Comparing tide gauges and altimetry observations in the Bay of Biscay

Marta Marcos, Guy Woppelmann, Wolfgang Bosch

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- Available data sets
- Sea level trends
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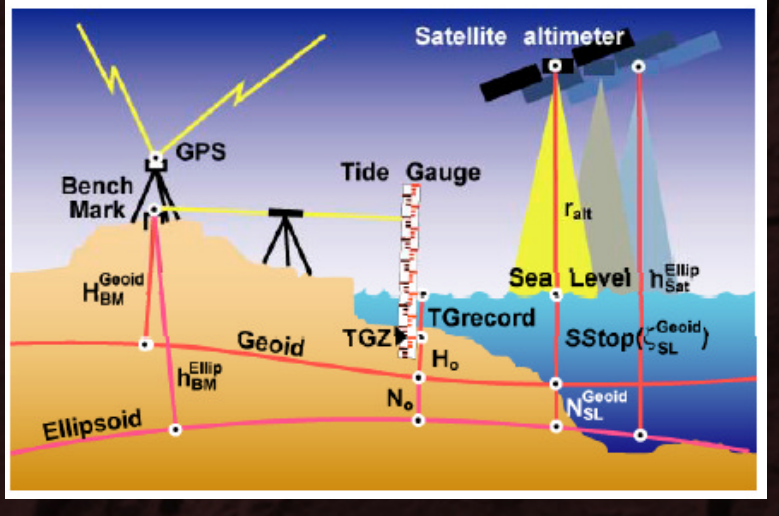
COSSTAGT Project

Coastal Sea Surface Topography from Altimetry, Gravity and Tide Gauge Data

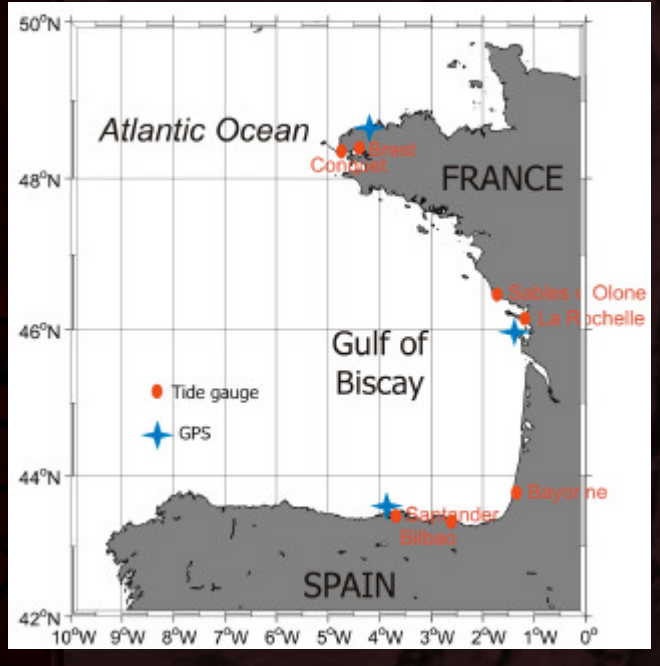
Objective:
Estimate the sea surface topography and its low frequency variability at selected coastal areas



