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A comparison of in-situ, satellite and model estimates of soil moisture

Jürgen Komma (1), Günter Blöschl (1), Stefan Hasenauer (2), and Wolfgang Wagner (2)

(1) Vienna University of Technology, Institute for Hydraulic and Water Resources Engineering, Vienna, Austria (komma@hydro.tuwien.ac.at), (2) Vienna University of Technology, Institute of Photogrammetry and Remote Sensing, Vienna, Austria

This study compares soil moisture estimates from three sources: ground-based point measurements using Time Domain Reflectometry, hydrological modelling in catchments, and ERS scatterometer satellite data. A dual layer hydrologic model is proposed here which helps bridge the scale gap between soil moisture modelling and satellite data in terms of penetration depths. The dual layer model improves the consistency with the satellite data over more traditional hydrological models. Using the satellite data increases the robustness of the estimated parameter of the hydrological model. The comparison between simulated with remotely sensed soil moisture for the Kamp catchment in the north-eastern part of Austria indicated good consistency between the spatial patterns of soil moisture. For the entire observation period there appears to be a seasonal pattern of the consistency of the two estimates with lower correlations in winter and higher correlations in summer. This appears to be due partly to biases due to snow in winter and underestimates of soil moisture in summer by the satellite data, as well as biases of the hydrological model. The ground based soil moisture data, generally, are not very well correlated with the satellite data. This is likely due to the very large scale mismatch, both in terms of spatial scale (decimetres versus tenths of kilometres) and the penetration depth (one decimetre versus a few millimetres). The soil moisture simulated by the hydrological model shows better correlations to the ground based measurements than the satellite data, which is likely due to the less pronounced scale mismatch in terms of spatial scale and penetration depth. The correlations, again, are better in summer than they are in winter with correlation coefficients ranging between 0.45 and 0.8 in summer.