Solar activity dependence of the electron density at equatorial and low latitudes

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We have investigated the solar activity dependence of the electron density at equatorial and low latitudes using six years of measurements between Aug.˜1, 2000–Aug.˜1, 2006 from the CHAMP satellite, and compared it with the International Reference Ionosphere model (IRI). The solar activity dependence observed by CHAMP at 400 km altitude exhibits significant variation with latitude, season and local time. First, the electron density in the crest regions of the Equatorial Ionization Anomaly (EIA) grows roughly linearly from solar minimum to solar maximum, with higher growth rate than that in the EIA trough region. Second, the solar activity dependence in the EIA crest regions varies strongly with season. The growth rate of with increasing solar activity around equinoxes is about 1.5 to 2 times of that around solstices. Third, the solar activity dependence of the EIA structure varies significantly with local time. In the noon sector, the crest-to-trough ratio (CTR) obtained at 400 km altitude varies within only a small range between 1.14 and 1.43 from solar minimum to solar maximum. In the post-sunset local time sector, however, the CTR grows remarkably with solar activity level, reaching values of above 3.9 at solar maximum. These differences are attributed to the different solar activity dependence of the vertical plasma drift in corresponding local time sectors. The IRI model was found to reproduce well the equatorial electron density near 400 km in the noon sector at all solar activity levels. However, it significantly overestimates it in the post-sunset sector. The CHAMP-IRI comparison indicates that IRI's representation of the post-sunset maximum height of the F2 layer (hmF2) at the dip equator seems to fall significantly below the true hmF2.