P21A-08 Effects of Downwelling in the Martian Atmosphere as Observed by MAVEN/IUVS Stellar Occultations

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09:40 - 09:50

Liberty N-P (Marriott Marquis)

Abstract

The ultraviolet nitric oxide nightglow emissions in 50-100 km altitude range have been detected in nadir images and limb scans by the Imaging Ultraviolet Spectrograph (IUVS) aboard the Mars Atmosphere and Volatile EvolutioN (MAVEN) spacecraft, as well as by the Spectroscopy for the Investigation of the Characteristics of the Atmosphere of Mars (SPICAM) experiment on board Mars Express (MEx). These emissions are produced when N and O atoms, created on the dayside, are transported to the nightside and down to the mesosphere where they radiatively recombine, serving as a tracer of Hadley circulation and downward transport. However, the models do not match the observations in critical aspects such as the altitude and local time of peak emission, implying that the downwelling and its effects are not well-understood. Previous studies have also reported the presence of recurring nightside mesospheric warm layer in the 70-90 km altitude range, that is related to the signature of thermal tidal propagation. However, it is not established if the warming could also be due to air subsidence of dayside-to-nightside circulation.

This work is intending to test the hypothesis that the dynamical effect of downwelling resulting in NO nightglow is also expected to generate a warm layer in the nightside mesosphere. We use 10 years of data extending from Martian year 33 to 37 to present the first observations of NO nightglow emissions in IUVS stellar occultation spectra. Since nightglow emissions cause background contamination of stellar signal, we explore means to disentangle the signal from the mid-ultraviolet spectra to retrieve temperature profiles. We study (a) the climatology by comparing the location of observed NO nightglow emission and nightside mesospheric warm layer, especially for polar winter night observations, and (b) the NO volume emission rate predicted by Mars Planetary Climate Model (MPCM) and the threshold vertical winds required to predict a mesospheric warm layer by downwelling. Preliminary analysis indicates that downwelling is the

common cause of both mesospheric nightside warm layers and NO nightglow emissions. This work would have important implications on characterizing the dynamical processes that govern the structure and composition of the martian mesosphere, as well as provide constraints on the models.

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