EQUATORIAL PLASMA BUBBLE DEVELOPMENT DUE TO MAGNETOSPHERIC FORCING

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Past studies of the influence of magnetospheric forcing on the evolution of equatorial plasma bubbles (EPBs), which have used ground-based or in situ observations, have focused on the precursory aspects of the altered ambient ionospheric conditions due to magnetospheric forcing. An enhancement of eastward electric field in the nighttime equatorial ionosphere due to a magnetic storm or substorm has often been found to be associated with the generation of EPBs, which gave rise to scintillations on trans-ionospheric radio signals. Three dimensional modeling of the non-linear evolution of EPBs during storm time conditions has shown that evolution of EPBs under these conditions is on a much faster time scale than in the quiet time case (Keskinen et al., 2006). We have used ionospheric scintillation data recorded by spaced receivers at an equatorial station to study the evolution of EPBs generated due to magnetospheric forcing. Results indicate that for EPBs generated specifically due to magnetospheric forcing, the power spectrum of weak amplitude scintillations on a VHF signal differs significantly from that found during magnetically quiet times. The large shift in the Fresnel frequency towards lower values is due to increased height of the irregularity layer due to more rapid ascent of an EPB generated due to magnetospheric forcing and a reduced zonal drift of the irregularities due to disturbance dynamo effects. Thus, although there may be greater generation of irregularities in the intermediate scale length (~ 100m to few km) range in the disturbed nighttime equatorial ionosphere, due to lower electrical conductivity of the conjugate E regions coupled with the equatorial F region through geomagnetic field lines as well as the enhanced height of the equatorial F region, the above shift in the Fresnel frequency implies that EPBs generated due to magnetospheric forcing are less likely to cause loss of lock of GPS receivers than quiet time EPBs.

Equatorial plasma bubbles, magnetospheric forcing

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