CRISTAL Marine Data Centre Algorithms Specification Study

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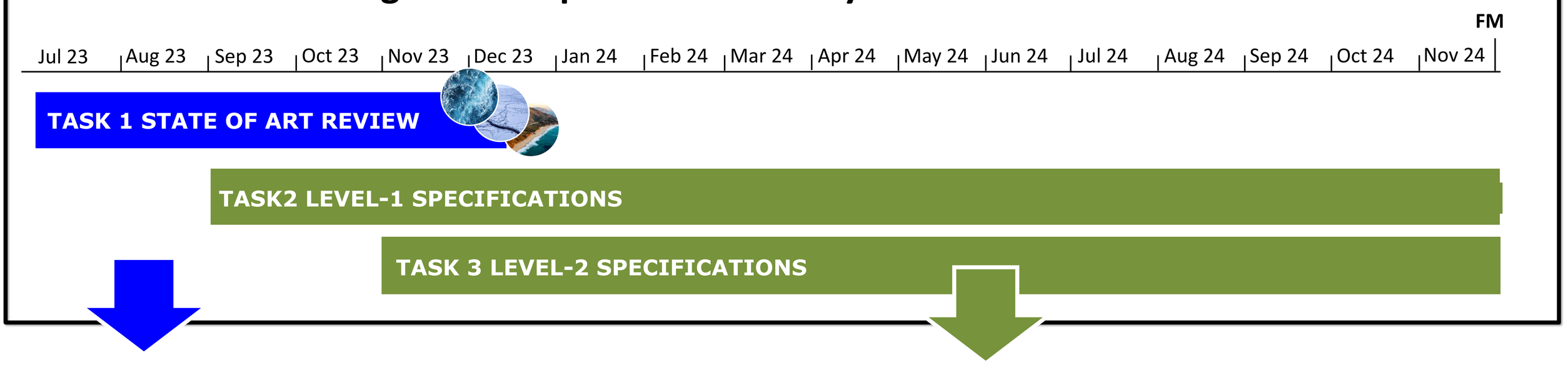
General Description

The **Copenicus polaR Ice and Snow Topography ALtimeter** (CRISTAL) is one of the high-priority candidate missions under consideration by the European Commission (EC) to enlarge the constellation of Sentinel satellites and expand the Earth observation capacity of the Copernicus program. The primary objective of CRISTAL is to measure and monitor key climate change indicators related to the cryosphere (sea-ice thickness, snow depth and ice-sheet elevations) using, for the first time, a Ku/Ka band dual-frequency radar altimeter (IRIS), which will significantly improve the data quality compared to its predecessor altimetry missions . One of the mission secondary objective is to contribute to the global measurement of the sea-surface height, wind speed and significant wave height up to the polar oceans. Thanks to CRISTAL the ocean observing system will benefit from operational ocean data at latitudes currently not covered by any operational mission. This will be essential for the long-term climate records and forecasts of oceanographic essential climate variables.

Over Ocean, improved measurement performances are expected thanks to the CRISTAL advanced altimeter features: high range resolution/sampling, dual frequency operation and their synergy, interferometric capability, and open-burst acquisition mode in the polar regions, etc. These advanced technological upgrades will enable the production of very high-accurate sea-surface height into the lead, in addition to capturing smaller ocean structures, and getting closer to the coast shore.

In the context of this mission, EUMETSAT is entrusted to operate the marine data center generating operational global ocean products. To this end, a group of experts, led by CLS in the framework of the Copernicus Altimetry Services (COPAS), will support EUMETSAT through different steps in the specifications of the CRISTAL marine products, as described below. These activities are funded by the European Union.

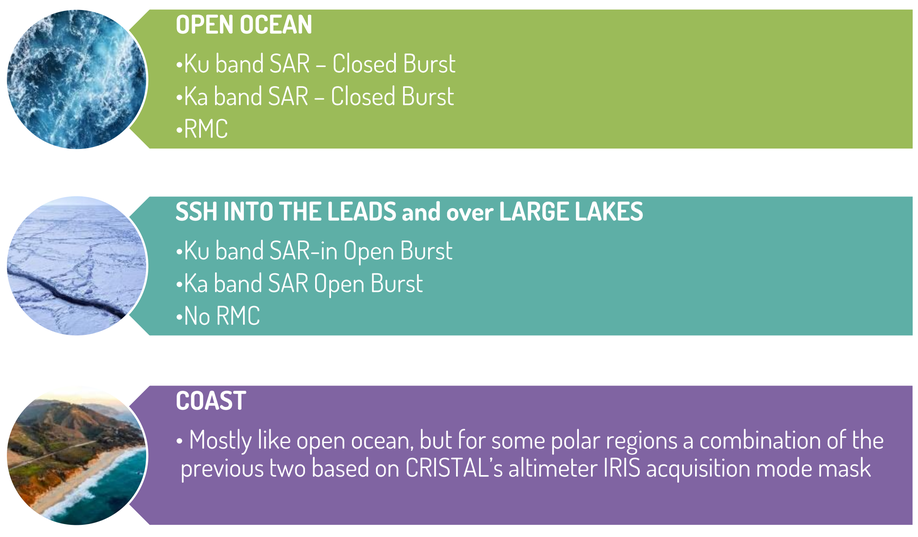
CRISTAL Marine Algorithms Specification Study Timeline



Task 1 State of Art Review

Objective:

To define the state-of-the-art review for the CRISTAL marine products taking into consideration the different acquisition modes (SAR CB, SAR OB, SARin OB), processing that are to be exploited (LR, UFSAR, FF-SAR, SARin) and timeliness constraints, over the different surfaces under responsibility of EUMETSAT (**open ocean, coastal zone and polar ocean**). Highlighting the challenges of the CRISTAL mission and recommending algorithms ready for the implementation in the CRISTAL marine Ground Segment (GS) based on altimetry literature.



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In particular, this study will address issues critical to the CRISTAL altimeter data processing in global ocean, namely:

- the continuity of the SSH measurements between sea-ice leads and open ocean (as well as between coastal and open ocean),
- the computation of an ionospheric correction for the Ku-band range estimates using dual band Ku/Ka altimetry data,
- the effect of rain in Ka band, and
- the observation of different ocean surfaces resulting from possible intrinsic difference between Ka and Ku antenna beams.

Task 2-3 Level 1/2 Specifications

Objective:

- **To define the CRISTAL marine Level-1 and Level-2 product generation specifications** based on outcomes from the state-of-art review (and on the Sentinel-6 PGS heritage),
- **To define the CRISTAL marine Level-1 and Level-2 product formats (PFS)**.

Advanced and mature algorithms will be proposed to allow for processing ocean data for all IRIS acquisition modes ensuring the compliance of the ocean requirements. All the proposed algorithms will be ready for operational use, in turn allow satisfying the different timeliness (NRT, STC and NTC) as mentioned below.

Near-Real time	Short Time Critical	Non Time Critical
• Mainly for operational Met agencies (wind and wave mainly) • Products split by satellite dump/granules (LR/HR) • NetCDF and BUFR	• For ocean modelling and assimilation • Product split by pass (pole to pole) • NetCDF	• For oceanographic and geophysical research and climate studies • Products split by pass (pole to pole) • NetCDF
CRISTAL		
• **3-hours latency** • **Level 2:** Standard and Reduced • **BUFR** • **MWR L2**	• **48-hours latency** • **Level 1A** • **Level 1B** • **Level 2:** Standard and Reduced • **MWR L2**	• **30-day latency** • **Level 1A** • **Level 1B** • **Level 2:** Standard and Reduced • **MWR L2**

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