An overview of recent progress in Coastal Altimetry and its synergies with modeling

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The Coastal Altimetry Community

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- Int   sts

Highlights from CAW-10 in Florence

- 73 abstracts, 35 orals, 38 posters, **118 participants, 28 countries**

- Synergy with coastal and regional modelling featured prominently
    - dedicated ARCOM session

- Data access and user support are crucial
    - High-resolution along-track should be made more accessible to non experts, with well-documented manuals in user-oriented formats.

- Need to improve MSS, MDT, better bathymetry, and studies on how to exploit the higher resolution

Highlights- waveforms and retracking

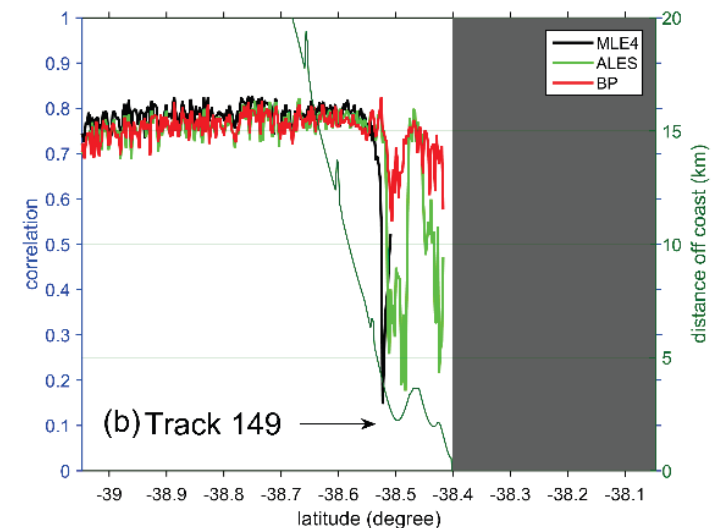- Precision and reliability of high-resolution data in the coastal zone steadily increasing (better retracking)
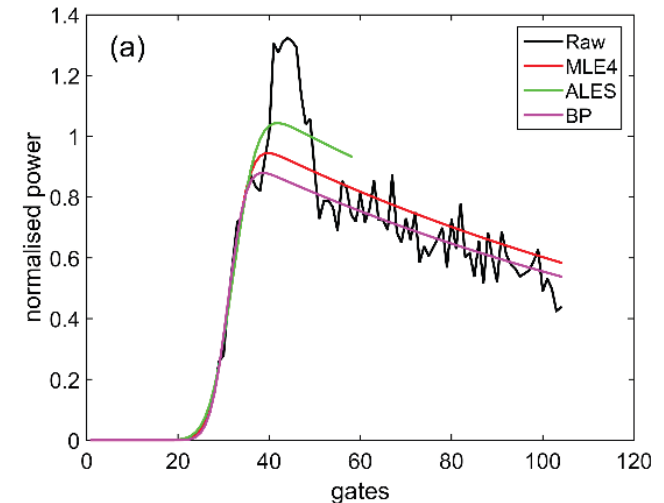
Examples of fitted waveforms from BP, ALES and MLE4
Peng and Deng
With a new retracker for Brown-peaky waveform

Highlights- waveforms and retracking

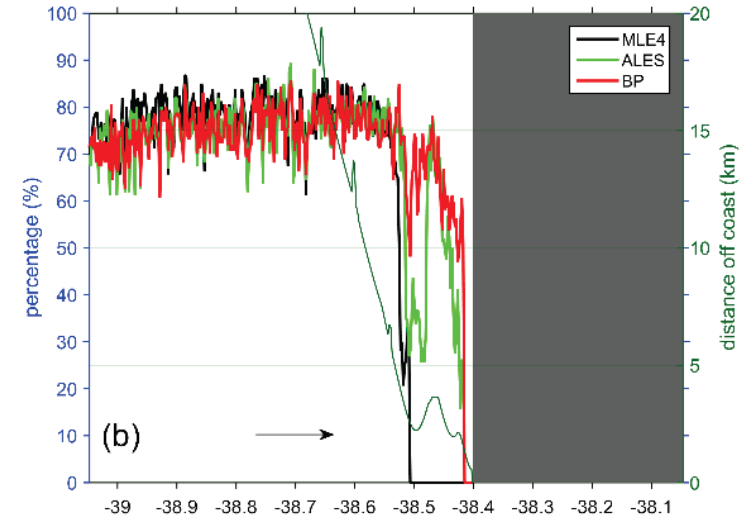- Precision and reliability of high-resolution data in the coastal zone steadily increasing (better retracking)

