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Surface soil moisture retrieval from ASAR imagery to support multiscale hydrological model applications in Global Change research

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Remote Sensing is the key to an integrative monitoring concept for the transdisciplinary project GLOWA-Danube. Multitemporal and multisensoral (and hence multiscale) remote sensing information is used as a source of input and validation data for integrated modeling approaches in the framework of the Global Change decision support tool DANUBIA. Hydrologic processes, such as runoff production or evapotranspiration, largely depend on the variation of soil moisture and its spatial pattern. While standard image products usually lack sufficient spatial extent and availability, Envisat's ASAR-WideSwathMode imagery synoptically covers mesoscale areas in medium spatial resolution and high temporal repetition. This study presents a semi-empirical model for the retrieval of near surface soil moisture from ASAR-WSM imagery. The procedure compensates for the different topographic and vegetation effects on the backscatter signal. Small scale variations in vegetation, especially in agricultural areas, are crucial for the accuracy of soil moisture retrieval. Since GLOWA-Danube operates on a 1km^2 grid, a scaling procedure was developed which takes into account subscale land cover datasets derived from AVHRR and MERIS imagery. If the vegetation effect on the radar backscatter signal is accounted for on a subscale basis, quantitative comparisons of derived near surface soil moisture products to field measurements and mesoscale hydrologic model results show a remarkable improvement and overall good agreement. Based on the mesoscale results of the soil moisture retrieval for the Upper Danube watershed, a bi-directional scaling procedure was developed to utilize this information for global scale applications. The validated soil moisture data derived from ASAR is aggregated to create virtual footprints of ESA's highly anticipated SMOS sensor. Simulated SMOS footprints for the Upper Danube

watershed are shown and discussed. The variability of soil moisture patterns monitored from upscaled multitemporal ASAR imagery compares in good agreement to the dynamics of soil moisture simulated with DANUBIA. Upon availability of SMOS imagery, the developed scaling procedure will in return be utilized to disaggregate soil moisture information for the mesoscale. This scheme provides a new, independent and spatially transferable method of validation for the simulation of soil water fluxes in hydrologic modelling.