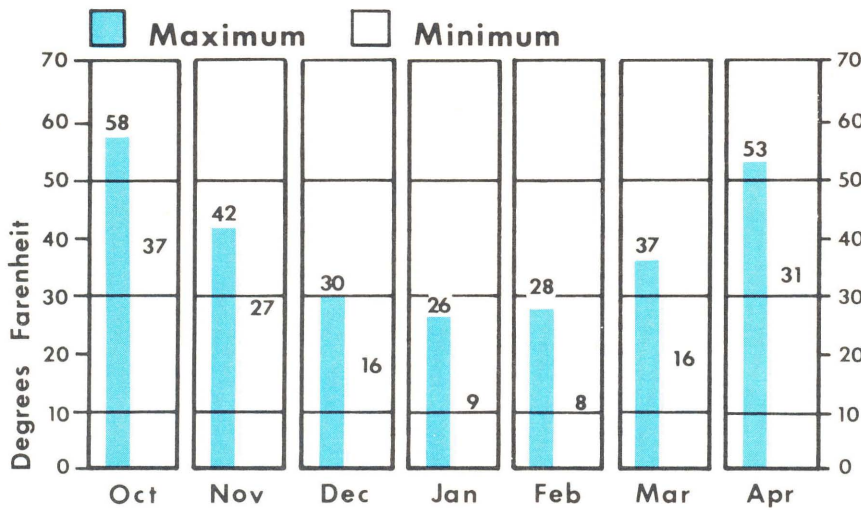


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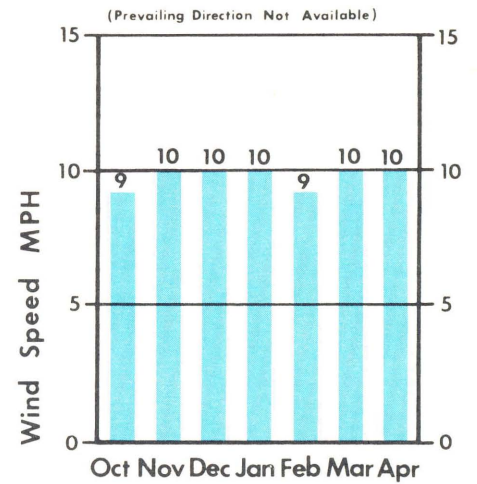