Highlights- waveforms and retracking

- Precision and reliability of high-resolution data in the coastal zone steadily increasing (better retracking)

- Retracked data available from a number of sources (new COSTA dataset from DGFI-TUM, PEACHI datasets from CNES/CLS)

- High-Resolution data allow observation of new signals, such as internal solitary waves;
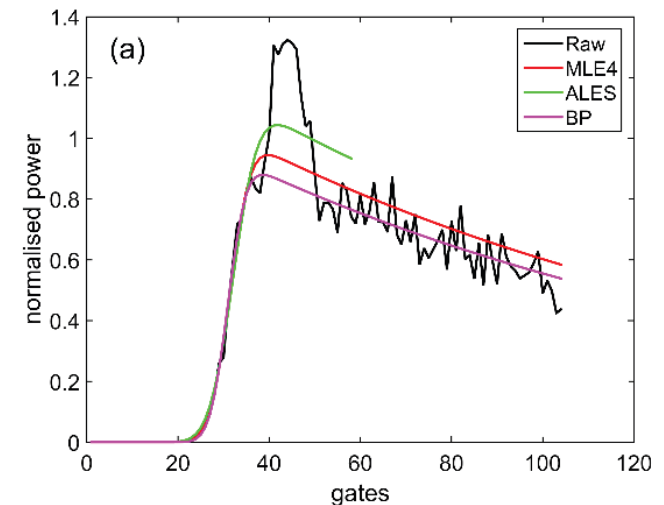

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Highlights - Corrections

- Further advances are expected from improvements in atmospheric corrections, geophysical corrections and Mean Sea Surface (MSS)

- Wet tropo correction and tides are always improving (examples: GPD+, FES2014) but remain main source of errors in coastal zone

- MSS is also an important source of errors in the retrieval of the sea surface height anomalies. Particularly for new untracked missions

Handoko , Fernandes and Lazaro
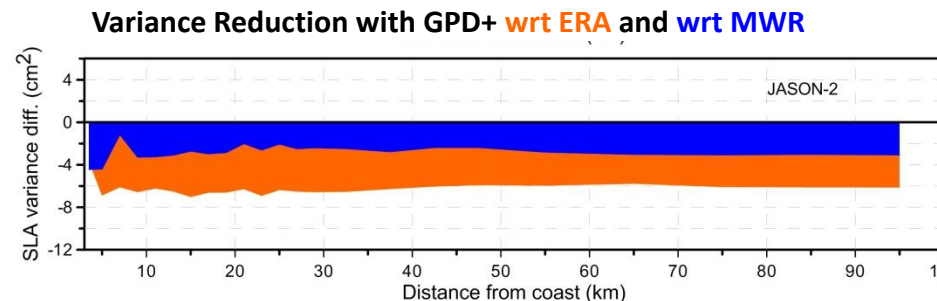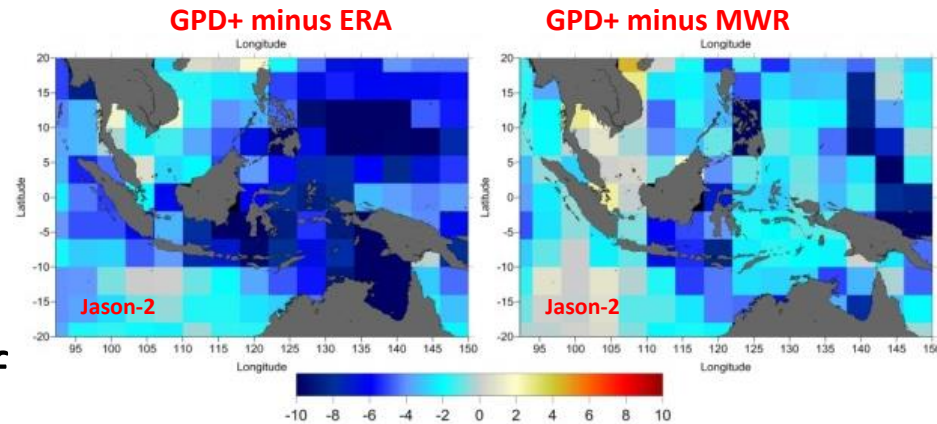
GPD+ minus ERA   **GPD+ minus MWR**

