POD performance for Jason-3 & Sentinel-3A and lessons learned for Sentinel-6 NG

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Workshop on the Sentinel-6NG Orbit

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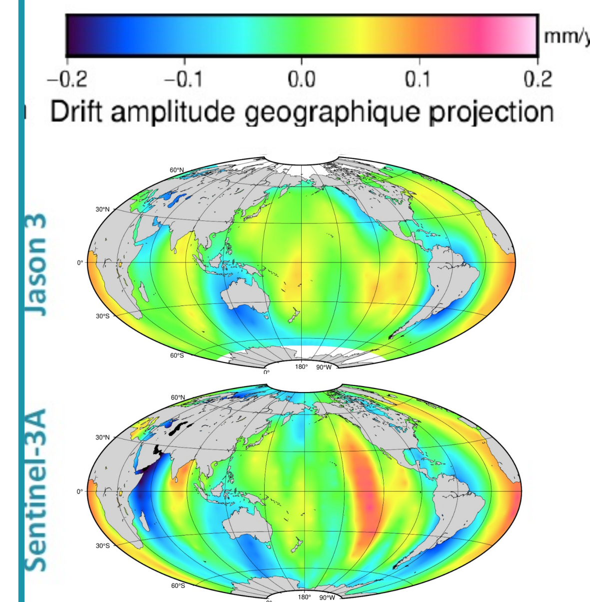
Geopotential extrapolation/modeling errors

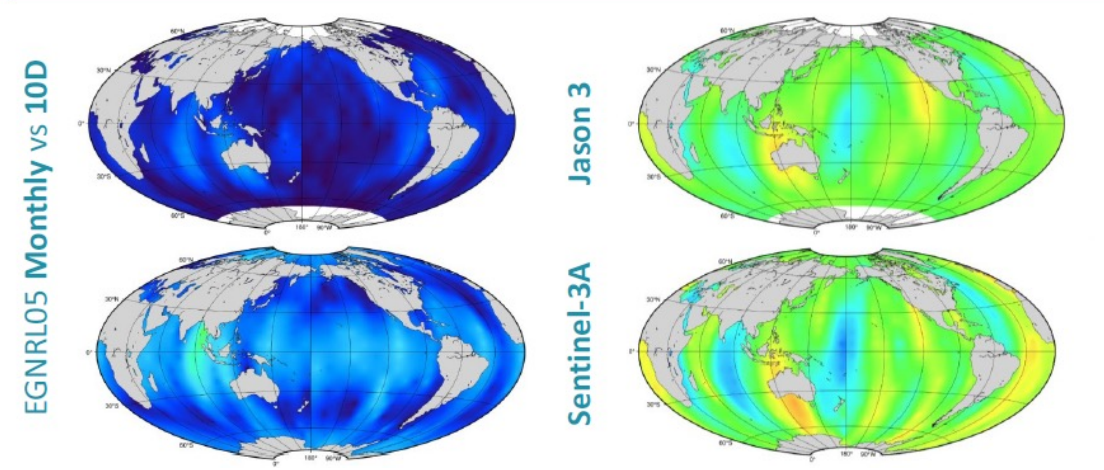
- <u>Time Variable Gravity (TVG) models:</u>
  - **Mean field:** CNES_GRGS.RL05MF, estimated up to 10/22 (then extrapolated)
  - **Monthly solution:** RL05 GSM monthly coefficients [https://doi.org/10.6096/5004]
  - **10-day solution:** RL05 GSM 10-day coefficients [https://doi.org/10.6096/5002]

⇒ **Sentinel-3A is more impacted than Jason-3**
⇒ **Need at least yearly updated mean TVG models (monthly solutions for Sentinel-3A?)**

