Splinter Session Summary

Quantifying Errors and Uncertainties in Altimetry Data

Chairs: Remko Scharroo, Michaël Ablain

Summary
Quantifying Errors and Uncertainties in Altimetry Data

- **6 talks and 5 posters**
- **Detection and reduction of altimeter data errors**
  - Leveraging Sentinel-6A interleaved mode to characterize High Resolution error budget over ocean **(E. Cadier,CLS)**
  - Long-term stability of ionospheric GIM corrections in satellite altimetry data sets **(D. Dettmering, DGFI-TUM)**
- **Improvement of the uncertainty characterisation**
  - Uncertainties in SSB modeling and impact on MSL **(F. Bignalet-Cazalet, CNES)**
  - Limiting factors of the altimetry observing system to the Global Mean Sea Level monitoring accuracy **(P. Prandi, CLS)**
  - Improving long term estimates of global mean sea level, global ocean heat content and Earth's energy imbalance using CDR water vapour data **(A. Barnoud, Magellium)**
- **New formalism to characterize uncertainties**
  - Sea level rise uncertainties: insights from a metrological approach **(E. Woolliams, NPL)**
  - Propagating uncertainties and error correlation structures through retracking and sea state bias correction **(S. Behnia,NPL)**
- **Error and uncertainties assessment**
  - In-situ measurements for altimetry cal/val: overview of the H2020 CCVS project **(C. Tison, CNES)**
  - Validation of altimetry by using in situ observations of pressure and acoustic travel time in the Southern Ocean **(J. Schroeter, Alfred-Wegener-Institute)**
  - A Trihedral Corner Reflector to Support Radar Altimeters External Calibration **(A. Garcia-Mondejar, isardSAT)**

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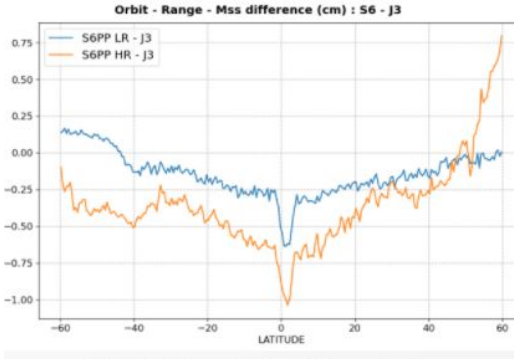
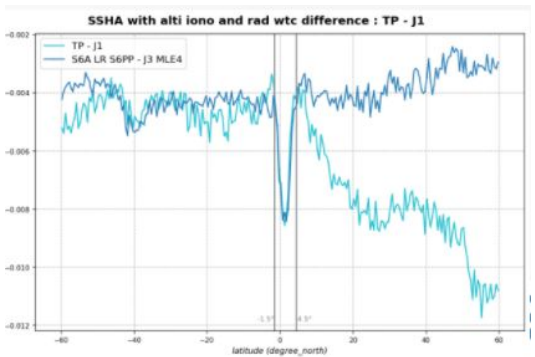
➔ **Improved sea level error budget provided for the S6-MF HR data (Emeline Cadier, CLS)**

⇒ Main outcome:

- Reduction of errors at different time and spatial scales is described , and will be available in next S6-MF L2 product release.
- 5 mm SSH signal error detected in equatorial band 20 years ago and attributed to TOPEX data is very likely due to Jason (1/2/3) altimeter measurements…

Error	Impact	Amplitude	Solution	PDAP Plan
PTR shape evolution	Drift on range	3.4 mm/year on GMSL (POS4-B)	Numerical retracking + Range walk	PB F09 (Q3 2023)
Ocean vertical velocity	SWH bias (impacting SSHA through SSB)	+30 cm at 2m-wave	NOAA LUT *2D retracking ?*	F10 (end Q4 2023)
Along-track wind	Range	2 cm	*2D retracking ?*	
Swell impact	Red noise on range and SWH	~several cm		
Others	?	?		





