An Electromagnetic Component for the Rayleigh-Taylor Instability: Evidence from the C/NOFS Satellite

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The Communication/Navigation Outage Forecasting System (C/NOFS) has ground and space-based components designed to specify the dynamics of the low-latitude ionosphere. The ground component consists of the widely distributed Scintillation Network Decision Aid (SCINDA) stations equipped with UHF and/or L-ban receivers. The C/NOFS satellite is flying in a 13° inclined orbit with apogee and perigee of approximately 850 and 400 km, respectively. Its sensor payload includes a planar Langmuir probe (PLP), an ion drift meter as well as a three-axis double probe and a triaxial fluxgate magnetometer to measure variations in local electric and magnetic fields. The PLP makes 1000 measurements of plasma densities per second and reports them at cadences of 1 Hz and 1 kHz. Here we discuss implications of plasma and field measurements acquired by the C/NOFS satellite near and above h_{mF2} during an eight-hour period on 13 – 14 January 2010 when strong 250 MHz scintillation activity was observed at nearby SCINDA ground stations. The PLP and double probes consistently detected small-scale density and electric field irregularities embedded within large-scale (~100 km) structures. *In situ* irregularities were encountered at the magnetic longitudes of the SCINDA sites. Significant spectral power was measured at the approximate Fresnel scale size (1 km) and suggests that C/NOFS was magnetically conjugate to bottomside irregularities similar to those directly responsible for observed scintillations. Simultaneous ion drift and plasma density measurements indicate three distinct types of large-scale irregularities: (1) upward moving depletions, (2) downward moving depletions, and (3) upward moving density enhancements. The first type has the characteristics of equatorial plasma bubbles; the second and third do not. These observations raise the question: "How do plasma density irregularities develop in linearly stable layers of the ionosphere?" The data suggest that both they and embedded small-scale irregularities may be regarded as Alfvénic images of bottomside irregularities. This interpretation is consistent with simultaneous C/NOFS electric and magnetic field power spectral densities as well as with previously reported theoretical modeling predictions of and with satellite observations of upward directed Poynting flux in the low-latitude ionosphere.