C/NOFS In situ and Beacon Measurements during the main phase of the first magnetic storms within solar cycle 24

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Abstract

The objective of the study is to utilize the high resolution PLP and the beacon on the C/NOFS satellite to determine the impact on the equatorial ionosphere of two moderate magnetic storms during solar cycle 24. These two storms perturb various SCINDA sites at dusk. The in-situ C/NOFS data allows the tracking of the plasma bubbles on a global scale. The spectral analysis of the PLP data shows interesting variation in the spectral shapes depending on its location with respect to the bubbles. Current analysis is ongoing to determine the impact of the spectral shapes on UHF scintillations from C/NOFS.

Summary

Two moderate magnetic storms with their Dst minima on the order of -75nt were observed during the rising phase of the solar cycle 24 in 2010. The objective was to utilize the high resolution Planar Langmuir Probe (PLP) and the beacon on the C/NOFS (Communication/Navigation Outage Forecasting System) satellite to determine the impact on the equatorial ionosphere of these moderate magnetic storms. A statistical study for solar cycle 23 has shown that during large magnetic storms with Dst < -100 nT and dDst/dt >50nt/hour, scintillations and plasma bubbles occur over a specific longitude sector for which the evening period corresponds to the time interval of the main phase of storms (S. Basu et al., Radio Science, 2010). This was attributed to the penetration of the high latitude electric field to the magnetic equator which enhanced the rise in the F-region at dusk thereby generating the instability that gives rise to plasma bubbles. This statistically significant result is important for predicting the onset of scintillations in the equatorial region during magnetic storms. The scintillations observed for the magnetic storms during solar cycle 24 did not require a large rate of change of the Dst index leading to the implication that smaller electric field perturbations were sufficient to destabilize the ionosphere which has been cooled and contracted by the preceding unusually long and quiet sunspot phase. We will present two storms, one of which perturbs the SCINDA (Scintillation Network Decision Aid) sites in the African/American sector and the other one which perturbs the Pacific sector site, both at dusk. The outstanding addition to our study in this case is the availability of the in situ C/NOFS data allowing the tracking of the plasma bubbles on a global scale, something that has not been done using a low-earth orbit satellite in equatorial orbit, particularly during magnetic storms. The spectral analysis of the 512 Hz PLP data done using the MEM technique has shown interesting variation in the spectral shapes depending on its location with respect to the bubbles. Current analysis is ongoing to determine the impact of the variability of the in-situ spectral shapes on scintillations, in particular on the phase scintillation of the UHF beacon on C/NOFS.

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