



Climate Trends at Apostle Islands National Lakeshore

- We monitor weather and climate using existing weather stations in or near Network parks. Summaries presented here represent precipitation and temperature data collected by a weather station on Madeline Island.
- Data are collated on the website www.ClimateAnalyzer.org and were summarized here through an agreement with the website's creator.

Comparing Recent Years to a 30-Year Reference Period

Typically, when a weather report states that a particular month was warmer or cooler than “average,” it is making a comparison to a set of averages calculated over an agreed upon time period. These average are known as “climatological normals” and are updated every 10 years by the National Oceanic and Atmospheric Administration (NOAA). They are not simple averages or totals, but instead have been corrected for missing values and other irregularities.

The most recent normals available for Madeline Island were calculated for the period 1981–2010 (Figure 1; referred to as the “30-year average”). The data show that the wettest months in a year are typically June–September, when nearly half (46%) of the total precipitation falls (33 inches annually). The hottest month is July, with an average daily maximum temperature (Tmax) of 78 degrees Fahrenheit (°F); the coldest month is January, with an average daily minimum temperature (Tmin) of 6 °F. (Figure 1).

Overall, 2011–2012 was warmer (Tmax 2 degrees above average; Tmin 1.5 degrees above) and drier (82% precipitation) than the 30-year average (Figure 2). Temperatures were consistently above average from September 2011 through March 2012, with Tmax during March 2012 a remarkable 12.7 degrees above the 30-year average. This warm period culminated with the wet months of March and May 2012, which had 160% and 165% average precipitation, respectively (Figure 2).

During 2012, July, the warmest month, had average daily maximum temperatures (Tmax) of 84 °F and average daily minimum temperatures (Tmin) of 64 °F. January, the coldest month, had a Tmax of 29 °F and Tmin of 16 °F (Figure 3).

Longer-term Perspective

Since 2002, the 5-year running mean Tmax has fluctuated between roughly 52 and 53 °F, and the 5-year running mean Tmin has tracked between 32 and 34 °F. These temperatures are as warm or warmer than the last comparable warm period during the 1950s (green lines in Figure 4). During the last 10 years, these warm temperatures have combined with the generally below average precipitation (Figure 5) to produce drought-like conditions. (The precipitation in October—bottom panel of Figure 5—is the exception to the annual precipitation pattern.)

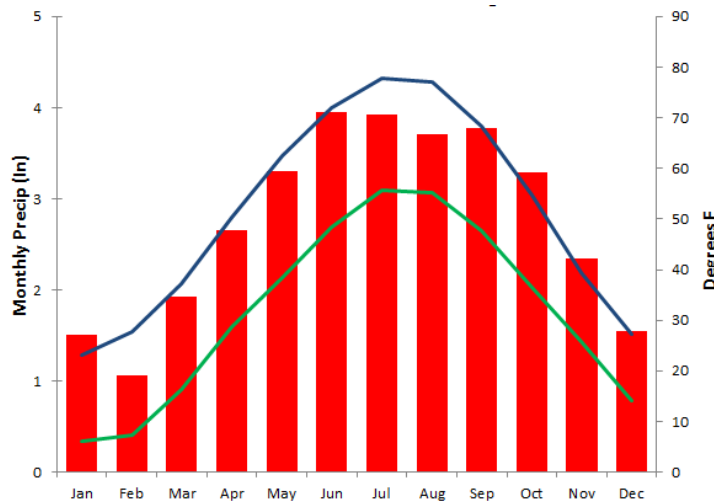


Figure 1. Official climatic normals (averages) for the Madeline Island, WI, weather station (COOP ID#474953), 1981–2010. Red bars = precipitation. Blue line = temperature maximum (Tmax). Green line = Tmin.

