Toward an improved NASA AMSR-E SWE product: Validation and refinement

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The knowledge of snow storage plays a fundamental role for many reasons. For example, in many regions of the world the majority of total annual precipitation occurs as snowfall and melting snow represents a major source of fresh water. Improved estimates of snow storage will benefit regional-scale hydrological models and general circulation models (GCMs) and will lead to better simulations of large-scale runoff. In this context, space-borne passive microwave instruments are fundamental and can be used to map SWE at regional scales with a daily repeat. The AMSR-E snow water equivalent (SWE) product is one of the five key science product suites that are available for Earth system scientists interested in investigating cryospheric science questions. The product suite consists of daily, pentad (five-day) maximum and monthly average SWE estimates that together comprise the only NASA satellite-based SWE product available to the scientific community.

In our talk, we will report results regarding the effort of validating and refining the current ASMR-E SWE product.

In particular, we report the validation of the SWE product using SWE values distributed over the continental U.S. derived by the NOHRSC Snow Data Assimilation System (SNODAS) data [e.g., 1,2]. Snow depth values measured by weather stations of the World Meteorological Organization (WMO) are also used for validation purposes. Density values used in the AMSR-E SWE product are compared with those derived from SNODAS and the results are discussed. Effective grain size is also estimated from the inversion of an electromagnetic model. The relative spatio-temporal distribution is discussed in conjunction with the dynamic coefficients used to derive snow depth from the brightness temperature differences in the current operational algorithm.

In the second part of the talk we discuss the refinement of the current operational algorithm [e.g., 3,4]. In particular, we first investigate potential venues for short-term, mid-term and long-term plans. On a short-term period, we introduce the use of 'normalized' brightness temperatures derived by dividing the AMSR-E brightness temperatures with surface temperature derived from the combination of brightness temperatures. On a medium timescale we propose to combine the current approach with a neural network based approach, which has shown to provide significant improvement [5]. We finally discuss a long-term strategy which will be modular and physically driven, not anymore driven by retrieval coefficients but by the inversion of an electromagnetic model supported with a neural network architecture and/or outputs from land surface models.

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