

The contrasting response of the thermosphere and ionosphere to the 2018 global encircling dust storm on Mars

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The 2018 global dust storm on Mars is a rare event that provide a good case for studying atmosphere-ionosphere coupling processes on the red planet. Using both neutral and plasma observations from NGIMS aboard the MAVEN spacecraft, we examine the simultaneous response of the martian thermosphere and ionosphere to the storm event. In particular, we focus on wave signatures in three neutral species (O, Ar, CO₂) and three ion species (O⁺, O₂⁺, CO₂⁺) between 150 and 250 km altitude. The analysis reveals that all ion densities and O decreased during the storm, in contrast to increases in Ar and CO₂. Furthermore, there is significant change in the wave characteristics. In addition to a previously reported enhancement in wave amplitude, we found a large shift of the dominant wavelength towards larger values, from ~100/150 km to ~150/200km for neutrals/ions, along with a significant broadening of the wave spectrum. These changes are likely caused by the filtering effect of the changing middle atmospheric circulation during the dust storm. To further advance our understanding, it is necessary to carry out numerical simulation and also to compare with local dust events.

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