Quantify Errors and Uncertainties in Altimetry Data

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Overview

- **Objectives:** Establish the link between altimetry experts and applications (MSL, mesoscale, etc)
- New insights about errors in the altimeter system

⇒ From experts to applications

- User needs and requirements in terms of errors, including formalism of errors

⇒ From applications to experts

- This year, we focused **on orbit errors** and **short wavelength errors** with 4 talks complementary to these both subjects

- 4 Posters on **Global MSL uncertainties** and **short wavelength errors**

Description of orbit errors

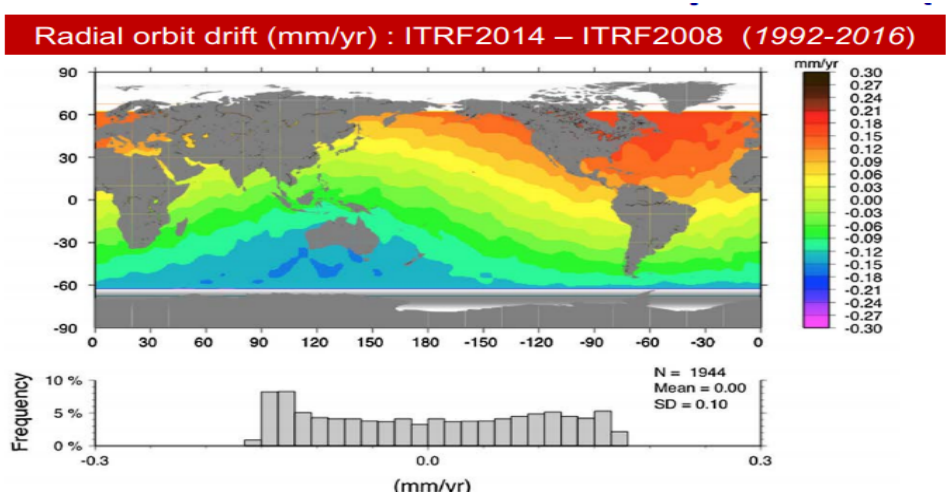
- **Issue #1:** Exhaustive description of error orbit has been performed by ***F. Lemoine*** (requirements, source of errors, uncertainty estimation): this kind of analysis is very useful to better understand sea-level errors.

Source of errors:

A. Reference Frame

B. Geophysical Models
   - (1) Gravity Field (Static & Time-Variable Gravity).
   - (2) Radiation Pressure Models (SRP, PRP).
   - (3) Geocenter.

C. Data specific Modeling (examples)
   - (1) SLR. Station accuracy; Biases;"Target" retroreflector correction
   - (2) DORIS. USO effects (radiation, temperature).
   - (3) GNSS. Draconitic effects on GPS satellites.



Description of orbit errors

- **Issue #2 :** Cross-comparison between different several orbit solutions is useful to estimate derived sea-level estimations : application for TOPEX with 3 orbit solutions (GFZ, GSFC std1504, GRGS) has been performed by ***S. Rudenko*** and leads to a relevant error budget.

Global mean radial orbit errors over the ocean:
-*RMS*: up to ~ 7 mm, *seasonal* negligible,
-*interannual* < 0.1mm/year, *decadal* < 0.05 mm/year

Regional upper bound radial orbit errors:
-*RMS* <11 mm, strong sub-seasonal signal;
-*Seasonal*: up to 6 mm, sources: Earth's time variable gravity field, stability of tracking station sub-networks, AOD gravity modelling, geocenter motion correction;
-*Interannual* (5 years): up to 1.2 mm/year, sources: z-component of the reference system, Earth's time variable gravity field
-*Decadal*: up to 1.0 mm/year (~interannual variability), sources: Earth's time variable gravity field model, reference systems only secondary

Altimetry errors at short wavelengths

❑ **Issue #3:**

a) Spectral analyses based on Fourier transform are often used to describe sea-level errors at small ocean scale, however they present some limitations (parameterization, sensitivity, large variance and could prevent the estimation of errors at short wavelengths.

b) The alternative approach proposed by ***C. Mailhes*** is based on Auto-Regressive Spectral Analysis with data pre-processing to to warp the frequency.

