FPI observations of nighttime thermospheric winds and temperature over Oukaimden observatory and their comparisons with thermospheric models: HWM14, NRLMSIS-00, TIE-GCM and GITM

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The subject matter of our work is the analysis of the nighttime horizontal neutral winds and temperature in the thermosphere ($\sim$ 250 km) derived from a Fabry-Perot interferometer (FPI) installed at Oukaimden observatory in Morocco (31.206 N, 7.866 W; 22.84 N magnetic), during three years of measurements from 2014 until 2016. The seasonal and solar cycle dependencies of the winds and the temperature have been discussed. Observations confirm that the horizontal winds are dominated by seasonal effects, the equatorward components are stronger through spring and summer, whereas the eastward component reaches there maximum during the locale winter and autumn. However, the temperature has a strong solar cycle dependence, where the measurements show a considerable variation between 2014 and 2016, which can reach 200k.
Comparison of the observed seasonal climatologies of neutral winds and temperature to that provided by four different models; the empirical models, 1) Horizontal Wind Model (HWM14), 2) The Mass-Spectrometer-Incoherent-Scatter model (NRLMSIS-00), and two physics-based models, 3) the Global Ionosphere Thermosphere Model (GITM) and 4) the Thermosphere Ionosphere Electrodynamics General Circulation Model (TIE -GCM) are provided. We found a noticeable dependence of the models performance on the seasonal variation where HWM14 and TIE-GCM show a good agreement with measured climatologies during winter and autumn. We have also noted that the models predict better meridional winds than zonal ones. All the models have predicted the solar cycle impact on thermospheric temperature. HWM14 and TIE-GCM models agree well with the measured temperature. Whereas, GITM greatly overestimates the measured temperature.
In order to preview the models response to the geomagnetic storms, we have compared the disturbance winds and temperature predicted by the four models with the observed measurements during the 27-28 February 2014 geomagnetic storm. Comparison results show that the TIE-GCM model predictions are generally in good agreement with measured winds especially the zonal one, while it underestimates the temperature enhancement caused by this storm. On the other hand, GITM

showed a more or less satisfactory response to temperature changes during the storm compared to other models.