GLOBAL MAPS OF ATOMIC OXYGEN IN THE THERMOSPHERE OF MARS DERIVED FROM OI 135.6 NM EMISSION OBSERVED BY THE EMIRATES MARS ULTRAVIOLET SPECTROMETER (EMUS) INSTRUMENT

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Introduction:

One of the key investigations of the Emirates Mars Mission is to "determine the abundance and spatial variability of key neutral species in the thermosphere on sub-seasonal timescales" [1]. The Emirates Mars Ultraviolet Spectrometer (EMUS) instrument observes ultraviolet emissions between approximately 100 and 170 nm [2]. The thermospheric column abundance of atomic oxygen determined from measurements of the O I 135.6 nm emission. On the Martian dayside, this emission feature is produced by oxygen atoms excited into the 5S state by photoelectron impact transitioning to their ground state.

Forward Modeling:

Our primary tool used to determine the thermospheric oxygen abundance is a forward model consisting of a one-dimensional photochemical equilibrium atmospheric model coupled to a photoelectron transport and emission model [3]. The coupled model calculates the 135.6 nm emission rate accounting for a variety of external (solar EUV spectrum) and internal (atmospheric structure) parameters. We run the coupled model varying parameters such as the solar EUV spectrum, mesosphere and exosphere temperatures, N2 and Ar mixing ratios, and eddy diffusion coefficient over reasonable expected parameter ranges. This results in a multidimensional look up table constructed from several thousand individual runs.

Retrieving Atomic Oxygen:

We find that there is a nearly one-to-one relationship between the oxygen column abundance and the predicted 135.6 nm emission over a broad range of input values. Thus, for each pixel, the retrieved oxygen column abundances are those that are associated with the best match from the lookup table to the EMUS-observed brightness. Here we show initial results of the spatial and temporal variability of thermospheric oxygen abundance from the first few months of EMUS observations.

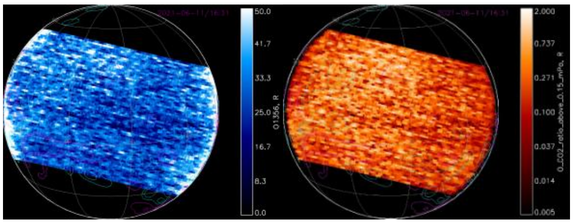

Figure 1: Measured 135.6 nm brightness (left) and retrieved O/CO_2 column ratio (right).

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