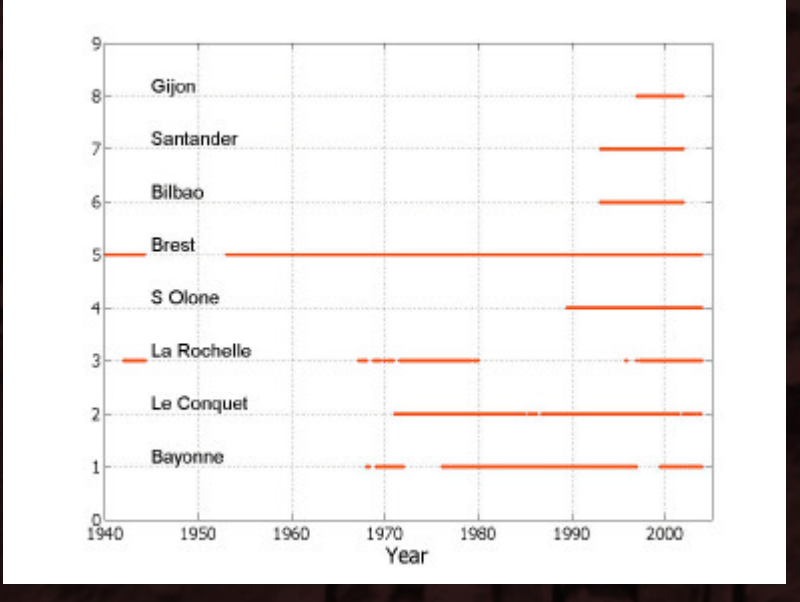
http://www.dgfi.badw.de/COSSTAGT

Data sets

Tide gauges in the Bay of Biscay



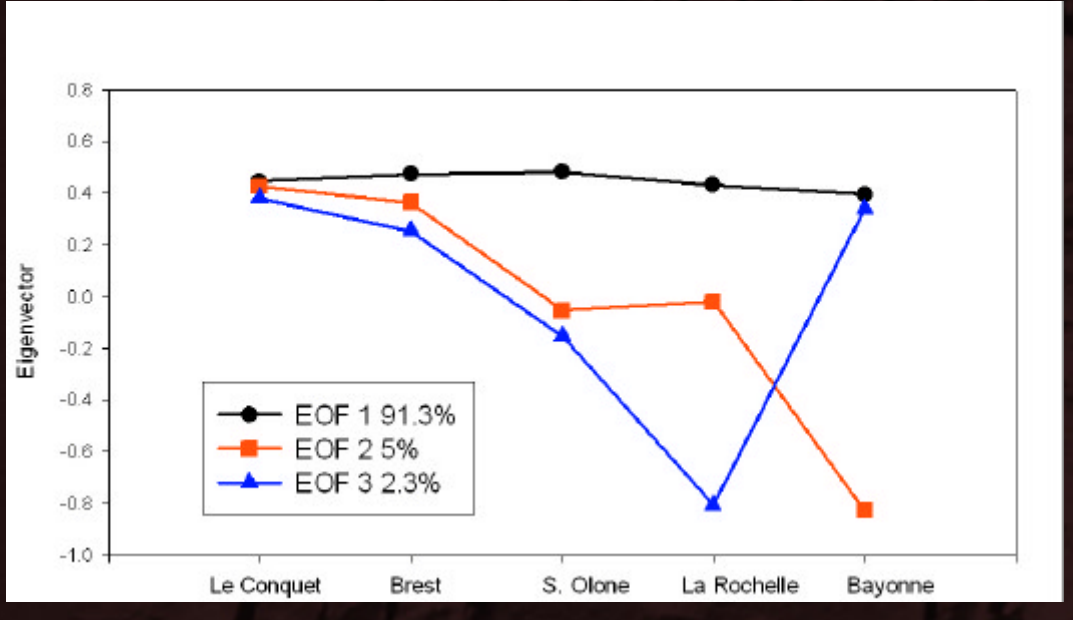
Available data periods



Data sets

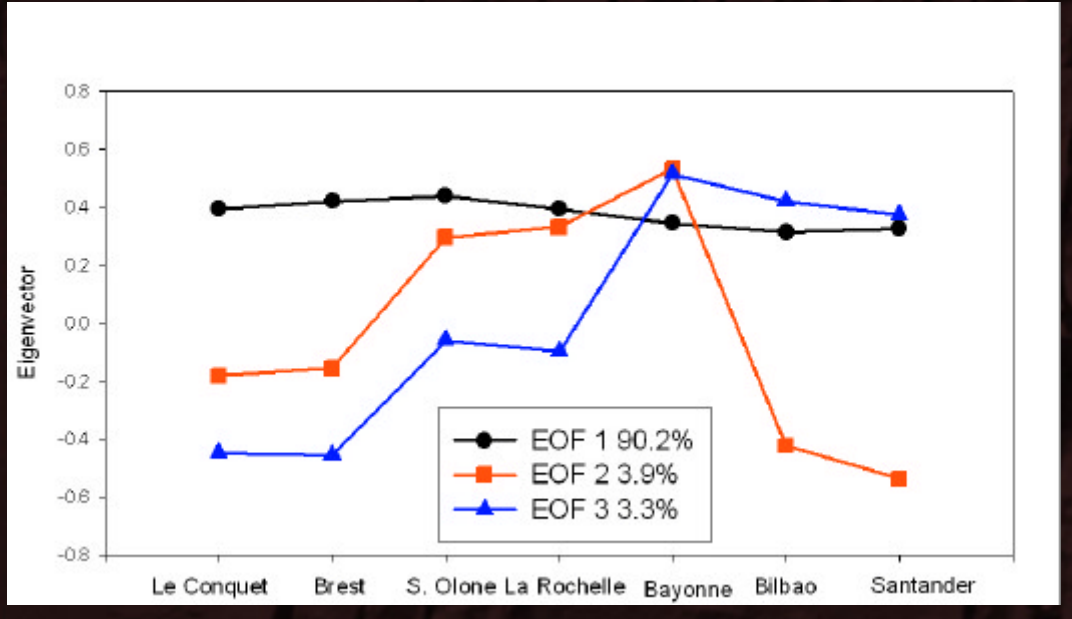
Intercomparison between TG

EOF analysis for daily TG data



Data sets

Intercomparison between TG



Data sets

Tidal contribution to sea level variance

Station	% variance of tides
Brest	99.16
Le Conquet	99.32
Sables d ' Olonne	98.63
La Rochelle	98.97
Bayonne	98.50
Bilbao	99.03
Santander	99.02
Gijón	98.86

Data sets

Sea level trends

Station	Period	Trend (mm/year)	95% C.I. (mm/year)