Variance Reduction with GPD+ wrt ERA and wrt MWR
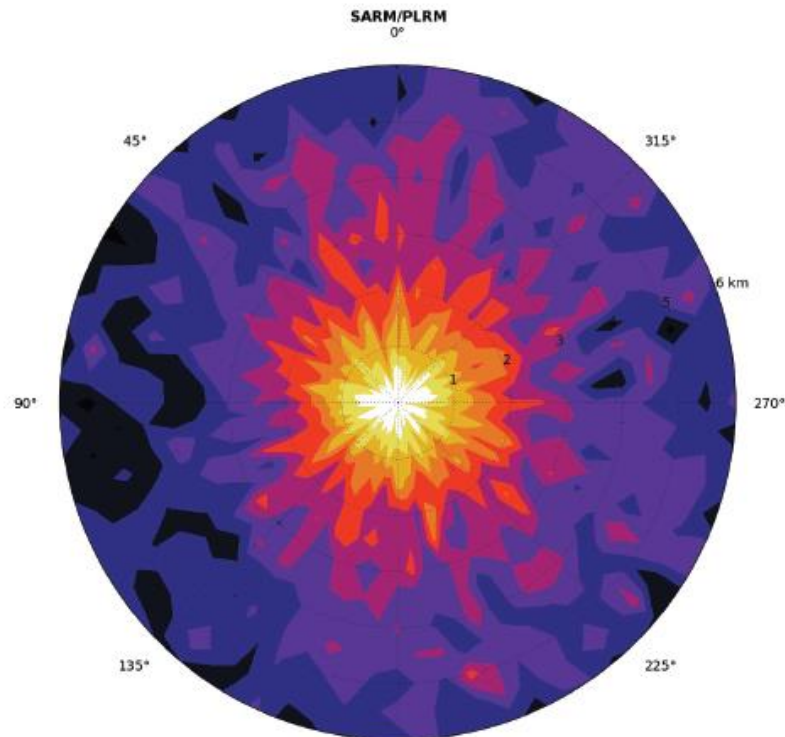
Highlights - Performance and Cal/Val

- SAR processing (Sentinel 3 and Cryosat-2 in some areas) offers much improvement but still work in progress.

  Sentinel-3 Validation Team meeting feedback (*R.Scharoo)*
  - ✓ Caspian Sea and Great Lakes to be included in Marine as well as Land product
  - ✓ New L2 in June revision: SAMOSA 2.5, MSS CNES-CLS15, MSS DTU15, FES2014b tide model, sigma0 attenuation applied, netCDF compression
  - ✓ Future enhancements: specialized distance-to-coast, dedicated L1 for sea-ice and land, GPD+, improved rain flag
  - ✓ Reprocess all data with next baseline (produce L1A, L1B-s) in April
  - ✓ Reprocess all data (including prior to June '16) in Summer 2017

Highlights - Performance and Cal/Val

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- Focus on Sentinel-3 coastal approach (*M.Raynal*)

Measurement available as a function of the **coastal distance** and the **coastal approach angle**

➢ Close to the coast, the <u>number of available</u> measurement is <u>higher in SARM</u> compared to the classical measurement mode

Highlights - Performance and Cal/Val

- SAR processing (Sentinel 3 and ... much improvement but still wc...