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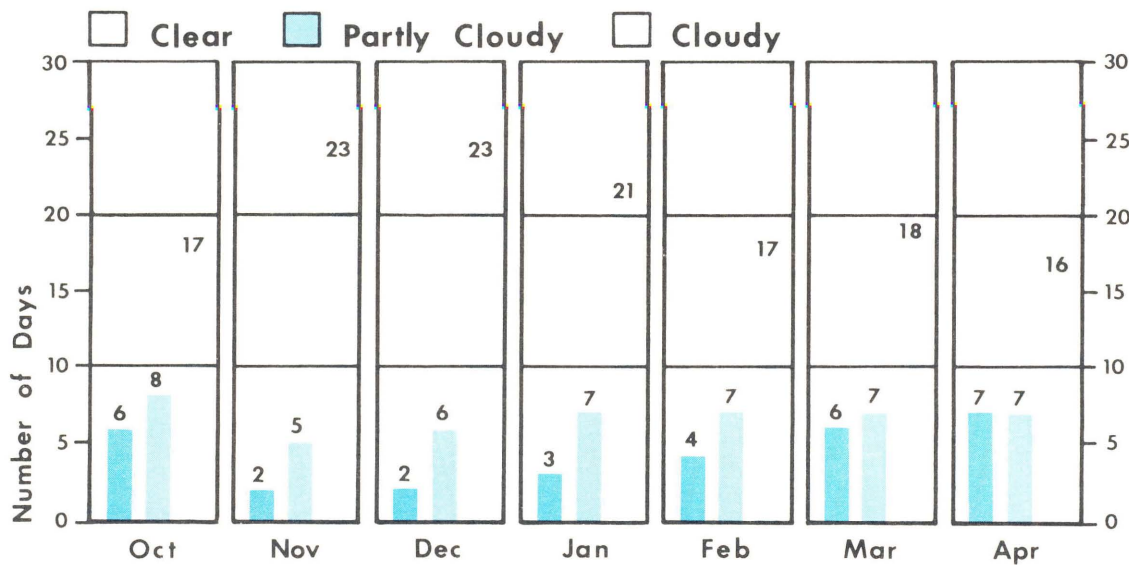
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**NORMAL DAILY MAXIMUM  
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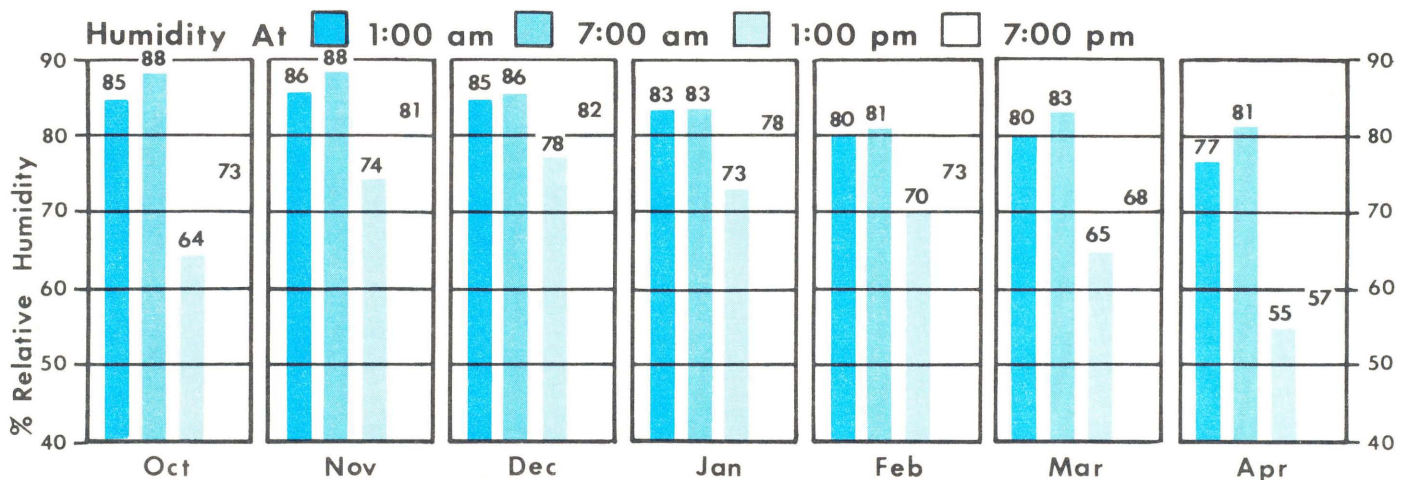


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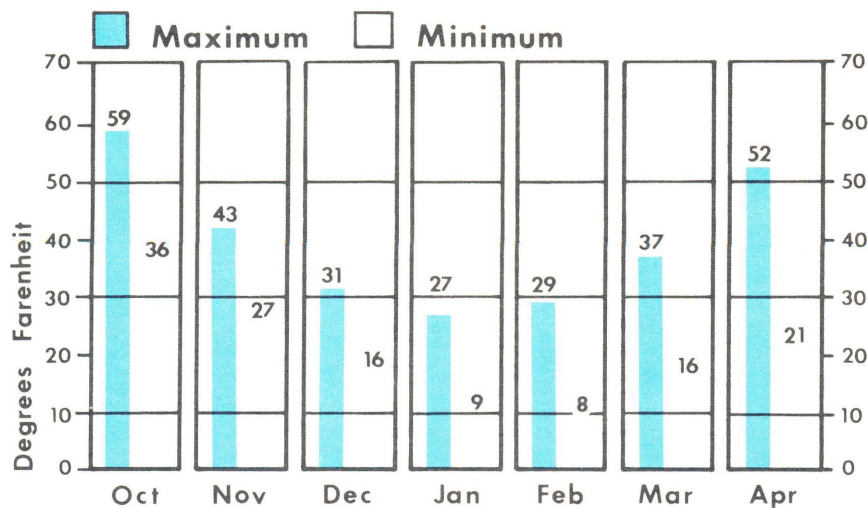


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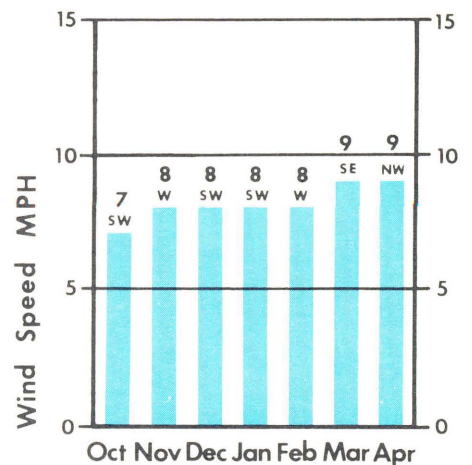
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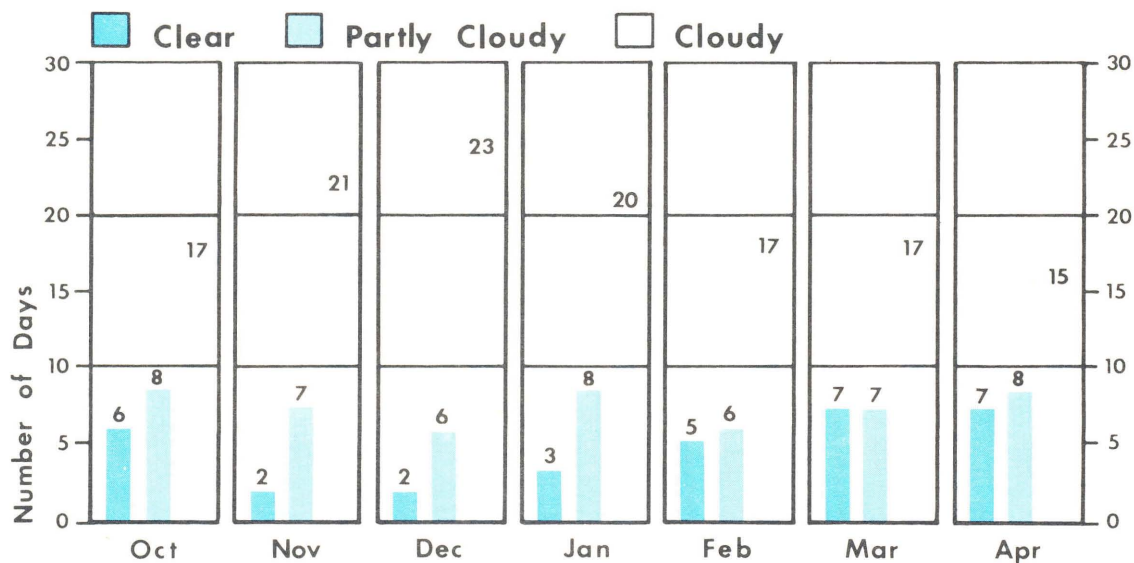
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**NORMAL DAILY MAXIMUM  
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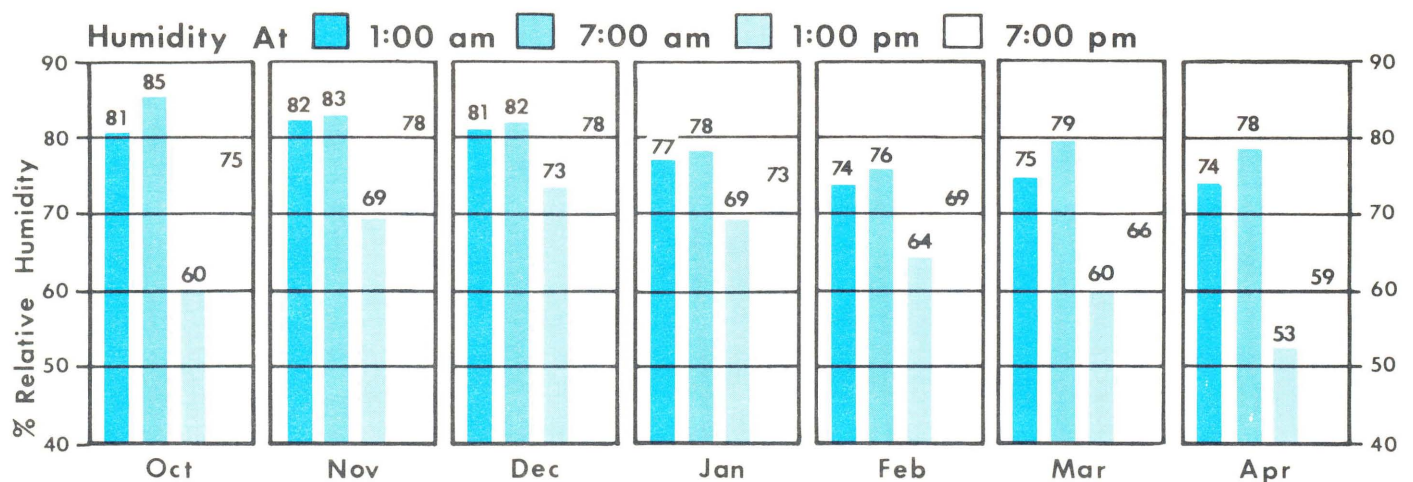


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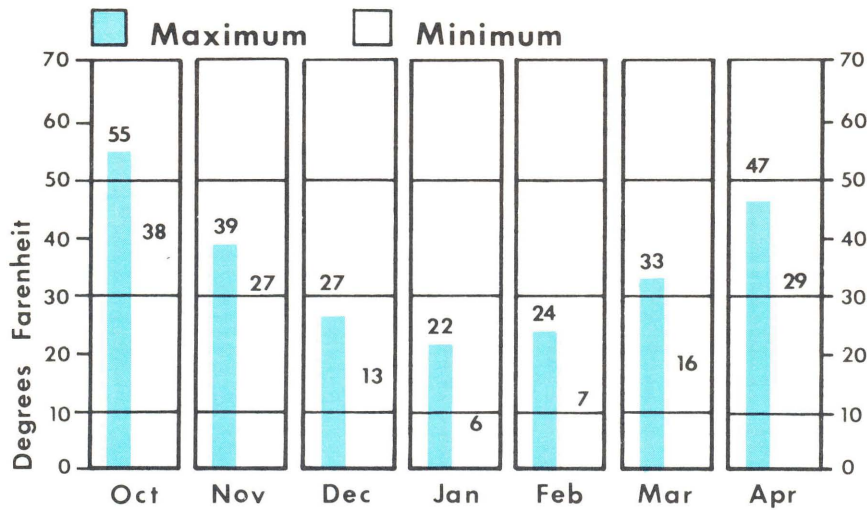


