



THE ATMOSPHERIC RESERVOIR

Examining the Atmosphere and Atmospheric Resource Management

Seeing Colors in NORTH DAKOTA'S SKIES

By Mark D. Schneider

North Dakotans experience beautiful sunrises and sunsets on a regular basis. Much of what makes them so spectacular are the vibrant colors of red and orange that decorate the early morning and evening skies. When the sun is low in the sky its rays are passing through many more layers of atmosphere to reach our eyes than when it's overhead. In fact, depending on the sun's angle, there could be over 40 times the amount of air that its light must travel through! This thicker layer of atmosphere is more dense and "filters" out the shorter wavelengths of light (blue) more, leaving longer ultra-violet (red) wavelengths more visible to us.

We have Lord Rayleigh partially to thank for his 1871 theory of electromagnetic scattering because it helps to explain how molecules in our atmosphere scatter sunlight into various wavelengths of color. Blue wavelengths are shorter and Rayleigh Scattering is inversely proportional to the fourth power of the wavelength, so blue is scattered about four times more than red which has a much longer wavelength. Our sun also has its own unique spectrum that favors violet wavelengths and the oxygen in Earth's atmosphere acts to absorb ultra-violet wavelengths. All these factors explain why our sky is primarily blue.

During the western U.S. and Canada annual wildfire season, smoke particles are transported hundreds of miles into our state and have a profound effect on our sun's appearance. Smoke particles act to filter out the shorter wavelengths of light (blue) because of their size. These particles are also able to become lofted high in the atmosphere making our sun's appearance red, even during the daytime when its angle is higher. Pollution particles can also have the same effect on the sun as smoke particles, however, they oftentimes become confined to low-lying areas and valleys due to temperature inversions around large cities.

When you factor in North Dakota's excellent visibility due to minimal pollution, a fairly flat landscape, and few trees, its no wonder that prime sky viewing conditions exist in our state. As tree leaves begin to change color this Autumn, you may have the opportunity to experience colors in our skies as well.

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