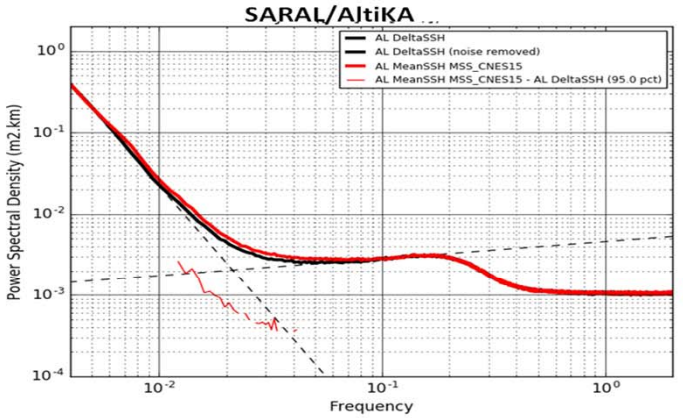
c) It is recommended to test this method with realistic and large data sets to validate it.

Altimetry errors at short wavelengths

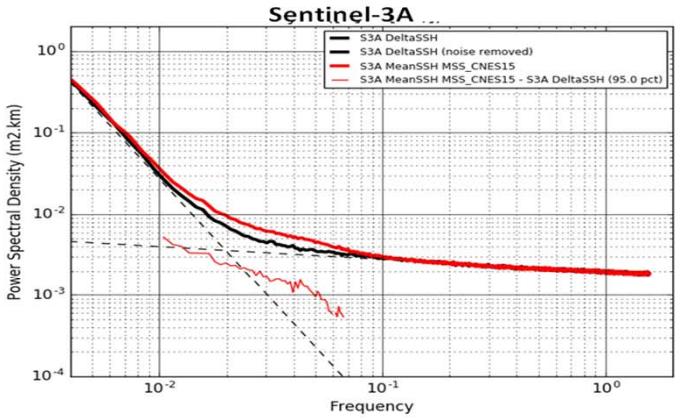
- **Issue #4:**

a) The seasonal variations of number spectra and noise presented by O. Vegara are of main importance to characterize altimetry errors.

b) Improving these kinds of analyses at regional scales will allow to prepare the SWOT mission : SARAL/Atika and Sentinal-3A are good candidates for this purpose



➢Mean MSS errors over [100, 30km] = 0.35 cm (**12.1%** of the SLA variance)



➢Mean MSS errors over [100, 30km] = 0.55 cm (**30.3%** of the SLA variance) = **2.5 x errors observed along AL tracks**

Round Table summary (1)

- **Recommendation #1: How to correct the TOPEX-A GMSL Drift?**

  Recognising the efforts currently performed on reprocessing the TOPEX data on JPL and CNES side, the best solution is to wait for the outcome of these efforts and include in the processing a newly produced internal path delay correction based on the analysis of the available Cal1 data (if possible). New validation phase has to be performed and this outcome is expected for next OSTST.

- **Recommendation #2: Error orbit solutions**

  To regularly update historical POD solutions based on gravity field variations, ITRF changes, and model improvements, as extrapolation of gravity fields variations and ITRF solutions into the future has proven to significantly affect the sea level time series.

Round Table summary (2)

- **Recommendation #3: Are our cal/val methods sufficient to verify the Jason-CS/Sentinel-6 global and regional mean sea level stability requirements?**

  A 1 mm/yr cannot be verified over a 1-yr commissioning period with tide-gauge comparison, we need a longer time series to check the requirement with this method.

- **Recommendation #4: Considering the possibility of switching on the redundant altimeter on JCS/S6 during the cal/val phase with Jason-3. If feasible, what is the number of cycles that the redundant altimeter should operate?**

  We are not convinced that switching for redundant side for a short period provides sufficient information to warrant the exercise : we recommend to do not activate the redundant JCS side during tandem