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Seasonal, Equinox and Solstice Variations of the Ionosphere over Turkey

Abstract:
The ionosphere is a region of the upper atmosphere, from about 50 km to 1000 km altitude. Due to its space-time variability and dispersive nature, inhomogeneity and anisotropicity, ionosphere plays an important role in High Frequency (HF) and satellite signal propagation. Since it responds to solar EUV radiation, the ionosphere varies with multiple temporal scales such as diurnal, seasonal, annual and 11-year cycle of solar activity. Ionosphere also varies with irregular temporal and spatial dynamic processes, known as ionospheric disturbances and anomalies.

The sun can vary the structure of the ionosphere in winter and summer seasons and special periods in a year such as equinoxes and solstices. The dynamic processes can cause density depression in the form of “bite-out” in the ionosphere.

Total Electron Content (TEC) is an important observable that represents the variability characteristics of the ionosphere. TEC is proportional to the total number of electrons on a path crossing the atmosphere. TEC measurements can be obtained by Global Positioning System (GPS) using the network of world-wide receivers.

In this study, by using IONOLAB-TEC (www.ionolab.org), GPS-TEC values are estimated for each chosen special periods of 10-30 days for winter and summer and before and after the equinoxes and solstices between May 2009 and September 2012. In this study, the behavour of the ionosphere in the winter and summer and solstice and equinox periods are examined for the solar minima and maxima periods using Symmetric Kullback-Leibler Distance (SKLD).

It is observed that the days between March and September and June and December are different from each other in geomagnetically quiet periods. When a disturbance occurs in the ionosphere, the difference between the same periods of the different years increases.

The seasonal variability and anomaly structures are distinguished from each other by fusion of metric distance and correlation coefficient measures. Within-the-hour occurance and duration of disturbances are examined by computing experimental probability densities of disturbances.

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