Intense Stormtime Equatorial Electric Fields and Evidence for Anomalous Resistivity in the Electrojet

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In November 2004, a severe disturbance in the interplanetary electric field led to a magnetic superstorm. The Jicamarca radar registered unusually strong vertical drifts (±120m/s) due to the highest magnitude penetrating electric field ever recorded. These large and variable drifts were highly correlated with the interplanetary magnetic and electric fields, creating a double F layer on the dayside and affecting the development of a convective equatorial ionospheric storm that night. Additionally, the equatorial electrojet (EEJ) was driven at the highest value of the zonal electric field component ever registered. The curiosity is that the current in the electrojet did not register a corresponding increase suggesting a form of anomalous resistivity. We present a possible mechanism to explain them.

The effect of dust particles on the growth time and amplitude of type I and type II irregularities in the E-region

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Two stream and cross-field instability mechanisms operating in the collisional plasma in the E-region of the ionosphere are affected by the ambient dust particles. It is assumed that only electrons are magnetized in this height region. The production of ions and electrons and their loss due to attachment on dust particles are included in the analysis. In the low-density region between E and F layers, density irregularities, ionization and other features are known to be associated with meteors. The extremely low effective conductivity of the mesospheric dusty plasma can explain the existence of vertical electric fields observed in the lower mesosphere, in the vicinity of noctiluscent clouds and polar mesospheric solar summer echoes. We strongly suggest that the observation of persistence of Leonid meteor trails is due to a reduction in the wave amplitudes and their dependent diffusion rate by the process. This reduction is possible due to the presence of sub-micron size dust particles introduced mainly by meteors. We show that due to attachment of both ions and electrons on dusts the two stream instability requires drift velocities much higher than ion acoustic velocities for its onset. The wave growth rate and the amplitude of both Type I and Type II irregularities are modified by the meteoric dust particles by modifying the collision parameters as well as by creating electron bite outs. These studies are important to assess the generation of density irregularities and associated effects, especially during the period of intense meteor showers.