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New nitric oxide (NO) nightglow measurements with SPICAM/MEX as a tracer of Mars upper atmosphere circulation

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In the upper atmosphere of Mars, CO_2 and N2 are photo-dissociated by solar UV and EUV on the day side, producing O and N atoms. They are carried to the night side by planet rotation and general circulation in the thermosphere. When they recombine to form nitric oxide (NO), they emit light in the UV in the so-called δ and γ bands, producing a UV nightglow that was discovered by SPICAM/Mars Express in 2005 during dedicated limb observations. Therefore, it provides an important tracer of thermospheric circulation, tracing mostly descending air.

A new data set has been produced by using more frequent star occultations (more than 2000), which in about 10% cases revealed the presence of the NO emission in addition to the star signal. We have developed a method allowing to retrieve the vertical profile of the NO emission intensity, after disentangling the star signal from the limb signal. We have made a first-order comparison with the MGCM LMD model. The peak intensity (a few KiloRayleigh) and the peak altitude (50-100 km) are in reasonable agreement with model predictions. There is a clear seasonal pattern of the latitude location of the emission. The latitude of the emission as a function of season (solar longitude Ls) can be approximated with a relationship of the form Lat= -80 sin (Ls). At solstices (Ls=90 and 270°) this is in agreement with the MGCM model, which predicts an emission in the depth of the winter polar night. At equinoxes (Ls=0 and 180°), the emission is observed near the equator, in total contradiction with the model, which predicts on the contrary an emission simultaneously at both polar regions. The significance of this major discrepancy for the general circulation of the upper atmosphere of Mars will be discussed, and the NO and O_2 observed nightglows will be compared.