Discussion, Recommendations, conclusions

Revised Error Budget for Coastal Altimetry - 2011

Parameter	0-10 km From coast	10-20 km From coast	20-50 km From coast	>50 km From coast
Wet Tropo PD **SSH**	**2 cm**	**1-2 cm**	**1 cm**	**1 cm**
SSH Slope	**2 µrad**	**0.5-1 µrad**	**0.5 µrad**	**0.5 µrad**
SSH spatial scale	**10 km**	**20 km**	**20 km**	**20 km**
SSH temporal scale	**6 hrs**	**6 hrs**	**6 hrs**	**6 hrs**
Tidal Correction **SSH**	**10 cm**	**Over shelf 10 cm**		**Open Ocean 2 cm**
SSH Slope	**5-10 µrad**	**2.5 µrad**		**<0.25 µrad**
SSH spatial scale	**10-20 km**	**40 km**		**50-500 km**
SSH temporal scale	**6 hrs**	**6 hrs**		**6 hrs**
Tracking **SSH**				
SSH Slope				
SSH spatial scale				
SSH temporal scale				

Session reports

New Data!!

09:10	**10:20**	**Session 1 : The New Coastal Altimetry Data**	**Chairs:**	**Jessica Hausman (JPL), Martín Saraceno (Univ. Buenos Aires)**

1. Is there a significant difference in products that use global or regional corrections and filtering?

2. Are the data appropriate for the entire science community, or still only experimental (algorithms are documented, peer reviewed, etc.)?

3. If they are still experimental, what can the coastal altimetry community do to help so they can be used by the entire science community?

4. Where can be found the new coastal altimetry data? Are they freely available?

Applications – old and new!

10:50	**13:10**	**Session 2 : Applications of Coastal Altimetry**	**Chairs:**	**Joana Fernandes (Univ. Porto), John Wilkin (Rutgers Univ.), Soma Yenamandra (NIO)**

1. Are there applications for which coastal altimetry data are particularly suited?

2. Are there applications for which coastal altimetry data should be used with particular caution?

3. What impediments are there to more wide-spread use of coastal altimetry in applications? Can these be categorized into local/global issues (e.g. local = accurate MDT, global = real-time delivery)

4. Would studies of e.g. boundary currents or coastal trapped waves be hampered if the Jason-CS LRM and SARM operated separately without overlap?

5. Are applications making full use of coastal altimeter data in terms of maximum along-track resolution and new range corrections?

Modelling and assimilation

14:40	16:10	Session 3: Synergy with Models	Chairs:	Kaoru Ichikawa (Kyushu Univ.), Villy Kourafalou (Univ. Miami)

1. What is the model grid resolution necessary for achieving benefits from the resolution of coastal altimetry?

2. How does the physical content of coastal models compare with coastal altimetric data (tides, atmospheric pressure, winds, vertical reference etc.)?

3. Is coastal altimetry mature enough to assimilate CA data into a coastal model simulation (in particular on the continental shelf)? Can we achieve a CA error budget?

4. How does one perform data assimilation of altimetry in the presence of internal tides, which affect both CA data and temperature/salinity observations?

Technical improvements: corrections

16:40	**17:50**	**Session 4: Corrections**	**Chairs:**	**Ole Andersen (DTU), Lifeng Bao (Chinese Acad. Sciences)**

1. With CryoSat-2 not carrying a radiometer and being important for coastal purposes. How do we quantify the "error" for C2 in coastal regions.

2. With CryoSat-2 and Sentinel-3 measuring with even higher spatial resolution than conventional altimeters in coastal regions what demands does this put on corrections in the future.

3. There is an urgent request from the marine geophysical society with Jason-1 in a new geodetic phase to have more accurate and high resolution tide models in the coastal region.

4. Which will be the most urgent corrections to improve for C2 and S3 (wet, tide, dynamic atmosphere etc) in the coastal domain.

5. With only 2 satellites being operational in the future will this be adequate for the use of coastal altimetry i.e. for warning and safety.

Technical improvements: LRM retracking

08:30	**10:20**	**Session 5: LRM Retracking**	**Chairs:**	**Xiaoli Deng (Univ. Newcastle), Luciana Fenoglio-Marc (TU Darmstadt)**

1. Which are the recent achievements in retracking **methods**? Has a „most successful“ methodology been identified?

2. **Validation -** What are the main results of the PISTACH and COASTALT dedicated studies? Do they give comparable results?

