Hydrology and Earth System Sciences Discussions

Interactive comment on "Spatial modelling of the variability of the soil moisture regime at the landscape scale in the southern Qilian Mountains, China" *by* C.-Y. Zhao et al.

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First authors thank the anonymous referee #2 who has given good suggestion to improve our manuscript. According to the specific comments, we have revised the manuscript as follows: 1. Referee: "The authors introduce the paper from the perspective of water management in the region where the analysis is conducted. However, the conclusions of the paper and main value of the paper for an international audience revolves around the proposed new wetness index. Because of this selected approach, the existing literature on the relationship between soil moisture and topography is

sparsely reviewed….." Authors: "the existing literature on the relationship between soil moisture and topography is reviewed and added in the section one introduction. This literature is also referenced in the conclusions to state the limitations of what is shown." 2. Referee: "Much more detail is needed about the methods throughout the paper. For example, Fig. 6 is the central test of the proposed estimation method. The authors state that soil moisture was measured in 22 plots, but the figure only includes 15 points. Where are the other 7 points? Also, the soil moisture was measured over 4 months, but the time interval was not stated. How many observations were collected at each point in the 4 months? Also, what is meant by observed soil water content in the figure? Is it an average? Also, the authors state that soil moisture was measured at 4 depths. What depth are these measurements from? Why are the results only shown for June? Why only one depth (or an average of depths)? These are important details to understand the strength of the analysis." Authors: "Much more details have been added about the methods throughout the paper in section 2.2: 1) Total 27 plots were located to measure soil water content, 22 plots were in Pailugou catchment. At final, we can get available data of 15 plots. 2) The soil moisture was measured from May to September. In section 3.2 We mentioned we were focusing on the spatial distribution of precipitation during the ecologically meaningful time period, i.e., growing seasons approximately from May to August, so spatial distribution of soil moisture only show 4 months. 3) the time interval of Soil moisture measurement was stated, at a biweekly interval. 4) soil water content is average in the figure 3, which is calculated by Eq.(1). Soil moisture was measured at 4 depths (0-10, 10-20, 20-40, 40-60 cm). 5) Figure 3 was changed. It shows Scatter plots of observed soil moisture content and modeled soil moisture status from May to August 4 months. Why are the results only shown for June?" 3. Referee: "Figure 6 is also troubling due to the grouping of the data. There is a cluster of very low observed soil moisture values and another broader cluster of higher soil moisture values. Within these clusters, it appears that the method is totally unsuccessful at predicting the soil moisture variations. The method is only successful at distinguishing these two groups. That raises concerns

for me about its general applicability." Authors: "Soil moisture is obvious difference in north-facing slope and the south-facing slope in Qilian Mountains because the trend of the Mountains is east-west. A cluster of very low observed soil moisture values and another broader cluster of higher soil moisture values resulted from the sample plots which most were located in south-facing slope and north-facing slope. We have located some plots that distributed east-facing slope and west-facing slope in 2008. In this way, there may be no cluster." 4. Referee: "Another important limitation is that the method only estimates the soil moisture "status". In this paper, the authors have only shown that the modified wetness index is linearly correlated with the soil moisture, but it appears that the authors are performing a different regression against observed soil moisture each month in the comparison. In that case, the very definition of soil moisture status and its relationship to soil moisture is implicitly changing each month. In the end, the method does not allow direct prediction of soil moisture âËŸA ËĞTonly a soil moisture proxy." Authors: "The modified wetness indices only indicate the soil moisture state. Only after they would be converted into soil water content, could we use them to serve for hydrological simulation and ecological construction. Therefore measurement of soil water content is needed. Because soil moisture has seasonal variation due to precipitation and vegetation growth, a different regression against observed soil moisture each month should be built. We will make measurement for long time for obtaining average monthly regression coefficients. We will focus on the distribution of soil water content in July for ecological construction and that in April for using the model to set up the distributed initial soil water conditions in the hydrological modeling of the study area. " 5. Referee: "I believe the conclusions are too broadly stated. Conclusion 3 does not represent a significant advance. It is a statement of the behavior of the soil moisture status, which is directly implied by its definition when applied to any topography. I would suggest removing it. Conclusion 2 is stated far too generally. The wetness index is probably not universal in the sense that many studies have shown that it does not reliably predict soil moisture patterns (the authors may mean that it is universal in a different sense, but this should be clarified). Precipitation

