Reference Frame Working Group

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Overview of the Working Group Charter

- **"Generate the official IGS station coordinates, velocities and Earth rotation parameters"**
  - Combination of daily AC SINEX solutions → **daily IGS combined SINEX solutions**
  - Accumulation of daily IGS combined SINEX solutions → **IGS cumulative solution** (long-term station coordinates)

- **"Specify the successive IGS Reference Frames"**
  - **IGS08** (adopted 2011-04-17), **IGb08** (adopted 2012-10-07), **IGS14** (adopted 2017-01-29), **IGb14** (adopted 2020-05-17)
  - **IGSR3** (specific RF for IGS repro3)

- **"Collaborate with the IGS AWG in updating estimates of the satellite antenna offsets"**
  - **igs08.atx** (based on ITRF2008 scale), **igs14.atx** (based on ITRF2014 scale)
  - **igsR3.atx** (based on Galileo satellite z-PCOs provided by GSA)

- **"Contribute to the ITRF by providing the official IGS submission for the ITRF updates"**
  - Combination of daily AC SINEX solutions from the successive IGS reprocessing campaigns

Progress since last AM Meeting (Dec 2019)

- **IC recommendation (Paris, 2017):**
  "To create a way forward **to provide at least weekly positions for ALL IGS network stations**, rather than just having the stations that Final ACs have selected."
  - Missing IGS stations now listed in weekly SINEX combination summaries
  - GFZ AC volunteered to include missing IGS stations in their final products.
  - < 10 IGS stations now missing in weekly SINEX solutions (against ≈40–50 before)

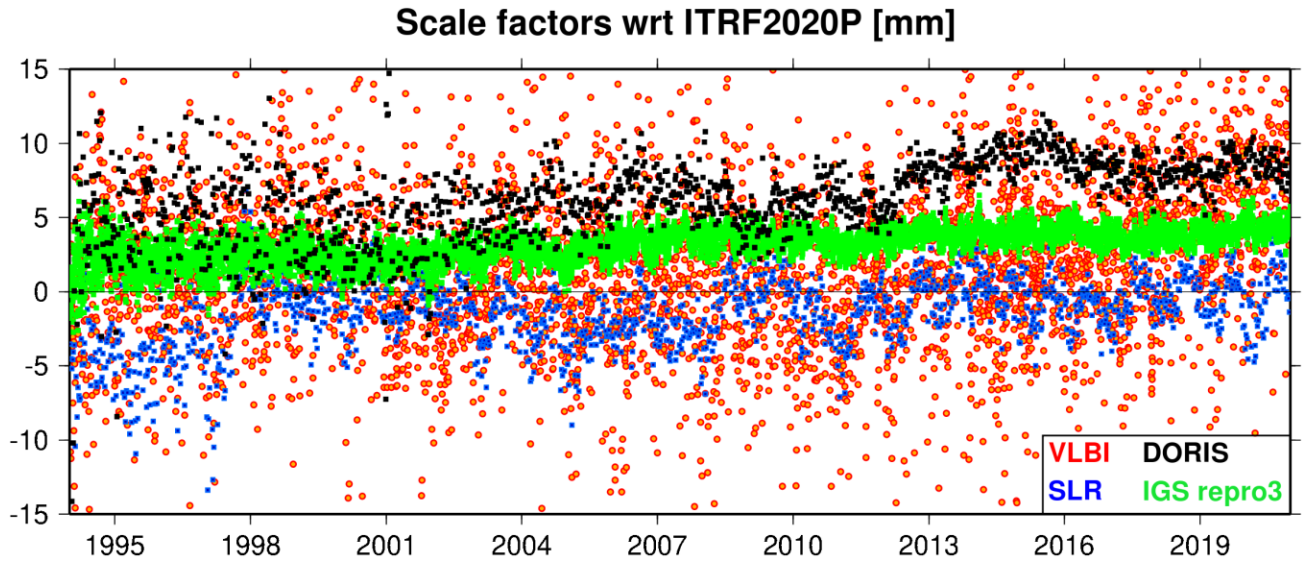
- **Adoption of IGb14 reference frame for IGS operational products (2020-05-17; IGSMAIL-7921)**
  - Update of IGS14 made necessary because of growing number of unusable RF stations (affected by discontinuities) and growing extrapolation errors

- **Combination of repro3 daily AC SINEX solutions → IGS contribution to ITRF2020**
  - See next slides

Progress on repro3

- **Final IGS repro3 SINEX solutions (= IGS contribution to ITRF2020) made available on April 10, 2021 (IGSMAIL-8044)**
  - repro3 SINEX combination results presented at EGU, IAG & Tour de l'IGS
  - repro3 station position time series longer, denser, more numerous and more precise than repro2 series
  - 7 / 10 contributing ACs provided **multi-GNSS** solutions

- **IGS repro3 solutions provide for the first time an ITRF-independent, Galileo-based estimate of the terrestrial scale.**
  - "Preliminary" igsR3.atx-based results confirmed by more rigorous propagation of Galileo-based terrestrial scale (Glaser et al., EGU & Tour de l'IGS)
  - Galileo-based repro3 scale offset from SLR/VLBI-based ITRF2020P scale by: **+4 mm @ 2015.0 ; +0.1 mm/yr** (see Altamimi et al., AGU)



Progress on repro3 time series analysis

- **Manual offset detection and modeling of post-seismic displacements, aided by statistical tests**
  - repro3 discontinuity list and PSD models published along with ITRF2020P
- **Confrontation with GGFC loading models (Boy, 2021)**
  - Annual signals and non-seasonal scatter of repro3 series reduced in expected proportions
  - Strong impact of loading corrections on vertical background noise spectrum
- **Spectral analysis**
  - 'Usual' spurious draconitic and tide-related signals on top of white+flicker background noise
  - New GLONASS-related combs at harmonics of ≈8 d + previously undetected tide-related signals
  - Evidence of non-stationary [seasonal+] draconitic signals, which bias noise models, if unaccounted for
- **See details in Rebischung et al. (AGU)**
  - https://www.essoar.org/doi/10.1002/essoar.10509008.1

Future Work

- **IGS transition to ITRF2020**
  - Define new IGS20/igs20.atx framework in cooperation with AWG
  - Work toward transition together with ACs

- **Further analysis of errors in repro3 station position time series**
  - Provide feedback to ACs
  - Pinpoint areas of possible further improvements

IGS INTERNATIONAL GNSS SERVICE

Thank You!

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