



ESA Sea level CCI

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1. Executive Summary

1.1. Scope

The Sea Level CCI responds directly to the GCOS requirements for the Sea level ECV (Product O.2 in GCOS-107) through the generation and validation of multi-mission ECV products from the altimeters on TOPEX/Poseidon and Jason series, as well as ERS1/2, Envisat and GFO. To achieve this global objective, the specific objectives for the Sea Level CCI are:

- To involve the Climate research community to improve the understanding of their needs;
- To develop, test and select the best algorithms and standards in order to produce high quality sea level products for climate applications;
- To assess and collect information on the quality and error characteristics of the Sea Level ECV product through the involvement of independent climate research groups;
- To provide a complete specification of the operational production system that should be developed during the phase 2 of the ESA CCI programme.

1.2. Project Status

The project held its first Annual Review in Sept with over 30 attendees, including all project partners, CMUG and members of the sea level external expert group, contributing to a successful 2 day meeting. Main conclusion of the meeting is that the project is on track with no major issues and delay. The first big achievement of this year has been the finalisation of the User requirements document at the Annual Review meeting, a key output of this project. Further, extensive work has been performed on Algorithm development and selection tasks.

During this quarter, further algorithms have been finalized: up to now, 35 Round Robin datapackage have been produced, gathering 2000 pages of diagnosis on performances, long term trend comparison.... The validation reports, summarizing the RRD results, are going to be delivered to the expert Team. Work is continuing on the Systems Engineering activities, resulting in the delivery of the second systems engineering deliverable, the System Specification (v0) Document, which builds on the System Requirements analysis and forms a solid basis for the final System Specification (v1) document expected in the first half of 2012. During this first year, the Sea Level CCI team has set up connections with other European altimetry projects, and communicated to the international altimetric and climate community. This is a key element in fulfilling the ambitious objectives of this project. In order to further promote the project, the second SLCCI newsletter has been released in September.

2. Project Status

2.1. User Requirements

An updated version of the URD was presented at the project's First Annual Review meeting in September, taking into account feedbacks from the second progress meeting and from the CMUG meeting in Reading (UK). The document has been improved by numbering the requirements and better explaining how the requirements are collected from the Climate Modelling Community. The requirements have been detailed for each application and the mesoscale application has been added. The new version has been discussed at the Annual review meeting and several propositions have been made in order to complete the document: illustrations of applications associated to the number proposed, and adding a requirement for time-mean. A new version is planned to be delivered before the 2nd CCI collocation meeting in October.



2.2. Data Requirements

30 types of data have been necessary to run the algorithms and to perform the inter-comparison and selection task: satellite and ancillary from 6 altimeter missions (ERS-1, ERS-2, Envisat, Jason-1, Jason-2, T/P, GFO) as well as in situ data. Strong efforts have been supplied by the SL project in terms of coordination: several meeting and teleconferences with ESA and CNES were organised in order to allow the CCI to benefit from the optimal input data from the external projects. This will allow the generation of the most complete possible sea level ECV time series. Among all the input datasets required, several issues were encountered which have induced a delay in the development planning.

2.3. Products specification

A first version of the PSD was delivered in March 2011. It was presented at the integration meeting in order to demonstrate how the product specifications meet the needs of the climate research group in the SL CCI. The requirements concerning the global and regional mean sea level applications in terms of spatial resolution and length of the time data series have been taken into account in the definition of the sea-level ECV. In comparison with sea-level products currently available, new information (crucial for climate studies) will be provided concerning the evolution of the time data series (such as the trend, the description of periodic signals...) and the errors associated.

The PSD is intended to be updated to show traceability with URD requirements. At the third SLCCI progress meeting, it was suggested that the review comments for the URD and PSD should be included in the new versions of the documents. A revised version of the PSD is planned prior to the CCI collocation meeting in Oct 11.

2.4. Round Robin

The round robin phase was started in March 2011. 50 algorithms have been cross compared: the 35 Round Robin Data Package (RRDP) reports are now available on the sea-level ftp website (<http://www.esa-sealevel-cci.org/node/133>). The whole altimetry time series have been used to produce the RRDP; The new algorithms have been applied on up to 7 missions in order to allow us to compute the most relevant statistics (trend...) for the selection phase.

For the orbit calculation, 5 new orbit solutions derived from the Reaper and SLCCI projects (for ERS-1 and ERS-2) and from CNES and ESA production centres have been already evaluated. For the wet troposphere correction, the ERA-interim data have been compared to the radiometer and operational ECMWF models. New algorithms concerning the ionosphere correction, the sea state bias correction, the oceanic tides and the atmospheric corrections have been tested as well. Finally, 23 RRDP have been produced and made available in September 2011. Preliminary analyses look very encouraging. For instance, significant improvements are detected on ERS-1, ERS-2 and Envisat sea level calculations, thanks to the new orbit solutions which directly impact climate studies.

Now that the RRDP are well under way, a first draft of the validation reports, where the analysis of all the RRDP (relative to a same correction) is summarised and synthesized, have been produced and will be delivered in early October.

The annual review meeting also provided an opportunity to discuss the final algorithm selection process, considering a suitable approach to bring together the external expert team to support this activity. The planning of this activity will continue over the final quarter of 2011.



2.5. Scientific Cooperation

The Sea Level CCI Project is closely connected to international activities related to global and regional analyses of the climate system specifically activities within the WCRP, such as CLIVAR or CLIC. Both are concerned with the Arctic system and its changes. This concerns observations (CLIVAR/GSOP and OOPC), changes in the climate system (CLIVAR/AIP) and specifically sea level (CLIC). In February a joint WCRP/IOC workshop on regional sea level variations and drifts was held in Paris. During the workshop detailed discussions of regional sea level variability was held and the role of the Arctic and its hydrological cycle was highlighted for predictions of regional and global sea level.

The ESA CCI on sea level has also cooperated with two EU projects, notably MONARCH-A (led by NERC) and MyOcean (led by Mercator-Ocean), either through direct collaborations such as envisioned with MONARCH-A or through the interface with MyOcean for which high resolution sea level products should be delivered. The role played by CLS, as leader of the SL Thematic Assembly in MyOcean, ensures a good coordination between the two projects. The work of MONARCH-A is directly related to the CCI effort both with respect to altimetry, but also Arctic tide gauges. At the same time MONARCH-A is a candidate model for bringing several ECVs together in a joint use and evaluation.

The ECV Integration meeting was also a very good opportunity to reactivate the links with the other ECV teams and the modelling community, established at the 1st CCI collocation meeting. Although the sea level ECV does not have a direct linkage with other ECV projects, a potential synergy has been identified with the SST ECV. The correlation between the two ECVs at low frequencies/long term will be useful for the ECV product assessment. It has to be noted that the ESA CCI on sea level will also cooperate with the two soon to be launched CCI projects on sea ice and ice sheet and glaciers.

One outcome from the collocation meeting and the CMUG meeting is that despite its relatively good maturity, the sea level ECV is not really used by the coupled climate models even for validation purposes. The ESA CCI program represents a very good opportunity to enhance the use of the sea level ECV.

2.6. Project Outreach (scientific and public)

The Sea Level CCI web site (www.esa-sealevel-cci.org) has been operational since early November 2010 and has been regularly updated, particularly following a comprehensive review by ESA in the summer of 2011. Promotion of the project to the international scientific community continues to be one of the main objectives of the Sea Level team in 2011. The project activities will be represented at the WCRP Open Science Conference due to be held in October 2011, the OSTST Meeting in San Diego also in October 2011, AGU Fall Meeting in Dec, and for next year the team is planning for the Ocean Science Conference in Feb 2012, the Planet under pressure Conference, and the 20yrs of Altimetry meeting in Venice. In order to further promote the project, the second SLCCI newsletter was published in September.

2.7. Next Steps

In 2011 Q4,

Most of the project's effort will be dedicated to the finalisation of the RRDP and the Validation reports, necessary step to prepare for the selection process. A few additional algorithms will be tested by November, allowing us to prepare a first version of the validation reports. These reports will be delivered at the end of October to the Expert Team, marking the start of the Selection Process. A preliminary meeting with the expert team will be organized during the next OSTST meeting in order to present to the experts the next steps of the selection process. The target is to have the selection meeting between mid-March and mid-April at the latest.



The development of the SLCCI prototype has started as planned and will continue in the coming months. This processing chain will allow us to start the production of the Phase 1 SLCCI products, which will be validated in 2012-2013 as part of the WP4 task. It is important to note that despite some of the delays we have faced for the algorithms development, test and selection, these will not impact the delivery of the SL CCI ECV (July 2012). Finally, the WP 5000 team will be providing an updated version of the system requirements document following ESA's review, and will continue work on the design of an operational system, via the System Specification Document (SSD v1).