Estimating Snow Cover Properties over Northern Hemisphere in a Period of 30 Years

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Snow is an important physical parameter in hydrology and climate research. The thickness of snowpack is related to the water discharge when the snow melts and related to the Earth's water cycle. Snow Water Equivalent (SWE) describes how much water will be released when snowpack melts. The knowledge of SWE together with exact snow clearance date is an important input for hydrological and climate models. For example, once the growing season begins after snow melt the amount of CO_2 changes in the atmosphere. Spaceborne microwave radiometers are well suited for monitoring SWE and snow melt in global scale since the globe can be mapped in continental scale twice a day and bad weather and night time do not interfere with the measurement.

The SWE algorithm [1] is based on assimilating ground-based observations of snow depth together with spaceborne microwave data. A time series from 1995-1997 and 2006-2008 have been produced covering Eurasia and North America and the results have been valified with ground truth data from Canada and Russia. The result show improvement in accuracy compared to present operative SWE products.

The snow clearance date algorithm [2] is based on time series analysis of brightness temperature channel differences. The algorithm has been validated using russian INTAS-SCCONE snow depth measurements. A time series of 30 years exists and the results have been compared to other sources of snow clearance dates showing good consistency. A comparison of the results with climate model ECHAM5 is ongoing.

This work aims at producing a combined, global snow product and a time series of 30 years estimating SWE, snow clearance date and snow status. Snow status means differentiation between wet and dry snow, for example. Land use issues need to be further investigated. Especially mountains pose a challenge when working with radiometer data. There can be some other local effects as well. According to the validation results these two algorithms are well suited for global monitoring of snow.

References

[1] J. Pulliainen, "Mapping of snow water equivalent and snow depth in boreal and sub-arctic zones by assimilating space-borne microwave radiometer data and ground-based observations", *Remote Sensing of Environment 2006*, vol. 101, n°2, pp. 257-269.

[2] M. Takala, J. Pulliainen, S. Metsämäki and J. Koskinen, "Detection of Snow Melt Using Spaceborne Microwave Radiometer Data in Eurasia from 1979 to 2007", *IEEE Trans. Geo. Sci. 2009*, Vol 47, pp. 2996 - 3007.