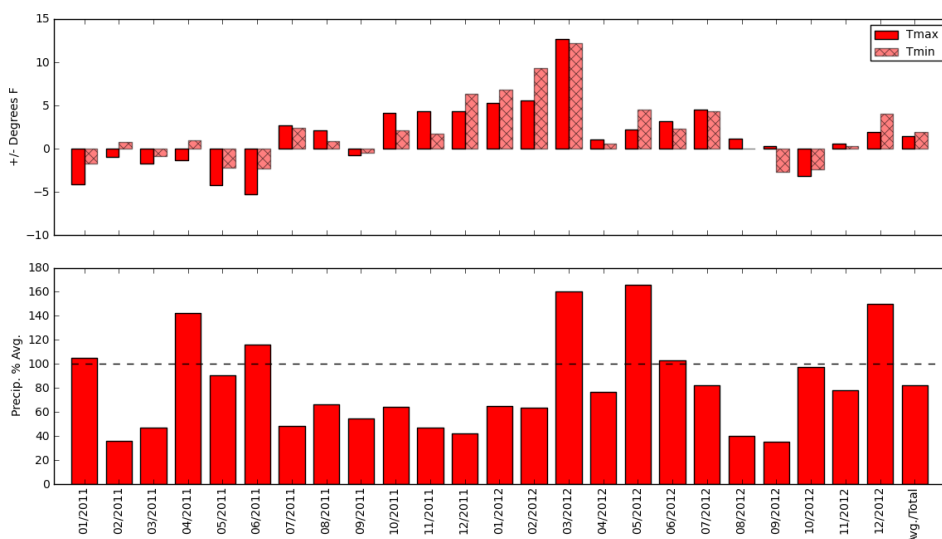


Figure 2. Monthly departures from the 1981–2010 normals as recorded at the Madeline Island, WI, weather station, 2011–2012. The rightmost column shows the departures for 2011–2012 overall. Tmax = average daily maximum temperature. Tmin = average daily minimum temperature.

The Reconnaissance Drought Index (RDI, Figure 6) integrates the effects of both temperature and precipitation by comparing the ratio of annual precipitation to cumulative potential annual evapotranspiration, which is the amount of water that could be evaporated given the temperature, solar radiation, and other factors that lead to desiccation. If the amount of potential evapotranspiration greatly exceeds the amount of precipitation in a year, there is more drought. Once this ratio (precipitation:evapotranspiration) is calculated for each year, it is compared to the average of this ratio for the period of interest (1944–2012, in this case), yielding a normalized index of drought. Thus, even though the last 10 years were not the most droughty on record for Madeline Island, they are notable for being consistently dry for 10 consecutive water years (Figure 6). A drought of this length had not occurred since the period 1954–1964. More information on the methods used to calculate the RDI are available on www.ClimateAnalyzer.org.

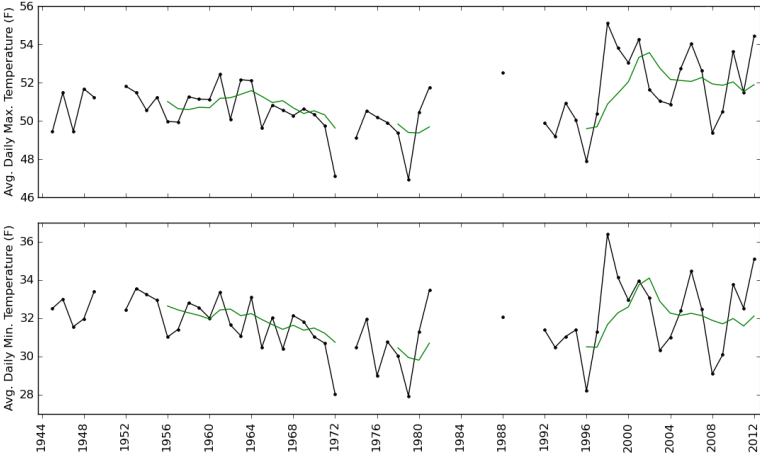


Figure 4. Average annual temperatures on Madeline Island, 1944–2012. The five-year running average (green lines) includes the current year and previous four years.

Figure 5. Precipitation in May (top) and October (bottom), 1944–2012, at Madeline Island, WI. Note the slightly different scales on the y-axes. Dots = actual precipitation totals. Solid red line = 5 year moving mean of annual precipitation. Red-shade = years when the moving mean is below the average (dashed magenta line). Blue-shaded areas = years when the moving mean is above average.

