New Arctic SMOS Sea Surface Salinity product

We are pleased to announce the publication of the latest version (v3.1) of the Arctic SMOS Sea Surface Salinity product produced at BEC.

First results on the performance of ARIEL radiometer in MOSAIC Expedition

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New SMOS Sea Ice Concentration products

Remote sensing of ocean surface currents: a review of what is being observed and what is being assimilated

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New methodology to estimate Arctic sea ice concentration from SMOS combining brightness temperature differences in a maximum-likelihood estimator

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New Sea Surface Salinity products in High Latitude

SMOS Sea Ice Concentration maps

Since more than a year ago, the Barcelona Expert Center (BEC) team researches on the capabilities of SMOS for the characterizations of the Cryosphere.

First maps of the Arctic Sea Ice concentration from SMOS data have been produced for the year 2014, with the algorithm explained bellow.

Two indices have been chosen to compute ice concentration: Angular Difference ($AD=TBV(\theta_2)-TBV(\theta_1)$) and Polarization Difference ($PD=TBV-TBH$). The sensitivity of those indices to ice salinity and temperature is much less (about 60%) than that of raw TB’s, but they are still quite sensitive to the physical state (sea or ice). This property is very convenient for the empirical characterization of the physical state, because the distribution of the geophysical parameters is not very well known (specially for the ice salinity).

A necessary parameter to retrieve ice concentration is the set of tie-points. Tie-points are typical radiometric measurements of sea ice (100% sea ice concentration) and open water (0% sea ice concentration) used to assign each pixel with a given observed radiometric parameter to ice or open water.

The values of AD ad PD, for a convenient incidence angle, can be used as tie-points for ice and sea water, because the characteristic distributions of sea and ice according both indices are clearly disjoint (see figure below), what allows a good classification. However, the distributions of values of AD and PD on First Year Ice (FY) and Multi Year ice (MY) overlap, with different shapes, making the correct classificaction of both types more challenging. The temporal and spatial stability of the tie points has been verified.

Tie points for Ice and Sea for the Arctic.

The values of ice concentration have been obtained applying an inversion algorithm which uses the Maximum Likelihood Estimation (MLE) algorithm, which takes into account the mean values of AD and PD but also their standard deviation.

The following figures show SMOS Sea Ice Concentration maps of the Arctic compared with the values from OSI-SAF algorithm for March, July and November.

SMOS 2nd-5th March	OSISAF 3rd March	OSISAF – SMOS
SMOS 2nd-5th July	OSISAF 3rd July	OSISAF – SMOS
SMOS 2nd-5th November	OSISAF 3rd November	OSISAF – SMOS

Maximum differences are observed during Autumn, at the time of maximum extent of thin ice (less than 60 cm) in the Arctic. If thin ice is present, SMOS measurements of completely ice covered pixels will be reported as mixed (i.e. not 100% ice), since the brightness temperature is not as high as for thick ice (used for the tie point definition). This is because SMOS measures electromagnetic radiation at a lower frequency than AMRS and SMMI, and therefore presents larger penetration into ice than higher frequency bands, as the ones used in the OSISAF algorithm.The differences observed during melting period (July maps) are not yet well understood.

Stay tuned to see more applications of SMOS data on Sea Ice now being explored by BEC.

What can SMOS tell us about the Arctic oceans?

SMOS Local Oscillators impact on Sea Surface Salinity quality