

IGS Real-Time Service for Ionosphere Modeling and Monitoring

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The accuracy of Global Navigation Satellite System (GNSS) can be largely improved by using GNSS correction services. Such services can enhance GNSS performance and enable positioning accuracy down to the centimeter level by transmitting real-time data streams containing correction information on GNSS signal errors. In addition to the corrections of satellite orbits, clock offsets, pseudorange and phase biases, the precise ionospheric correction information is also highly required. For many decades the International GNSS Service (IGS) is delivering high-precision ionospheric products for various scientific applications. The Ionosphere Associated Analysis Centers (IAAC), for instance, routinely provide maps of the vertical total electron content (VTEC), i.e., the integral of the electron density along the height to correct measurements for ionospheric influences, usually disseminated with latencies of days to weeks and based on post-processed observations. Benefiting from the IGS Real-Time Services (RTS), it is possible to model and monitor the ionosphere, and provide high-precision and high-resolution ionospheric correction models in real-time. Progresses of using IGS-RTS for real-time ionosphere modeling and monitoring is summarized in this work, including 1) discussing different time scales for designing / delivering different types of IGS ionospheric State Space Representation (SSR) messages; 2) finalizing global ionosphere corrections in the IGS real-time working group (RT-WG) proposed IGS-SSR product format; 3) continuing the IGS experimental RT-combination of real-time global ionospheric maps (RT-GIMs) based on CAS, CNES, UPC and WHU provided RT-GIM streams; and 4) initiating questionnaire for improving IGS-SSR ionospheric correction messages within the IGS RT-WG (see Figure 1). For real-time ionosphere modeling, the decided roadmap is to define an agreed format and broadcast the RMS map associated to the RT-VTEC product within 2-3 year (see Figure 2). The potential roadmap for future activities is to define an agreed format and broadcast a satellite-dependent slant TEC (potential indicators about Slant TEC or Vertical TEC, global VTEC or regional VTEC with sector identifier or spatial range and interval, might be considered) within 3-5 years.

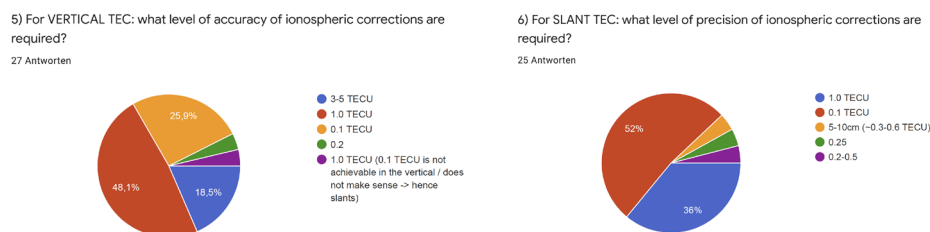


Figure 1. Questionnaire results for improving IGS-SSR ionospheric correction messages within the IGS real-time working group.

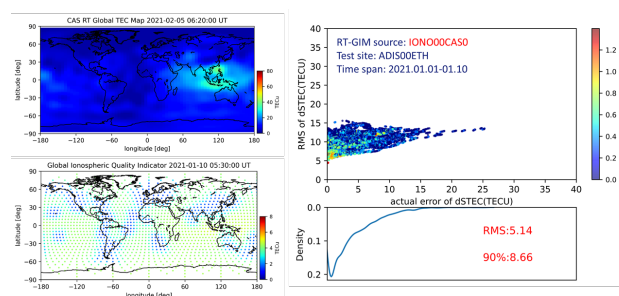


Figure 2. Example of provided real-time ionospheric VTEC corrections, VTEC quality indicators (QI), as well as the performance assessment at one equatorial site ADIS00ETH.