- Focus on Sentinel-3 coastal app...

- The very small scales of ocean dynamics, i.e. those at the high resolution offered by the SAR and SARin modes, need to be investigated further

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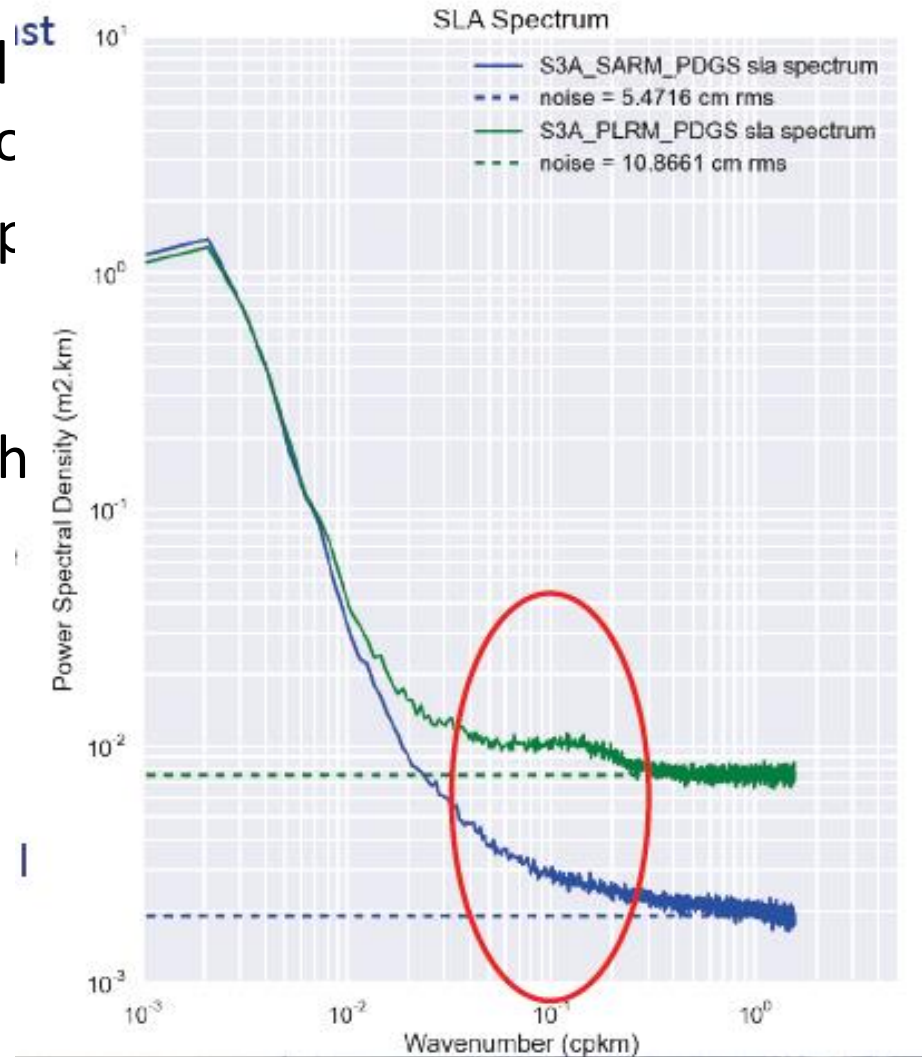
- Focus on Sentinel-3 coastal approach (*M.Raynal*)

- The very small scales of ocean dynamics, i.e. those at the high resolution offered by the SAR and SARin modes, need to be investigated further

- Absolute calibration requires a very well defined datum, as it is the case for the Corsica site.

