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CryoSat Long-term Ocean Data Analysis and Validation

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Abstract

- ESA's Earth Explorer CryoSat-2 mission is dedicated to precise measurement of the changes in the thickness of marine ice floating on the polar oceans and variations in the thickness of the vast ice sheets that overlie Greenland and Antarctica. With the effects of a fast-changing climate, particularly in the Polar Regions, it is increasingly important to understand exactly how Earth's ice fields are responding. Diminishing ice cover is frequently cited as an early casualty of global warming and since ice plays an important role regulating climate and sea level, the consequences of change are far-reaching. To understand fully how climate change is affecting these remote but sensitive regions, there is an urgent need to determine exactly how the thickness of the ice, both on land and floating in the sea, is changing. By addressing this challenge, the data delivered by the CryoSat-2 mission completes the picture and leads to a better understanding of the ice role in the affected Earth system. In order to achieve this, the quality of the orbit, the measurements of the altimeter, and all required corrections have to meet the highest performance, and this not only over the ice caps and sea-ice surface but also over the oceans.

- The objective of our research is the long-term analysis and validation of the CryoSat-2 Level-2 Geophysical Ocean Product (GOP). This is achieved by assessing the quality, consistency and stability of Level-2 GOP parameters, among which the sea level measurement and the orbital height, when compared to concurrent in situ data from e.g. tide gauges and transponders, when compared to relevant numerical ocean and meteorological models and when compared to other concurrent altimeter data sets in the Radar Altimeter Database System RADS. In particular the research presented here repeats earlier analyses on Baseline-B data, but now applied to Baseline-C data, and similar analyses on the prolonged data series.

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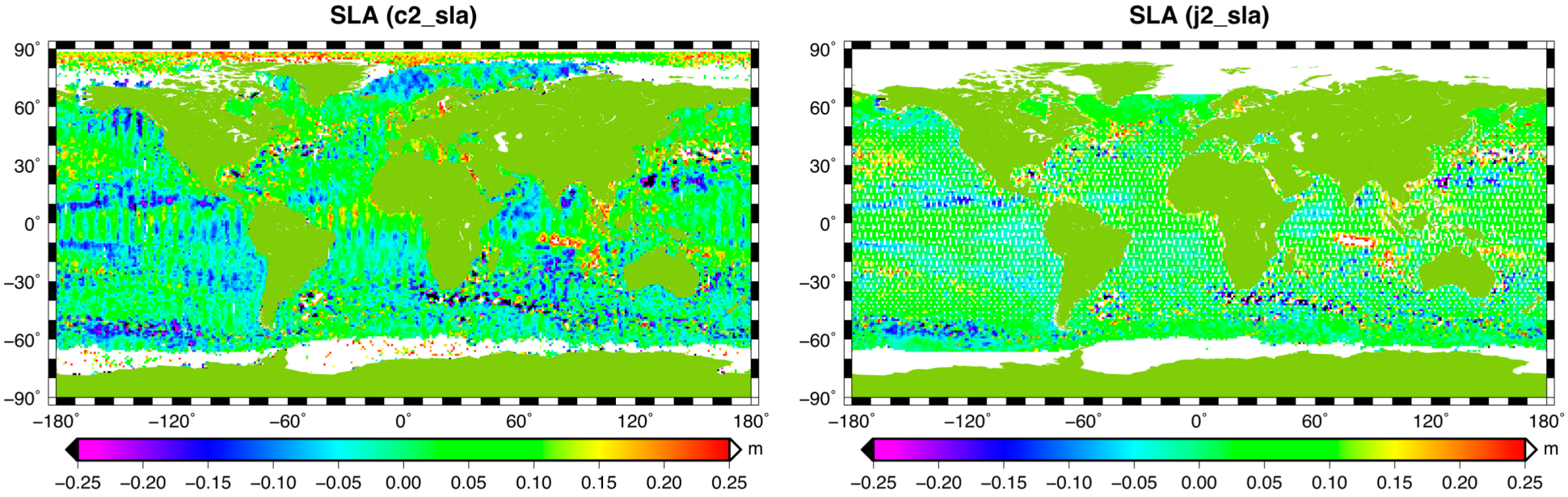
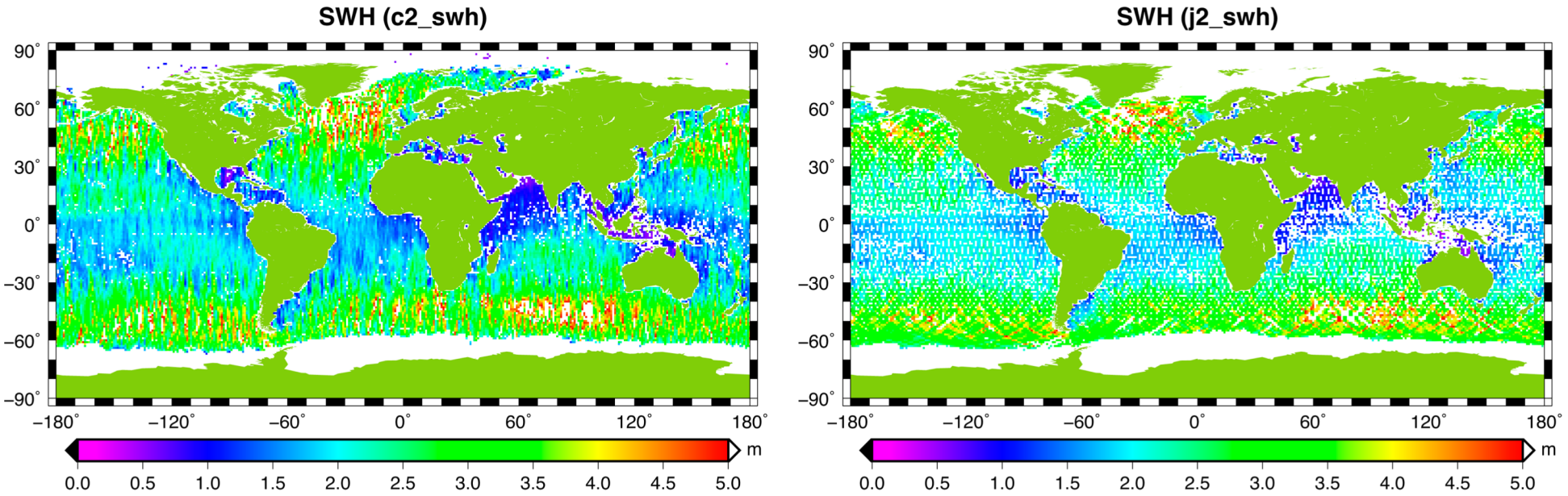
Sea Level Anomaly cycle 34



