Meteoric dust effects on the electrodynamics of low latitude E-region plasma

Muralikrishna, Polinaya

Electrodynamic processes occurring in the E-region of the equatorial ionosphere can be affected by dust particles of meteoric origin. The dust particles can capture the ambient electrons and cause considerable increase in the loss rate of electrons thus affecting the growth rates and amplitudes of the plasma irregularities. The attachment of electrons on dust particles can increase the threshold velocities needed for the onset of two stream and gradient drift instability mechanisms responsible for the generation of Type I and Type II plasma irregularities respectively, observed in the equatorial E-region plasma. In situ rocket observations also indicate that, under similar ambient conditions, the amplitudes of Type II irregularities observed in the lower E-region are considerably smaller than those observed at higher altitudes. This probably is a direct evidence for the effect of dust particles that dominate the lower E-region altitudes practically all the time. Electric field changes in the low latitude E-Region are attributed to changing neutral winds and to remote causes like the mapping of storm time electric field changes or changes in the neutral winds caused by Sudden Stratospheric Warming (SSW). Variation of electrojet currents is a manifestation of changing electric fields and/or electrical conductivities. Changes in the conductivity parameters, especially in the lower E-region can also be caused by the ambient dust particles of meteoric origin. Statistical studies have shown that the monthly occurrence rate of reversals in the electrojet currents is highly correlated to the monthly mean of meteor showers. This high correlation is seen even during geomagnetically disturbed periods. The meteoric dust particles thus play a very important role in altering the local electrical conductivities in the lower E-region and in controlling the electrodynamic processes in this region.

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