Synergy with modeling, ARCOM

After 2015 first ARCOM pilot event, we want to

✓ Pursue to **arouse interest for altimetry** within the coastal modeling community trough 2 events :

> ✓ ARCOM17'a :During CAW10
>
> ✓ ARCOM17'b: During the 5th ICM COSS-TT (today)

✓ Guide the modeling community in the uptake of **coastal/HR altimetry**

> ✓ Improve products information and access
>
> ✓ Establish concrete links

1st ARCOM session during CAW10

- 8 oral presentations , 4 posters
- **Three different thematics** :
  - Data products for modelling systems (1)
  - Sea level processes in regional and coastal seas (6)
  - Altimeter Data Assimilation (5)
- **Main outcomes**
  - Request of high-level products, easier to use
  - More visibility for altimetry products dedicated to COSS
  - Focus to be done on the COSS dynamics

1) Need of higher-level products

Products vary today in ease of use. Need help from expert altimetrist

Request :

– 20 Hz level 2 with limited set of recommended and documented defaults ("*not only ingredients but also recipes"*)

– 20 Hz level 3 (ready-to-test) enriched with corrections (tides, DAC, …)

– No need of level-4 (gridded product)

– Unity/consistency in multi-sat products and formats

– Community tools in support of applications

2) COSS Dynamics

– Growing interest in submesoscale – unifying coastal and open ocean communities

– IB and DAC are different dynamics – should be separated

– Using altimeter data in conjunction with tide gauges is not obvious

3) Visibility for altimetry products dedicated to COSS

- Wiki or User Forum: expert help for novice users
- Demonstrate value-added by comprehensive use
- Encourage greater focus on sea level in model analysis
- Identify coastal regimes/processes (river plumes, fronts, internal waves, estuaries) potentially informed by altimetry

Coastal/High-Resolution datasets

➢ List drafted in 2015 during the ARCOM-pilot worskhop

➢ Updated in November 2016 by *Cipollini et al., Surv. Geophys., 2017*

Available on to http://www.coastalt.eu/community#datasets

ID	Produced by	Altimeter	Product level	Posting rate	Coverage	Download from	Comments
PISTACH	CLS CNES	j2	L2	20 Hz	Global	AVISO+	Experimental Jason-2 products for Hydrology and Coastal studies with specific processing. Will be discontinued at the end of 2016 in favour of PEACHI
PEACHI	CLS CNES	sa, (j2 to be added soon)	L2	40 Hz	Global	AVISO+ / ODES	Experimental SARAL/AltiKa products including dedicated retracking and corrections leading to more accurate products for coastal zones, hydrology and ice. From 2017 expected to generate also j2 products
XTRACK	LEGOS-CTOH	tx, j1, j2, gfo, en (sa to be added soon)	L2, L3	1 Hz 20Hz (test)	23 regions covering the whole coastal ocean	CTOH AVISO+ / ODES	Specific processing using improved data screening and latest corrections available
ALES	NOC	j2, n1, (j1, j3 to be added soon)	L2	20 Hz	Global, <50 km from coast	PODAAC	Experimental products from the ALES processor included in SGDR-type files alongside the standard products and corrections.
SARvatore	ESA-ESRIN	c2 (SAR only)	L2	20 Hz	SAR mode regions	ESA GPOD	On-demand Processing service for the CryoSat-2 SAR mode data where the user can configure some processing parameters to meet specific requirements (for istance for the coastal zone)
COP	ESA	c2 (LRM/PLRM)	L2	20 Hz	Global	ESA	Global products for CryoSat-2 from an Ocean processor (output is in PLRM over the SAR mode regions) - but no specific coastal processing
COSTA	DGFI-TUM	e2,en (j1,j2,e1 to be added soon)	L3	1 Hz 20 Hz	Mediterranean and North Sea	PANGAEA	Dedicated coastal altimetry sea level measurements based on enhanced ALES retracker

« Coastal Altimetry »

