Real-Time Working Group

André Hauschild & Manuel Hernandez Pajares
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)
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/wg/real-time) & [https://igs.org/rts](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 model 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!