

IN-SITU F-REGION PLASMA MEASUREMENTS OVER INDIAN REGION FROM RPA AERONOMY PAYLOAD ONBOARD SROSS-C2 INDIAN SATELLITE

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ABSTRACT

An Aeronomy payload of Retarding Potential Analyzer (RPA), consisting of an electron RPA, ion RPA and a Potential Probe (PP), developed by National Physical Laboratory, New Delhi was flown onboard the Indian satellite SROSS-C2 in May, 1994. The payload made simultaneous samplings of the electron and ion plasma in the altitude range of 420 – 620 km. The paper presents the highlight of the payload and scientific results on the diurnal and seasonal variability of the plasma parameters ion density (N_i), electron temperature (T_e) and ion temperature (T_i) over the Indian equatorial region

INTRODUCTION

SROSS-C2 was spin-stabilized satellite and placed in an elliptical orbit having inclination of 46.3°. The RPA sensors were mounted on the top deck of the satellite. Moving in cartwheel mode the payload made simultaneous samplings of the electron and ion plasma in the altitude range of 420 - 620. The nominal latitudinal coverage as is 5°N to 30° N and which got extended to 40°S to 40°N during special campaign modes.

I-V characteristic curves of ion and electron RPAs are used for deriving the electron and ion temperatures and ion constituents, O^+ , H^+ , He^+ and O_2^+ . The total ion density and density irregularities are derived from the duct mode ion current collected when the sensor faces the satellite velocity vector. The preliminary results using initial two years of data have already been published. In the present communication, highlights of the results from solar minimum to maximum of the 23rd solar cycle over the Indian region and covering equatorial & low latitudes, are presented.

RESULTS

Electron Temperature (T_e)

Morning shoot out in electron temperature is observed in all seasons touching the values from 3000 to 4000 K or even more after the night-time low values of 800 - 1000 K. Evening enhancement of ~500 to 1500 K is also observed in electron temperature and is prominent during summer and equinoctial months. Morning enhancement is larger during 1995 (solar minimum) and less during 2000 (solar maximum). On the contrary, evening enhancement exhibit quite a different pattern showing lesser values around 1996 and 1997 and maximum during 1995 and 1998.

Ion Temperature (T_i)

Ion temperature is found to be lesser than electron temperature and at all times of the day and in all seasons, with a few exceptions. Morning overshoot and evening enhancement is also seen in ion temperature, though the values are not as high as observed for the electron temperature. The night time mean values of T_e & T_i are higher during solar maximum compared to that during solar minimum.

Ion Density (N_i)

Ion density followed a fixed diurnal pattern in all the seasons, with a minimum density varying between few parts in 10^9 to $1 \times 10^{10} / m^3$ at around 03 to 04 LT. The local time at which maximum ion density reached varied from season to season. The value of peak ion density varied from 1×10^{11} to $3 \times 10^{12} / m^3$. In general an inverse relation is found to exist between ion temperature and ion density

Heavy Ions

During meteor shower events heavy metallic ions like iron, cobalt, magnesium and calcium were detected in the height region of 400 to 600 km. Although the number density of these ions are very small (about $100 / cm^3$), the existence of these heavy elements at those altitudes remained to be explained.

Conclusion

The SROSS-C2 data will be of a great help in any modelling effort of the ionosphere over low and equatorial latitudes, particularly over the Indian longitude sector.