

# The Role of Altimetry in Coastal Observing Systems

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**EXECUTIVE SUMMARY** This contribution is about **coastal altimetry**. We summarize the technical **challenges** that satellite altimetry faces in the coastal zone, and the **research** that is being carried out on this topic by a very lively **community**. We introduce the new coastal altimetry **data** that are becoming available, and discuss how we can **calibrate/validate** those data. Then we show several of the possible **applications** of coastal altimetry and conclude by looking at the **future** of the discipline, and at how we can **build capacity** in coastal altimetry.

## CHALLENGES

- The main challenges in coastal altimetry are:
- Reprocessing of the high-rate altimetric waveforms (known as **retracking**) is needed to recover the sea surface height (SSH) signal in the 'last 10 km' next to the coast. Specific coastal retracers are subject of ongoing research and account for the effects on waveforms due to land and bright targets.
  - The **wet tropospheric correction** is a main source of error in the coastal zone where the open-ocean microwave radiometer-derived correction becomes inadequate due to land contamination. Several alternative methods are being developed, with encouraging results.
  - Some applications require removal of **tides and atmospheric signals**, and large errors in tidal models and in the models used to obtain HF and inverse barometer corrections remain a problem. These models are improving, but require detailed coastal bathymetry with horizontal resolutions of at least 1 km (preferably 200 m)
  - The **ionospheric delay correction** and the **sea state bias correction** are also a concern, although not the greatest error source.

## RESEARCH & COMMUNITY

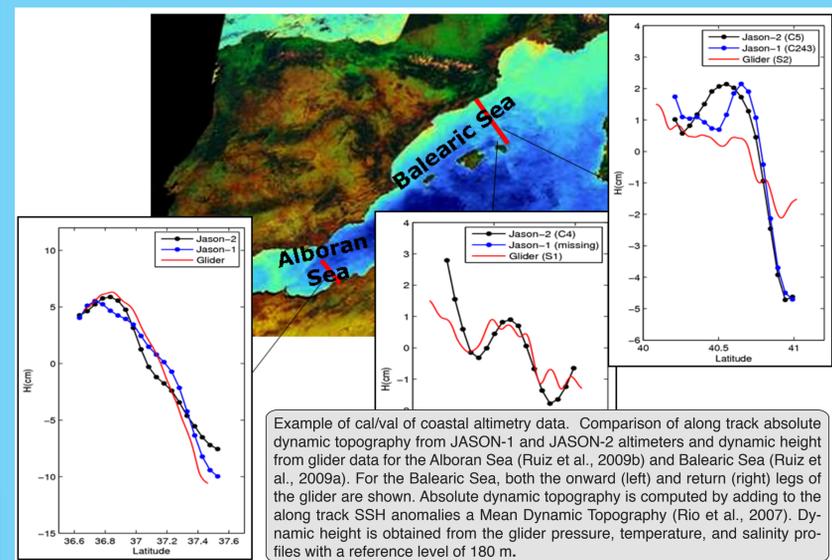
Many efforts are being put into overcoming these challenges and extending the altimeter-derived measurements of sea level, wind speed and significant wave height as close as possible to the coast. The major Space Agencies are sustaining coastal altimetry research through dedicated projects like PISTACH (funded by CNES), COASTALT (ESA) and some OST-ST projects (NASA/CNES). A new and lively coastal altimetry community, inherently interdisciplinary, has already had three well-attended international workshops, and is producing a book on the subject

## DATA

Coastal altimetry data are starting to become available. Improved along-track data from the XTRACK reprocessing scheme are made available by CTOH. Recently, the PISTACH project has reprocessed the whole Jason-2 archive near the coasts to give access to high-resolution (20 Hz i.e. ~350 m) along-track altimetric measurements (available from ftpsedr.cls.fr/pub/oceano/pistach/), with an ensured continuity from the open ocean up to the shoreline. These data allow a finer description of short scale (5-20 km) coastal phenomena, with the most significant gain with respect to classical 1-Hz Level-2 altimetry products expected on the representation of local gradients and hence currents. COASTALT is also reprocessing data from the Envisat RA-2 altimeter over a selection of pilot passes around Europe.

