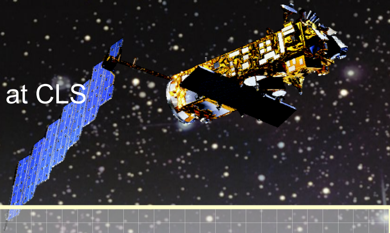
Monitoring of altimeter measurements against a global tide gauge network



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Objectives

The relative range calibration consists in monitoring the long term altimeters' bias.
Our objective is to estimate temporal drifts of altimeters with long term monitoring of satellite altimetry systems and to correct them by the means of tide gauges data network.
This poster presents the results of the monitoring of altimetry satellites (TOPEX/Poséidon, Jason-1, EnviSat and Geosat Follow-On) against tide gauge data.

Problematic

The usefulness of tide gauge data networks for calibrating satellite altimetry systems was demonstrated by several authors (Mitchum [1994, 2000], Chambers et al. [1998], Cazenave et al. [1999]…). Their proposition was to use tide gauge data as an independent system to monitor drifts and bias of altimeter system over time.

We took over their works and improved them for operational purposes to compare altimeter measurements with a specific tide gauge database processed at CLS: BaDoMar (Base de Données Marégraphique: tide gauge database). It is based on the GLOSS/CLIVAR "fast" sea level data tide gauge network (formerly known as the WOCE network).

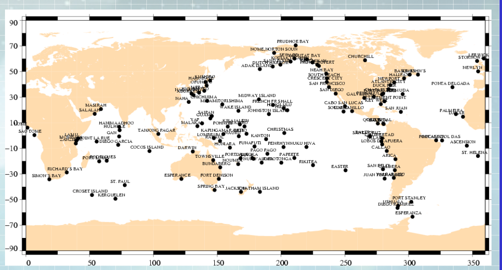
The main interest of tide gauges for altimetry is to provide independent measurements of sea surface height variations. The basic idea of the method is that differences between tide gauges and altimetry should not have any drift or bias over long time scales. Selecting tide gauge stations where the differences between altimetry heights and tide gauge sea levels are small, is essential to get good variance estimates.

The methodology of the comparisons of altimeter data against tide gauge measurements is now operational.

Inventory of the used tide gauges

Tide gauge network:
GLOSS/CLIVAR "fast" sea level data

- Main activity of the University of Hawaii Sea Level Center (USHLC)
- Supported by the NOAA Climate and Global Change program
- ~140 tide gauges (sometimes available since more than 10 years!!!)
- Near real time data



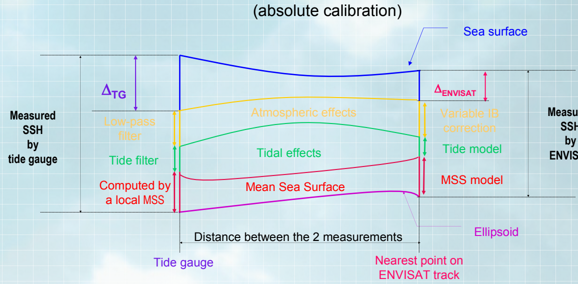
Methodology

A specific method named CAlaMar (Calibration Altimétrie/Marégraphie: Altimetry/Tide Gauge calibration) is developed and operationally run at CLS:

1. Download of the data from the UHSLC
2. Conversion on the UHSLC to CLS NetCDF data with some validations
3. Processing and filtering of tide gauge data:
   - Filter the short wavelengths (semi-diurnal and diurnal) : low-pass filter (Demerliac filter [Bessero, 1985]
   - Filter the long wavelengths (weekly to annual) : specific algorithm (adapted from [Cartwright and Eden, 1973])
4. Processing and filtering of altimetry data:
   - Altimetry data extracted from the GDRs available at CLS
   - Instrumental corrections and geophysical corrections applied:
     - Tidal correction (FES2004, [Lyard et al., 2006])
     - Atmospheric corrections (IB [Dorandeu et al., 1999] or DAC [AVISO, 2006])
   - Along-track filtering (reduce measurement noise and improve data accuracy used in shallow water)
5. Selection of the several types of data to compare
6. Computation of statistics