Brest	1940-2003	1.44	0.10
Le Conquet	1971-2003	3.25	0.21
S. d ' Olonne	1989-2003	**8.08**	0.74
La Rochelle	1942-2003	2.08	0.15
Bilbao	1993-2004	4.45	0.82
Santander	1993-2004	3.78	0.74

Data sets

Sea level trends

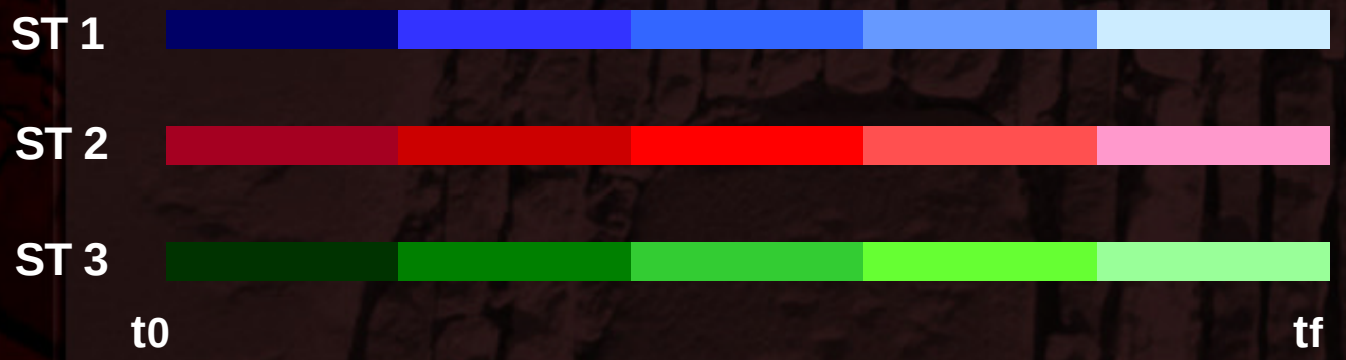
Station	Period	Trend (mm/year)	95% C.I. (mm/year)	Trend (mm/year) 1993-8/2002	95% C.I. (mm/year)
Brest	1940-2003	1.44	0.10	2.91	1.45
Le Conquet	1971-2003	3.25	0.21	5.66	1.38
S. d ' Olonne	1989-2003	**8.08**	0.74	**10.44**	1.42
La Rochelle	1942-2003	2.08	0.15	3.97 (1.19)	2.93 (3.24)
Bilbao	1993-2004	4.45	0.82	4.36	1.28
Santander	1993-2004	3.78	0.74	2.99	1.09