may be important in this particular case, but no general conclusions about its role can be stated based on this analysis. This analysis offers a single data point in that respect. Conclusion 1 says the use of the new wetness index was validated. But this validation is only based on one catchment. The authors should caution that it may not apply beyond the limits of this catchment. They mention the role of vegetation, but what about soil texture, soil depth, latitude (and its effect on solar insolation angles), extent of spatial variability in precipitation, type of precipitation (snow, rain), etc.? Changes in these factors also limit the applicability." Authors: "Conclusion 3 has been removed from the revised manuscript. In conclusion 2, we mean that the wetness index is universal in a different sense, this is clarified in conclusion 2. Precipitation is important factor affecting soil moisture status in the study area (Qilan Mountains). Specially, precipitation is large different in the eastern part and western part. Due to precipitation variation resulting in soil water content difference, forest can grow in the eastern part, but not in western part. So modeling spatial distribution of precipitation is very important. By the study, we found linear regression is best model to simulate the spatial distribution. We want to give people who undertake the interest study impression that this method is good. In conclusion 1 states the new wetness index was validated. But this validation is only based on one catchment because of no available data obtained in southern Qilian Mountains. In the section 3.3, we added table 4 to use vegetation data for validation. We mention the role of vegetation, we should consider soil texture. Soil depth is not an important factor in the study area. Latitude (and its effect on solar insolation angles), as a factor, was considered in spatial variability of precipitation. Many factors mentioned by the referee such as soil texture, soil depth, latitude (and its effect on solar insolation angles), extent of spatial variability in precipitation are added conclusion 3." 6. besides revision according to the Referee, we also make revision as follows: 1) added equation (1) for calculation mean value of soil water content 2) added equation (5) for simulating spatial distribution of precipitation in Pailugou catchment 3) added table1 4) adjust the sequence of figures 5) added table 4, use vegetation data for validation purposes.

Please also note the supplement to this comment:
http://www.hydrol-earth-syst-sci-discuss.net/6/C3092/2010/hessd-6-C3092-2010-supplement.pdf

