Development of Long-Term Satellite-Based Snow Mass Records in the ESA Snow CCI Project

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Reliable information on snow cover across the Northern Hemisphere and Arctic and sub-Arctic regions is needed for climate monitoring, for understanding the Arctic climate system, and for the evaluation of the role of snow cover and its feedback in climate models. In addition to being of significant interest for climatological investigations, reliable information on snow cover is of high value for the purpose of hydrological forecasting and numerical weather prediction. Terrestrial snow covers up to 50 million km² of the Northern Hemisphere in winter and is characterized by high spatial and temporal variability making satellite observations the only means for providing timely and complete observations of the global snow cover. The ESA Snow CCI project was initiated in 2018 to improve methodologies for snow cover extent (SE) and snow water equivalent (SWE) retrieval [1] using satellite data and construct long term data records of terrestrial snow cover for climate research purposes.

The first new long term SWE data record from the ESA Snow CCI project, spanning 1979 to 2018 has been constructed and assessed in terms of retrieval performance, homogeneity and temporal stability. The initial results show that the new SWE dataset is more robust, more accurate and more consistent over the 40-year time series, compared to the earlier ESA GlobSnow SWE v1.0 and v2.0 data records [1].

The improved SWE retrieval methodology incorporates a new emission model (within the retrieval scheme), an improved synoptic weather station snow depth data record (applied to support SWE retrieval), extension of the SWE retrieval to cover the whole Northern Hemisphere.

The new Snow CCI SWE data record has been used to assess changes in the long term hemispherial snow conditions and climatological trends in Northern Hemisphere, Eurasia and North America. The general finding is that the peak hemispherial snow mass during the satellite era has not yet decreased significantly but has remained relatively stable, with changes to lower and higher SWE conditions in different geographical regions.
References: