Sea Level CCI project

Phase II
1st annual review

WP1100

User requirements for climate-quality sea level observations in the coastal zone

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National Oceanography Centre
NATURAL ENVIRONMENT RESEARCH COUNCIL

Sea Level CCI – Phase II 1st annual review – Jan. 29th – 30th 2015

User requirements

- **SL_cci Phase II has more focus on the coast**
- **a necessary preamble to the work is a quantification of the requirements for accuracy and long-term stability for climate-quality observations of sea level in the coastal zone**
- **This was done by a survey in May 2014**
  - we asked altimeter specialists, i.e. experts of the processing and/or analysis of altimetric data, drawn from the International Coastal Altimetry Community and from 14 different countries

Survey – the questionnaire

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A short questionnaire on

Requirements for climate/quality monitoring of coastal sea level from satellite altimetry

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for the ESA Sea Level CCI Project, Phase 2 – WP1

Why this questionnaire?

Within Phase 2 of the ESA Sea Level CCI Project there is a specific task to update the User Requirements for climate-quality monitoring of sea level from satellite altimetry. Phase 1 of the project had summarized the requirements from different sources (including GCOS, WMO/WCRP, GOOS, OSTST, the Coastal Altimetry Community and the CCI's Climate Modelling User Group) in the following table[1]:

Synthesis of target sea level requirements from Sea Level CCI phase 1.

Observable	Horizontal resolution	Temporal resolution	Accuracy	Long-term Stability
Global mean sea level	Global mean	one orbital cycle[2]	**2-4 mm**	Decadal scale: < **0.3 mm/y** Annual scale: < **0.5 mm/y**
Regional sea level	50-100km	weekly	**1 cm**	**< 1 mm/y**
Mesoscale	15 km	daily	**0.5 cm**	(No strong requirements)

One issue that requires a dedicated focus in Phase 2 is **the coastal zone.** The purpose of this questionnaire – targeted to altimetry specialist and expert users of altimetry data – is to help us to define **specific requirements for altimetry in the coastal zone, in terms of:**
- Accuracy: congruence of the single value ('single' = 'averaged over one space and time grid cell') to the true value
- Long-term stability: consistency over time of the instrument calibration and corrections

Note that the requirements in question are those **for climate applications** – i.e. where one uses repeated observations to derive some statistical properties of the phenomena. A simple example to illustrate this concept: a one-off observation of some 'extreme' event does not belong to the 'climate' category;

[1] The full User Requirement Document that this table is taken from is available at http://www.esa-sealevel-cci.org/webfm_send/90
[2] Individual global mean sea level values are obtained by geographically averaging sea surface heights measured over the ocean during an orbital cycle (10 days for Topex and Jason satellites; 35 days for ERS and Envisat). To reach a 2-4 mm accuracy, individual (1Hz) sea surface height measurements must be accurate to 1-2 cm.

Coastal Sea Level Questionnaire
v1.0 Apr 2014

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…and then just a few questions: please answer them based on your own experience.

Note that for each question you are asked to specify TWO values:
- *a THRESHOLD value (= the MINIMUM value that makes that parameter usable for at least one climate application)*
- *a TARGET value (= a "nice-to-have" value that will enable a fuller range of applications – TARGET values should be STRINGENT but REALISTIC at the same time!)*

Let us first focus on a LOCAL product, i.e. sea level on a single grid cell in the coastal zone (say a 15 km x 15 km stretch along the coast) and with a time resolution (i.e. time average) of ONE MONTH.

Q1) What level of ACCURACY of LOCAL altimetric measurements of sea level would be required?

THRESHOLD cm TARGET cm

Q2) What level of LONG-TERM STABILITY of LOCAL altimetric measurements of sea level would be required?

On an ANNUAL SCALE: THRESHOLD mm/y TARGET mm/y

On a DECADAL SCALE: THRESHOLD mm/y TARGET mm/y

Then let us think of a GLOBAL COASTAL product, i.e. one generated by quality-controlling and averaging all the measurements in the global coastal strip (0-15 km from coast) and with a time resolution of ONE MONTH.

Q3) What level of ACCURACY of GLOBAL COASTAL altimetric measurements of sea level would be required?

