

***In-situ* F-region plasma measurements over Indian region from SROSS series of Indian satellites: A review**

S. C. Garg(1), P. Subrahmanyam(1) , M. Bahl(1), , H. K. Maini(1), T. John(1) , P. Chopra(1), Vishram Singh(1), Dhan Singh(1), U. N. Das(2) & A. R. Jain(1)

(1) National Physical Laboratory, New Delhi- 110 012, India

(2) ISRO Satellite Centre, Airport Road, Bangalore, 560 067, India

In-situ measurements of F-region plasma parameters were made over the Indian region for about a decade using the Ion & Electron Retarding Potential Analysers (RPA) aboard Indian satellites SROSS-C and SROSS-C2 during — solar cycle. I-V characteristic curves of ion and electron RPAs are used for deriving the electron and ion temperatures and ionic constituents, O^+ , H^+ , He^+ and O_2^+ . The total ion density and density irregularities are derived from the ion current. SROSS-C mission yielded data in the F region bottom side from 370 Km down to 200 Km during 1992 & SROSS-C2 in the altitude range from 620 km down to 400 km during 1994-2001 period. NPL led a team of scientists from several universities in analysing about 4000 orbits of RPA data. In the present communication highlights of the scientific results from this mission are reviewed.

- The initial settling orbit of SROSS-C2 was 930 km X 430 km during 1994. The upper transition height (H_t), derived from heavier ions O^+ and lighter ions ($H^+ + He^+$), was computed over equatorial and low latitudes. H_t reaches a maximum of around 910 km during afternoon hours and reached a minimum value of about 550 km during midnight hours.
- Ion density followed a fixed diurnal pattern in all the seasons, with a minimum density varying from $\sim 1 \times 10^9 / m^3$ to $\sim 1 \times 10^{10} / m^3$ before local sunrise. The local time at which maximum ion density reached varied from season to season. The peak ion density varied from $1 \times 10^{11} / m^3$ to $3 \times 10^{12} / m^3$.
- Morning shoot out in electron temperature is observed in all seasons touching the values from 3000 K to 4000 K or even more after having the night-time lower values of 800 K - 1000 K. Evening enhancement of ~ 500 K to 1500 K is also observed in electron temperature. Morning overshoot and evening enhancement is also seen in ion temperature with a lesser prominence
- A comparison of ion and electron parameter measurements from SROSS-C2 with IRI model show that IRI over estimates electron and ion temperatures (T_e , T_i) for all local times and latitudes. IRI also overestimates electron density (N_e) for all local times and all seasons.

- Very steep plasma depletion occurrences near the magnetic equator in the pre-midnight hours were recorded by SROSS-C and later by SROSS-C2. These always exist northward of the magnetic equator extending to 20°N.
- The spectral analysis of time series of Te and Ti using Fourier and wavelet techniques reveal the presence of quasi periodicities, such as 14-day, 19-day, 27-day, 55-day, 154-day, 180-day, 1-year and 1.3 year periods.
- Latitudinal ion distribution during magnetic storms from ion RPA data demonstrate that EXB drifts along with meridional winds contribute significantly to the redistribution of ionization at low and equatorial latitudes.
- During meteor shower events heavy metallic ions like iron, cobalt, magnesium and calcium were detected in the height region of 400 km to 600 km. The number density of these ions is about $100 / \text{m}^3$.

Irregularity scale sizes encountered by SROSS-C2 matched with those measured by geo stationary INMARSAT during October 1994. The scale sizes are of the order of 317