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A robust algorithm for mapping snow cover dynamics over large spatial domains using MSG data

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The spatial and temporal dynamics of snow cover (SC) are of utmost importance to accurately assess water and energy fluxes for applications in meteorology, hydrology and other environmental sciences dealing with land surface processes. As terrestrial monitoring networks of SC (and other snow characteristics) are usually of insufficient density, models of varying complexity are applied to describe the temporal and spatial pattern of SC for large scale coverage. Again, validation of these models is difficult with conventional methods.

The high potential of monitoring snow cover from space has been demonstrated in numerous studies using sensors operating in the reflective, thermal and microwave spectral domain. In the past, only polar-orbiting (low-frequency) satellite sensors had the required spectral or spatial resolution to accurately distinguish between snow cover and clouds. Only with the launch of the first MSG (Meteosat Second Generation) in 2002 (operational since 2004), geostationary satellite systems became feasible to address this sometimes difficult task. This sensor series offers high resolution, both in the spectral and temporal domain (covering the visible to thermal in 11 spectral bands every 15 minutes). Several institutions have developed algorithms to retrieve snow cover products at an (pre-)operational level. Yet, thorough analysis of these products highlights the difficulties in providing the required stability, especially when these algorithms are applied to large areas with strongly varying physical characteristics.

A method is proposed, which applies an hierarchical decision tree classifier to MSG data based on enhanced indexing techniques. The algorithm, currently implemented at the MSG receiving station at the University of Kiel, is specifically designed for an operational application for central Europe. It shows very promising and robust results under various SC conditions, with validation being performed against in-situ measurements and MODIS imagery. Confusion in the classification scheme remains for extended ground fog, which is currently under further investigation.

The potential of the derived product for data assimilation in and validation of macro-scale hydrological and NWP models is discussed.