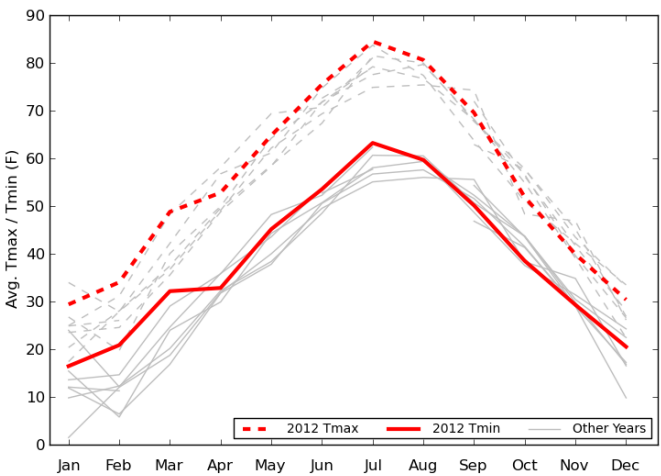
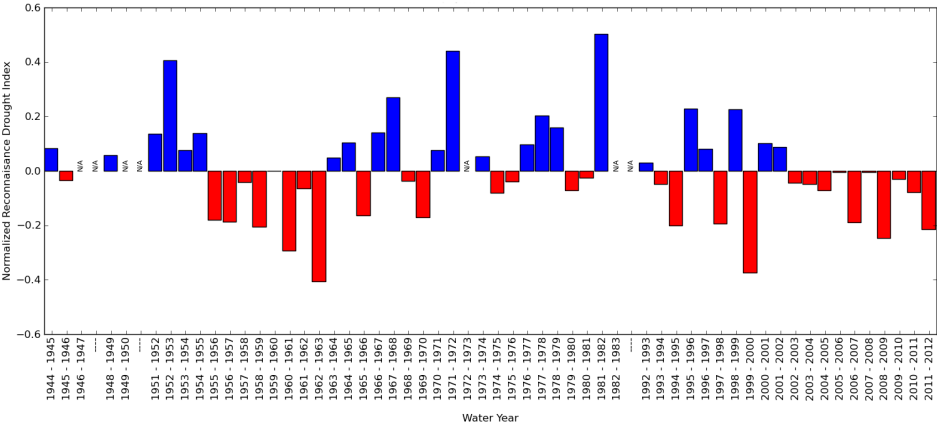


Figure 3. Monthly average temperatures for 2012 (red lines) compared to 2005 – 2011 (the period of record) at the Apostle Island automated weather station.

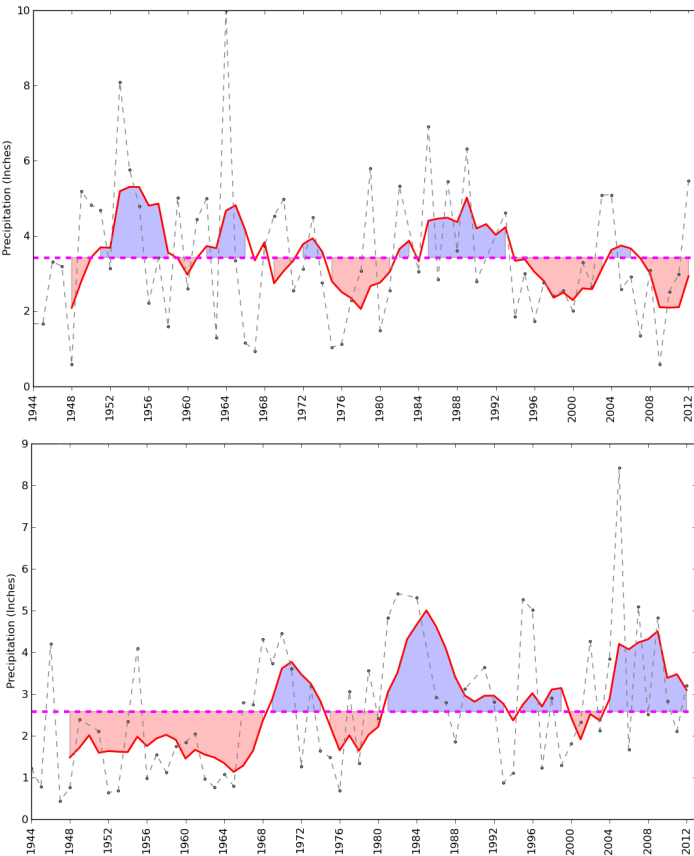


Figure 6. The Reconnaissance Drought Index for Madeline Island, 1944–2012.