Data sets

Analysis of the tide gauge in Sables d'Olonne

Le Conquet, Brest, S. d'Olonne, La Rochelle

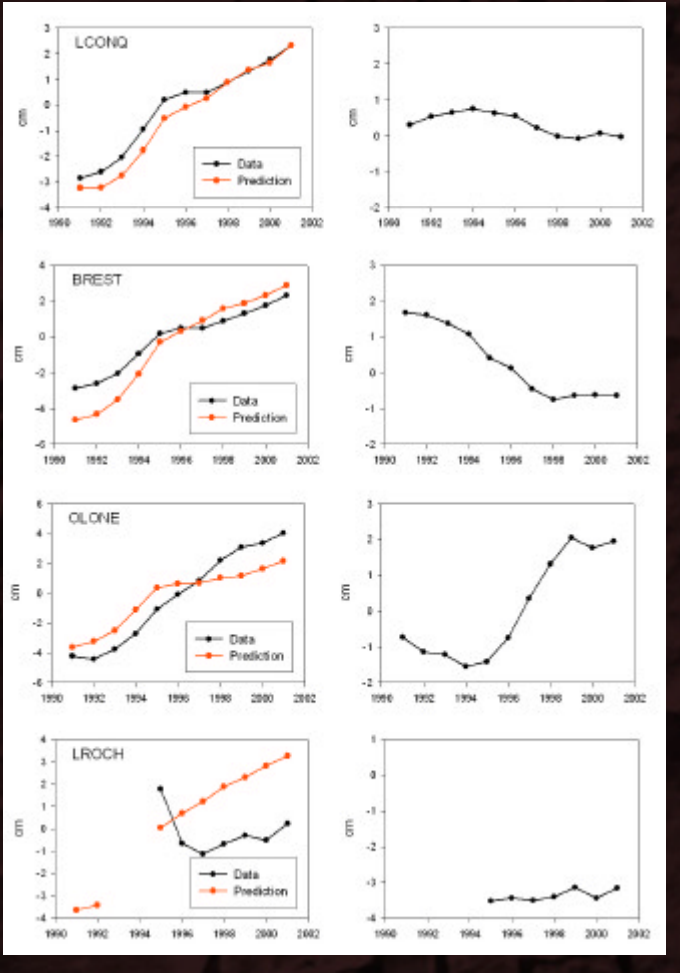
EOF analysis: fills data gaps using neighboring stations



Data sets

Period : 1989-2003

The results indicate a possible reference jump in Sables d'Olonne during the period 1996-1998.