= where land contamination of altimeter and radiometer footprints

(a <u>question of distance</u> to the shore)


credits : ww.coastalt.eu
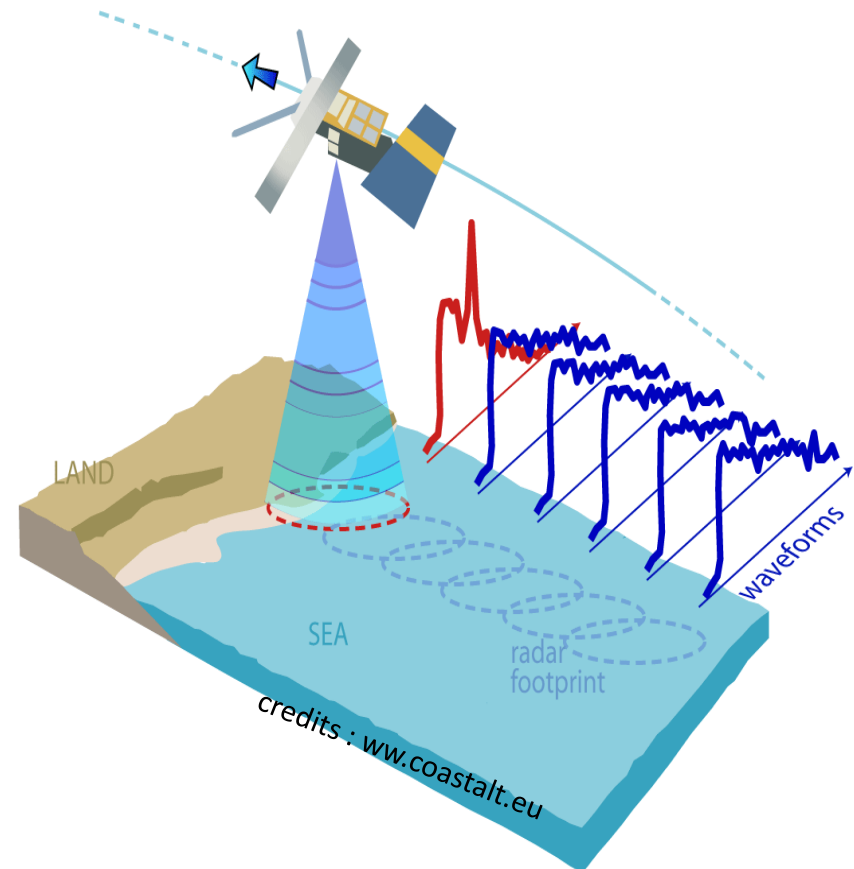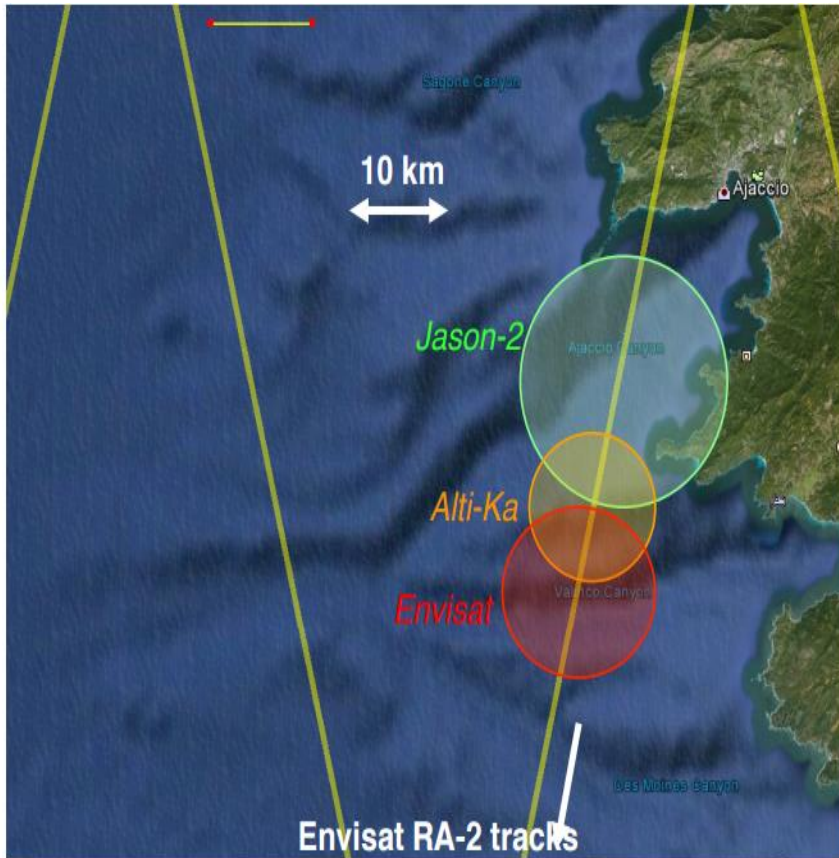
« Coastal Modeling »

