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Oral
(Student Speaker)
Ion species heavier than O?, such as molecular N??, NO?, and O??, as well as metal ions, were observed in the high-altitude regions of Earth's ionosphere and magnetosphere. These ions obtain sufficient energy through effective energization mechanisms, including Suprathermal Electron (SE) impact, and wave-particle interactions (WPI), which are largely associated with the geomagnetic activities and plasma properties experienced by these ions. This study employs the Seven Ion Polar Wind Outflow Model (7iPWOM), a first-principled hybrid model that solves the transport of ionospheric ions with the combination of hydrodynamics and kinetic particle-in-cell (PIC) approaches. The simulations adopted a parameter study to examine the properties of molecular ion outflow in connection with wave energy input. The results indicate that molecular ions are more sensitive to the wave spectrum than other ion species and tend to demonstrate the valve effect, which is a minimum wave energy required to lift the molecular ions against the Earth's gravitational potential. These findings suggest that tracking outflowing heavy species can provide valuable insights into the properties of geospace environments and help determine if Earth-like conditions for habitability are possible.
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