

Contribution of Solar Irradiance to Ionospheric and Odd Nitrogen Chemistry

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It is well known that nitric oxide (NO) production and loss in the lower thermosphere are each controlled by the solar ionizing irradiance. Less clear is how much each wavelength contributes to which process. While it is generally agreed that the soft x-rays lead to production and Ly-beta and Ly-alpha lead to loss, a more quantitative assessment of the relative contributions from these and the other EUV wavelengths is needed.

Answering this question requires connecting the NO chemical sources (N(2D), N2(A)) and sinks (N(4S), O2+) with their origins in the solar spectrum. Such precursor minor species ultimately derive from the irradiance and are created via chemical cascade from higher energy ions like N2+ and O+. Thus each species in this chemical chain must be traced back to its origins in the solar spectrum.

Furthermore, the chemical cascade itself is primarily initiated by fast photoelectrons. The multitude of processes governing their path to thermalization (e.g. inelastic collisions, secondary production) precludes a simple determination of which photoelectron energies are controlled by which solar wavelengths. However, at altitudes where the equilibrium assumption is appropriate (lower E-region) untangling these contributions is straightforward.

In summary this talk will quantify the contribution of each wavelength of the solar ionizing irradiance to the net NO production and loss. This claim is evaluated for quiet and flare conditions. Uncertainties in the photoelectron spectrum from recent laboratory results on the electron impact cross sections and quantum chemical results for the chemical cascade are assessed.