

ISSI - Virtual Sea Ice Mission - Notes first meeting 29-30 September 2016, ISSI Bern, Switzerland

TOP1: ISSI Working Groups

Maurizio Falanga welcomed the participants and provided an overview of ISSI and its mission. For a working group such as this, the publication of a book is the expected result with publication costs being covered by ISSI. In addition, the group discussed the development of a technical tool including a manual / user guide for the community model to be developed in support of the community using it, as one of the main outcome of this workshop.

TOP2: Objectives

Susanne Mecklenburg introduced the objectives and concept of this virtual mission working group. For missions like SMOS (or SMAP) the Polar Regions were originally not identified as potential application areas and consequently a approach for parameter retrievals and validation had to be defined at a later stage in the mission.

It was agreed that - as an overarching goal for the Working Group - a community sea-ice emission model would be defined and as part of this a better understanding of the measured signal at low frequency microwave frequencies over sea ice, in particular L-Band, should be established.

In the long term this will support an increased accuracy of sea ice thickness retrievals, an improved characterization of uncertainties and limitations of such measurements, and will support the case being made for the continuity of the L-Band observation systems.

Complementing the development of the sea ice model, the outcome of the working group's work shall include:

- 1) A strategy for a common validation of the community sea-ice model and input going into this model;
- 2) A dedicated campaign plan for model and parameter validation
- 3) A coherent sea ice parameter retrieval algorithm development
- 4) A consistent integration of auxiliary data sets

TOP3: Model status and developments

The group discussed the advantage of using observations from multiple frequencies and to what extent they should be included into the community model. Higher frequencies are needed for snow measurements, but the effect of the atmosphere would need to be

considered. It was felt though that already substantial work had been done for higher frequencies, i.e. a good maturity was reached in this area. Since 100 GHz roughly defines the transition from Rayleigh to Mie scattering it was decided to focus on the range from 0.5 GHz to 90 GHz. In terms of community building, a wide range of frequencies to be covered by the community model is considered beneficial.

Coherency (phase interference), even in low frequencies, should be taken into account.

Convergence to open water remains a problem, i.e. the brightness temperatures values for an ice thickness of 0 do not match the ones obtained for open water.

The effect of snow on sea ice shall be taken into account.

TOP4: Selection of model framework

It was decided to make use of existing capabilities. The SMRT model, currently developed by a consortium led by the University of Grenoble under contract from ESA, was defined as a suitable starting point. It already provides a framework for radiation transfer models and is based on Python. The model will be released early November 2016, with a Peer reviewed publication being planned in Spring 2017. A beta delivery of SMRT could be made available before the end of the year for first actions, see below under TOP5.

The Rosenkrantz model, covering the atmospheric effects, is available in Python through University of Hamburg.

Particular attention should be paid to the scattering at the ice - snow interface and scattering brine pockets in the ice. Comparing different parameterizations of the dielectric properties of the ice shall be one of the first steps.

TOP5: SMRT

The model is based on substantial experience with regard to the validation in avalanche/snow research. To expand the model to sea ice will not be a simple task, hence there is definitely a need of further measurements under laboratory conditions for radiation transfer models for sea ice. The problem is the characterization of the ice layers

and their dielectric properties. With sea ice, we are at the very beginning.

The first steps in adjusting SMRT to sea ice conditions will be:

An intercomparison of dielectric constants, summarize different parameterizations, compare results of all parameterizations by using synthetic snow packs - led by Nina Maaß & Ludovic Brucker

An implementation of sea ice parameterizations to the SMRT framework, extending from snow only to land sea ice inclusion. Using MEMLS as help - led by Friedrich Richter.

TOP6: Campaigns

An opportunity for in-situ measurements is the MOSAIC campaign, which will take place 01.09.2019 - 31.10.2020, organized by AWI. The approach is to mount radiometers with different frequencies (L,C,X) on the Polarstern for one year complemented with thermal information for surface temperatures and optical data to monitor conditions and take samples of ice and snow. ESA and the University of Hamburg will investigate options to take part in this campaign in the frame of this working group.

TOP7: Next meeting

To continue the work of the group it was decided to organize a webex every 2,5 months, to discuss progress versus the first steps agreed above under TOP5. The next working group meeting is foreseen for May 2017, or at the Arctic Science Summit 2016 at the end of March 2017.

TOP8: Additional participants

Stefan Bühler will be invited to join the group to support the atmospheric component. Melodie Sandels and Michel Tsamados (UCL) will be invited to cover the modeling aspects.

TOP9: Follow-up / Actions

Christina Gabarro contacted A. Camps (UPC) wrt to radiometers for MOSAIC. Instruments are available and were used in ocean campaigns already. Conditions for use would need to be discussed.

Matthias Drusch met A. Camps (UPC), specs and requirements for the campaign are needed in order to check whether the available radiometers are suitable. Testing will be needed.

Friedrich Richter contacted Nicolas Flourey (ESA) and agreed on a SMRT delivery date within ESA. The SMRT / TRP contract will be kept open allowing for a limited project extension including sea ice. Co-funding could potentially come from SMOS.

Contact point for MOSAIC is Markus Rex at AWI. ESA to clarify whether an ESA engagement could be feasible and under which conditions.