

# **Reviewing the synergistic use of SMOS and CryoSat observations for ocean-ice forecasts on weather to seasonal time scales**

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## **Abstract**

The rapidly warming Arctic with the accompanying retreat and thinning of sea ice fortifies the need for better ocean-ice monitoring and forecast capabilities. One outstanding key parameter is the sea-ice thickness with great importance for diagnostics and predictions. To determine seasonal and interannual variations of the sea-ice thickness has been the main objective of ESA's Earth Explorer mission CryoSat. ESA's second Earth Explorer mission SMOS provides data that can also be used to derive the thickness of sea ice although this was not its primary objective. Both missions are highly complementary in terms of spatio-temporal sampling and their sensitivities with respect to different ice thickness regimes. How to make best use of the available and future satellite observations in various operational application domains is a valuable research goal. The optimal choice of a certain data product or assimilation approach depends on different requirements including the time scales under consideration.

In this presentation we review different application examples including

- 1) The assimilation of SMOS data in the Copernicus Marine Environment Monitoring Service (CMEMS) Arctic Monitoring Forecasting Centre (ARC MFC) coupled ocean and sea ice forecasting system TOPAZ (Xie et al., 2016).
- 2) The synergistic use of SMOS and CryoSat2 data with an optimal interpolation method for the generation of a weekly Arctic sea-ice thickness product, named CS2SMOS (Ricker et al., 2017).
- 3) The assimilation of the merged CS2SMOS product in the operational ensemble forecasting system at the ECMWF and its impact on seasonal sea-ice forecasts.
- 4) The assimilation of the merged CS2SMOS product in the CMEMS TOPAZ system (Xie et al., 2018).
- 5) The way towards direct assimilation of SMOS brightness temperatures (Richter et al., 2018).

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