3. **Validation –** (for 1.2 and in other studies) How does improve the statistics of the „validation parameters“ near coast? (e.g. distance to coast, agreement with in-situ data)

4. Is the **Intercalibration** of retrackers (e.g. for point 1.2) still an issue, and what has been achieved?

5. Which improvements are still feasible?

…including SAR alt – a great opportunity

10:50	12:40	**Session 6: Waveform Analysis and SAR Retracking**	**Chairs:**	**Jesus Gómez-Enri (Univ. Cadiz), Walter Smith (NOAA)**

1. With the demise of EnviSat, ESA no longer has an altimeter mission making classical measurements. The next ESA altimeter, Sentinel-3, will make SAR measurements at the coast. Will ESA continue to support research to understand classical altimeter measurements in the coastal zone?

2. Are the inter-calibrations (e.g. sea state biases) between open ocean data (e.g. MLE3 or 4) and coastal data (e.g. RED3) sufficiently well understood?

3. The Sentinel-3 and Jason-CS baseline scenarios call for conventional (LRM) measurements in open ocean and (closed burst) SAR (CryoSat heritage) near the coasts. Given that the tide gauge calibrations are necessarily at coastlines, is this what we want? Would the (open burst) "interleaved option" under consideration for Jason-CS be a better alternative?

Cal/Val: needs more efforts

14:00	**15:10**	**Session 7: CAL/VAL**	**Chairs:**	**Florence Birol (CTOH/OMP), Guoqi Han (Fisheries and Oceans)**

1. How to improve validation of coastal altimetry using tide-gauge, glider, HF radar, current meter, and buoy data?

2. How to improve consistency of coastal altimetry datasets?

3. What kind of long term independent measurements is required for the validation of coastal altimetry data? What kind of strategy?

4. Do we have enough independent measurements to validate the different coastal altimetry data sets? Are they freely available?

Future missions / coordination

15:10	**16:30**	**Session 8: Future Data and Missions**	**Chairs:**	**David Griffin (CSIRO), Andrey Kostianoy (P.P. Shirshov Inst.)**

1. Is coastal altimetry a more cost-effective way of measuring coastal sea level and currents than in-situ obs?

2. Some nations will welcome satellite obs of their coasts, some will not. Do we have a good way of dealing with such sensitivities?

3. Which of all the new altimeters will contribute to a 'coastal altimetry' array?

Are we at a 'hinge point'?

- coastal altimetry widely recognized (by scientists, OSTST, and Agencies)
- considerable technical development
  - reprocessing of old missions? how? when? funded by who?
- new data/missions coming
  - SAR altimetry, but also AltiKa
- **can we go from scientific experiment to operational tool?**
  - **coastal dynamics / waves**
  - **hazards**
  - **sea level rise**
- **In which funding framework?**

Recommendations from the 6th Coastal Altimetry Workshop

The Coastal Altimetry Community

"The community of coastal altimetry scientists and users who convened in Riva del Garda for the 6th Coastal Altimetry Workshop on 20/21 September 2012 recommends that…"

1. coordinated efforts for products

"…coordinated effort should be put into generating and distributing a harmonized, well-documented multi-mission coastal altimetry product calibrated to common standards and tailored to end-users, to foster the uptake of those data for improved analysis and prediction of coastal ocean circulation. This effort should include a reprocessing of the existing ~20 year record from past missions, a portal for data access and information sharing."

[this objective sounds very ambitious – but we will get there

2. continued R&D

"…further R&D should be invested towards improving the techniques for processing, interpretation and cal/val of altimetry data in the coastal zone, including a full exploitation of the new opportunities offered by SAR altimetry and Ka-band altimetry. The in situ and modelling community need to be engaged in this process"

[This follows on the experience gathered in 20 years of open-ocean altimetry, where the support by Space Agencies has proved crucial to achieve the current, climate-level maturity of the field]

3. easy access to level 1 data

"…level 1 data should be made easily available as the foundation of further R&D and the basis for reprocessing since significant progress can only be made by going back to full bit rate data"

4. planning future missions

"…every effort should be made to maximize the sampling and information content of future altimetric missions, which is particularly important for coastal zone applications. To this purpose, the adoption of the interleaved mode for Jason-CS is strongly recommended as it will also benefit retrospectively previous SAR missions."