Data sets

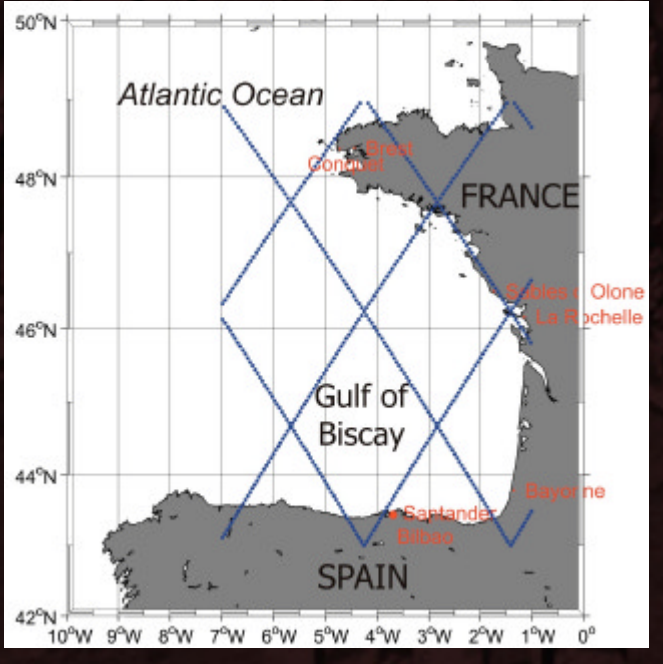
Altimetry data set

SSH from TOPEX/POSEIDON (T/P)

Period 1993-Aug/2002

SLA computed used the Mean Sea Surface
CLS01 model

Tidal correction:
FES2004 model



Data sets

Resampling into bins of altimetry data:

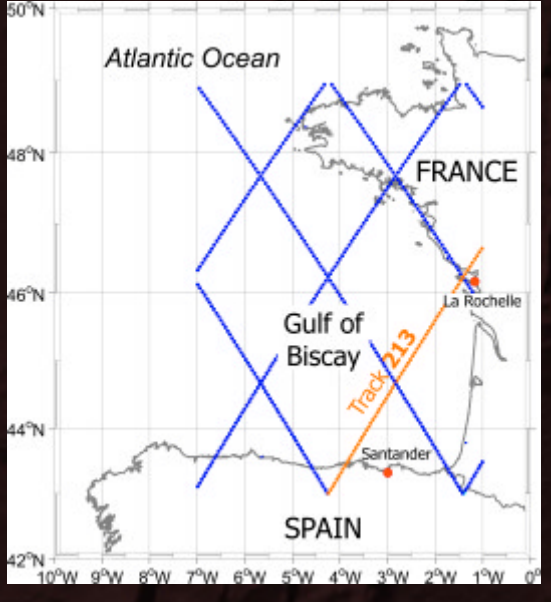
Each measure is interpolated to the centre of the bin using the along and cross-track slopes given by the mean sea surface CLS01

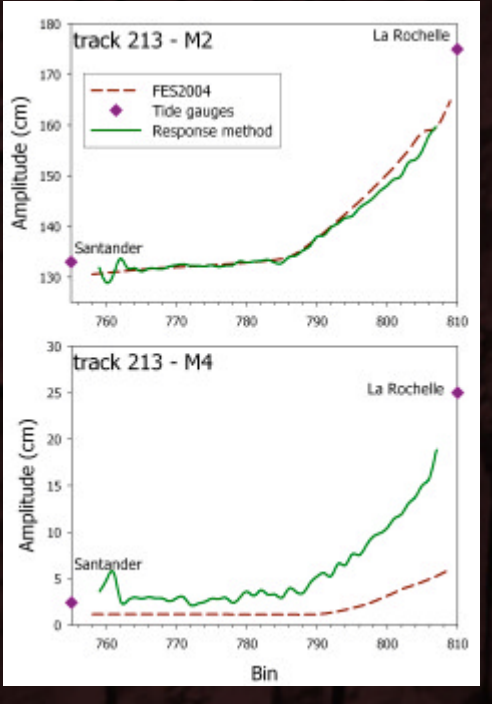
Size of the bins ~7 km

Data sets

Data post-processing:

