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A processing system for runoff modelling and forecasting in mountain basins using remote sensing and other data sources

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The concept and implementation of a system for runoff modelling and forecasting is presented that handles input data from remote sensing and other data sources. The Hydrological Modelling Platform (HMP) is a modular processing system developed by ENVEO that is dedicated at modelling and forecasting the stream flow in mountainous basins with substantial snow and glacier melt contributions. The system has modular design and can be easily adapted to basins in other environments. The present implementation of HMP requires input from hydro-meteorological stations or numerical weather forecast models and spatially detailed information on the snow extent as provided from various spaceborne sensors. Procedures have been developed for automated generation of snow maps from optical sensors (e.g. TERRA MODIS, Envisat MERIS) and SAR (Envisat ASAR, Radarsat) satellite sensors, including geocoding, radiometric calibration, classification of snow, and screening of un-observed areas (e.g. clouds in optical images, layover and shadow areas in SAR data). In the case of optical satellite data a multi-spectral classifier is applied. SAR snow mapping algorithms are based on a multi-temporal change-detection approach. Digital snow maps, an output product of the system, are presented. The implemented hydrological model is an improved version of the semi-distributed Snowmelt Runoff Model (SRM) of Martinec et al. (1994). SRM operates at the scale of sub-units of a basin, called Hydrological Response Units (HRUs), which are characterized by similar hydrological properties. During model initialisation HRUs are delineated by combining maps of hydrologically relevant land surface types, as derived from high resolution optical satellite images, with terrain parameters such as elevation, slope and aspect. Temporal aggregation and spatial extrapolation of meteorological data and assimilation of

satellite based snow information for each HRU is carried out in a pre-processor by taking the elevation dependence and spatial gradients into account. After model set up and calibration the system HMP operates automatically. In simulation mode the system has been tested successfully for modelling daily runoff in several drainage basins in the Austrian Alps, as well as for modelling runoff and mass balance of individual glaciers. In forecasting mode it was tested in a 3-month demonstration phase in 2005, during which daily runoff forecasts of good quality were produced.