

## Benefits of IGS RTS for real-time global ionospheric total electron content modeling

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To enable GNSS applications with low or no time latency, real-time services (RTS) of the International GNSS Services (IGS) has been launched since 2013. The IGS RTS provides real-time data streams with latencies of less than few seconds, containing multi-frequency and multi-constellation GNSS measurements from a global network of high-quality GNSS receivers, which provides the opportunity to reconstruct global ionospheric models in real-time mode. For the computation of real-time global ionospheric maps (RT-GIM), a 2-day predicted global ionospheric model is introduced along with real-time slant ionospheric delays extracted from real-time IGS global stations. GPS and GLONASS L1+L2, BeiDou B1+B2 and Galileo E1+E5a signals with a sampling rate of 1 Hz are used to extract slant TEC (STEC) estimates. Spherical harmonic expansion up to degree and order 15 is employed for global vertical TEC (VTEC) modeling by combining the observed and predicted ionospheric data in real-time mode. Real-time ionospheric State Space Representation (SSR) corrections are then distributed in RTCM 1264 message (123.56.176.228:2101/CAS05) aside from the generation of RT-GIM in IONEX v1.0 format (available at <ftp://ftp.gipp.org.cn/product/ionex/>). The quality of CAS RT-GIMs is also assessed during an 18-month period starting from August 2017, by comparison with GPS differential slant TECs at the selected IGS stations over continental areas, Jason-3 VTECs over the oceans and IGS combined final GIMs on a global scale, respectively. Results show that CAS's RT-GIM products exhibit a relative error of 13.9%, which is only approximately 1-2% worse than the final ones during the test period.