

OPTIMAL DISTRIBUTION OF TIDE GAUGES FOR CALIBRATING MULTIPLE SATELLITE ALTIMETRY MISSIONS

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Introduction: the VLM in the sea-level records

- Satellite altimetry needs to be calibrated with in-situ data from tide gauges for which vertical land movement information is available
- **o** 3 official absolute CAL/VAL sites: **Harvest**, **Corsica** and **Bass Strait**
- During the last OST/ST in Konstanz there was a demand for larger CAL/VAL network
- Preliminary study to evaluate the potential of a tide gauge network to calibrate one or several satellite altimetry missions, <u>only through a geometric approach</u>

Imagine that in-situ sea level observations and VLM information are available at every point of the french coastline... What would be the best potential sites for altimetry calibration?

Datasets

Satellite altimetry missions tracks & coastline

- Source: CNES(Aviso+) and ESA
- cleaning' usig Arcmap 10.1





EN = ERS + ENVISAT + SARAL/ALTIKA S3A = SENTINEL 3A S3B = SENTINEL 3B

+ GEBCO coastline



Ideal case...

In France

- **10 km** buffer on both sides of the tracks longer than **30 km**
- Intersection of the 4 polygons and the coastline





Ideal case...

In France



Intersection of the 4 polygons and the coastline





Case #1: Ideal case...

Globally



- Back to reality...
 - What is the current status? To what extent the density of the current network of tide gauges is a limitation?
 - **•** What about the availability of robust vertical land movements velocities at the coast?

Outline



- **a** 3 examples of runs: the four tracks, Sentinel missions & Sentinel missions + one Jason
- **For each run: current status & potential sites**
- **For each run: with and without the VLM information availability**

Datasets

Tide gauge network



Each point represents a place where a tide gauge is measuring (or has measured) sea level, so where it's pratically possible to have in-situ sea-level observations

IOC/SSC tide gauge network

SLV observations availability



IOC/SSC tide gauge network

SLV observations availability



What about the vertical land movement velocity availability?

Datasets

ULR GPS solution

 Calculation of a vertical velocity field from a global network of continuous GPS stations located nearby tide gauges over the period 1995-2014.



Median = 0.36 mm/yr

of stations

IOC/SSC tide gauge network

SLV observations + GPS vertical velocity availability



Where should be installed future TG and GPS stations to densify the 'calibration' network?

Potential on tide gauges installations

Where could it be 'esay' to install a tide gauge and GPS?





150°W 120°W 90°W 60°W 30°W 0° 30°E 60°E 90°E 120°E 150°E

Ifremer



Preliminary remarks

High constraints by the availability of in-situ sea-level measurements and VLM velocities

- Currently only Los Angeles (California, USA) and Santa Cruz (Galapagos, Chile) meet all the criteria.
- The 4 tracks datasets together (case #1): very high constraints over the calibration network.
 - EN tracks dataset has become 'unused'
 - Sentinel missions started to measure in 2016 for many years. What is the current status and potential of calibration network for both sentinel missions? (case #2)
 - What about adding one Jason mission (TP tracks dataset)? (case #3)

Current status – IOC/SSC network



Current status – IOC/SSC network + GPS velocity



< 50 km from a robust ULR6 GPS velocity

Potential of densification – IOC/SSC network + IFREMER harbours





Potential of densification – IOC/SSC network + IFREMER harbours + GPS velocity





< 50 km from a robust ULR6 GPS velocity

Case #3: Sentinel missions + Jason

Current status – IOC/SSC network

Adding one Jason mission...

S3A S3B TP



Current status – IOC/SSC network + GPS velocity

Adding one Jason mission...



TP





< 50 km from a robust ULR6 GPS velocity

Case #3: Sentinel missions + Jason

Potential of densification – IOC/SSC network + IFREMER harbours

Adding one Jason mission...



S3A

S3B

TP

from IFREMER dataset

Case #3: Sentinel missions + Jason

Potential of densification – IOC/SSC network + IFREMER harbours + GPS velocity

Adding one Jason mission...

S3A S3B TP



from IFREMER dataset

< 50 km from a robust ULR6 GPS velocity

Conclusions & perspectives

High constraints from the availability of in-situ sea-level measurements and VLM velocities

- **©** Few stations meet the criteria for one Jason and the 2 Sentinel missions
- **D** Need to install new tide gauges and GPS stations to obtain a globally distributed calibration network
- The availability of the GNSS@TG geodetic ties has not been investigated, but it still very important for absolute calibration \rightarrow need of leveling campaign at tide gauge sites
- The selection criteria are only geometric: the altimetry and tide gauge data still need to be compared.
- Refine the processing parameters (width of the buffer, minimum length of the tracks, ...). Adjust parameters depending on the missions?
- Provide these results through a dynamic map on the SONEL portal



THANK YOU FOR YOUR ATTENTION