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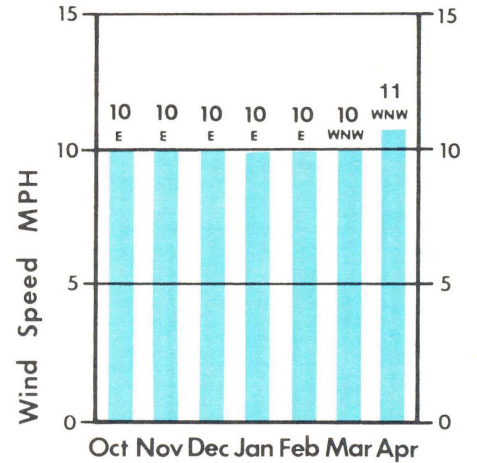
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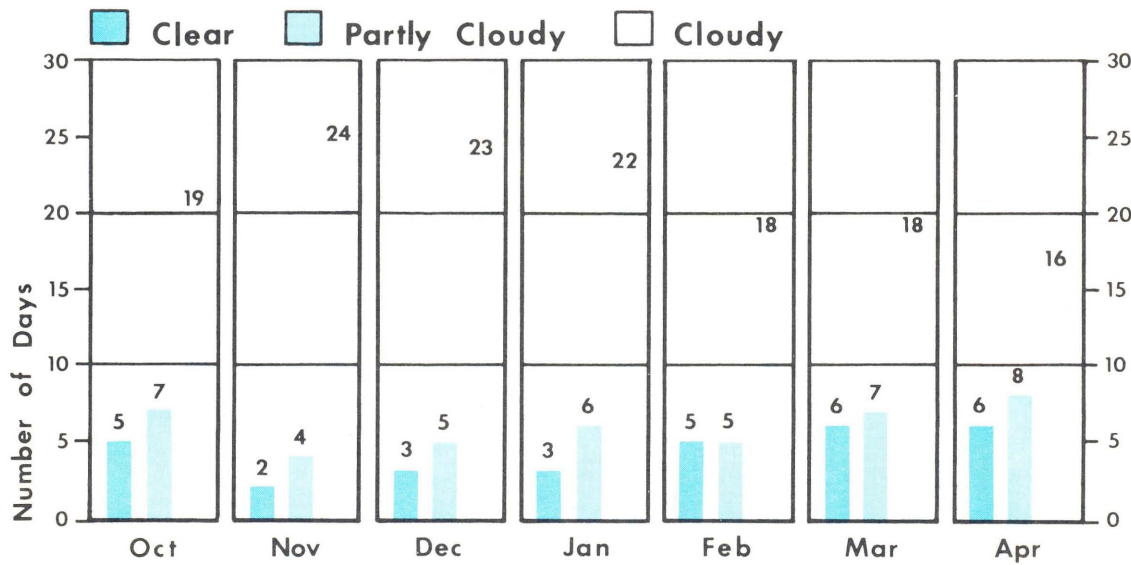
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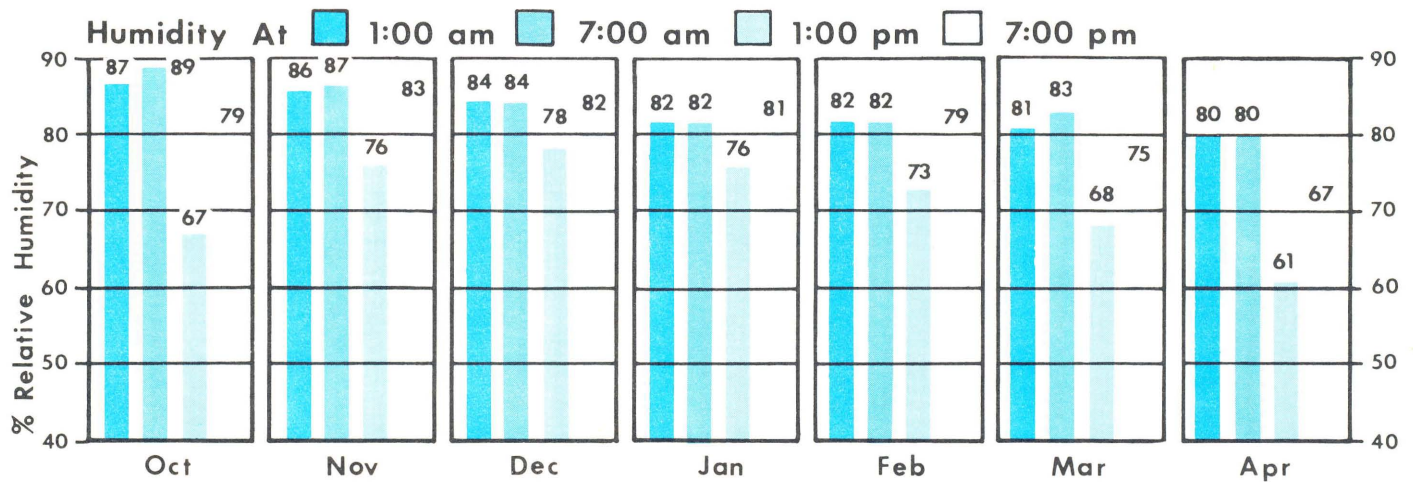
**NORMAL DAILY MAXIMUM  
& MINIMUM TEMPERATURES**



