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Equatorial evening prereversal vertical drift and spread F/plasma bubble irregularity developments under disturbance time electric fields and winds

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Equatorial plasma bubble/spread F (EPB/ESF) irregularity development can suffer large variability on a day-to-day basis due to the highly variable dynamic state of the evening ionosphere. An important cause of the ESF variability lies in the prereversal enhancement in the F region vertical plasma drift (zonal electric field), that is subject to large modifications under forcing from magnetospheric disturbances, when penetrating inter-planetary electric fields, and disturbance dynamo electric field, cause large enhancement, or total suppression, of the PRE, and hence of the ESF development. Additionally the disturbance meridional/ trans-equatorial wind can cause total suppression of the ESF development independent of the modification of the PRE vertical drift. Many details regarding the nature of the impact of the penetration electric fields on the PRE vertical drift and that of the disturbance winds on ESF growth lack our understanding. In this paper we have analyzed data on F layer heights and vertical drifts obtained from Digisondes operated in Brazil, including from conjugate point observations, to investigate the connection between magnetic disturbances occurring during and preceding the sunset hours and the consequent variabilities in the PRE vertical drift and EPB/ESF development. The impact of the prompt penetration under-shielding eastward electric field and that of the over-shielding, and disturbance dynamo, westward electric field on the evolution of the evening PRE vertical drift, and that of disturbance meridional/trans-equatorial wind on EPB/ESF development are briefly examined.

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