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Soil moisture monitoring in remote catchments: temporal stability and its use in active microwave remote sensing validation

K. Schneider (1), J.A. Huisman (2), L. Breuer (1) and H.G. Frede (1)

(1) Institute for Landscape Ecology and Resources Management, Justus-Liebig-University Gießen, Germany, (2) Forschungszentrum Jülich, Institute of Chemistry and Dynamics of the Geosphere (katrin.schneider@umwelt.uni-giessen.de / Phone: +49-641-9937394)

Soil moisture is an essential component of ecohydrological flows and runoff generation in watersheds. Thus, information of temporal and spatial soil moisture dynamics is required to understand hydrological processes and for modelling purposes. Also, soil moisture could offer an alternative parameter for model calibration, i.e. when other information is lacking as often encountered in poorly gauged or remote catchments. For years, remote sensing has been proposed as an effective tool for soil moisture monitoring of large areas, thus providing regional data that cannot be collected manually. Nevertheless, land cover properties change the quality of soil moisture data retrieved by remote sensing and require ground measurements for validation. A major concern is that the scales of ground and space observations do not fit, and that the sampling effort to upscale field measurements to remote sensing footprints is high. If a small set of sampling locations representing the mean soil moisture of a larger area could be identified, the sampling effort could be rigorously reduced. In this study, we present soil moisture data collected at 0-0.06 m depth in the steppe environment of the Xilin river catchment in northern China. During the vegetation period of 2004, 2005 and 2006, soil moisture was collected at 100 sampling points on each of four study sites (approx. 1.5 ha), representing different grazing intensities. We analyzed temporal stability to test whether the sampling effort can be reduced to a few characteristic points. Also, we performed a rank correlation to test the temporal persistence of soil moisture patterns. Independent from grazing intensity, we found time stable points

on all sites, whereas the persistence of soil moisture patterns changed with grazing practice. As the study sites only represent a small portion of the 3600 km^2 Xilin river catchment, the question arose whether the data could be upscaled to catchment level and how well ground measurements match with soil moisture data retrieved from an active microwave sensor. The measured soil moisture data were compared to a surface wetness index derived from ERS scatterometer data with a resolution of 50 km. Due to satellite sensor problems, only few satellite overpasses coincide with the ground measurements. Results show that the data match well in some cases, while in other cases the scale gap between ground and air-borne measurements seems to promote differences.