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Martian upper-atmosphere circulation and tides revealed through MAVEN/IUVS observations of nitric oxide nightglow.

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Mars' upper atmosphere glows in the ultraviolet through chemoluminescence, and glows mostly brightly on the descending branches of global circulation patterns. We can therefore use the nitric oxide delta and gamma bands as a tracer of the dynamics between Mars's upper- and middle-atmospheres, particularly of day-to-night and summer-to-winter pole circulation. We analyse this rate as it varies over Mars's surface in mission-long aggregations and local-time divisions. Our data were gathered by the Mars Atmosphere and Volatile Evolution (MAVEN) mission's Imaging Ultraviolet Spectrograph (IUVS) and span different seasonal conditions and latitudes. The data span allows a limited comparison between two subsequent Mars years. In our previous study of atmospheric limb scans from a limited dataset, we discovered a wave-3 structure to the nightglow at equatorial latitudes. For this study, we use scans taken of the full disk of Mars as seen at apoapse over 1.25 Mars years. We observe the same wave-3 structure, but find seasonal and local-time dependencies on position and brightness. We also discovered a wave-2 structure in northern polar regions that persists through all observed local times and seasons. We compare this to a similar feature observed in polar ozone. We compare our observations to model calculations from the LMD-MGCM. We find the model generally under-predicts the brightness of the nightglow at all sub-polar latitudes, suggesting it over-estimates the efficiency of atomic transport to the poles. However, we also find that the model reproduces the observed equatorial wave-3 and polar wave-2 structures. We identify the dominant atmospheric tide component of the equatorial wave-3 structure and analysis of the local-time dependencies of the wave structures and the brightness across all latitudes.