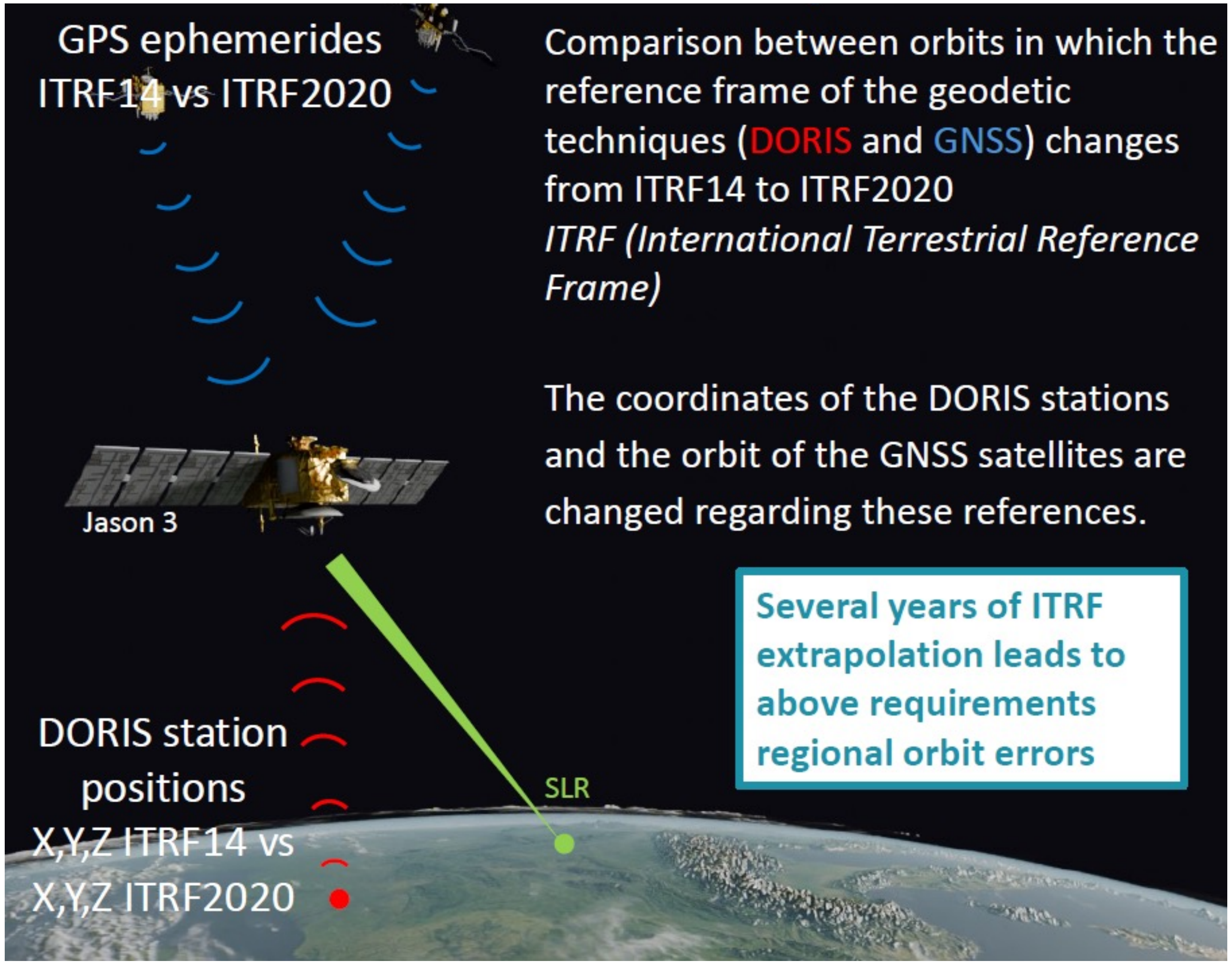
Over the adjusted period of the mean TVG model (up to 10/22), 0.1 mm/y stability of the radial orbit is not guaranteed for Sentinel-3A

Gravalon et al. (EGU25)

