THE AMSR-E SNOW WATER EQUIVALENT PRODUCT: ALGORITHM DEVELOPMENT AND PROGRESS IN PRODUCT VALIDATION

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Snow is an important storage component of the hydrological cycle and its influence is evident both in terms of river basin runoff and climate change dynamics. In many parts of the world snow contributes a very high percentage of total annual water supply and the allocation of limited water resources has significant economic and policy consequences. Furthermore, snow is considered a renewable resource but in a changing climate system that is placing considerable pressures on regional water supplies, significant questions are emerging about how best to use this valuable water supply. It has been shown that snow cover can affect directly climate dynamics and so our ability to estimate global snow coverage and volumetric storage of water in seasonal and permanent snow packs impacts on our ability to monitor climate and climate change and to test climate model simulations. Thus, in a changing global environment, there are compelling reasons why we need to be able to map and monitor the distribution of snow storage through winter seasons and from year to year.

The Advanced Microwave Scanning Radiometer – EOS (AMSR-E) launched in 2002 aboard NASA's Aqua satellite, has improved spatial resolution capabilities compared with previous passive microwave instruments. In this paper we show how the standard SWE product has evolved from a static semi-empirical algorithm to a more dynamic algorithm that incorporates estimates of snow properties in the retrieval process. This recent evolution has been possible by using a suite of calibration and validation field experiment data. The basis of the algorithm is a brightness temperature difference approach that uses the 10 GHz and 36 GHz vertically polarized channels. We demonstrate how the 10 GHz response from snow is less affected by snow than the standard 18 GHz response. Also, a new dynamic component of the algorithm is shown that is derived from the polarization difference at 36 GHz which from DMRT simulations is known to be responsive to grain size variations. The updated algorithm is tested against various field experiment data sets. Comparisons with MODIS snow cover extent are also described showing the agreement of AMSR-E estimates with MODIS snow cover maps.

For validation, snow depth retrievals from AMSR-E are tested using several data sets. First, we compare AMSR-E estimates with GEWEX (Global Energy and Water Experiment) Asian Monsoon Experiment (GAME) and Coordinated Enhanced Observing Period (CEOP) data. AMSR-E brightness temperatures are used in the study. Seven acoustic snow gauge sites recorded daily snow depth within a 100 km x 100 km domain located near Yakutsk in Siberia. These point snow depth measurements span a period between October 2002 to February 2003 and October 2003 to April 2004. Additionally, Cold Land Processes Experiment data from Colorado in 2002 and 2003 are also used to test AMSR-E estimates. Finally, snow depth data from WMO measurement sites are used to test the AMSR-E estimates. For each of these validation data sets, error statistics are used to derive uncertainties in the AMSR-E retrievals which are generalized to produce per-pixel uncertainty statistics in the final product.