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Modelling of ionospheric Medium Scale Travelling Disturbances and a comparison with simultaneous ground-based TEC measurements and DEMETER plasma observations at 650 kilometres

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Medium-scale Travelling Ionospheric Disturbances (MSTIDs) are quasi periodic ionospheric disturbances with typical periods of 15 to 60 minutes and wavelengths of several hundreds of kilometers. They are triggered by Atmospheric Gravity Waves (AGWs) mostly generated at high latitudes. Simultaneous measurements of the Total Electron Content (TEC) by the US dense GPS receiver network and of the thermal ions by the CNES DEMETER micro-satellite at 650 km altitude have provided several examples of MSTID and shown typical variations of the ion density and velocity component parallel to the Earth's magnetic field during these events. A quantitative interpretation of such ionospheric disturbances has been undertaken by means of the SAMI2 ionospheric model. A representative pattern of an Atmospheric Gravity with a wave velocity toward the equator was developed to infer the variations of the neutral density and of the meridional component of the neutral velocity. These variations are introduced in the model and directly couples with the ionospheric plasma in the collisional region of the ionosphere. At higher altitudes, when the neutral atmosphere is too faint to have a direct effect on the ions, the resulting plasma disturbance propagates along the magnetic field lines. The computed variations of the plasma parameters along the orbit of DEMETER and of the TEC are analyzed for various parameters of the Atmospheric Gravity Wave. They are compared to the GPS-TEC and DEMETER observations in order to retrieve the AGW characteristics and study the propagation mechanism of the ionospheric plasma disturbance.