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# Snow cover mapping for Central Europe - enhancement of optical and microwave remote sensing methods towards an operational service

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The lower mountainous regions in Central Europe are characterised that due to frequent temperature changes the snow pack accumulates and melts off several times during a winter season. Especially rainfall in combination with snow melt is the most critical situation for the origin of floods. Remote Sensing has a strong potential to provide desired spatial characterisation on snow properties to control and update hydrological models. Within the framework of a national programme funded by DLR, existing algorithms for snow detection and processing of remote sensing data were adapted and extended for operational use. The focus has been given to spatial snow distribution and snow properties, all being major flood supporting factors in the watershed areas of the Neckar and the Mosel river basins in Central Europe. In close cooperation, all developments to provide sustainable and transferable techniques settled close to the actual needs of the local flood warning services. As current users, the flood forecast centers of Baden-Württemberg and Rheinland-Pfalz were involved. Algorithms and methods for a multiscale retrieval of snow covered area and its liquid water content from optical (NOAA-AVHRR) and microwave (ENVISAT-ASAR) image interpretation and techniques are shown. The major challenges for operational processing are the creation of robust, automatically applicable remote sensing products. Besides snow classification, detailed geometric processing is premise for product generation. Using this multisensoral approach of snow cover monitoring, important information for hydrologic modelling had been provided by remote sensing. The snow cover mapping approaches at VISTA consist of two different processing chains for optical and microwave data, relevant for flood forecasting and early warning The first

product provides daily information of snow covered area, the snow line, and snow free areas using medium resolution optical imagery (NOAA-AVHRR). Snow is detected using ratio and threshold techniques for several spectral bands of the sensor. The service is provided operationally for Central Europe. Products will be provided online within one hour after data reception. The second product additionally identifies the extent of snow with a high content of liquid water from SAR data using ENVISAT ASAR in wide swath mode. A semi empirical backscatter model and change detection techniques are applied. The snow service outputs consist of EO based snow cover maps, snow line delineation and snow melt maps through classification of wet/melting snow. The products can be provided within some hours after data availability. Results from last winter seasons of automatic NOAA-AVHRR processing and wet snow distribution determination from ENVISAT ASAR Near-Real-Time data will be presented.