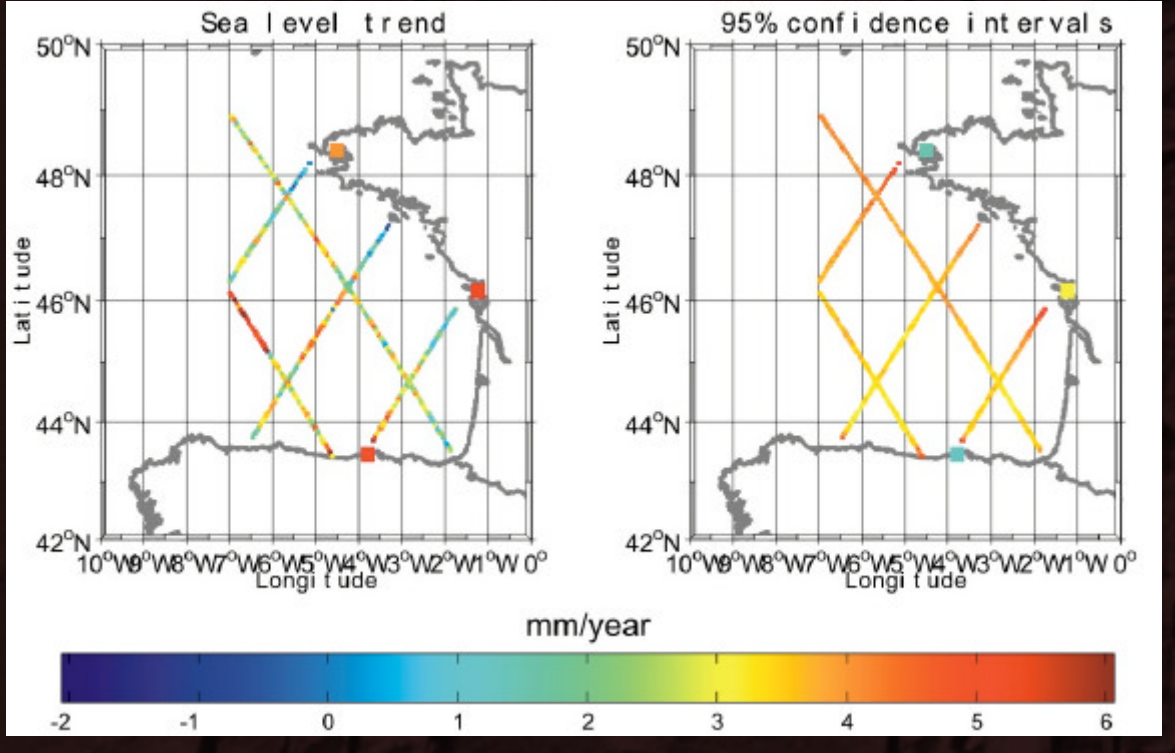
- removing of outliers
- residual tidal analysis





