

Institute of Communications and Navigation of the German Aerospace Center (DLR)

DLR is Germany's national research centre for aeronautics and space. Its extensive research and development work in aeronautics, space, transportation and energy is integrated into national and international cooperative ventures. As Germany's space agency, the German federal government has given DLR responsibility for the forward planning and implementation of the German space programme as well as international representation of Germany's interests.



Fig. 1: Working group "Ionospheric Effects and Mitigation Techniques" in front of the ACE antenna. From left to right: Mainul Mohammed Hoque, Daniela Wenzel, Jens Berdermann, Tatjana Gerzen, Claudia Borries, Volker Wilken, Norbert Jakowski.

The DLR is a privileged partner of NOAA, the US Space Weather Prediction Center, and is, as a member of the Real Time Solar Wind (RTSW) observation network, engaged in the data transfer and analysis of the ACE (Advanced Composition Explorer) satellite. The Institute of Communications and Navigation (IKN) develops and investigates new systems and methods for radio transmission and positioning. In particular, the Ionospheric group in Neustrelitz is involved in ionospheric monitoring, modelling and studying ionospheric impact on radio signals for many years. Ionospheric monitoring over Europe is carried out on a routine basis since 1995, i.e. over more than one solar cycle. IKN operates an own GPS receiver network for scintillation measurements across Europe from high to lower latitudes.

Besides satellite data reception, the German Remote Sensing Data Center (DFD) branch in Neustrelitz develops processor systems for generating value-added geo-information products for environmental research. The institute manages the reception of geophysical research satellites such as CHAMP and GRACE which are used to derive three-dimensional ionospheric

information on global scale. Both institutes offer a unique infrastructure for sounding, monitoring and modelling the ionosphere, for analysing and interpreting ionospheric data and for operating adequate data management systems for data use and dissemination.

Thus, both institutes together have

established a Space Weather Application Center Ionosphere (SWACI), which was essentially supported by the state government of Mecklenburg - Western Pomerania. SWACI is established on the heritage of the former project SWIPPA which was one of the Space Weather Pilot Projects funded by ESA. As formerly SWIPPA, also SWACI contributes to the Space Weather European Network (SWENET) with various nowcast data. Ground and space

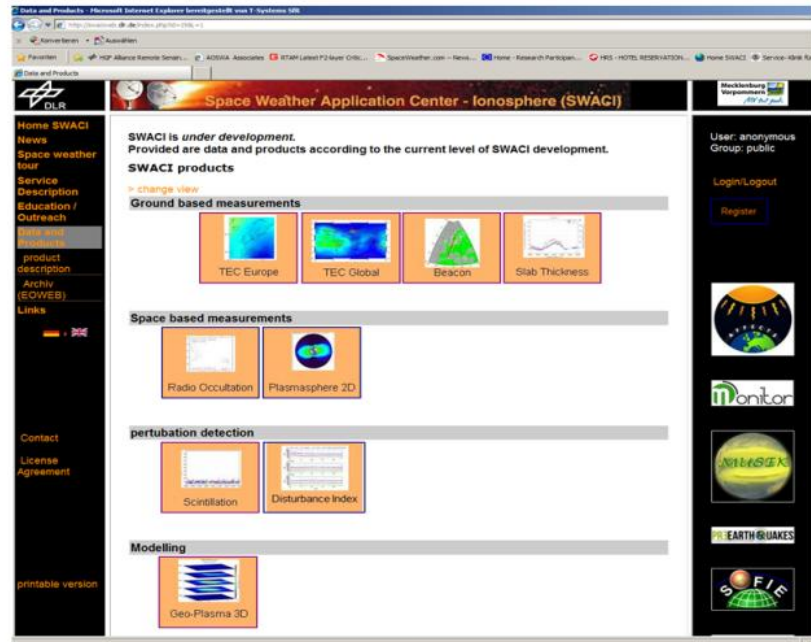
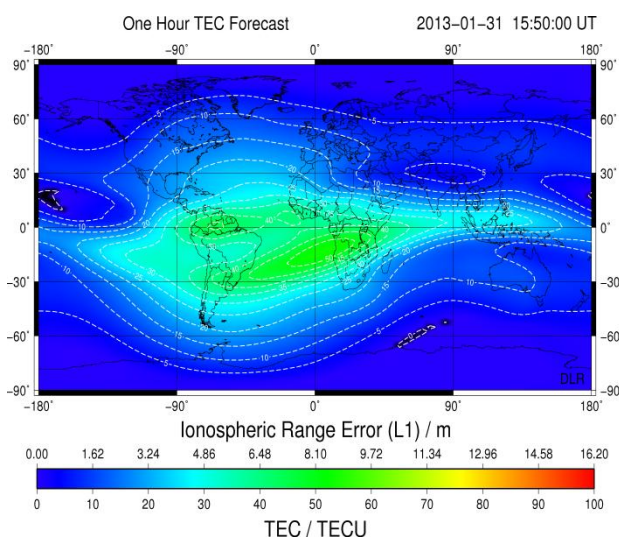


Fig. 2: SWACI



based GNSS measurements form the main data base for the SWACI data service which provides already some selected data products via the internet portal <http://swaciweb.dlr.de> (see Pic. 2).

Provided are regional and global data on the ionosphere such as the Total Electron Content (TEC) and related quantities such as horizontal gradients and TEC rate of



change in near real time. Satellite missions such as GRACE and TerraSAR-X and SWARM shall be used to get global three-dimensional information on the ionosphere. The SWACI team is in close contact with customers to find solutions really needed by the users.

The German Aerospace Center (DLR) contributes to FP7 projects (e.g. AFFECTS, Pre-Earthquake, TRANSMIT, ESPAS) and ESA projects (e.g. MONITOR, EGNOS-V3) to monitor space weather, develop protection strategies and correction algorithms and to warn GNSS users in time. Modelling and real time monitoring of the ionosphere at the DLR with satellite and ground based observation leads already to a promising space weather forecast.