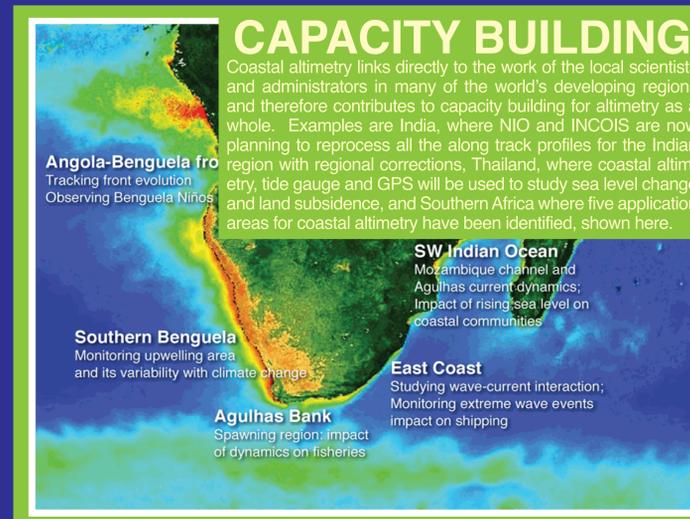
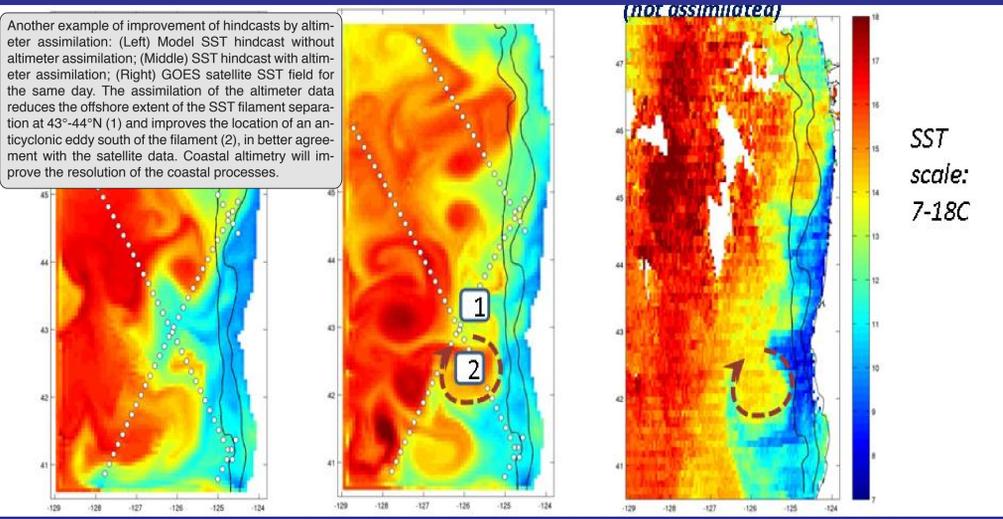
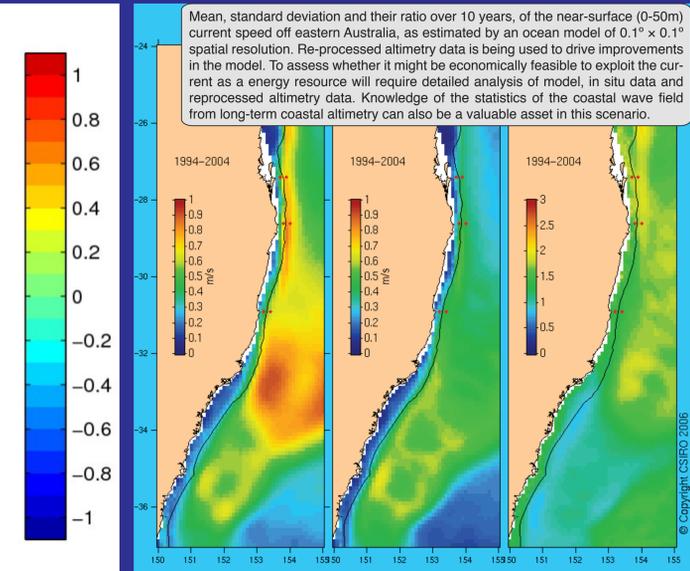
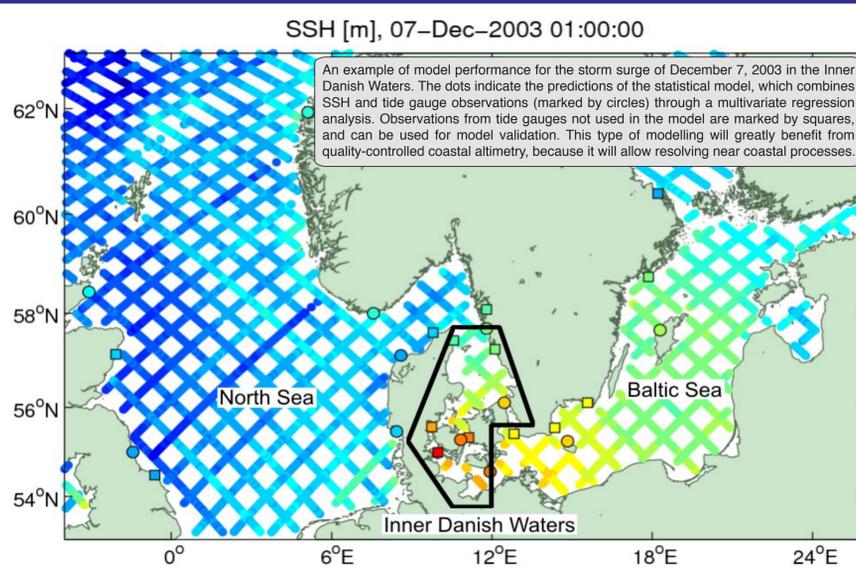
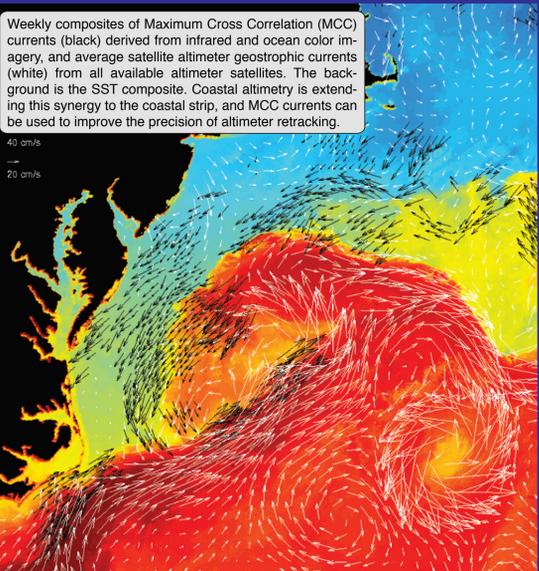
## CALIBRATION AND VALIDATION

