



Vertical propagation of acoustic waves which generate magnetic ripples and electron density fluctuation as observed by Swarm satellites caused by lower atmospheric disturbances

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Cumulative convection and/or strong rain fall in lower atmosphere is expected to generate acoustic mode atmospheric waves which can propagate vertically upward through the ionosphere. In the ionospheric E-region, they are expected to drive field-aligned currents (FACs), and the FACs are observed along the orbit of low-altitude satellites such as the CHAMP or the Swarm satellites as the “magnetic ripples” (Aoyama et al., EPS, 2017). The waves may propagate to upper ionosphere and cause ion and electron density variation through collisions and they are expected to be observed by GPS-TEC observation and by Langmuire probes on board the satellites. In this paper, we analyze the relationship among strong rainfall, micro-barometric and GPS TEC variations, magnetic ripples and electron fluctuations observed by the Swarm satellites. The results strongly support the idea that the vertical propagation of acoustic mode waves from lower atmosphere causes both the magnetic ripples and electron density fluctuations observed in the upper ionosphere.