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Retrieval of snow parameters from AMSR-E brightness temperatures using a physically-based simplified approach: first results

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The capabilities of space-borne microwave brightness temperatures to retrieve snow parameters such as snow depth and water equivalent (SWE) have been widely investigate in the literature. Popular (e.g., often used) techniques are based on a linear relationship between the measured brightness temperatures and snow depth or SWE. It is widely recognized that these techniques have limitations deriving from the use of static coefficients, in both space and time. Recently adopted operational algorithms (e.g., AMSR-E SWE, September 2005) suggest the use of dynamic coefficients for relating measured brightness temperatures and snow depth, with the use of low frequencies (e.g. $\sim$ 10 GHz) not present in the past algorithms. However, these approaches based on the linear combination of microwave data and snow parameters cannot fully account for the physics of the problem and for the potential deriving from multi-temporal information. Although many efforts are nowadays focused on assimilation-based techniques, many investigations regarding several aspects are still required before these techniques become mature enough for being applied operationally. These aspects involve consistency between electromagnetic and snow models, computational costs, selection/availability of forcing data and error assessment, to name a few.

In the meantime, it is important to investigate the use of simple, physically based and dynamic approaches for the retrieval of snow parameters. In order, for a technique based on a physical approach to be able to retrieve the parameters of interest (inversion process), it is necessary that this technique is able to reproduce the quantities of interest (e.g., brightness temperatures, forward modeling). This also helps to characterize and quantify errors and uncertainties associated with the inversion, being not possible when using linear regression approaches.

In our talk, we will show results regarding the modeling of AMSR-E brightness temperatures measured over two different test sites located in Canada (Yellow Knife) and Russia (Agata) for the period 2002 – 2005. For the same period and test sites we will also show results concerning the retrieval of snow depth and SWE. In the case of forward modeling, all inputs to the electromagnetic model (e.g., *a priori information)* are derived from combination of brightness temperatures and from simplified models accounting for the evolution of snow parameters, with the only exception of snow depth. We will show how the use of very simple assumptions on the evolution of snow parameters allows us to model the seasonal trend of AMSR-E brightness temperatures. These results are then used as starting point for refining the inversion technique by reducing the error between measured and modeled brightness temperatures but always being coherent with the philosophy of keeping the retrieval process *'as simple as possible but not simpler'*. Results reported here confirm the potential of a simple physically-based approach for the retrieval of snow parameters, expanding the potential of retrieving not only snow depth and SWE, but also snow temperature and grain size.