Geophysical Research Abstracts
Vol. 19, EGU2017-4452, 2017
EGU General Assembly 2017

Arctic sea ice concentration observed with SMOS during summer

Carolina Gabarro (1,2), Justino Martinez (1,2), Antonio Turiel (1,2)

(1) Institut de Ciències del Mar (CSIC), Physical Oceanography, Barcelona, Spain (cgabarro@icm.csic.es), (2) Barcelona Expert Center

The Arctic Ocean is under profound transformation. Observations and model predictions show dramatic decline in sea ice extent and volume [1]. A retreating Arctic ice cover has a marked impact on regional and global climate, and vice versa, through a large number of feedback mechanisms and interactions with the climate system [2].

The launch of the Soil Moisture and Ocean Salinity (SMOS) mission, in 2009, marked the dawn of a new type of space-based microwave observations. Although the mission was originally conceived for hydrological and oceanographic studies [3,4], SMOS is also making inroads in the cryospheric sciences by measuring the thin ice thickness [5,6]. SMOS carries an L-band (1.4 GHz), passive interferometric radiometer (the so-called MIRAS) that measures the electromagnetic radiation emitted by the Earth's surface, at about 50 km spatial resolution, continuous multi-angle viewing, large wide swath (1200-km), and with a 3-day revisit time at the equator, but more frequently at the poles.

A novel radiometric method to determine sea ice concentration (SIC) from SMOS is presented. The method uses the Bayesian-based Maximum Likelihood Estimation (MLE) approach to retrieve SIC. The advantage of this approach with respect to the classical linear inversion is that the former takes into account the uncertainty of the tie-point measured data in addition to the mean value, while the latter only uses a mean value of the tie-point data. When thin ice is present, the SMOS algorithm underestimates the SIC due to the low opacity of the ice at this frequency. However, using a synergistic approach with data from other satellite sensors, it is possible to obtain accurate thin ice thickness estimations with the Bayesian-based method.

Despite its lower spatial resolution relative to SSMI or AMSR-E, SMOS-derived SIC products are little affected by the atmosphere and the snow (almost transparent at L-band). Moreover L-band measurements are more robust in front of the accelerated metamorphosis and melt processes during summer affecting the ice surface fraction measurements.

Therefore, the SMOS SIC dataset has great potential during summer periods in which higher frequency radiometers present high uncertainties determining the SIC. This new dataset can contribute to complement ongoing monitoring efforts in the Arctic Cryosphere.

[1] Comiso, J. C.: Large Decadal Decline of the Arctic Multiyear Ice Cover, Journal of Climate, 25, 1176–1193, 2012.
[2] Holland, M. M. and Bitz, C. M.: Polar amplification of climate change in coupled models, Climate Dynamics, 21, 221–232, 2003.
[3] Font, J, et al.: SMOS: The Challenging Sea Surface Salinity Measurement from Space'. Proc. IGARSS, no. 5, 649 -665, 2010.
[4] Kerr, Y., et al.: The SMOS mission: New tool for monitoring key elements of the global water cycle Proc. IGARSS no. 5, 666-687, 2010.
[5] Kaleschke, L., et al.: Sea ice thickness retrieval from SMOS brightness temperatures during the Arctic freeze-up period, Geophys. Res. Lett., doi:10.1029/ 2012GL050916, 2012.
[6] Huntemann, et al.: Empirical sea ice thickness retrieval during the freeze up period from SMOS high incident angle observations, The Cryosphere Discuss., 7, 4379–4405, 2013.