

# THE ATMOSPHERIC RESERVOIR

*Examining the Atmosphere and Atmospheric Resource Management*

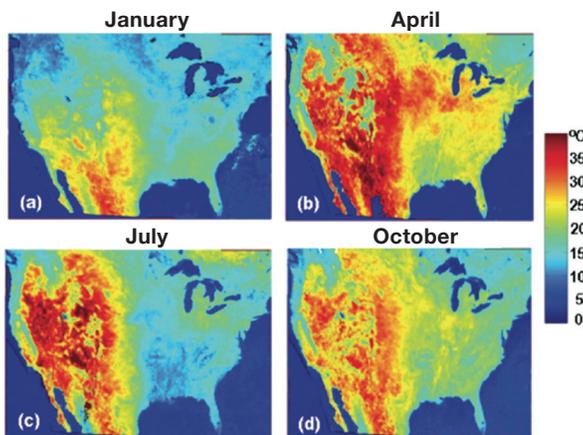
## "Northern Plains Temperature Variability"

By Mark D. Schneider

Living on the northern plains we know that the temperature can change quickly and to always be prepared for it. You might be surprised just how fast the thermometer can change though. Residents of Granville received a pleasant surprise on February 21, 1918 when the temperature warmed 83 degrees Fahrenheit in twelve hours. Imagine waking up to an air temperature of -33°F, bundling up with layers of warm clothes for the day and by the time the sun was setting barely needing a light jacket in 50°F weather!

On January 22, 1943 in Spearfish, S.Dak. a world record two-minute temperature change occurred. The temperature rose from -4°F to +45°F two-minutes later! This 49-degree change was caused by strong downslope or Chinook winds, which compressed and warmed the air as it moved down a mountain slope. Almost as incredible was the 58-degree temperature drop at Spearfish that morning in just 27 minutes as the Chinook wind subsided. The greatest 24-hour temperature change in the United States was recorded on January 15, 1972 in Loma, Mt. Also caused by Chinook winds, the thermometer rose from a low temperature of -54°F to a high of +49°F - an increase of 103 degrees!

**U.S. 1996-2000 Diurnal Temperature Range  
From Goes-8 Satellite Observations**



**Sun, D. L., R. Pinker, M. Kafatos, 2006: Diurnal temperature range over the United States: A satellite view. *Geophysical Research Letters*, 33, L05705, doi:10.1029/2005GL024780**

In general, "land-locked" states such as North Dakota have much greater daily or diurnal temperature variability than coastal areas of the U.S. The mean daily temperature range for North Dakota often exceeds 30°C (See Image) because land warms and cools rapidly. In addition, strong warm and cold fronts oftentimes contribute to this large variability. Now, travel to the western U.S. coast and the mean daily temperature ranges are only about 15°C to 20°C. The oceans off the U.S. coasts provide moderation to the adjacent land. Water holds heat much more efficiently than land and thus cools off slower. This also applies to inland areas with higher humidity, as humid air heats up and cools down more slowly than dry air. This explains why desert areas of the southwestern U.S. have some of the greatest variations in daytime temperatures.

Looking closer at the Goes-8 Satellite image averaging the Diurnal Temperature Range (DTR) for the U.S. from 1996-2000, it becomes apparent that there are large seasonal variations in DTR. In January, North Dakota's DTR is relatively small because of cloud cover and a close temperature/dew point spread. Clouds provide insolation by trapping heat in our atmosphere; especially during the nighttime. The temperature of the air can only cool until it reaches the dew point. Once this occurs, the air becomes saturated and we oftentimes experience low clouds and fog. During the transitional months of April and October, when warm and cold air masses are passing through the central U.S. quite frequently, larger DTRs are observed. In July, warm, humid air is oftentimes in place over much of North Dakota, thus average DTRs are smaller.

In North Dakota there's no reason why you wouldn't want to wear both shorts and a winter coat on the same day. After all, large temperature swings are a way of life here.

Atmospheric Resource Board  
North Dakota State Water Commission  
900 East Boulevard, Bismarck, ND 58505  
(701) 328-2788 • <http://swc.nd.gov>  
ND Weather Modification Association  
PO Box 2599, Bismarck, ND 58502  
(701) 223-4232