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Hydrology and Earth System Sciences
Discussions

Interactive comment on "High-resolution fully-coupled atmospheric–hydrological modeling: a cross-compartment regional water and energy cycle evaluation" *by* Benjamin Fersch et al.

Anonymous Referee #3

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With the development of fully-coupled atmospheric-hydrological model especially the improvement in the hydrological part, whether the improvement in land surface process (e.g., hydrological process) can lead to a better simulation of regional water and energy cycle is an issue that is concerned by the whole literature. Fersch et al., presents a very comprehensive research on this issue by comparing the coupled model (WRF-Hydro) with the original one (WRF_SA). Generally, their experiment is well designed, the results are convincing and the research does have added value to deepen our understanding on the performance of fully-coupled atmospheric–hydrological modeling. I think it can be published in HESS after addressing the following comments: Major comments: 1.Introduction of WRF-Hydro. From the introduction of the WRF-Hydro, it

seems that WRF-Hydro improves the physical description of surface flow and baseflow transportation. But do the WRF-Hydro and WRF_SA have the same runoff scheme? Will and how the surface/subsurface lateral flow feed back to the land (e.g., through re-infiltration)? I suggest the author give some introduction on the difference of basic WRF and WRF-Hydro as not all readers are familiar with this model. 2.Meaning of different parameters. The current interpretation of physical meaning of parameters is distributed. For example, in P12,L12 "The LSM surface runoff scaling parameter REFKDT is globally set to 2e−06 as smaller values would have decreased infiltration to very small amounts." P28,L12"Also the percolation parameter SLOPE was mainly reduced as compared to the standard value, meaning that a considerable portion of former infiltration excess water needed to be transferred to the bucket-storage to assure good performance for the simulated baseflow". They should be directly introduced in the calibration section. Moreover, I suggest a brief interpretation of the physical meaning of changes of parameter. 3.What is the uncertainty of observations especially for the evapotranspiration? Does the improvement exceed the uncertainty?

Major comments: 1.P10, L25: What do the "two dimensional" and "three dimensional" mean? Does the "soil layer depths" mean the "soil layer thickness"? 2.P12, L12: The LSM sets the REFKDT as 0.2e-6, this value is not within the range given in the Table 2. 3.section 2.4.6: Please give the timescale of calibration and validation. P13,L4-8: If you do not include the abnormally high value, which NSE efficiency you can get? Will it comparable to that in calibration period. 4.P26,L8: What do the 50% and 100% mean? Which reference they refer to? 5.P26,L17: Just a suggestion. Will the results improve if you use daily streamflow, as the hourly streamflow is difficult to simulate? 6.P29,L12: Again, I do not know how does the lateral water transport saturate the soil as you do not introduce this in the model introduction section.

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