**MEAN WIND SPEED &  
PREVAILING DIRECTION**

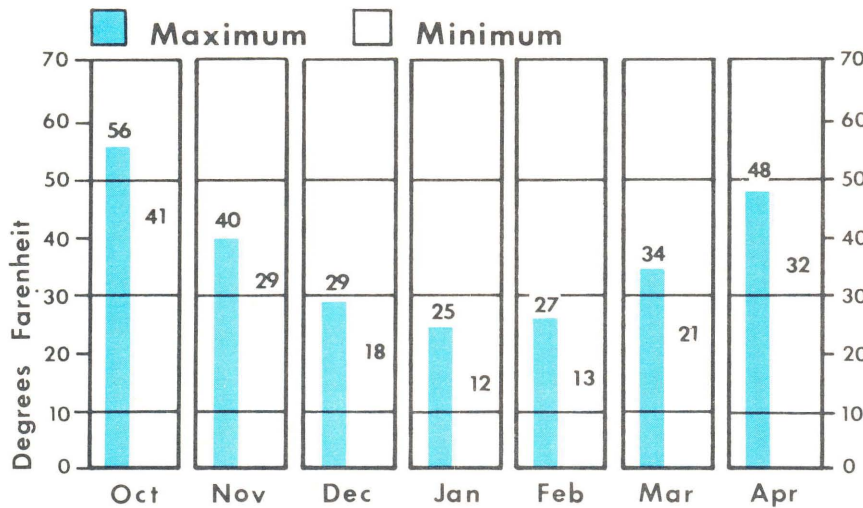


**CLOUD COVER DAYS—SUNRISE TO SUNSET**

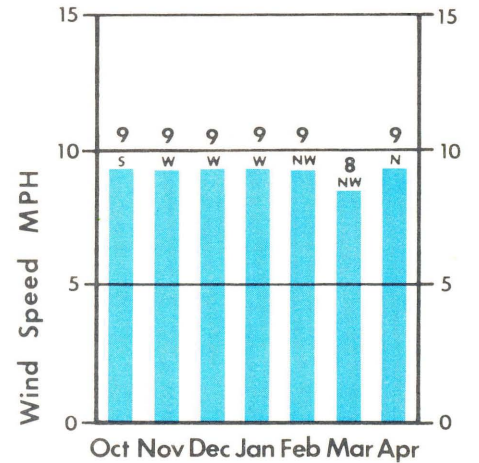


**AVERAGE RELATIVE HUMIDITY**

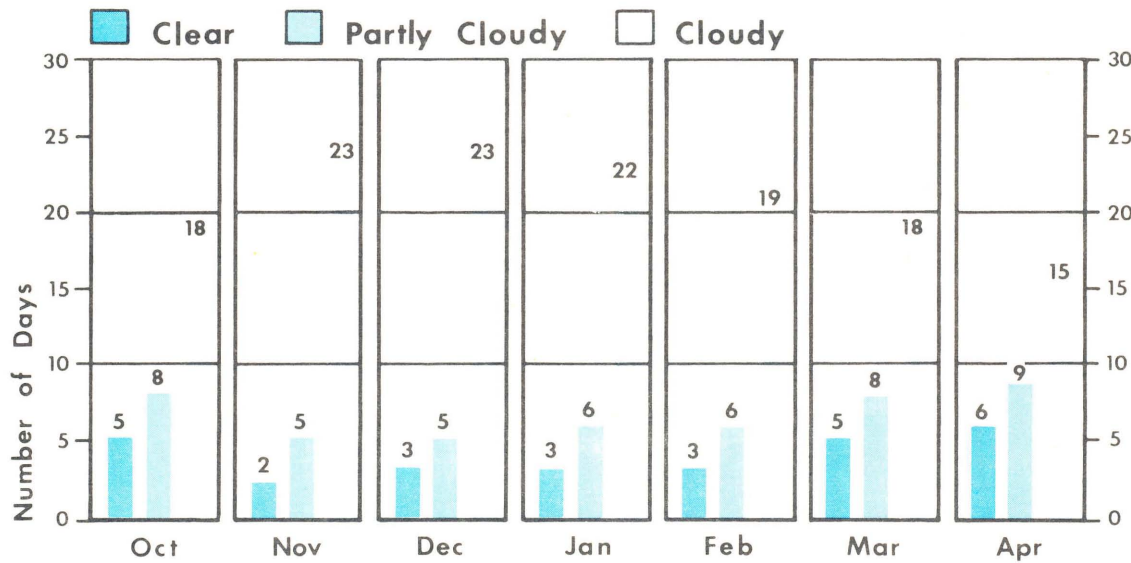
