

Initial Results of DC Electric Fields, Associated Plasma Drifts, Magnetic Fields, and Plasma Waves Observed on the C/NOFS Satellite

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Initial results are presented from the Vector Electric Field Investigation (VEFI) on the Air Force Communication/Navigation Outage Forecasting System (C/NOFS) satellite, a mission designed to understand, model, and forecast the presence of equatorial ionospheric irregularities. The VEFI instrument includes a vector DC electric field detector, a fixed-bias Langmuir probe operating in the ion saturation regime, a flux gate magnetometer, an optical lightning detector, and associated electronics including a burst memory. Compared to data obtained during more active solar conditions, the ambient DC electric fields and their associated $\mathbf{E} \times \mathbf{B}$ drifts are variable and somewhat weak, typically < 1 mV/m. Although average drift directions show similarities to those previously reported, eastward/outward during day and westward/downward at night, this pattern varies significantly with longitude and is not always present. Daytime vertical drifts near the magnetic equator are largest after sunrise, with smaller average velocities after noon. Little or no pre-reversal enhancement in the vertical drift near sunset is observed, attributable to the solar minimum conditions creating a much reduced neutral dynamo at the satellite altitude. The nighttime ionosphere is characterized by larger amplitude, structured electric fields, even where the plasma density appears nearly quiescent. Data from successive orbits reveal that the vertical drifts and plasma density are both clearly organized with longitude. The spread-F density depletions and corresponding electric fields that have been detected thus far have displayed a preponderance to appear between midnight and dawn. Associated with the narrow plasma depletions that are detected are broad spectra of electric field and plasma density irregularities for which a full vector set of measurements is available for detailed study. Finally, the data set includes a wide range of ELF/VLF/HF oscillations corresponding to a variety of plasma waves, in particular banded ELF hiss, whistlers, and lower hybrid wave turbulence triggered by lightning-induced sferics. The VEFI data represents a new set of measurements that are germane to numerous fundamental aspects of the electrodynamics and irregularities inherent to the Earth's low latitude ionosphere.