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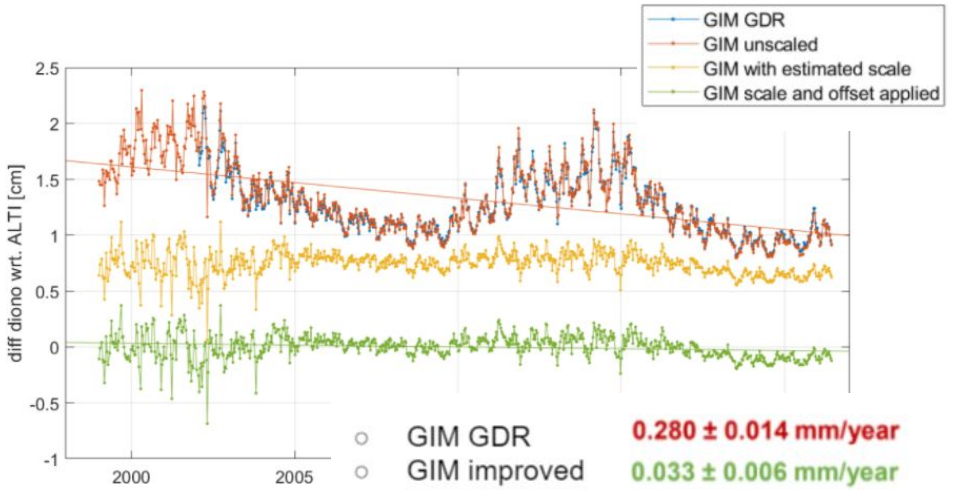
➔ **Revisiting the long-term stability of ionospheric GIM corrections in satellite altimetry data sets (Denise Dettmering, DGFI-TUM)**

◆ An updated “scale” coefficient is estimated based on the linear relationship between dual frequency and GIM vertical electron content (using TOPEX, J1, J2, J3) :

$$TEC_{ALTI}(t,\lambda,\phi) = TEC_{GIM}(t,\lambda,\phi) \cdot scale + offset$$

⇒ **Main outcome :**

- to update the GIM ionospheric correction scaling with constant factor determined over full period (0.881 for reference missions)



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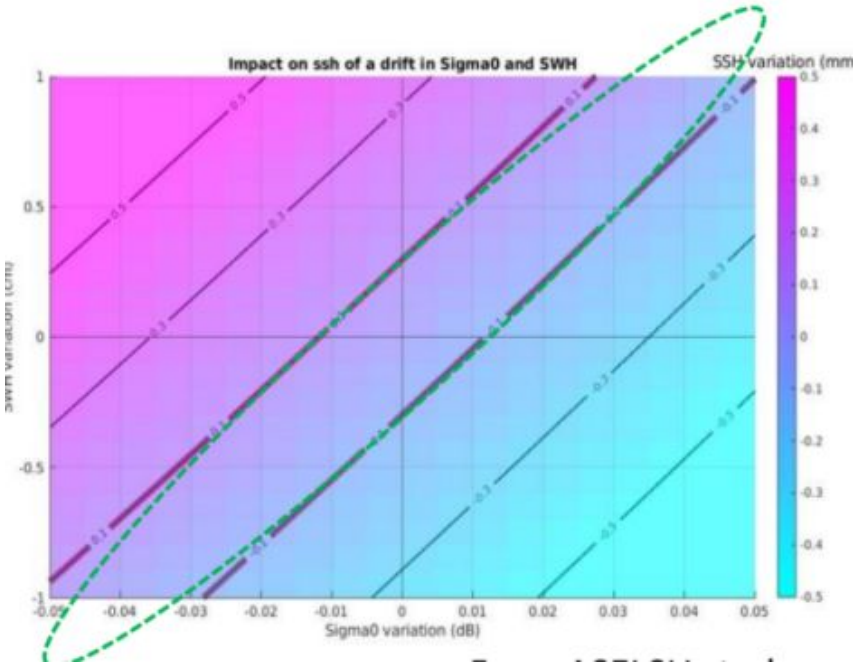
➔ **Improvement of the SSB uncertainties characterisation (François Bignalet-Cazalet, CNES)**

⇒ Main outcomes :

- Better traceability , description and assessment of the SSB correction uncertainties
- SSB must be evaluated over at least a 3-year period to reduce the effect of the inter-annual sea state ocean variability
- A 0.01 dB/yr stability is required on sigma-0 (assuming a perfect stability SWH)