= the transition between shoreline and deep-ocean <u>including the continental shelf</u>

✓ Marked by **Energetic processes**: waves, tides, storm surges, eddies, filaments

✓ **HF dynamics** (atmosphere, tides)

✓ With complex hydrodynamical features of **small scale** (low Rossby radius)

✓ **Exchanges** area between the shelf and the open ocean (slope currents)

➡ ✓a <u>question of ocean processes</u>

✓Including the shelf region (bathymetry)
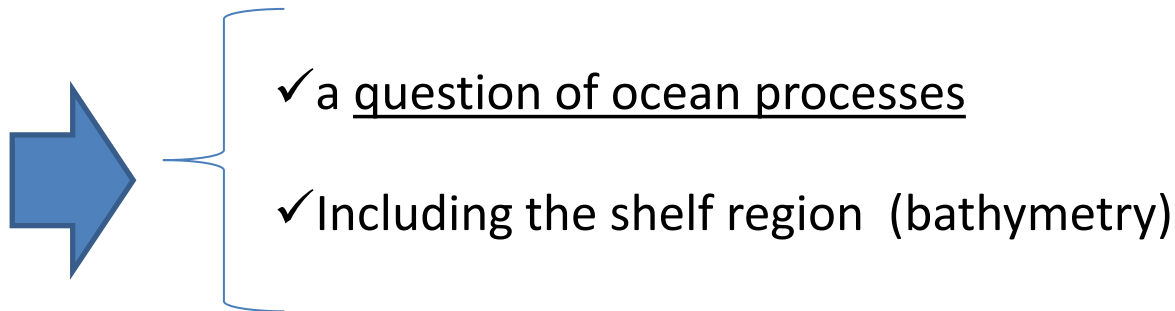
Coastal Altimetry vs. Coastal Modeling
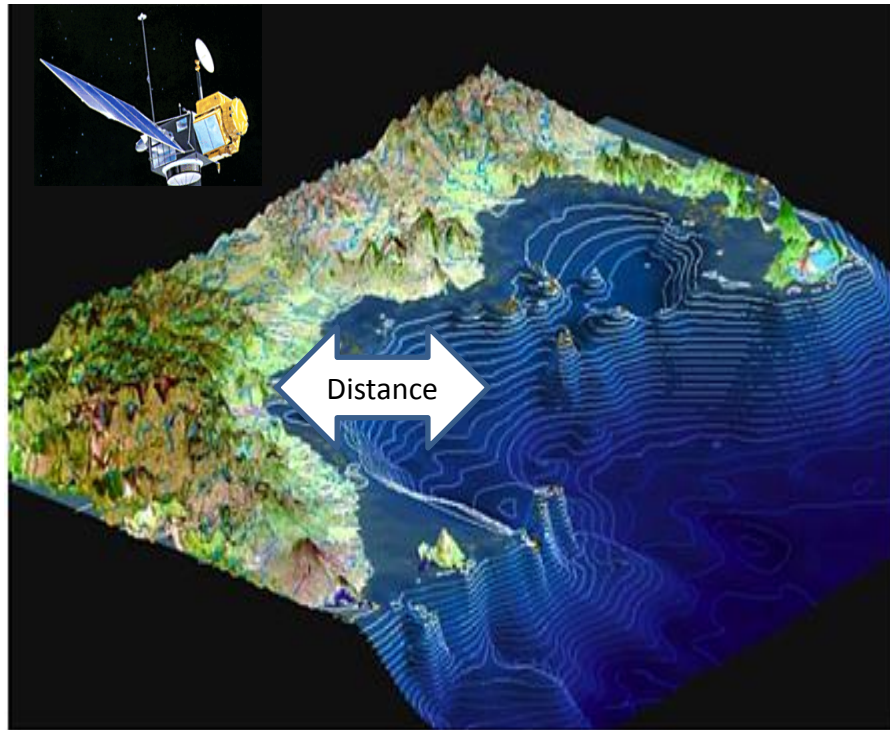
✓Limitation <30km from the shore