Coastal altimetry must be calibrated and validated with independent observing systems at several temporal and spatial scales. There is consensus that the so far unexploited capabilities arising from the merging of existing in situ (glider, tide gauges, drifters) data sources with remote sensing data (SST, altimetry) must be investigated in a calibration-validation environment to improve the understanding of the physical contents of each measurement



# APPLICATIONS

current and foreseen applications of coastal altimetry data, exploiting their synergy with other data and models



## THE FUTURE

**We need to:**

- continue the cutting edge **research on re-tracking and corrections**
- invest in advanced calibration/validation systems to **validate the new data** in the context of dramatic space/time variability in the coastal zone
- keep **promoting widespread adoption** of coastal altimetry and **capacity building** maximise the **impact of the existing data**, (a 17-year long dataset) in **applications** like those described above
- exploit future missions**, both nadir-viewing (CryoSat, Sentinel-3 both sporting a novel delay-Doppler altimeter) and wide-swath (SWOT), which should improve both quantity and quality of coastal altimetry data

**TAKE HOME MESSAGE:** Altimetry is a **legitimate component of operational coastal observing and modelling systems**, and can play a significant role in those systems now that the obstacles in retrieving the coastal SSH, wave and wind data are being overcome. But **continued support is needed for coastal altimetry**, with efforts towards promoting the long existing datasets (a real asset) and exploiting the several forthcoming missions, so that the multi-decadal record is not only continued, but also improved in quality and quantity, and the transition to operational systems is completed