Cryosat-2 altimeter performance assessment

over ocean

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1: CLS 2: CNES





Service Altimetrie Localisation

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Overview

- Cryosat -2 mission is dedicated to Cryosphere sciences.
- Yet, the relevance and quality of this mission for ocean purpose was already largely demonstrated.
- Indeed, and since 2011, ocean Prototype Product (CPP) delivered by CNES is used for ocean monitoring purpose and constitutes a relevant additionnal mission to SALP/DUACS system.
- Its ingestion into data bases enables to enrich the Level 3 products distributed to users for mesoscale applications thanks to a careful **Calval analysis** of the data used as input of the system. It consists in:
 - Estimating the quality of the geophysical content
 - Removing spurious data and select only valid data from a SLA point of view

Overview

- Recents studies focused on the second step of the calval activity which consists of selecting the valid data.
- This step, essential to the final quality of the products, is difficult and needs to find the best compromise to:
 - Remove spurious data AND
 - Keep as many data as possible
- This talk focuses on 2 examples of recent improvements of data selection to prevent from:



- 1. Ice pollution
- 2. Coastal pollution



It is the most polluted by ice, as the only one to reach Latitudes > 82°

It has a drifting orbit and thus is more affected by the MSS quality between the mean profiles



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Data selection: Ice detection





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Dedicated to the very dry polar areas, Cryosat-2 payload does not include any radiometer. The usual ice detection based on Brighness Temperature can therefore not be applied.



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- A dedicated method (statistics on altimeter parameters based) enables to removes 100% of the ice pollution
- Applied over 60° were ice was more likely possible to exist





Yet, the limit of 60° can be refined to suit better the complexity of the ice extention signature.





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Data detection near ice:

use of an external reference

4-12-2013 / 5-12-2013 - South Hem.

Every day, OSI-SAF concentration maps is interpolated under Cryost-2 tracks

December 2013: Strong melting period: Dynamic signature of the OSI SAF content seen by Cryosat-2 over the 29 day subcycle →



Ice concentration (pct)





cycle 50 (Dec. 2014) - North Hem.



Valid Cryosat SLA selected with (Iterative editig \cap OSI-SAF mask)

100% bad data removed + Improvement of the coverage by 5% above 60°Lat (0.4% in global)

Very high latitudes can be reached with a quality level consistent with open ocean!



cycle 50 (Dec. 2014) - North Hem.



Additionnal valid data compared to OSI-SAF mask alone

Added value of altimetry compared to OSI-SAF information: 8% above 60°Lat (1% in global)

Mutual benefits of merging 2 sources of information!



A new solution for ice data detection: use of an external reference

- New algorithm for ice detection + merging the information of 2 independent products (altimetry+OSI-SAF)
 - → Increases the number of valid data in ice areas (more and more of interest)
 - Undergoes the lack of radiometer for Cryosat mission (one of the 3 missions above 66°Latitude)
- Very good results for Cryosat-2 dataset (will be used on Cryosat-2 Duacs DT data in a future version)
- Could be applied for other missions (of higher interest for those without radiometer data)



Data selection: Coastal approach





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A new solution for validation near coasts

- Altimetric data are polluted by coastal proximity
- More particularly drifting missions (Cryosat-2, Jason-1 and Envisat drifting phase) because the Mean Sea Surface used as a reference is not built with an associated mean profiles and because of tide higher uncertainty in these zones
- To avoid it, a margin of 20km from the coast can be taken to avoid affected points.
- We tried to refine this distance by using a statistics based method:
 - Application of a *median filter on SLA* for valid data only, to reject residual spurious values



Data selection near coasts along track analysis



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Data selection near coasts

SLA (cm)- C2 cycle 45



Data selection near coasts

SLA (cm)- C2 cycle 45



Valid SLA Zoom on Egean Sea



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Conclusion

New frontiers of altimetry??? -> Also via pushing the limits of data selection

- Approaching ice or land with altimetry is more and more a challenge to rise.
- Properly selecting the data consists in finding the good compromise between :
 - Not keeping spurious data that could deteriorate the data quality
 - Keeping as much observations as possible
- Such tunning is hard to fix and requires a good knowledge of the geophysics to recover. It is also much depending on the application field
- Through the example of Cryosat-2, we presented 2 methods that refine the current methods and pushes forward the limits of observations with altimetry
- Accounting for the mission specificities, both methods can be applied to other missions and benefit to the future operational products at Level 2p, Level 3 and Level 4 in Delayed Time and Near Real Time products



Thank you for your attention!

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- Dedicated to the very dry polar areas, Cryosat-2 payload does not include any radiometer. The usual ice detection based on Brighness Temperature can therefore not be applied.
- A first solution had then been developped to remove efficiently 100% of the potential ice pollution in the data.
 - Based on an iterative statistical process applied on the waveform estimated trailing edge slope





Perfo mission

Cryosat-2 data quality is satisfactory to insure a good mesoscale purpose in SALP/Duacs system





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Perfo mission

Cryosat-2 data quality is satisfactory to insure a good mesoscale purpose in SALP/Duacs system





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