CryoSat-Plus For Oceans CP4O

CP4O Team

David Cotton, Marc Naeije, Ole Andersen, Francois Boy, Mathilde Cancet, Alejandro Egido, Joana Fernandes, Pablo Garcia, Christine Gommenginger, Thomas Moreau, Monica Roca, Lars Stenseng, Jérôme Benveniste, Nicolas Picot, Salvatore Dinardo, Bruno Lucas

d.cotton@satoc.eu

CP4O Final Presentation, ESRIN, Frascati, 1-2 July 2014

CryoSat Plus for Oceans (CP4O)

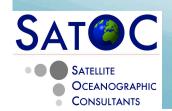Project supported by the ESA Support to Science Element programme and by CNES.

- ITT issued by ESA in September 2011, with a deadline of November 2011

- CP4O consortium: SatOC as prime, partners are CLS, DTU Space, isardSAT, NOC, Noveltis, STARLAB, TU Delft, University of Porto.

- Brings in experience and knowledge from SAMOSA, CoastALT, and CCI for Sea Level.

- CNES agreed to financially support CLS participation

- Project Kicked Off in June 2012, with a planned 2 year duration.

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CryoSat Plus for Oceans (CP4O)

Objectives:

- Build a sound scientific basis for new applications of CryoSat-2 data over the *open ocean*, *polar ocean*, *coastal seas* and for *sea-floor mapping*.

- Generate and evaluate new methods and products that will enable the full exploitation of the capabilities of the CryoSat-2 SIRAL altimeter, and extend their application beyond the initial mission objectives.

- Ensure that the scientific return of the CryoSat-2 mission is maximised. Preparation for Sentinel-3, Jason C-S

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CP4O Sub-Themes – Science Objectives

Open Ocean
- Meso-scale features < 100km
- RDSAR processing, New SAR re-tracking schemes

Coastal Ocean
- **SAR Mode:** Fine scale coastal features / minimise land contamination
- **SARIN Mode:** Discriminate/mitigate contamination from off-nadir land targets

Polar Ocean
- Processing schemes applicable to sea-ice affected regions
- Improvements to mean sea surface, mean dynamic topography, polar ocean circulation, polar tide models

Sea Floor
- **SAR Mode:** Ability to map uncharted sea-mounts / features

Geophysical Corrections
- Ionosphere, wet troposphere, regional tide models

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Technical Challenges

- **SAR Echo Model**
  - SAR echo is hybrid pulse limited and beam limited, new echo model needed – applies developments from SAMOSA project.

- **Continuity across modes and with previous missions**
  - Generating LRM like products from SAR mode data

- **Doppler Processing**
  - Waveform calibration, beam forming/stacking, range alignment/compression, multi-looking

- **How to process to resolve ocean features**
  - New processors
  - Improved corrections.

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CP4O Overview

- **Define user and scientific requirements**
- **Describe State of the Art**
- **Develop and validate products for ocean applications in four themes (open ocean, coastal ocean, polar ocean, sea floor bathymetry), plus geophysical corrections**
- **Large scale assessment of products**
- **Scientific Road Map for development and exploitation**
  - **Maximise exploitation of CryoSat-2 data**
  - **Planning and preparation for future SAR altimeter missions**

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State of the Art

- **Known issues with ESA Cryosat-2 products (Baseline A and B).**
    - Need to resolve mispointing, time tag, tracking point issues
    - Effect of truncation of waveform trailing edge in Baseline B
        - Does it change sensitivity of retrieved SSH to mispointing?
        - impact on coastal applications (mitigate land signals) ?
    - Some addressed in new FD Marine Product, and to be addressed in "Baseline C" – expected early 2014.

- **Other Issues**
    - Is there an effect of long waves, wave direction on SAR SSH and SWH ?
    - Spreading of the SAR leading edge (in baseline B) impacts C2 SAR retrieval accuracy
    - Sea State Bias model for SAR waveform re-tracking

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CP4O Data Sets Coverage

		Initial Development and Validation	Large scale assessment
1	**LRM** for **Open Ocean**	Global (RADS & CLS)	N/A
2	**RDSAR** for **Open Ocean**	NE Atlantic / Pacific SAR boxes	Pacific and N Atlantic SAR boxes
3	**SAR** for **Open Ocean**	NE Atlantic / Pacific SAR boxes	Pacific and N Atlantic SAR boxes
4	**SAR** for **Coastal Ocean**	NE Atlantic SAR region	NE Atlantic SAR boxes
5	**SARIn** for **Coastal Ocean**	Cuba, Chilean Coast	N/A
6	**SAR** for **Polar Ocean**	Arctic (initially Baffin Bay)	Lats > 60° N
7	**SAR** for **Sea Floor** Mapping	Pacific SAR Boxes	
8	Improved **wet trop correction**	Global, full C2 mission	
9	Improved **iono correction**	Mediterranean Sea, European continental shelf	
10	Improved **regional tides**	North East Atlantic (coastal)	

CP4O Results Presentation

- **Objectives**
  - Presentation of CP4O results: Assessment of CryoSat-2 products for ocean applications
  - How do the products from the different processing schemes compare?
  - What are the additional benefits of CryoSat-2 data?

- **Recommendations**
  - Issues for further investigation
  - Roadmap to develop / fully exploit CryoSat-2 data in ocean applications
  - How to apply findings to support planning / preparation of future missions