



## Space Weather Activities of IONOLAB Group: IONOLAB-TEC

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Space Weather (SW) is the concept of changing environmental conditions in outer space and affect Earth and its technological systems. SW is a consequence of the solar activities and the coupling of solar energy on Earth's atmosphere due to the Earth's magnetic field. The monitoring and prediction of SW has utmost importance for HF communication, Satellite communication, navigation and guidance systems, Low Earth Orbit (LEO) satellite systems, Space Craft exit and entry into the atmosphere. Ionosphere is the plasma layer of the atmosphere that is ionized by solar radiation and it is a key player of SW. Ionosphere is a temporally and spatially varying, dispersive, anisotropic and inhomogeneous medium that is characterized primarily by its electron density distribution. IONOLAB is a group of researchers of various disciplines, getting together to handle challenges of the Earth's ionosphere. The team has researchers from Hacettepe University and Bilkent University, Department of Electrical and Electronics Engineering and General Command of Mapping of Turkish Army. One of the most important contributions of IONOLAB group is the automated web-based computation service for Total Electron Content (TEC). TEC corresponds to the line integral of electron density distribution on a given path. TEC can also be expressed as the amount of free electrons within 1 m<sup>2</sup> cross-sectional area of the cylinder on the ray path. Global Position System (GPS) provides a cost-effective medium for monitoring of ionosphere using the signals recorded by stationary GPS receivers in estimating TEC. IONOLAB group has developed IONOLAB-TEC for reliable and robust estimates for all latitudes and both calm and disturbed days by using RINEX, IONEX and satellite ephemeris data provided from the IGS centers. IONOLAB-TEC consists of a regularized signal estimation algorithm which combines signals from all GPS satellites for a given instant and a given receiver, for a desired time period or for 24 hours, with 30 s time resolution. IONOLAB-TEC values also include the receiver differential code bias (DCB) for each GPS station estimated uniquely by the IONOLAB-BIAS algorithm. The web based computation program is written in JAVA and it is provided both in Turkish and English at [www.ionolab.org](http://www.ionolab.org). The IONOLAB-TEC computation requires no installation or licensing on the client side. The application has a layered design. Developed components are modular that allows possible changes regarding the estimation method can be easily adapted. Same flexibility is also provided for the data access. Also, presentation of estimation data is architected to support different client types. Currently, the user can login to the IONOLAB-TEC web site and choose the desired location and dates on-line for TEC estimation. The carrier phase leveled TEC estimates of IONOLAB-TEC are provided for the chosen station/s and for the chosen day/s along with two-hourly GIM-TEC estimates of IGS centers. The output is provided in the user designated form either in graphs or an excel data sheet. The IONOLAB-TEC provides robust, reliable, and high resolution TEC estimates and provides a medium for comparison of the GIM-TEC values from the IGS centers.