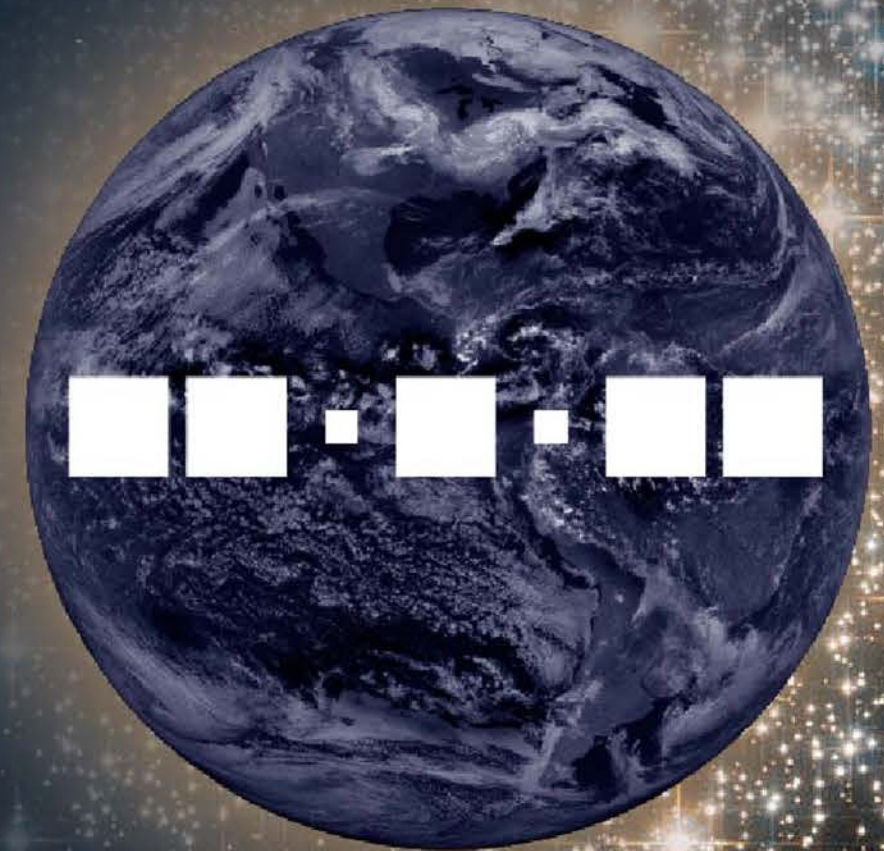




Real-Time Working Group

André Hauschild & Manuel Hernandez Pajares

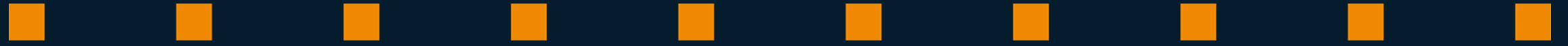


IGS INTERNATIONAL
GNSS SERVICE

2022 Virtual Workshop
"Science from Earth to Space"

Session Agenda

- **Activities since Previous Workshop**
- **Scientific Use Cases of Real-Time Products**
 - Qi Liu, Manuel Hernandez-Pajares (UPC)
 - Tomasz Hadas (UPWR)
 - Xinyuan Jiang (GFZ)
 - Attila Komjathy (JPL)
- **Roadmap for Future IGS Real-Time Activities**



Activities since Previous Workshop

Progress since **Previous Workshop (Wuhan 2018)**

- New experimental Real-Time Ionospheric Combination Product (co-operation with IONO-WG)
- Extension of BKG combination to include Galileo and Beidou (in addition to GPS & GLONASS)
- Monitoring of AC streams and BKG combination streams extended to cover Galileo (in addition to GPS & GLONASS)
- Improved Broadcast Ephemeris Quality in IGS Combined Streams

Progress since Previous Workshop (Wuhan 2018)

- Broadcaster Guidelines released (co-operation with infrastructure committee)
- IGS-SSR Multi-GNSS Standard released as alternative to RTCM-SSR
- Survey for improved IGS-SSR ionosphere messages (co-operation with IONO-WG)

