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Hemispherical Snow Water Equivalent Records of Satellite-Based Data and CMIP5 Climate Model Simulations

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The European Space Agency (ESA) GlobSnow project has produced a daily hemisphere-scale satellite-based snow water equivalent (SWE) data record spanning more than 30-years. The GlobSnow SWE record, based on methodology by Pulliainen [1] utilizes a data-assimilation based approach for the estimation of SWE which was shown to be superior to the approaches depending solely on satellite-based data [2]. The GlobSnow SWE data record is based on the time-series of measurements by two different space-borne passive radiometers (SMMR and SSM/I) measuring in the microwave region, spanning from 1980 to present day at a spatial resolution of approximately 25 km.

We briefly present the on-going efforts taking place for further enhancement of the satellite-based SWE retrieval and the way this transfers to the reliability of the long-term SWE climate record. The development of SWE retrieval are focused on application of a new HUT multi-layer snow emission model and variational snow density scheme for SWE retrieval and efforts carried out to improve the homogeneity of the long-term record of weather station-based snow depth observations that are applied within the SWE retrieval scheme.

In addition, the GlobSnow satellite-based dataset is inter-compared with climate model simulations from the CMIP5 archive. The objective of this work is to investigate the performance of the CMIP5 models in capturing the evolution of hemispheric scale snow conditions for the period of 1980 to 2010. The climate model simulations on snow cover extent, snow depth and snow water equivalent are evaluated against the GlobSnow SWE record. The goal is to assess the performance of the CMIP5 models to simulate snow conditions for the time-period that is covered by satellite-based observations.

The results indicate a clear decreasing trend in total hemispherical snow mass for the period of 1980 to 2010 in the remote-sensing based data record. The inter-comparison of satellite-based record and climate model simulations show notable differences in capturing the evolution of Hemispherical scale snow conditions. Similar trends of decreasing snow cover are also seen in the investigated CMIP5 models, although there are notable differences between the various climate models. Some of the models capture the overall hemispherical snow mass more accurately than others. In general the winter months (December, January and February) seem to be rather well captured, while the spring season, (March, April and May) appears more challenging for the climate models.

REFERENCES

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