Rapid Photochemical Production of Ozone at High Concentrations in a Rural Site During Winter

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Ozone is an air pollutant that can cause severe respiratory health effects. Photochemical ozone production near the Earth's surface is considered a summertime, urban phenomenon, where hourly average ozone concentrations may exceed 150 ppb compared to background values of ~50 ppb, and wintertime U.S. ozone concentrations are generally 35-50 ppb. We have recently documented rapid, diurnal, wintertime, cold temperature, photochemical ozone production in the rural Upper Green River Basin (UGRB), Wyoming, in the vicinity of the Jonah-Pinedale Anticline (JPA) natural gas field, at air temperatures as low as -17°C. In these events, hourly average ozone concentrations rise from 10-30 ppb at night to >140 ppb shortly after solar noon, under the influence of a stagnant, high pressure system that promotes cold temperatures, low wind speeds and limited cloudiness. Under these conditions, intense, shallow temperature inversions develop in the lowest 100m of the atmosphere, that trap high concentrations of ozone precursors at night. During daytime, photolytic ozone production then leads to rapid daytime photolytic ozone production. We have recently also observed this phenomenon in NE Wyoming near a coal mining area, in a natural gas field in northern New Mexico, and in an urban area (Logan, Utah).

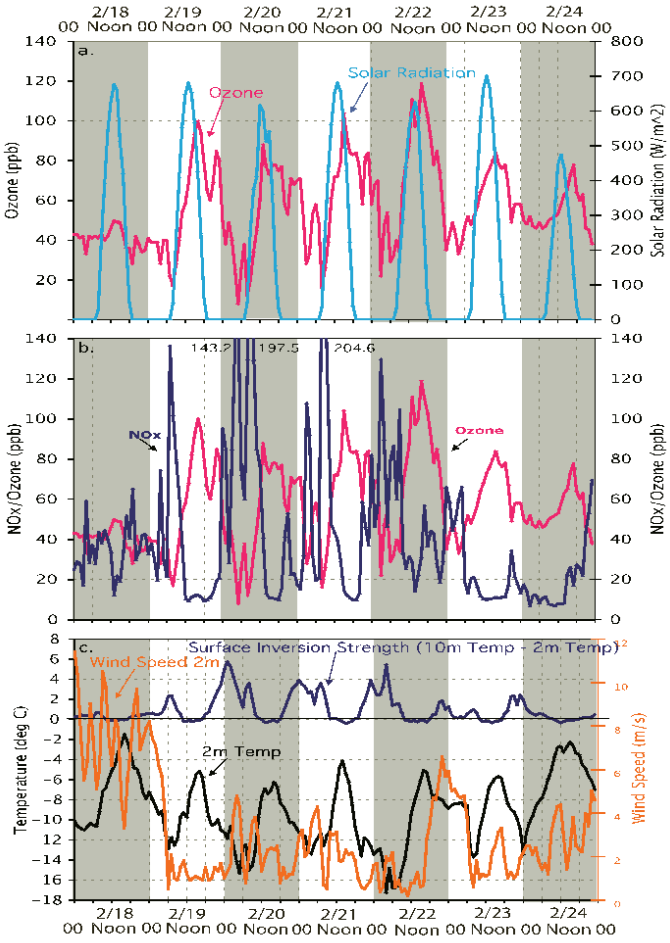

Figure 1. Hourly average solar radiation, ozone, NOx and temperature data for the Jonah air quality monitoring site, Feb 18-25, 2008 showing rapid ozone production closely tracking solar radiation with a 1-2 hour time lag and associated NOx, temperatures and winds.