IGS INTERNATIONAL GNSS SERVICE

GUIDELINES FOR IGS REAL-TIME BROADCASTERS AND STATIONS

Contact: cb@igs.org

International GNSS Service (IGS)
IGS Real-Time Working Group (RTWG)
IGS Infrastructure Committee (IC)

Version 1.0
October 2021

IGS SSR v1.00 2020-10-05

IGS State Space Representation (SSR) Format

Version 1.00

International GNSS Service (IGS)

October 05, 2020

Questionnaire for improved IGS-SSR Ionospheric Correction Messages

29 Antworten

Analytics veröffentlichen

1) Are you a user or provider of real-time ionospheric corrections? If you have both roles, please fill out the survey twice, once for each role.

29 Antworten

Role	Count	Percentage
User	16	55.2%
Provider	13	44.8%

2) Which IGS products are you using?

29 Antworten

Product	Count	Percentage
None	1	3.4%
Orbits and clocks	24	82.8%
Code biases	21	72.4%
Phase biases	15	51.7%
Ionosphere	25	79.3%
Real-Time Streams	20	69%
GM TEC	1	3.4%
Use IGS to compare	1	3.4%
Altitude	1	3.4%

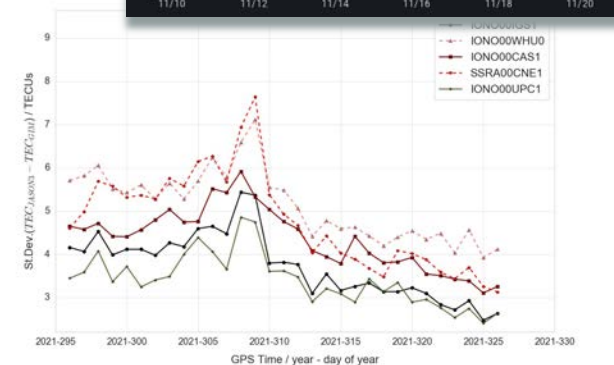
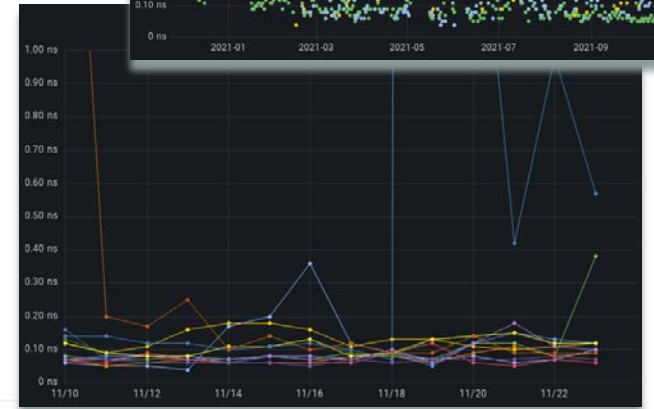
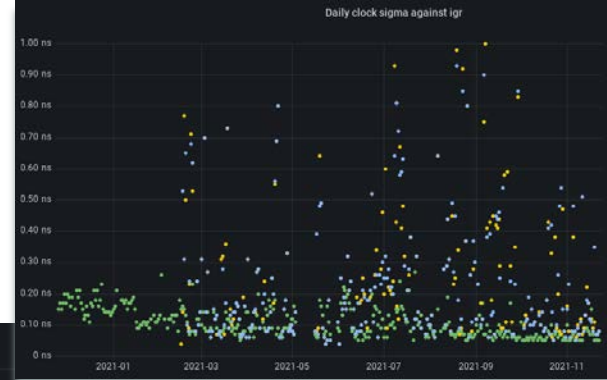
SSR Working Group, IGS Real-Time Working Group

