



## **GGOS Focus Area on Geodetic Space Weather Research – Essential Geodetic Variables**

Michael Schmidt (1), Klaus Börger (2), and Ehsan Forootan (3)

(1) Technische Universität München, Deutsches Geodätisches Forschungsinstitut (DGFI-TUM), München, Germany (mg.schmidt@tum.de), (2) German Space Situational Awareness Centre (GSSAC), Uedem, Germany, (3) Institute of Physics and Meteorology, University of Hohenheim, Stuttgart, Germany

Space weather means a very up-to-date and interdisciplinary field of research. It describes physical processes in space mainly caused by the Sun's radiation of energy. The manifestations of space weather are multiple, for instance, the variations of the Earth's magnetic field or the changing states of the upper atmosphere, in particular the ionosphere and the thermosphere.

The main objectives of the Focus Area on Geodetic Space Weather Research (FA GSWR) are (1) the development of improved ionosphere models, (2) the development of improved thermosphere models and (3) the study of the coupled processes between the thermosphere and the ionosphere as well as the considerations of Sun observations. Objective (1) aims at the high-precision and the high-resolution spatial and temporal modelling of the electron density. This finally allows to compute a signal propagation delay, which will be used in many geodetic applications, in particular in positioning, navigation and timing (PNT). Moreover, it is also important for other techniques using electromagnetic waves, such as satellite- or radio-communications. Concerning objective (2), satellite geodesy will obviously benefit when working on precise orbit determination (POD), but there are further technical matters like collision analysis or re-entry calculation, which will become more reliable when using high quality thermosphere models. Objective (3) links the first two objectives by introducing physical laws and principles such as continuity, energy and momentum equations and solving partial differential equations. These objectives are linked to altogether four Joint Study Groups (JSG) which have to or will be installed within the FA GSWR. In particular, these JSG are titled as: Electron density modelling within the ionosphere (JSG1), Thermosphere modelling including physics-based realisations of the coupled thermosphere-ionosphere processes (JSG2), Improved understanding of the coupled processes (JSG3) and Improved understanding of space weather events and their monitoring by satellite missions (JSG4).

In this presentation we provide the latest investigations and results and discuss the definition of so-called Essential Geodetic Variables (EGV) within the context of the FA GSWR.