Sea level trends

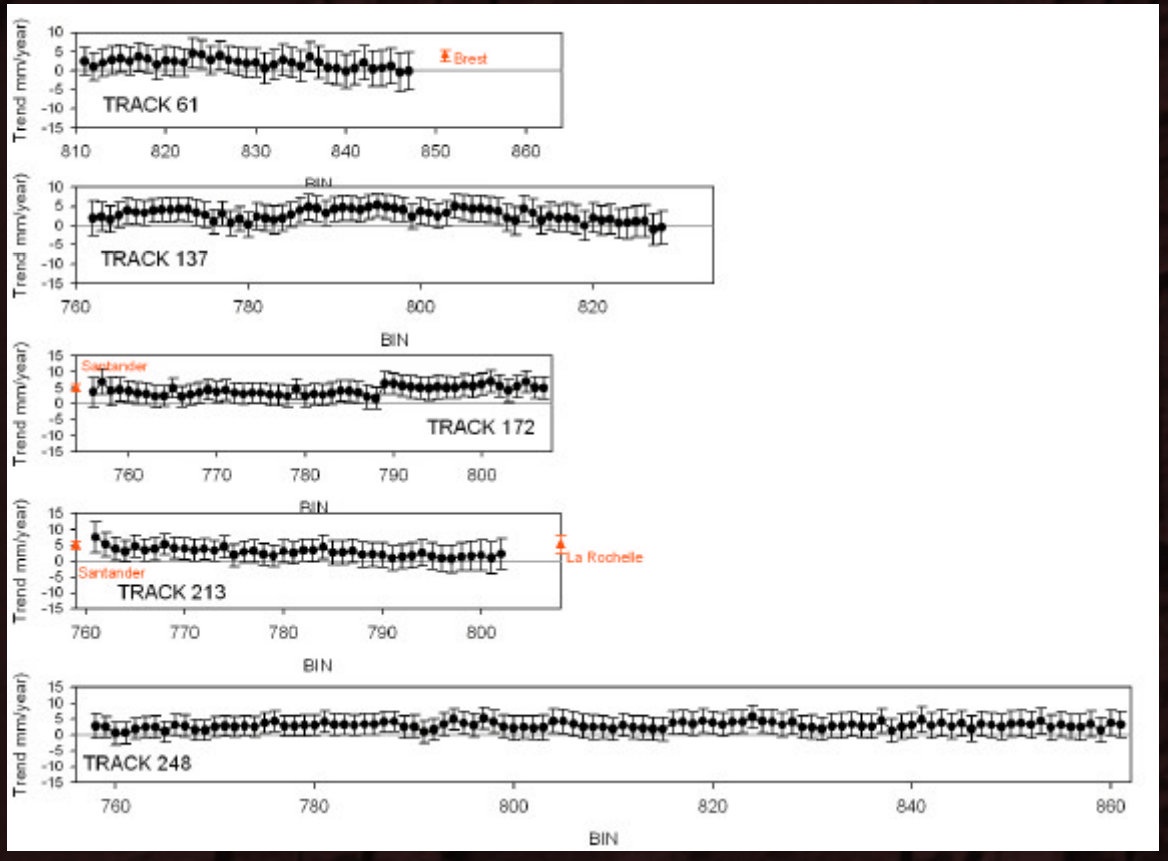
Sea level trends 1993-2002



Sea level trends

Station	Trend (mm/year)	GPS trend(mm/year)	GPS corrected trend(mm/year)
Brest	2.91 ± 1.45	-1.01 ± 0.23	3.92 ± 1.47
Le Conquet	5.66 ± 1.38	-	-
La Rochelle	3.97 ± 2.93	-1.93 ± 0.43	5.15 ± 2.97
Bilbao	4.36 ± 1.28	-	-
Santander	2.99 ± 1.09	-1.18 ± 0.47	4.92 ± 1.17

Sea level trends



Sea level trends

Mean sea level rise

T/P → 3.05 ± 0.21 mm/year

T/P IB corrected → 2.28 ± 0.10 mm/year

About 15% is due to atmospheric pressure effects that enhance the thermosteric sea level rise

Sea level trends

T/P → 3.05 ± 0.21 mm/year

TG → 4.59 ± 0.88 mm/year

Differences NOT caused by

- Different physical processes
- Different sea level rise velocities between coast and open ocean:

  "Coastal" MSL rise = 2.49 ± 0.45 mm/year

  computed for all the observations within a distance smaller than 70 km from the coast

Sea level trends

Possible causes of differences

Inaccurate parameterizations of T/P data:

ionosphere correction (error 0.4-0.8 mm/y, Zhao et al.,2004)

SSB model (Chambers 2003)

GPS data:

systematic errors from the models used in the GPS processing

Summary

• The COSSTAGT Project has provided the framework for the TG and T/P analysis in the Bay of Biscay

• A consistent TG data set is available in the region, after discarding the stations in Bayonne and S. d'Olonne

• The intercomparison of nearby TG has allowed the detection of a malfunctioning in Sables d'Olonne (a possible reference jump)

• Most part of the variance in the region is explained in terms of common processes

Summary

• Sea level trends computed at coastal stations and nearby altimetric measurements are statistically consistent, for the period 1993-8/2002

• However, regional sea level rise computed from TG and from T/P differ.