➢Overstep those limitations <30km
➢Increase the spatial resolution
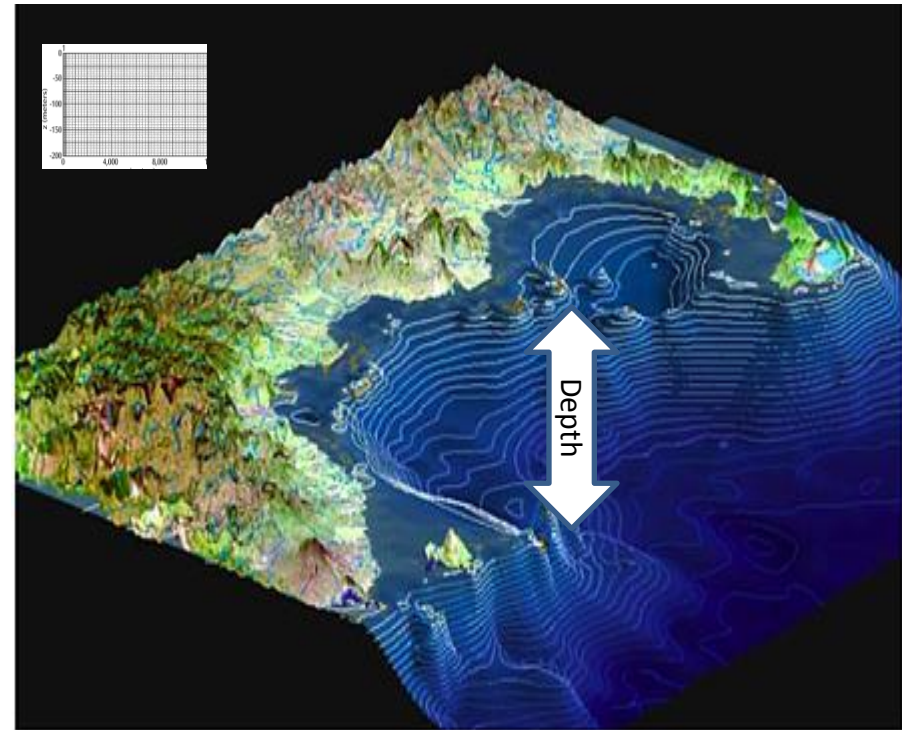
✓ large distance to the shore o(100km)
✓ various scales of ocean processes

➢ can use altimetry data and not only "coastal"

For this ARCOM session

- No detail today on Altimetry processing
  - still available online on the 4th COSS-TT ICM website if needed
- Altimetry datasets information (COSTA, PEACHI, DUACS-HR, X-TRACK)
  - 3 posters available in the corridor
- Examples of altimetry use in coastal regions from the CAW-10
- Focusing the discussion on :

  - ➢ What physical processes have a **signature in Sea Level** in the coastal ocean you're modeling?

  - ➢ Do you have the **information you need to begin**, or to **improve**, your **use of altimetry data**? If not, what do you need - more knowledge about processing, access to data, examples of their usefulness, or other?