

Very Large Array Observations of Disturbed Ion Flow from the Plasmasphere to the Nighttime Ionosphere

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We present the results of a multi-scale analysis of TEC fluctuations using a roughly five-hour observation of the bright radio source Virgo A with the Very Large Array (VLA) at 74 MHz in its B configuration. Our analysis combines data sensitive to fine-scale structure (~ 10 km and < 0.001 TECU in amplitude) along the line of sight to Virgo A as well as larger structures (hundreds of km) observed using several (~ 30) moderately bright sources in the field of view. The observations span a time period from midnight to dawn local time during 1 March 2001. Several groups of magnetic eastward directed (MED), wavelike disturbances were identified and determined to be located within the plasmasphere ($2.1 < L < 2.9$). We have also detected evidence of non-wavelike structures associated with these disturbances which are propagating roughly toward magnetic north. These likely represent a non-uniform density flow from the plasmasphere toward the nighttime ionosphere. AE and Kp indices and GPS TEC data indicate that during the observations, there were low levels of geomagnetic activity accompanied by somewhat localized depletions in ionospheric density. Thus, the observed plasmaspheric disturbance may be part of a flow triggered by these ionospheric depletions, likely associated with forcing from the lower atmosphere which is typically more prominent during quiet geomagnetic conditions. In addition, we have also observed several roughly westward directed and southeast directed waves located within the ionosphere. They are coincident in time with the plasmaspheric disturbances and may be related to the deposition of material onto the nighttime ionosphere.

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