THRESHOLD cm TARGET cm

Q4) What level of LONG-TERM STABILITY of GLOBAL COASTAL altimetric measurements of sea level would be required?

On an ANNUAL SCALE: THRESHOLD mm/y TARGET mm/y

On a DECADAL SCALE: THRESHOLD mm/y TARGET mm/y

Space available for specific comments:

Done, thanks!
The results will be made available in the updated User Requirement Document (via http://www.esa-sealevel-cci.org) and discussed at ESA symposia, OSTST Meetings and Coastal Altimetry Workshops.

Requirements expressed as…

- **ACCURACY (cm)**
- **STABILITY over 1/y period (mm/y)**
- **STABILITY over 10/y period (mm/y)**

- **for a LOCAL product**
  - (single cell 15km x 15km x 1mth in the coastal zone)
- **for a GLOBAL COASTAL product**
  - global QC-screened 1-mth average in 15-km coastal strip

We asked for a THRESHOLD value (minimum to enable at least one application) and a TARGET value.

40 surveys handed out, 15 (38%) returned – we can start making some basic statistics.

results 1

ACCURACY (cm)					
Median and *[range]*					
LOCAL	THRESHOLD	**3.0**	*[1.0 , 15.0]*	TARGET **1.0**	*[0.1 , 5.0]*
GLOBAL COASTAL	THRESHOLD	**1.8**	*[0.5 , 5.0]*	TARGET **1.0**	*[0.1 , 3.0]*

ACCURACY (cm)				
First–Third quartile				
LOCAL	THRESHOLD	**2.0–4.5**	TARGET	**0.8–1.8**
GLOBAL COASTAL	THRESHOLD	**0.6–2.0**	TARGET	**0.4–1.0**

results 2

STABILITY over 1 year (mm/y)						
Median and *[range]*						
LOCAL	THRESHOLD	**3.0**	*[0.5 , 10.0]*	TARGET	**1.0**	*[0.2 , 6.0]*
GLOBAL COASTAL	THRESHOLD	**1.0**	*[0.3 , 5.0]*	TARGET	**0.5**	*[0.1 , 2.0]*

STABILITY over 1 year (mm/y)				
First–Third quartile				
LOCAL	THRESHOLD	**1.0–7.5**	TARGET	**0.5–2.5**
GLOBAL COASTAL	THRESHOLD	**0.6–2.0**	TARGET	**0.3–1.0**

results 3

STABILITY over 10 years (mm/y)						
Median and *[range]*						
LOCAL	THRESHOLD	**1.5**	*[0.3 , 5.0]*	TARGET	**1.0**	*[0.2 , 3.0]*
GLOBAL COASTAL	THRESHOLD	**0.9**	*[0.1 , 2.0]*	TARGET	**0.4**	*[0.1 , 1.0]*

STABILITY over 10 years (mm/y)				
First–Third quartile				
LOCAL	THRESHOLD	**1.0–3.0**	TARGET	**0.5–1.0**
GLOBAL COASTAL	THRESHOLD	**0.5–1.0**	TARGET	**0.2–0.5**

Additions to the summary table

Table 14: Synthesis of the sea level requirements gathered by the sea level CCI project.

Variable/paramer	Requirement number	Horizontal resolution	Temporal resolution	Accuracy	Stability
Global Mean sea level	UR-SLCCI-SPC-01	Global mean	NA	2-4 mm over an orbital cycle[1]	Long term drift <0.3 mm/y Annual time scale <0.5 mm/y over 12 months
Regional sea level	UR-SLCCI-GEN-02	25-50 km	week	1 cm over a grid mesh of 50-100 km	<1 mm/y over a grid mesh of 50-100 km
Mesoscale[2]	UR-SLCCI-GEN-05	15 km	daily	0.5 cm	No strong requirements
Coastal (local)	UR-SLCCI-GEN-05	15 km	monthly	1.0 cm	Long term drift <1.0 mm/y Annual time scale <1.0 mm/y over 12 months
Global Coastal	UR-SLCCI-GEN-05	Global coastal mean	monthly	1.0 cm	Long term drift <0.4 mm/y Annual time scale <0.5 mm/y over 12 months