The main ionospheric trough behavior seen from the in-situ and radio measurements

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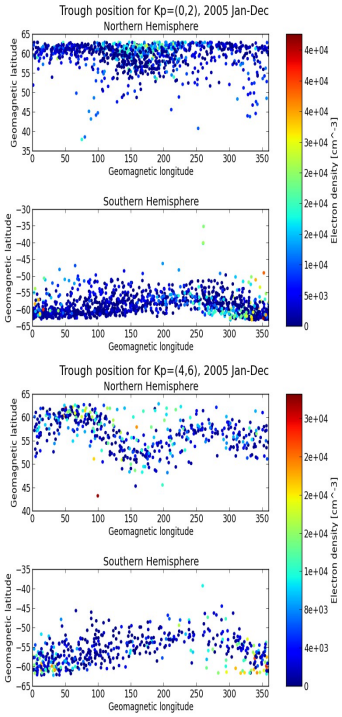
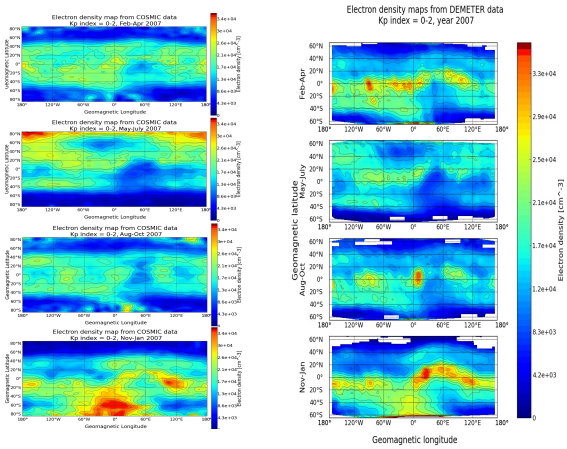
The main ionospheric trough (MIT) is large structure observed in mid-latitude area of Earth's ionosphere. It is depleted region of ionospheric plasma typical for the topside ionosphere, especially F layer, where electron density level can significantly decrease as compared to densities measured for adjoining sub-auroral and equatorial regions. The MIT itself and its variability strongly affect the propagation of different natural and artificial signals thus its characteristic is important for radio communication and for communication and space industry in general. We compared data from in-situ measurements collected onboard DEMETER satellite and electron density profiles obtained from radio occultation method used by FORMOSAT-3/COSMIC mission to study the nature of MIT and its behavior during different seasons and magnetic conditions. This paper presents the results obtained in both geographic and magnetic system at fixed local time.



The main ionospheric trough structure moves to the lower latitudes with both increasing level of geomagnetic activity and with increasing time interval from the local magnetic midnight. DEMETER data, analyzed orbit by orbit, show well how the magnetic conditions influence the trough morphology and dynamics, even during solar activity minimum. Figures on the right present the trough position under different magnetic conditions, featured here by Kp index. For quiet period (Kp about 0-2) in 2005 the trough is located at about 62° magnetic latitude North and South, which is recognized as typical location for MIT occurrence. As the geomagnetic activity increases (Kp about 4-6) the trough moves equatorward and can be observed even at 50-55°.

Structure of the mid-latitude trough is sensitive to insolation conditions and shows strong correlation of its characteristic with different seasons. The most significant feature is that during local winter the trough structure on both hemispheres becomes clearly visible and deeper than in other seasons. Data from both missions were used to create electron density maps and compared to find seasonal characteristic and behavior of the trough. Figures at the bottom shows how MIT structure changes during various seasons in 2007.



Our analysis showed that data from both missions (DEMETER, FORMOSAT-3) are in good agreement and give opportunity to complement studies of the main ionospheric trough structure by using different measurement techniques.