Electric field and Plasma Density Structures and Irregularities Gathered in the Low-Latitude Ionosphere with the VEFI instrument 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. The DC electric field detector has revealed zonal and meridional electric fields that undergo a diurnal variation, typically displaying eastward and outward-directed fields during the day and westward and downward-directed fields at night. In general, the measured DC electric field amplitudes are in the 0.5-2 mV/m range, corresponding to **E** x **B** drifts of the order of 30-150 m/s. What is surprising is the high degree of large-scale (10's to 100's of km) structure in the DC electric field, particularly at night, regardless of whether well-defined spread-F plasma density depletions are present. 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. On some occasions, localized regions of low frequency (< 8 Hz) magnetic field broadband irregularities have been detected, suggestive of filamentary currents, although there is no one-to-one correspondence of these waves with the observed plasma density depletions, at least within the data examined thus far. Finally, the data set includes a wide range of ELF/VLF/HF waves 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 set represents a treasure trove of measurements that are germane to numerous fundamental aspects of the electrodynamics and irregularities inherent to the Earth's low latitude ionosphere.