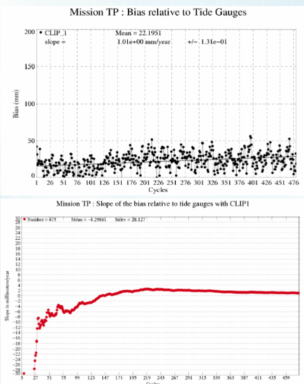
Bias = ΔENVISAT - ΔTG (+/- errors on models and measurements)

(absolute calibration)

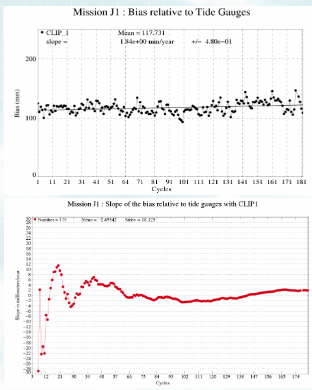


Main results

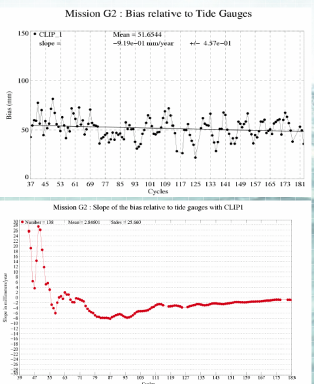
TOPEX/POSEIDON



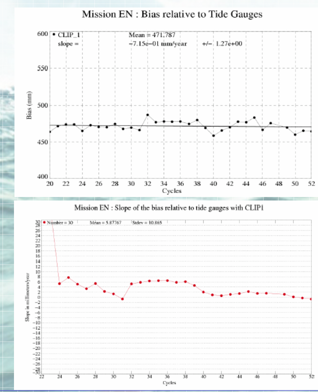
JASON-1



GEOSAT FOLLOW-ON



ENVISAT



Estimation of land drifts

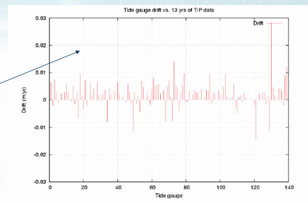
A main issue remains: the estimation of the land drift at tide gauge location.

Two on going sensitive studies are undertaken to estimate these drifts:

1. Using 14 years of TOPEX/Poséidon data
2. Using geodetic observations (ITRF2005)

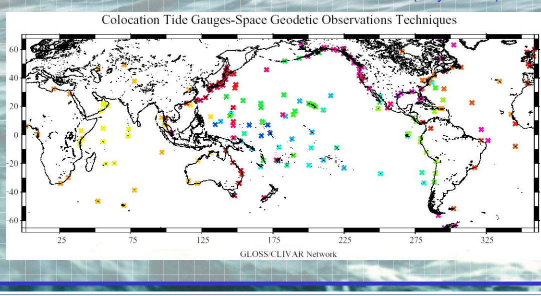
Main goals of this study on tide gauges:

- Collocate tide gauges with space-geodetic observations techniques:
  1. DORIS (Détermination d'Orbite et Radiopositionnement Intégrés par Satellite)
  2. GPS (Global Positioning System)
  3. SLR (Satellite Laser Ranging)
  4. VLBI (Very Long Baseline Interferometry)
- Extract vertical crustal motions from ITRF2005 data
- Compare these vertical velocities with those from tide gauges computed with T/P
- Correct tide gauges records of vertical crustal motions calibrate altimeter satellites



Estimation of land drift at tide gauge location by the means of T/P data

GLOSS/CLIVAR tide gauge Point La Rue collocated with a DORIS station in Mahe Island (Seychelles)



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