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Hydrology and Earth System Sciences Discussions

Interactive comment on "Temporal variation of soil moisture over the Wuding River Basin assessed with an eco-hydrological model, in-situ observations and remote sensing" *by* S. Liu et al.

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Response to Anonymous Referee #2

Q1: please explain if the models used by Wagner are valid on your geographical context?

A: There is a correlation between the scatterometer SM measurements and the in-situ data (Fig.3) although the measurement scales of these two datasets are different: The in-situ data are point measurements whereas the scatterometer observations are representing regional scale measurement. The Pearson correlation coefficients between the VIP simulation and the in-situ SM data are 0.28 and 0.19 at Suide and Yulin respec-

tively. The correlation coefficients between the VIP simulation and the TUW SM data are 0.20 and 0.18 at Suide and Yulin respectively. The correlation coefficients between the in-situ and the TUW SM data are 0.52 and 0.56 at Suide and Yulin respectively. Although the Pearson correlation coefficients (and Nash-Sutcliffe efficiency) are not high in all the cases, from Fig. 3, the simulated SM data by VIP model and the TUW data can catch the variation trend. Furthermore, from Fig. 4, over the basin, the seasonal pattern of averaged simulated SM by the VIP and TUW SM are generally consistent with each other. And the seasonal pattern of both of them follows that of precipitation over the basin. These support that the models used by Wagner are valid on our geographical context basically.

Question 2: please explain if only 2 SM measurements are sufficient to validate a model?

A: Surely not. However, as there are only two in-situ SM measurements in the basin, they are the only in-situ soil moisture data available to validate the model. In order to overcome this data scarce, we also validated the model with observed stream flow at several sub-catchments, as shown in the newly added Fig.5. Remotely sensed vegetation index and ground water table, as other important variables, can also be used for us to validate the model. However, the detail is not shown in this paper due to the limitation of paper length.

Q3: please explain how you can compare moisture values (SM) estimated from TUW which are in relative units and absolute values obtained from in situ data, and data resulting from model which are in absolute or relative units (to be specified).

A: Many thanks for the comments. Yes, the three types of SM data are in different units. The SM data simulated by the VIP model represent the volumetric soil moisture (cm3 cm-3). SM in-situ measurements in the two sites were made with gravimetric method from the top layer down to the 50 cm at the 10 cm interval on the 8th, 18th and 28th each month from 1992 to 2005 (g g-1). The TUW scatterometer soil moisture data

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are defined as normalized relative water content, the values of which range between 0 and 100%, which reflects the wetness status of land surface. In order for the convenience to make a comparison among the three dataset, these three kinds of SM data measurements were unified. Both the in-situ SM measurement and the data simulated from the VIP model are normalized to the range of 0 ˜ 100% as TUW observations by using the formulation as shown in Eq. (10) in the original version and now Eq. (13) in the revised version for the validation.

Please see it in detail in section 3.2.4. And also please noted, as TUW only catches the soil moisture information at the land surface, when making the comparison, only the top 10 cm SM data simulated by the VIP and the relative in-situ SM data are used.

Q4: please specify what is "in relative units between the driest and wettest conditions"

A: TUW algorithm is based on a change detection method. In this method the microwave backscatter measurements normalized at 40° incidence angle (Sigma_40_degree) are used to extract soil moisture dynamics. Eventually the Sigma_40_degree measurements are scaled between the lowest and highest values ever observed within the long-term observations (from 1 August 1991 to 31 May 2007) representing the driest and wettest conditions. In this way, the corresponds to the relative soil moisture values at topmost 2-5 cm soil surface ranging between 0 and 1 (0% and 100%) (Naeimi et al.).

Naeimi, V., K. Scipal, Z. Bartalis, S. Hasenauer, and W. Wagner, 2008: An improved soil moisture retrieval algorithm for ERS and METOP scatterometer observations. IEEE Transactions on Geoscience and Remote Sensing (in press).

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