Example 1Hz sea level anomalies from the GOP Baseline C level-2 P2P product, compared with those from Jason-2 (cycles 159-162).

Significant Wave Height cycle 34



Example 1Hz significant wave heights from the GOP Baseline C level-2 P2P product, compared with those from Jason-2 (cycles 159-162).

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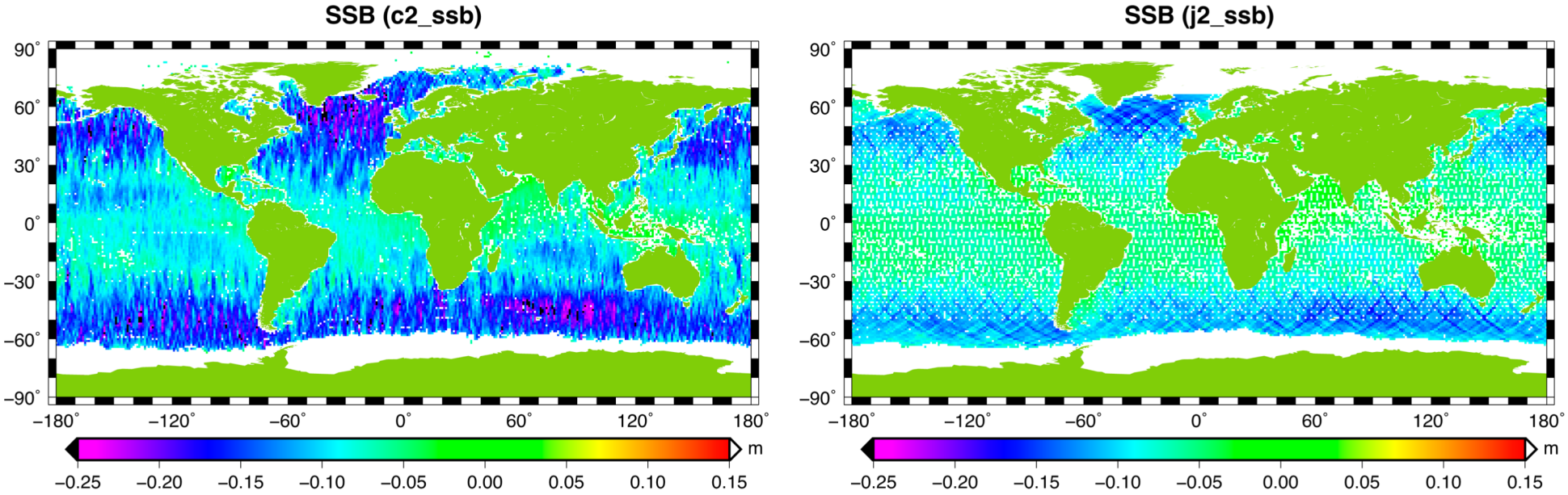
Sea Sate Bias cycle 34



Example 1Hz sea state biases from the GOP Baseline C level-2 P2P product, compared with those from Jason-2 (cycles 159-162).

Update on analyzing Baseline C

- Unfortunately we were not able yet to do a full Baseline-C analysis: we refer to our elaborate analysis of Baseline B given in the following paper:

  Naeije, M.C., and J. Bouffard (2019), *Long-term quality and stability assessment of CryoSat-2 Ocean data*, Adv. Space Res., available on line 6 September 2019, in press, https://doi.org/10.1016/j.asr.2019.08.039

  and presented at the 2019 OSTST in Chicago: poster to be found at our ftp site:

  ftp://deos.tudelft.nl/pub/marc/OSTST2020/

- From a quick look analysis (excerpts in the previous slides) we learn that qualitatively Cryosat-2 GOP Baseline C level-2 data compare well with Jason-2 level-2 data
- No exceptional biases were found in SLA and SWH
- Somewhat larger differences (yet to be investigated) in Sigma0, WND and SSB
- The latter could come from a change of SSB-model from Baseline B to C

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