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Hydrological processes and spatial characteristics influencing the accuracy of remote sensed soil moisture states: a west African case study.

J. Smits, J.(1), **M. Rutten** (1), N. van de Giesen, (1), R. van Beek (2), A. Heemink (3), H. Winsemius (1), J. Friesen (1)

(1) Water Resources Section, Delft University of Technology, the Netherlands, (2) Department of Physical Geography, Utrecht University, the Netherlands, (3) Institute of Applied Mathematics, Delft University of Technology, the Netherlands, M.M.Rutten@tudelft.nl

Data from the ERS-2 wind scatterometer can be used for soil moisture estimation over large areas. Unfortunately, according to the product definition, measurements provide information for only the top few centimeters of the soil and are limited to areas of low to moderate vegetation foliage. Hence, the measurements by the ERS-2 satellite would not provide detailed information about the soil moisture content of the first few meters below the earth surface, which is of interest in hydrology and climate modeling. However the ERS-2 topsoil moisture does show seasonal cycles and persistence, larger than expected from topsoil moisture, for reasons that are not yet understood. This research investigates how hydrological processes and spatial characteristic influence the accuracy of the topsoil moisture estimates of the ERS-2 satellite.

For three major river basins in West Africa, ERS-2 topsoil measurements are compared to modeled soil moisture states over the period from 2003 to 2006. A conceptual hydrological model is used that is forced with remotely sensed daily precipitation (TRMM) and actual evaporation, estimated from the surface heat balance.

Comparing ERS-topsoil moisture with a hydrological model shows that the satellite signal does not only show high correlations (r=0.76-0.86) to modeled soil moisture of the topsoil, but also to modeled soil moisture of deeper zones. For most pixels, the ERS-2 topsoil moisture correlated even better to modeled moisture of deeper zones

than of the topsoil. Pixel heterogeneity, azimuthal effects, and a high correlation between vegetation water and deeper soil moisture are possible explanations.