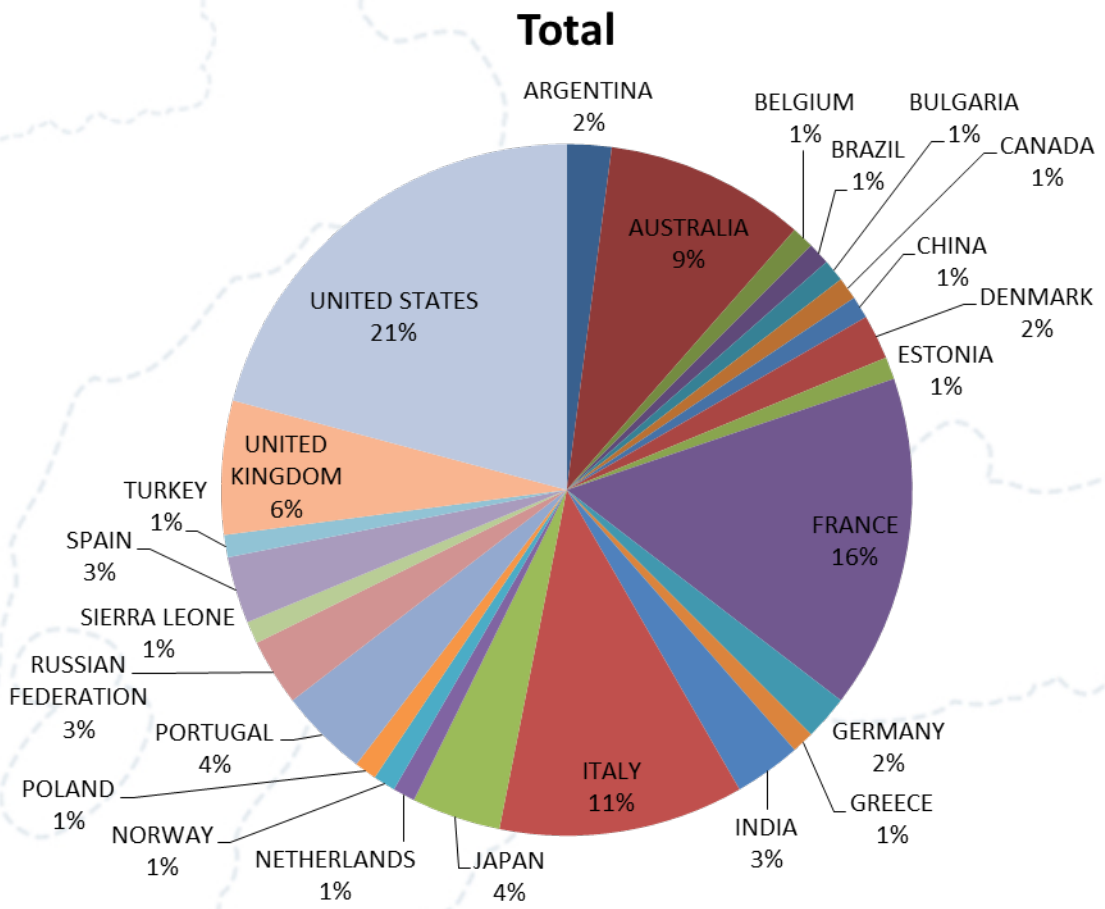
5. and, finally, SAR for Sentinel-3!

- "… in order to improve the precision and resolution of the data for all ocean applications, the area of Sentinel-3 SAR altimeter acquisition over the ocean should be maximized.

Concluding Remarks

90 Attending, 32 Talks, 24 posters

Row Labels	Count of Country
ARGENTINA	2
AUSTRALIA	9
BELGIUM	1
BRAZIL	1
BULGARIA	1
CANADA	1
CHINA	1
DENMARK	2
ESTONIA	1
FRANCE	15
GERMANY	2
GREECE	1
INDIA	3
ITALY	11
JAPAN	4
NETHERLANDS	1
NORWAY	1
POLAND	1
PORTUGAL	4
RUSSIAN FEDERATION	3
SIERRA LEONE	1
SPAIN	3
TURKEY	1
UNITED KINGDOM	6
UNITED STATES	20
(blank)	
Grand Total	96



Next Workshop (CAW-7)

- US East coast?
- Need to liaise with OSTST
  - perhaps CAW Mon/Tue, OSTST Wed-Fri ??

- Also opportunity to coordinate with Liege Colloquium March 2014 (A. Kostianoy)
  - perhaps one extra day on the applications of coastal altimetry?

Post workshop social activities

- Non-hosted dinner this evening:
  - ”Mago Merlino” 200 m from here, towards city centre
- “Lakeside Hike” tomorrow: two-stage, 500/1200 m climb (white road/mountain paths), 4/6 h, easy/intermediate
  - (disclaimer: at your own risk!!)
  - weather permitting (forecast good, 23°C max)
  - meet at clock tower 8:50 for start at 9:00 sharp
- And then… see many of you in Venice!!