On generation, propagation, and dissipation of gravity waves in the Martian upper atmosphere

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The exosphere is a collision-less region located in the uppermost layer of a planetary atmosphere. Because of efficient dissipation due to molecular diffusion (molecular viscosity and thermal conduction), any small-scale perturbations are expected to be quickly dissipated in the exosphere. However, recent MAVEN/NGIMS observations revealed that small-scale, large-amplitude perturbations are persistent even above the exobase at Mars [cf. Terada et al., 2017]. We have investigated statistical properties of these perturbations using MAVEN/NGIMS data and examined possible generation, propagation, and dissipation mechanisms using DSMC simulations of the Martian upper thermosphere-exosphere [Terada et al., 2016]. Based on MAVEN/NGIMS data obtained along satellite's tracks as well as DSMC simulations of gravity waves and acoustic waves propagating from the lower and middle atmosphere, constraints on the wavelength and frequency ranges of perturbations are obtained, which favor gravity wave modes with a very long vertical wavelength. Also investigated are properties of perturbations generated by precipitating pickup ions with DSMC simulations based on MAVEN parameters. Possible generation, propagation, and dissipation mechanisms of the perturbations in the Martian thermosphere-exosphere are discussed based on these results.

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