Observations of Lower Thermospheric Nitric Oxide from SOFIE

Padma Thirukoveluri[1], Scott M. Bailey[1], Mark E. Hervig[2], Larry L. Gordley[2], Lance E Deaver[2], and James M. Russell[3]

[1]*Virginia Polytechnical Institute and State University, Blacksburg, VA 24061*
[2]*GATS, Inc., 11864 Canon Blvd, Suite 101, Newport News, VA 23606*
[3]*Hampton University, 23 Tyler St., Hampton, VA 23668*

Nitric oxide (NO) is a key minor constituent in the lower thermosphere. Of particular importance is its role in the energy balance in that altitude region. NO is produced through the reaction of excited atomic nitrogen with molecular oxygen. Thus its production is very sensitive to those energy sources able to break the strong molecular nitrogen bond. These include solar soft X-rays and precipitating energetic particles. Nitric oxide emits efficiently in the infrared and is an important cooling mechanism in the lower thermosphere. The abundance of NO is thus both a direct response to recent energy deposition as well as a key mechanism by which the upper atmosphere releases that energy.

The variability in the NO is connected to the variability in the solar activity. Atomic Nitrogen (N) in the excited state is required to produce NO. N in the ground state and O_2^+ destroy NO. All of these species are created through processes involving solar irradiance, so the abundance of NO depends on the solar illumination. When the atmosphere is illuminated by the sun, photoelectrons are produced through photoionization of the major constituents of the lower thermosphere. These photoelectrons produce N in the excited state, which then reacts with oxygen molecule (O_2) to produce NO. NO is similarly produced in the polar regions by precipitating auroral particles. NO is therefore a coupling agent between the Sun, magnetosphere, and atmosphere.

The Solar Occultation for Ice Experiment (SOFIE) instrument was launched on-board the Aeronomy of Ice in the Mesosphere (AIM) satellite on April 25, 2007. It is currently in its third year of operation. SOFIE is a 16 channel differential absorption radiometer using the solar occultation technique to measure ice and environmental properties at a range of altitudes, and in particular the mesopause region. One of the constituents measured by SOFIE is NO in the mesosphere and lower thermosphere to about 130 km. The AIM orbit and the solar occultation technique confine observations to latitudes of 65 to 85 degrees in each hemisphere and varying with season. In this presentation, we present the SOFIE observations and discuss their relationship with current levels of solar particle and irradiance.