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Status of the IGN-IPGP AC and ongoing studies

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OUTLINE

- Operational part
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  - gravity field : GRGS RL05
  - IGNw16 solution for ITRF2020
- Research part
- Perspectives

Operational development

- HY-2C & SWOT implementation (everything ready, waiting for quaternions):
  - Macromodels created in GipsyX

- Problem with attitude law :
  - HY-2C not currently usable in GipsyX (To define attitude law, we need to define macromodels from Satellite reference frame and then define the rotation between the satellite ref frame and the HCL frame. HY-2C attitude law defined in the IDS pdf is not from Satellite ref frame but from “Satellite Navigation Body Coordinate System”) => we need quaternions !

  - SWOT : The rotation of the satellite due to the fact that the heater must be kept in the shade as much as possible is difficult to implement with the tools we have at our disposal. As quaternions will be available soon (but when ?), it is not efficient for us to implement it yet.

Operational development

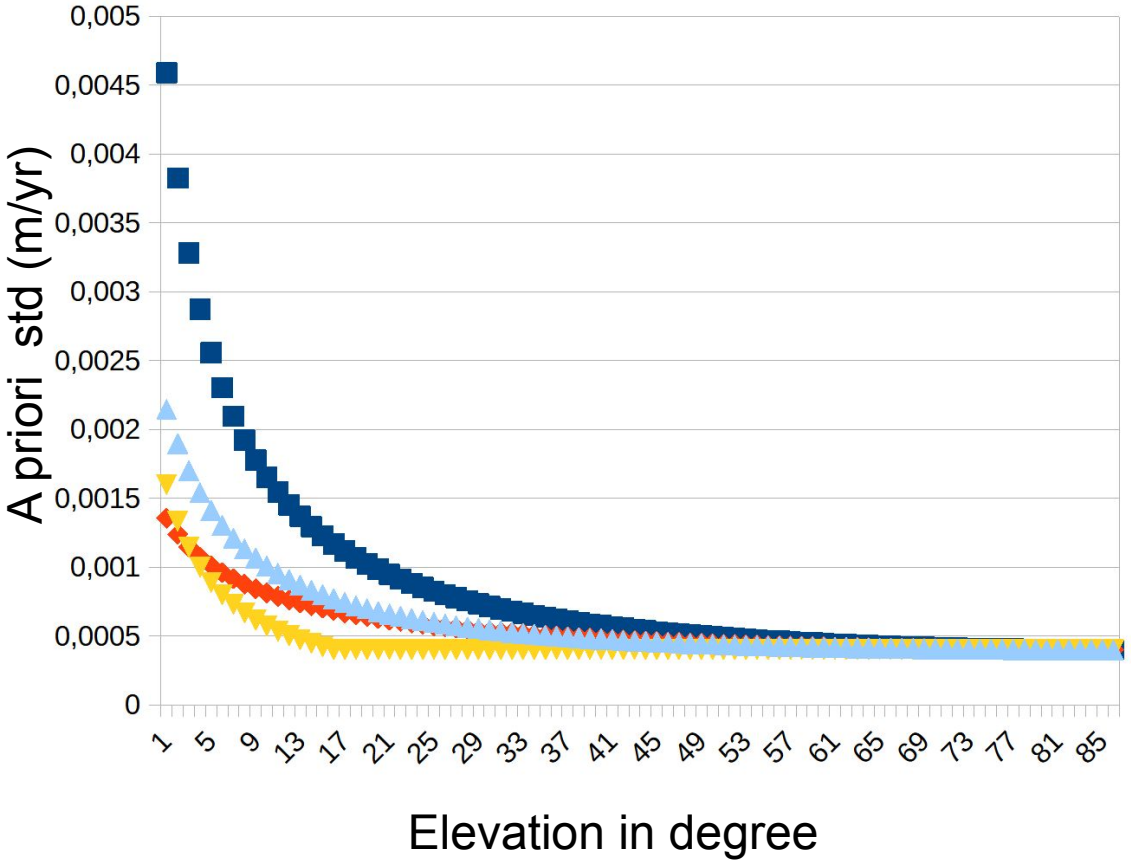
- Streamlining the calculation chain to facilitate the chaining of operational calculations

- Bug Detection :
  - The weighting ($\sin^2(e)$) is not correctly implemented in GipsyX for DORIS. It is GNSS compliant (based on the receiver antenna and not ground stations !)