Progress since **Previous Workshop (Wuhan 2018)**

- Transition to IGS-SSR for the RTS combination and AC products
- Combination performance improvements
 - Excluding incompatible solutions from ESOC combination
 - Alignment of APC reference points to use single-frequency APC
- Transition to receiver-generated multi-GNSS RTCM-MSM streams
- Long mountpoint names for all observation/product streams
- Deactivation of CB Caster and Transition to UCAR Caster
- New AC (SHAO, China) & station contributor (USACH, Chile)

Progress since Previous Workshop (Wuhan 2018)

- Major website update by RT-ACC, RT-WG & IGS-CB (<https://igs.org/wg/real-time> & <https://igs.org/rts>)
- New and updated content on user access, formats, products, monitoring and contributors
- Daily updated orbit and clock monitoring plots
- Daily updated ionospheric correction monitoring plots
- PPP performance monitoring with BNC

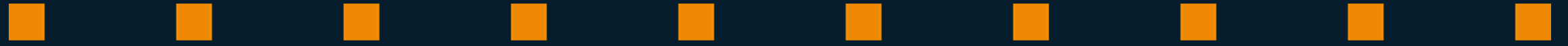


Progress since Previous Workshop (Wuhan 2018)



RT-WG: Recommendations (Wuhan 2018)

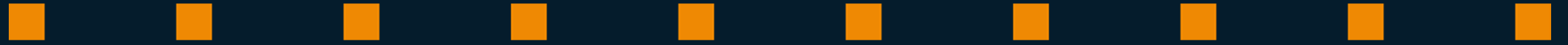
- I. Complete the mount point renaming on all observation casters of the IGS. Develop a more intuitive naming of product mount points
- II. Improve the validation of broadcast ephemerides records in merged streams
- III. Make the IGS RTS ready for the transition to a real multiGNSS service. The RT ACs are encouraged to move towards multi-GNSS processing. Capabilities for comparison and validation of multi-GNSS RT solutions need to be built up. As a prerequisite, the RT WG requests the availability of multi-GNSS orbit predictions.
- IV. The options available for broadcasting multi-GNSS RT SSR correction data using an open format have to be evaluated and a suitable format has to be selected for the IGS RTS.
- V. New IT developments broadcasting real time streams in a better scalable way will be actively supported



Scientific Use Cases of Real-Time Products

Scientific Use Cases of Real-Time Products

1. Qi Liu, Manuel Hernandez Pajares (UPC)
“The cooperative IGS RT-GIMs: a global and accurate estimation of the ionospheric electron content distribution in real-time”
2. Tomasz Hadas (UPWR)
“Overview of real-time GNSS meteorology: ZTD accuracy, horizontal gradients, low-cost receivers”
3. Xinyuan Jiang (GFZ)
“Real-Time GNSS processing for geohazard early warning: implementation in the EWRICA project”
4. Attila Komjathy (JPL)
„Ionospheric Detection of the 2022 Tonga Event Using Real-Time GDGPS Observations“



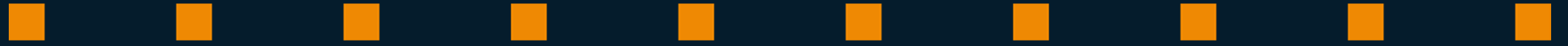
Roadmap for Future IGS Real-Time Activities

Roadmap for Future IGS Real-Time Activities

- Extend IGS-SSR format with new messages for attitude, SRP(APC)/CoM offset and PCV/GDV (1 year)
- Define an agreed format, and to broadcast, the RMS map associated to the RT-VTEC product (3 years)
- Define an agreed format, and to 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) (3-5 years)
- ...

Roadmap for Future IGS Real-Time Activities - Ideas

- Multi-layer RT-VTEC
- Phase biases for PPP-AR
- Real-time solar Xray GNSS signal reduction monitoring
- Message troposphere corrections/estimations
- Real-Time GNSS-based Integrated Water Vapour (IWV)
- Integrity messages
- Potential of using Starlink for correction dissemination
- For earthquake applications: standard format for station movements
- Real Time Crustal Deformation Monitoring
- Real-time time/clock synchronization
- GNSS signal interference monitoring



**Thank you very much for
attending the session!**