Longitudinal dependence of prereversal enhancement of equatorial ionospheric vertical plasma drifts

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The ISS-b satellite made topside soundings from 1978 through 1981, during the solar maximum period. F region ionospheric critical frequencies were scaled manually, but whole traces of the echo have not been processed yet. Recently electron densities at the satellite height were evaluated with the aid of an artificial neural network technique. This allows to reprocess whole observation data, i.e., 150,000 ionograms.

Local time vs. magnetic latitude distribution of the in-situ electron density is obtained. Two diurnal peaks of the density at the magnetic equator are clearly shown, which correspond to the daytime upward EXB drift and the evening prereversal enhancement. Regarding the evening maximum, longitudinal dependence is examined. First, global maps are drawn using the data set for each local time hour (+/- 1.5 hour). Then differentials are calculated between the maps of consecutive local times to examine temporal evolutions.

Although the topside electron density contains information on the vertical EXB drift, it is indirect as there coexists redistribution of the plasma by the diffusion along the magnetic field line. In order to interpret the global distribution maps, we made ionospheric model calculations using the empirical models for the vertical drifts and neutral winds. The calculations show that the local time of the equatorial electron density maximum in the topside coincides with the reversal time of the vertical drift, while the rate of temporal change in the electron density corresponds to the peak value of the drift enhancement. By the help of the model calculations, we conclude that the reversal time of the vertical drift is controlled by the declination angle of the earth's magnetic field line, while the amplitude of the enhancement is somewhat complicated as controlled both by the declination and by the offset of the magnetic and geographical equators.