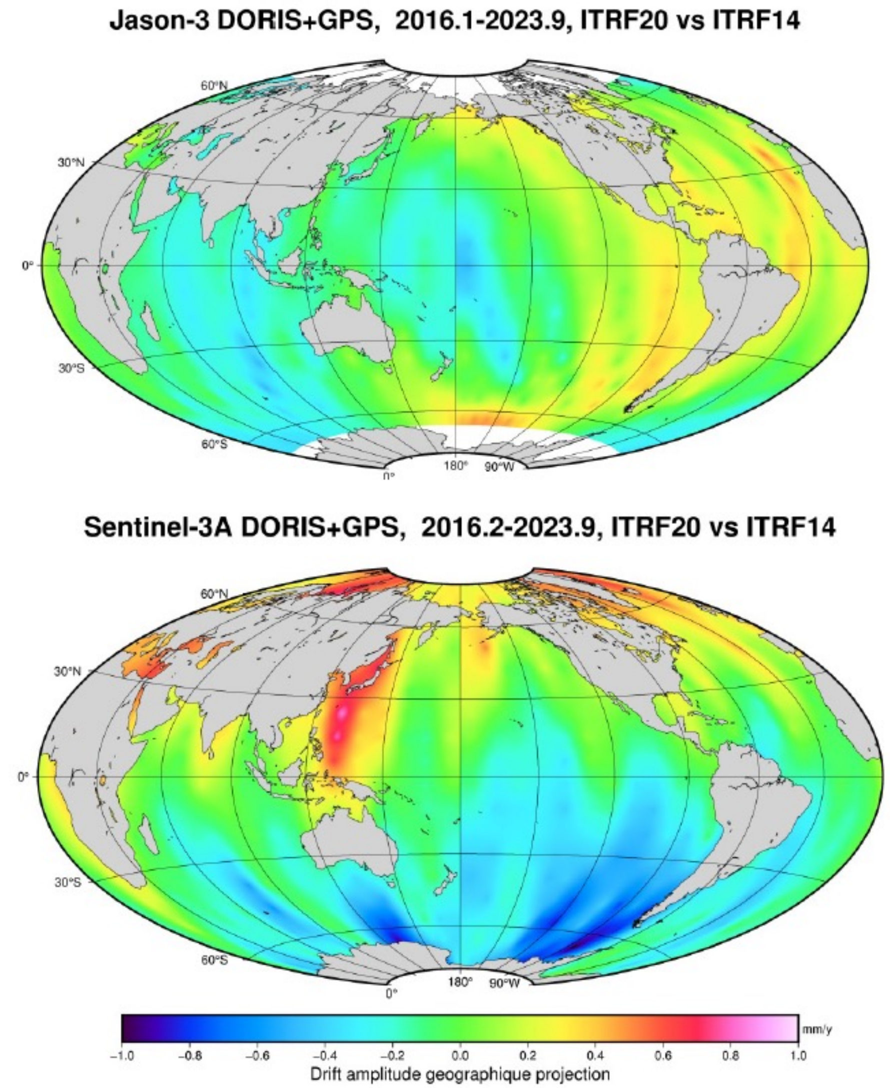




ITRF extrapolation errors

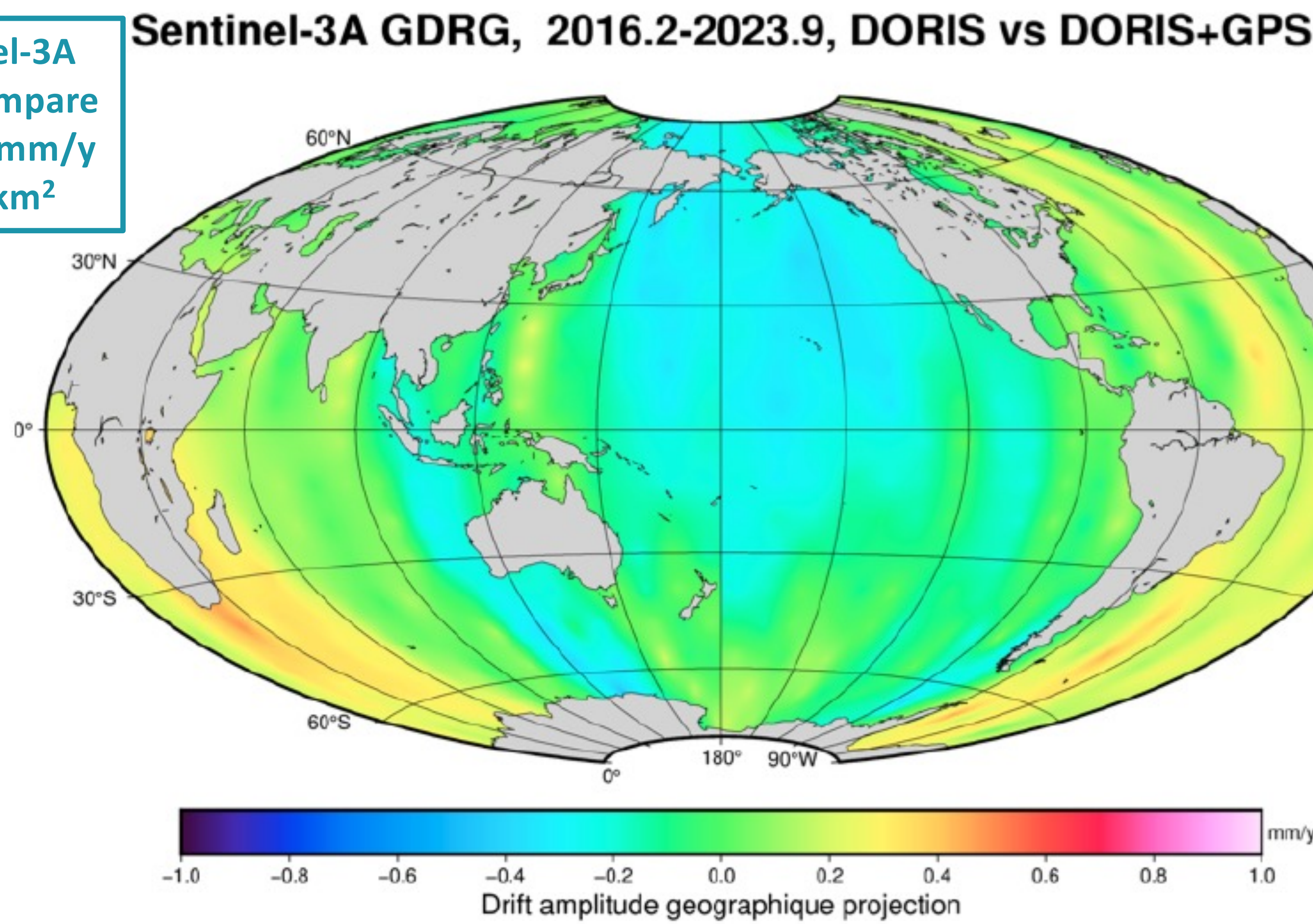


Gravalon et al. (EGU25)



DORIS and GNSS are vital to validate globaly and independently the regional radial orbit stability

DORIS and GPS Sentinel-3A POE-G orbits already compare radially at less than 0.3 mm/y over 8 years @ 1000 km²



- ⇒ SLR can only do this type of validation in a few areas
- ⇒ We also need stable loading models to take into account the motions of the crust where the laser stations are located

Recommendations for Sentinel-6NG

- Platform:
  - No heater on radial surfaces
  - Convex shapes for the satellite design are preferable to derive accurate SRP models
  - Make flips at zero-beta values to facilitate in-flight calibration of the position of the phase centers of the DORIS/GNSS/SLR instruments to improve the validation of the orbits:
    - Along-track: Decoupling of errors in the center of phase offset of the POD instruments from time tagging errors
    - Cross-track: Decoupling of miscalibrated POD instrument locations from mismodeled SRP and Z-component (North-South) of geocenter motion (Tz).
  - Improvement of the knowledge of surface force induced errors (drag, thermal effects, SRP) using an accelerometer (very low frequency measurements ~10^{-4} Hz?)
  - No fuel motions in the radial axis of the tanks
- Orbit:
  - Inclination: avoid draconitic periods close to the geophysical annual and semi-annual periods
  - Altitude: above 1000 km looks preferable to limit drag and time-variable gravity modeling errors, and also to reduce ionosphere effects affecting GNSS receivers
- General comments:
  - Wait for at least 25 days after the measurements to request Precise Orbit Ephemerides (POE) for a better stabilization of the environmental data

Future required studies

- The accuracy of current GNSS orbits still needs to be thoroughly validated using SLR and DORIS
- Determine the required performance for an accelerometer adapted for altimeter missions (along-track only?)
- Identify which background models have inadequate quality, which error models we have, and how to use them?