



Middle-latitude band structure observed in the nighttime ionosphere

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The characteristic of the nighttime middle-latitude ionosphere especially at the topside region has not been well understood. In this study, the Constellation Observing System for Meteorology, Ionosphere, and Climate (COSMIC) electron densities from 200 to 800 km during 2006-2017 are used to investigate the global distribution, vertical structure, solar activity dependence, and temporal evolution of the middle-latitude band structure of the nighttime ionosphere. The main results of this study are as follows. (1) In the nighttime, the electron density (N_e) at $\pm 40^\circ$ geomagnetic latitudes is generally greater, especially in the topside ionosphere. (2) Double bands of greater N_e are seen at all longitudes during the equinoxes, while only one latitudinal band is clearly visible at specific longitudes in the winter hemisphere during the solstices. (3) The middle-latitude band structure of the topside ionosphere is more pronounced at later local times (LTs) at night and under lower solar activity. (4) The middle-latitude band structure is mainly formed as a result of long-duration maintaining of N_e from 23 to 05 LT accompanied with the uplift of peak height of the F2 layer. (5) The N_e at the latitudinal bands and plasmaspheric total electron content (TEC) at low latitudes show consistent longitudinal variations. (6) The middle-latitude band structure tends to occur at the longitudes with upward field-aligned winds at middle latitudes in both hemispheres. (7) The middle-latitude band structure is probably associated with the combined effect of the equatorward neutral winds and plasma diffusion from the plasmasphere.