  - New tool developed to weight DORIS observations. Currently, six different a priori std usable
    - Flat (No elevation dependency - α_0)

    - A priori std observations, estimated per station and satellites $A_{sta,sat} + \frac{B_{sta,sat}}{\sin(e)}$

A priori std of DORIS observations in GipsyX



$$\frac{\sigma_0}{\sin(e)}$$

$$\frac{\sigma_0}{\sqrt{\sin(e)}}$$

GRGS AC

$$\begin{cases} \sigma_0 \text{ for } e \geq 20° \\ \sigma_0 \frac{20}{e} \text{ for } e < 20° \end{cases}$$

CNES POD study
Moyard et al, 2016
$K_a = 0.57647$; $K_b = 0.04$

$$\sigma_0 \sqrt{K_a + (1 - K_a)\left(\frac{1 + K_b}{\sin(e) + k_b}\right)^2}$$

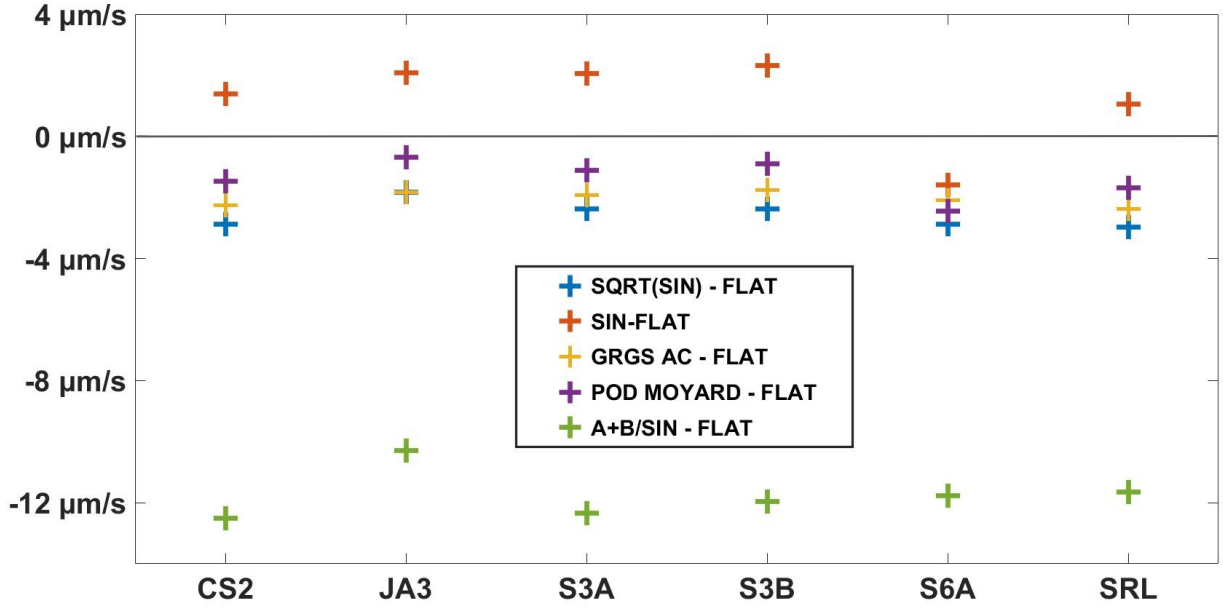
Research activities

Weighting of observations : 6 methods
Study on 6 satellites (CS2, JA3, S3A, S3B, S6A, SRL)
from 2020-12-17 to 2023-09-30 ; daily arc computation

Very preliminary results :

Median of differences of daily WRMS of residuals

For daily orbital arcs, using sqrt(sin) or GRGS AC weighting method slightly reduce residuals.



WARNING : sin(e) seems better for TRF but more investigation are needed to be sure

Perspectives

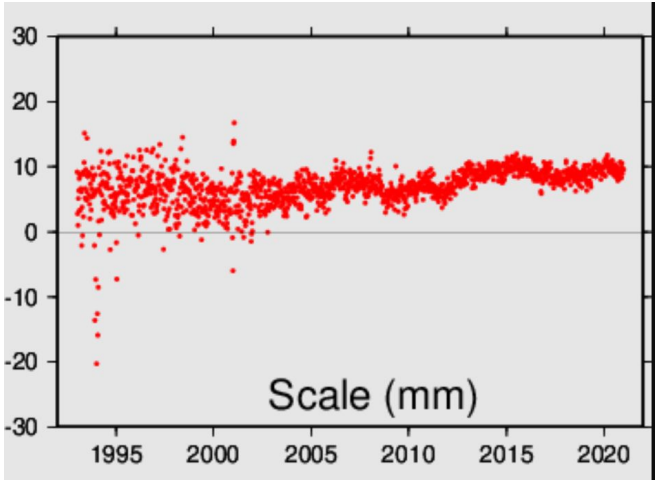
Need quaternions to implement more efficiently new satellites !

Complete weighting study (Residuals and TRF impact must be analysed in details)

Provide solutions to IDS in June

Study of the scale issue in DORIS :

VIF study : no multicollinearity effect between scale and other parameters !



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Multi-satellite solution at observation level and specific frame definition