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 6, 6335, 2009.
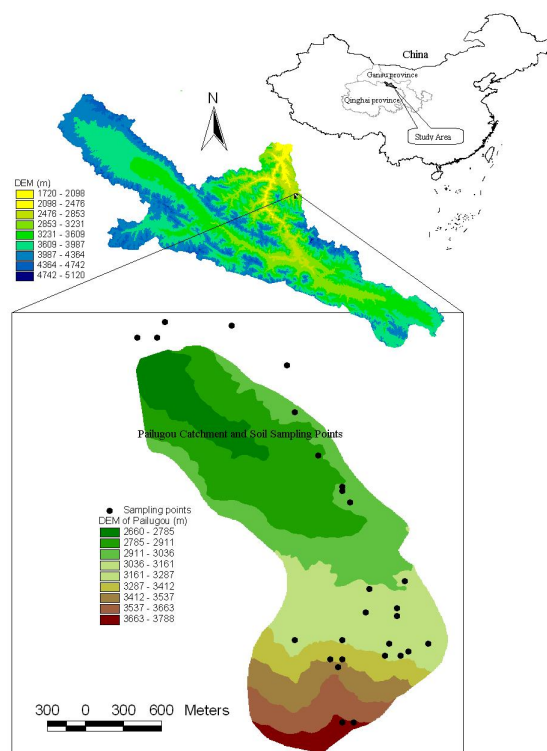
Fig. 1. Location of the study area, meteorological stations and rain gauges in Pailugou catchment.
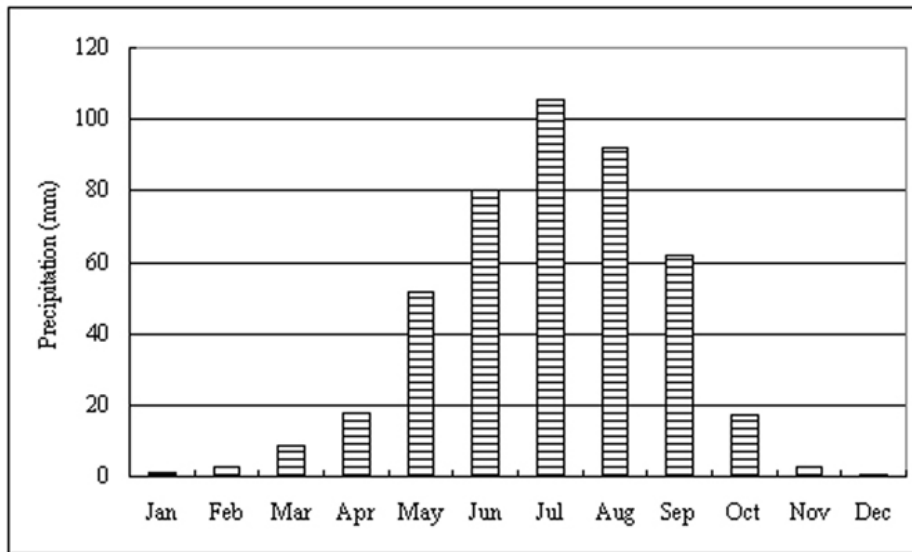
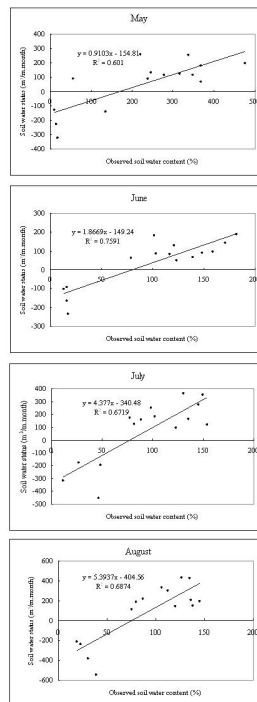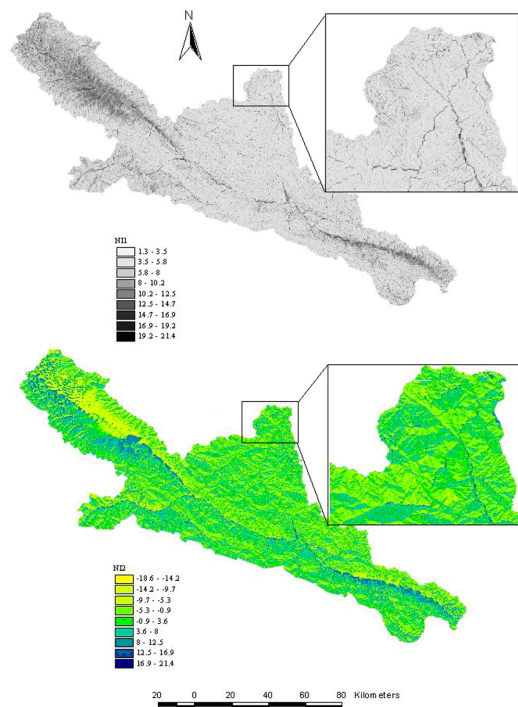**Fig. 2.** Distribution of monthly mean precipitation in Zhamashike meteorological

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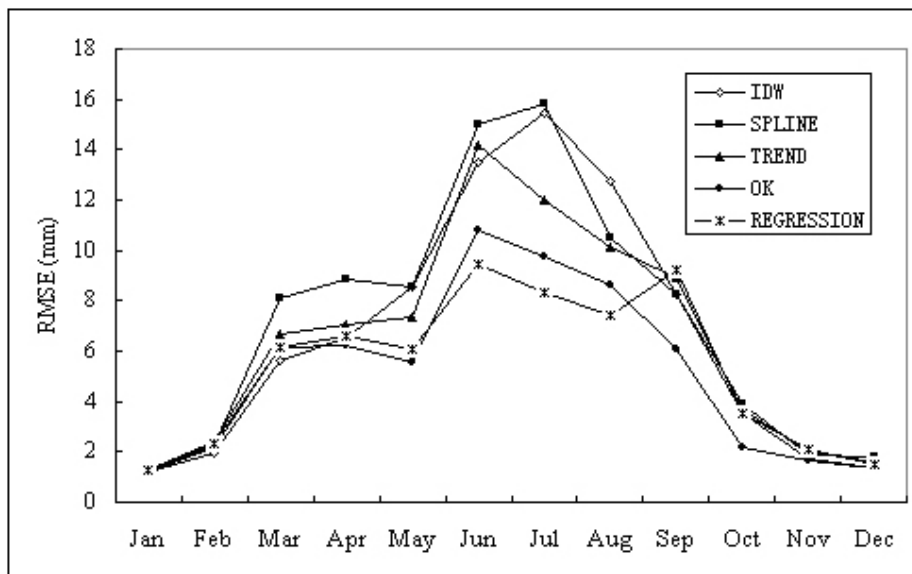**Fig. 3.** Scatter plots of observed soil moisture content and modeled soil moisture status from May to August