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**NORMAL DAILY MAXIMUM  
& MINIMUM TEMPERATURES**

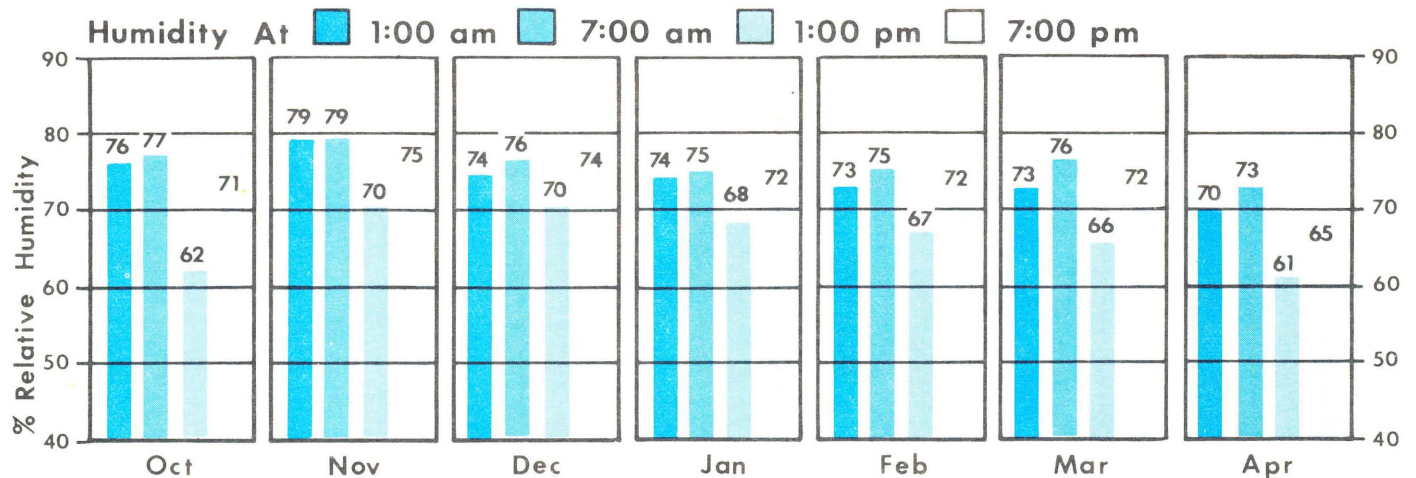


**MEAN WIND SPEED &  
PREVAILING DIRECTION**



**CLOUD COVER DAYS—SUNRISE TO SUNSET**

**Marquette**



**AVERAGE RELATIVE HUMIDITY**