Solar activity variations of the equatorial ionization anomaly

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Abstract. The equatorial ionization anomaly (EIA) is a phenomenon that is characterized by trough in ionization densities near the geomagnetic equator and duo crests on either side of the dip equator at roughly ±15 degrees magnetic latitudes. In this work, we have used International Reference Ionosphere (IRI) maximum plasma density of F2 layer (NmF2) to investigate the solar activity variations of EIA along longitude 358.48 degrees east at four levels of F10.7 solar ionizing flux namely 70 solar flux units (sfu), 80 sfu, 150 sfu, and 180 sfu corresponding to very low, low, moderate, and high solar activity conditions, respectively. We considered fixed local time (2100 SLT) and 350 km altitude corresponding to bottomside F-region and four seasonal periods: March, June, September, and December. The diurnal patterns of NmF2 obviously increase with increasing solar ionizing flux for all seasons. March NmF2 is found to be significantly higher in values than September NmF2, whereas the magnitude of NmF2 are comparable in June and December at each level of solar activity. On solar cycle scale, we found EIA signature during solar cycle 23 (1996-2008) with NmF2 depletion seen in the year 2001 and peaks occurring in the year 2000 and 2002 with correlation (NmF2, F10.7) of 0.9653 and correlation (NmF2, Sunspot Number) of 0.9480. Latitudinal variation of NmF2 exhibits different characteristics for different value of solar flux. EIA is well formed and asymmetric about magnetic dip equator during March moderate and high solar flux conditions and strongest during March high solar activity conditions with Northern and Southern crest position occurring at 12.86 and 15.63 degrees dip latitude, respectively, while Northern and Southern NmF2 are comparable at about 28×10^{11} el/m^3 and NmF2 trough of approximately 11×10^{11} el/m^3. We show that NmF2 versus F2 peak height (hmF2) and dip latitude (within ±20 degrees) indicates strong solar flux dependence. In addition, we demonstrate that hmF2 is solar and seasonal dependence from about +10 degrees dip latitude.