Abstract

TEC and Space Weather is a very important descriptive quantity for the ionosphere of the Earth. Some of its spatial and temporal fluctuations are strongly related to space weather. TEC is generally defined as a propagation effect which is observed on received radio signals which are transmitted from artificial satellites. TEC maps were collected in Europe systematically and on a long-term basis since 1965. The data are used to investigate geographical events, e.g., the Space Weather related storm effects. They are also used to form empirical models which are used to forecast Space Weather parameters. The TEC maps are produced in European TEC model, adopted by COST 251. They are also used to formulate empirical models which are observed on received radio signals which are transmitted from artificial satellites. TEC data have been collected in Europe systematically and on a long-term basis since 1965. The data are used to investigate geographical events, e.g., the Space Weather related storm effects. They are also used to form empirical models which are used to forecast Space Weather parameters.

Electron content on geographic latitude, longitude and time. As for the ionosphere in general we distinguish between three latitudinal regions:

- High latitudes.
- Mid latitudes and
- Low latitudes.

The configuration of the geomagnetic field is used to distinguish between these regions: the center of "low latitudes" is the "dip equator", whereas the "invariant magnetic coordinates" or "dipole coordinates" are used to separate mid from high latitudes.

The spatial scales range from "large" (e.g., 100 km) to "small" (e.g., 1 km). The large scale to medium scale TEC "structures" give the "background" which is often used to characterize the status of the ionosphere by means of empirical "models" with resolutions of a few degrees in latitude and longitude. Superimposed on the "background" are smaller scale structures. A persistent one is the "enhanced TEC region", which is identified in maps and time series of TEC data. TEC variations are strongly related to Space Weather parameters. The TEC maps are used to investigate geographical events, e.g., the Space Weather related storm effects. They are also used to form empirical models which are used to forecast Space Weather parameters.

Time dependence of Electron Content (TEC)

In the time domain we have to make a clear distinction between:

- Short term variability (time scales < 1 hour)
- Diurnal variation (24 hours and harmonics)
- Seasonal variation (months)
- Solar activity dependence (11 years "cycle" and cycle to cycle differences)
- Long term trends.

It is usual to separate the "regular" behaviour from any "fluctuations". Various smoothing procedures can be applied to separate these two parts. For example, the seasonal variation, the solar activity dependence, and long term trends are investigated by inspecting monthly medians of electron content. Except for "small scale TID" and "geomagnetic modulations" most of the "fluctuations" are Space Weather related and can be used as Space Weather Indicators and Triggers.

The strongest TEC related "geophysical events" are Magnetic Storm Effects. Especially strong magnetic storms and their ionospheric signatures are part of the "Space Weather event chains" which originate in the atmosphere of the sun end in the biosphere.