# Towards a more accurate performance estimation of altimetry

J.F. Legeais; C. Dufau; M. Ablain; G. Dibarboure; N. Picot. CLS, Space Oceanography Division, Toulouse. jlegeais@cls.fr

**Context :** Applications using satellite altimetry; Environnemental and climate studies

**Aim :** Altimetry is an operational observing system dedicated to various applications. It is therefore necessary to provide performance estimation as accurate and precise as possible.

## Global approach :

A complete error budget concern the altimeter itself, the satellite altitude, external geophysical corrections of the altimetric range, reference surfaces and other altimetric parameters.
Given the spatial and temporal sampling of the altimetric measurement, errors affect many different applications concerning ocean processes with various space and time scales. Error budget should take into account space or time correlation, dependency on physical parameters and heterogeneous distribution in space or time.
Moreover some corrections of the altimetric measurement depend on each other and the error on a correction may thus affect another one. *Figure 1* depicts a schematic view of these dependences.

In order to improve the altimetry error budget, a set of methods is proposed for analyzing the physical content of the altimetric corrections, their time and spatial scales and for assessing their impact on final altimeter data and surface references.

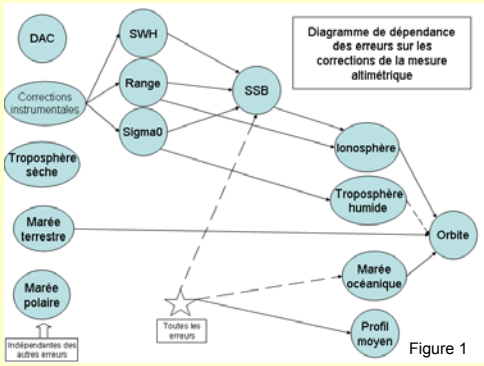


Figure 1

**Bibliography**

**Goal:** Sum up current knowledge, determine dependency of errors on each other and establish priorities in the study

**Tools:**
- Former published and unpublished studies
- Meeting and conference reports

**Analysis of the physical content**

**Goal:** Describe the signal itself before providing the associated error budget

**Tools:**
- Maps of mean and variance
- Along-track correlation
- Time series analysis of mean and standard deviation
- Spatial and temporal spectral analysis

**Comparison with different algorithms**

**Goal:** Quantify the improvement brought by a new algorithm

**Tools:**
- Maps of along-track differences
- Power spectra comparison

**Comparison with different versions of corrections**

**Goal:** Determine the impact of the corrections on SLA

**Tools:**
- Difference of mean profiles (mean of SSH)
- Difference of explained variance for comparison of 2 versions of a correction
- Power spectra comparison
- Analysis of SLA variance gain at crossovers via maps, temporal evolution and distribution vs distance from the coast

**Analysis of correlation between corrections**

**Goal:** Identify potential errors

**Tools:**
- Temporal filtering for analysis in a particular frequency bandwidth
- Correlation of a parameter with one or two others (e.g.. plot of MSLA vs wind speed and wave height)

**Comparison with in-situ data**

**Goal:** Determine coherence between altimetric measurements and in-situ data and quantify errors

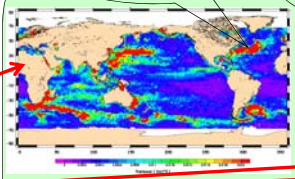
**Tools:**
- Use of tide gauge for estimating variance gain between altimetric SLA and SLA from in-situ measurement and analysis via temporal evolution and distribution vs distance from the coast
- Time series comparison

**Comparison with modeled corrections**

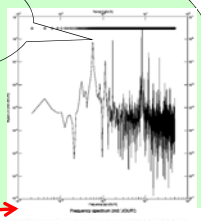
**Goal:** Determine coherence between altimetric measurements and modeled correction and quantify errors

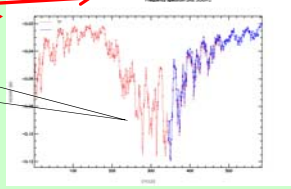
**Tools:**
- Map of variance difference
- Time series comparison
- Analysis of variance gain at crossovers via maps, temporal evolution and distribution vs distance from the coast
- Spectral analysis

Maxima of SLA variance shows oceanic variability

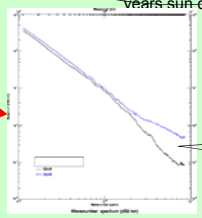


Temporal spectral analysis reveals energy peaks of tide

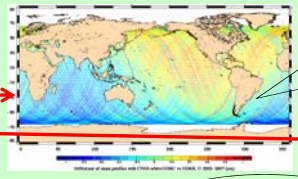




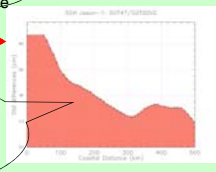
Magnitude of ionosphere correction impacted by the 11 years sun cycle



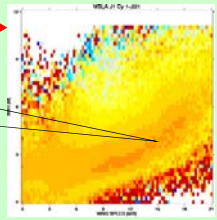
Varying slopes of $\sigma_0$ power spectra with different retracking: the more estimated parameters, the higher the error



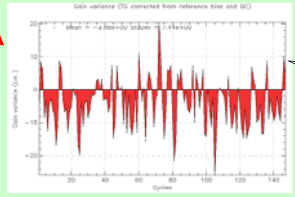
Impact of changing orbit on mean profile



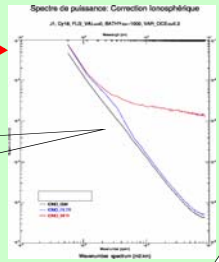
SLA variance gain at crossovers vs offshore distance for tide correction: improvement in coastal areas



Mean SLA vs wind speed and wave height: detection of potential absorption of oceanic variability by Sea State Bias



Time series of variance gain at crossovers between altimetric SLA and SLA from tide gauges



Power spectra of estimated, filtered and modeled ionosphere correction show noise suppress by filtering and accuracy of the model

## Outlook

This study is still under investigation and we progressively reduce the error on parameters due to their dependency on another parameter which error budget has been estimated.
The determination of which error affect which application (be it global or regional) will enable end-users to have an adapted error budget including the spatial and temporal distribution of the errors.
The results should constitute a step forward a better performance estimation of altimetry.