Study of fair- weather atmospheric electrical parameter at Maitri (Antarctica)

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Abstract:

Results of near-surface measurements of atmospheric electric field and meteorological parameters at the Indian Antarctic station, Maitri (lat. 70° 45/ 55// S; long. 11° 44/ 03//; 130 m above mean sea level) during 12 fair weather days of January and February, 2005 are presented. Fair-weather days are considered when there are no low –level clouds, high level clouds are less than 3 octa, wind are moderate (less than 10 m/sec) and there is no precipitation/snow fall. Data are analyzed to study the diurnal variation of electric field and its departure if any from the global electric fields. Fair-weather days are classified in two groups. Group one, when surface temperature varies between – 3 °C and 7 °C and group two when surface temperature during the nighttime is well below the freezing point and temperature varies between - 7 °C and 2 °C. The role of different ion sizes on the Maxwell current density and the air-Earth current density for the two groups are quite different under different conditions. To study the effect of ions on the atmospheric electric fields, ions are grouped as small ions, intermediate ions and large ions. We find that the small and the large ions largely influence the air-Earth current density having correlation coefficient higher than 70 %. The intermediate ions have negative correlation in the case of group one whereas for group two no correlation is found. The diurnal variations of the Maxwell current density and electric field show a peak between 1800 UT and 2000 UT and the nature of variation can be attributed to the variation in worldwide thunderstorm activity. The correlation coefficient between the measured electric field and the electric field from the Carnegie curve is 0.93 with < 0.0001 significance level. Thus, the observed electric field at the Maitri represents the global electric field. The results show that the wind velocity less than 10 m/sec and surface temperature lower than + 7 ^{0}C have almost no impact on electric field and Maxwell current density.