Fig. 4. Distribution of wetness indexes (IN1 and IN2) in the southern Qilian Mountains.

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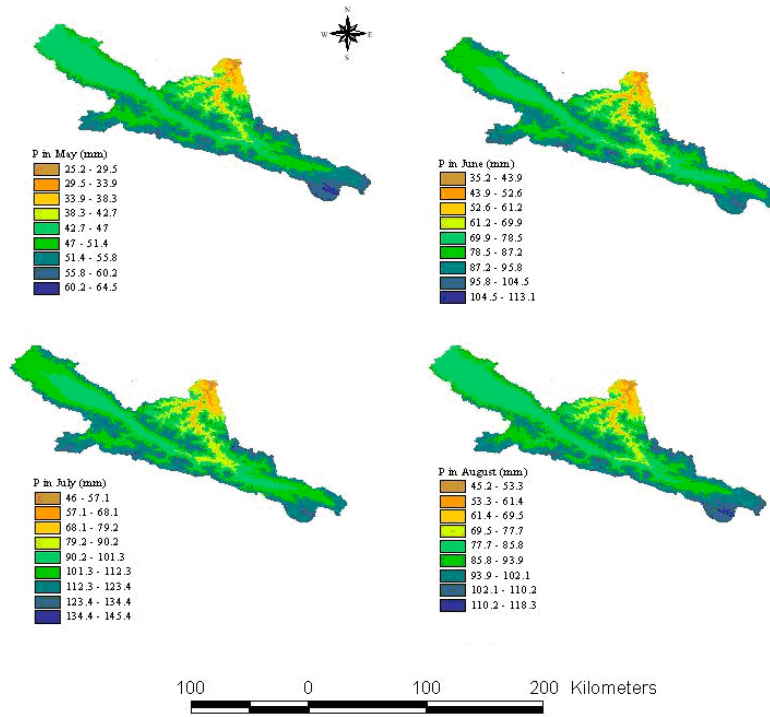**Fig. 5.** Validation RMSE for monthly mean precipitation averaged across 13 test stations for five methods.

Fig. 6. Distribution of monthly mean precipitation in southern Qilian Mountains
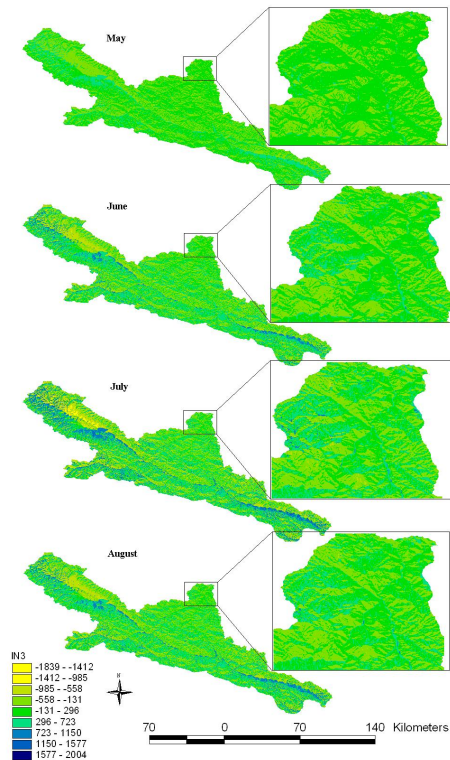
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Fig. 7. Distribution of monthly mean soil moisture status in southern Qilian

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