



Gravity Wave-Induced Ionospheric Irregularities in the Martian Atmosphere

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For the past few decades, it has demonstrated that gravity waves (GWs) and neutral winds can drive ionospheric irregularities on Earth. Still, as far as we know, the formation of ionospheric irregularity on Mars due to GWs has not been well studied. In this study, we use data from NASA's Mars Atmosphere and Volatile Evolution (MAVEN) mission to show evidence of an irregularity event in the Martian ionosphere, which is potentially seeded by the break of GWs (GWB). The statistical findings indicate that the observed ratio of GWB-related irregularity events varies from ~ 0.25 to 0.57 in each year, and the overall correlation for 2015 to 2020 is ~ 0.37 . Numerical simulations provide further insight into the processes behind irregularities formation, which employs neutral wind shear as a source of perturbation in the context of the GWB. The simulations yield results fundamentally aligned with the observed characteristics of ionospheric irregularities observed in the 2018 event by considering the wind shear as the disturbance source. This study provides supplementary insights into the perturbation sources involved in shaping irregularities within the Martian ionosphere and presents valuable information about the coupling between the Martian ionosphere and the lower atmosphere.