

THE ATMOSPHERIC RESERVOIR

Examining the Atmosphere and Atmospheric Resource Management

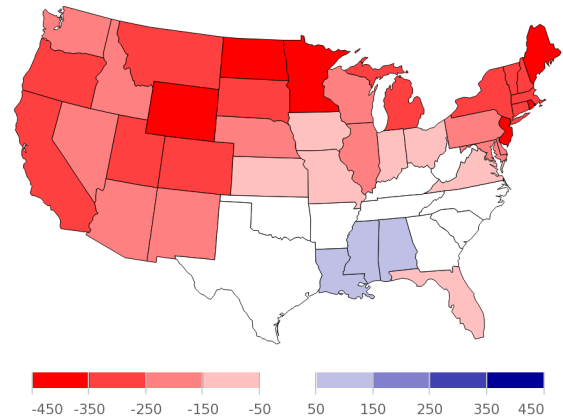
DEGREE-DAYS

By Mark D. Schneider

Is it possible for North Dakota to have more than 365 Heating Degree Days (HDD) in one year? Yes, this occurs every year and during the winter months can happen in only a couple weeks! To understand the concept of HDDs and Cooling Degree Days (CDD) let's look at their definitions. The American Meteorological Society (AMS) defines a HDD as a form of degree-day used as an indication for fuel consumption. In terms of your utility bill, "fuel" could refer to natural gas, propane, or electricity. CDDs are simply defined as a form of degree-day used to estimate the energy requirements for air-conditioning or refrigeration. To calculate either of these days, one starts with a base temperature of 65°F. Every degree that a calendar day's mean daily temperature drops below 65°F is considered one HDD and every degree a mean daily temperature rises above 65°F is considered one CDD. As you probably guessed, North Dakota ranks lower than most states in annual CDD because of our cooler climate.

With the warmer than average temperatures that have been observed in more recent decades, our state has seen an average annual decrease of 405 HDDs (see graphic) when the two periods of 1895-1954 and 1955-2015 are compared. Of recent interest was the near record stretch of temperatures at or above 0°F recorded at Bismarck. There were 338 consecutive days between February 21, 2020 and January 23, 2021 when Bismarck managed to remain at or above 0°F, ranking second only to a 342 day stretch between January 8 and December 15, 1878! The National Weather Service in Bismarck also noted that this was the latest into the season that the first subzero temperature occurred (-1°F on January 24) beating the previous date of January 11, 1914.

Change in Annual Heating Degree Days by State
1955-2015 VS 1895-1954



Data source: NOAA, 2016

North Dakota's farmers are more interested in Growing Degree Days (GDD) which are defined by the AMS as a heat index that relates the development of plants, insects, and disease organisms to environmental air temperature. We most commonly associate GDDs with the amount of time a crop takes to reach maturity. A GDD is calculated by adding the daily maximum and minimum temperatures, dividing by two, and then subtracting a base temperature. A crop's base temperature is usually between 5-10°C (41-50°F). This base temperature is determined by the specific life cycle of each plant. Wheat, barley, oats, and flaxseed typically have base temperatures of around 5°C, whereas soybeans and corn are closer to 10°C. A plant's growth is equal to zero any time the environmental air temperature is less than the base temperature.

With the next growing season almost upon us, let's hope for a good balance of HDD, CDD, and GDDs so that crops thrive and humans are comfortable!