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The Snow Climate Change Initiative - Towards a long term global snow climate data record from satellite data

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Seasonal snow is an important component of the global climate system. It is highly variable in space and time and sensitive to short term synoptic scale processes and long term climate-induced changes to temperature and precipitation. Current snow products derived from different algorithms applied to various satellite data show significant discrepancies in extent and snow mass, a potential source for biases in climate monitoring and modelling. The recently launched ESA CCI+ Programme addresses seasonal snow as one of 9 Essential Climate Variables to be derived from satellite data.

In the snow_cci project, scheduled for 2018 to 2021 in its first phase, reliable fully validated processing lines are developed and implemented. These tools are used to generate homogeneous multi-sensor time series for the main parameters of global snow cover focusing on snow extent and snow water equivalent. Using GCOS guidelines, the requirements for these parameters are assessed and consolidated using workshops and questionnaires addressing users dealing with different climate applications. Snow extent product generation applies algorithms for fractional snow extent and cloud screening, generating consistent daily products for snow on the surface (viewable snow) and snow on the surface corrected for forest masking (snow on ground) with global coverage. Input data are medium resolution optical satellite imagery (AVHRR-2/3, AATSR, MODIS, VIIRS, SLSTR/OLCI) from 1981 to present. An iterative development cycle is implemented including homogenisation of the snow extent products from different sensors by minimizing the bias. Independent validation of the snow products is performed using high resolution snow maps from Landsat and Sentinel-2 acquired across different seasons and climate zones around the globe from 1985 onwards as well as in-situ snow data following snow community agreed validation protocols.

Global time series of daily snow water equivalent (SWE) products are generated from passive microwave data from SMMR, SSM/I, and AMSR from 1978 onwards combined with in-situ snow depth measurements. Long-term stability and quality of the product is assessed using independent snow survey data and by intercomparison with the snow information from global land process models.

The usability of the snow_cci products is ensured through the Climate Research Group, which performs case studies related to long term trends of seasonal snow, evaluation of CMIP-6 and other snow-focused climate model experiments, and of the simulation of Arctic hydrological regimes.

In this presentation, we will summarize the requirements and product specification for the snow extent and SWE products, with a focus on climate applications. We will present an overview of the algorithms and systems for generation of the time series. Demonstration products for daily global snow extent and snow water equivalent products from different sensors will be presented along with first results of the multi-sensor consistency and validation activities and inter-comparisons with snow products from other sources.