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Zonal Winds in the Equatorial Upper Thermosphere: Climatology and Longitudinal Variation

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This study utilizes three years of continuous wind measurements from the accelerometer on board the CHAMP satellite to decompose the seasonal, geomagnetic, and solar flux influences on the equatorial zonal wind in the upper thermosphere. Several main features are noticed. (1) The solar flux significantly influences both the day- and night-time winds. It overrides the geomagnetic activity effect, which is found to be rather limited to the night side. An elevation of the solar flux level enhances the night-time eastward wind, but suppresses the day-time westward wind. (2) A seasonal variation with weaker wind around June solstice than in other seasons has been observed regardless of solar flux and geomagnetic activity levels. (3) The day-time wind is found to be generally more stable than the night-time wind, particularly unresponsive to geomagnetic activities. Predictions from the Horizontal Wind Model find good agreement with the CHAMP-observed wind at high solar flux levels during night time. Major deviations are seen at low solar flux levels and on the day side, most of which can be readily explained with the limitation of the data set used by the model. Comparisons with ground FPI observations and the NCAR Thermosphere-Ionosphere-Electrodynamics General Circulation Model (TIEGCM) predictions show that the solar flux effect obtained from CHAMP is consistent with that modeled by TIEGCM. Furthermore, these wind measurements indicate that the Earth's atmosphere superrotates, and the superrotaion is faster at higher solar flux levels. Finally, the night-time zonal wind has largest velocity at the geomagnetic equator compared to other latitudes. Consequently, at the geographic equator, the zonal wind experiences largest longitudinal variations