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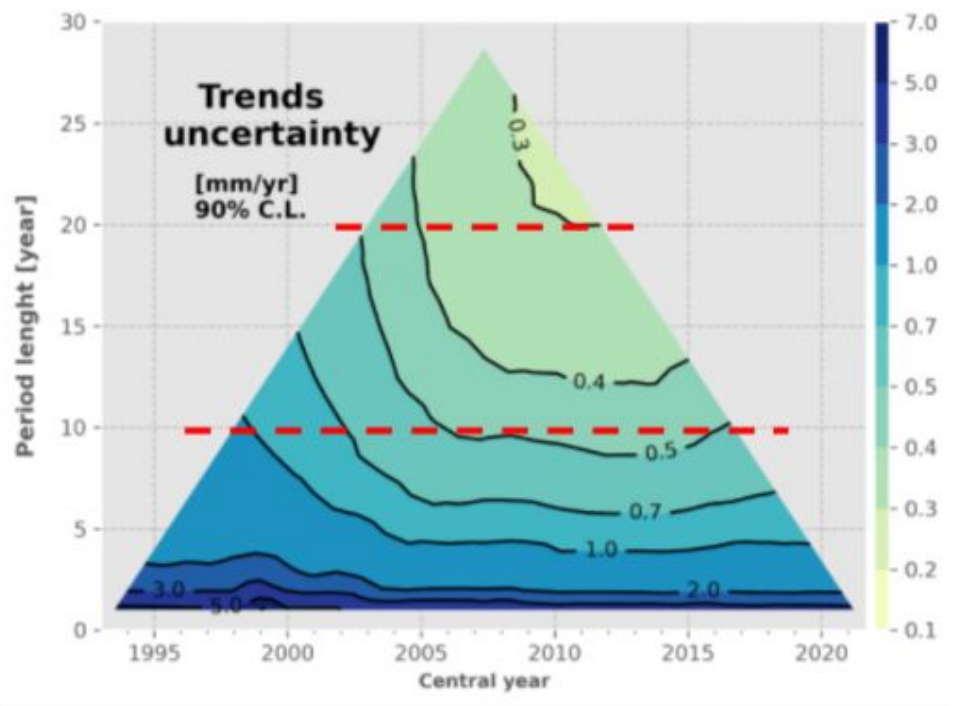
➔ **Update of the AVISO GMSL time series and the uncertainty table budget (Plerre Prandi, CLS)**

⇒ **Main outcomes**:

- Minimum of 0.3 mm/yr [90% C.L.] for 22 years of record centered in 2010
- Main limitations to reach the more stringent GMSL stability requirements are coming from ITRF, WTC and short time-correlated uncertainties.
- See Guerou et al., 2022



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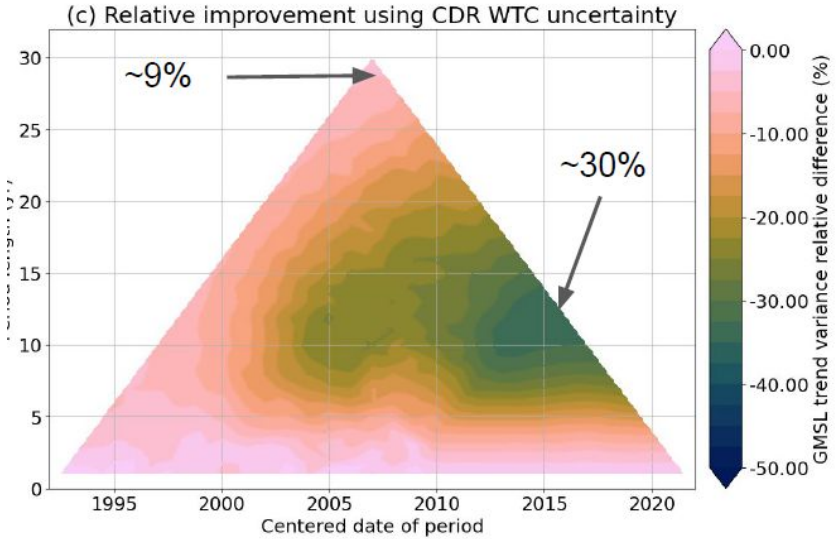
➔ **Improvement of the long term estimates of global mean sea level thanks to an alternative WTC correction based on the very stable water vapor CDRs (Anne Barnoud, Magellium)**

⇒ Main outcomes:

- reduction the GMSL trend uncertainty until 30 %
- detection of a drift on the Jason-3 radiometer WTC correction of the order of -0.5 mm/yr
- An empirical Jason-3 global mean WTC correction based water vapour CDR the will be very soon available for an independent assessment on AVISO+/ODATIS

GMSL trend variance reduction using a CDR-derived WTC



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➔ **Development of a new framework to estimate the Sea Level Rise Stability Uncertainty Budget from a metrological approach developed in the FIDUCEO project (Emma Williams and Hannah Cheales, NPL)**

⇒ Main outcomes:

- Produced systematic review of current processing assumptions and sources of uncertainty to give comprehensive end-to-end uncertainty analysis for altimeter
- To extend this work to POD and WTC