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Hydrology and Earth System Sciences Discussions

Interactive comment on "Soil moisture-runoff relation at the catchment scale as observed with coarse resolution microwave remote sensing" *by* K. Scipal et al.

K. Scipal et al.

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Remark #1: The soil moisture product used in this study is representative for the root zone (1 meter depth) and has been derived from remotely sensed surface soil moisture using a simple infiltration model. Respective references are given in section 4. Nevertheless the remark addresses an important issue which is currently of high relevance in the remote sensing community, namely how to link coarse resolution soil moisture product and insitu observations. Apparently the related problems are the different scales and the different layer depths. Each of these topics is very complex by itself and to the knowledge of the authors currently there exist no generally valid solution to these questions. The referee also has to consider that it was the intention of the authors to use a standard dataset and to investigate if it contains hydrological relevant information, and not assess the applied retrieval or the validation of the soil moisture

product. Sections on scaling and quality of the soil moisture products have been included to provide the reader with some indicators about the nature of the soil moisture product. A more complete discussion on these topics has already been published and would be far beyond the scope of this paper.

Remark #2: AMSR data has not been considered in this study as AMSR soil moisture products have only been released recently, the available data comprises only a couple of month. To retrieve any statistical meaningful conclusion a larger database would have been required. Additionally there is no temporal overlap between AMSR/SSMI data and hydrographic data available to the authors. The importance of giving a complete overview is however recognized. Therefore a specific remark about other available soil moisture datasets will be added in the revised paper.

Remark #3: Surface roughness, heterogeneous land cover and vegetation cover are critical issues in soil moisture retrieval from radar data. The method used to derive soil moisture is a change detection approach and therefore takes some of these effects directly into account. For example it can be assumed that, on the scale of the scatterometer, landcover will not change over time. Similarly surface roughness properties can be assumed to be invariable. The effect of vegetation can be described by using the multiviewing capabilities of the ERS scatterometers. The three antennas measure at different incidence angles. By combining measurements taken by the three antennas the contribution of vegetation to the total backscatter can be quantified. The applied method has fully been published in refereed journals therefore any details about the retrieval have been omitted. Proper links to these publications will be added to the revised version of the paper.

Remark #4: As the referee states the relation between soil moisture and runoff is determined by precipitation, but is not a linear one. In fact from a hydrologist's point of view this result does not present any new insight. It is however remarkable that a coarse resolution data set can be used to observe this relation and that this kind of data contains information relevant for hydrologic applications. It is also interesting to

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note that the relation between runoff and soil moisture does not only vary for different gauging station but that there is a clear linear relation to the basin size.

Remark #5: The authors agree with the referee that the morphology has a large impact on the soil moisture runoff relation and that it has not been properly considered in the paper. For completeness of the paper we will add a paragraph about the morphology of the Zambezi basin as far as information is available.

Remark #6: We do not agree in this point. Again, it was the intention of the paper to show that coarse radar observations are sensitive to soil moisture and that this data contains information which is relevant for hydrologic applications by comparing runoff data with soil moisture data derived from ERS scatterometer data. Clearly we agree that water level data alone is insufficient to describe runoff. However the analysis shows that for the Zambezi river it is still a sensitive indicator and that the same trends can be observed in both water level and soil moisture data.

Remark #7: The work presented in this study is only a first step towards the use of coarse resolution soil moisture in hydrology. To the knowledge of the authors there exists no other publication on this topic. Of coarse it would be interesting to extend the study and investigate how the soil moisture products can be assimilated into the model. However getting access to models within a realistic timeline is tedious especially in Africa, and was not possible in the course of the current study. The results of this work have however led to two new studies which address this topic. Any results will however only be available in a couple of month.

Interactive comment on Hydrology and Earth System Sciences Discussions, 2, 417, 2005.