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Interactive comment on "A coupled atmospheric-hydrologic modeling system with variable grid sizes for rainfall-runoff simulation in semi-humid and semi-arid watersheds: How does the coupling scale affects the results?" *by* Jiyang Tian et al.

Anonymous Referee #2

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This study examined the optimum scale of an atmospheric-hydrologic coupled system for rainfall-runoff simulation. The authors concluded that unnecessary complexity during model construction can result in an overfitting, which is quite well acknowledged by the hydrological community for the data-driven models, but not yet for the physically-based ones. Generally, I think that this study is well-designed, and the analyses presented in the manuscript are thorough to address the objective of the study. However, I have some concerns and questions related to the performance of the coupled sys-

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tem and the possible uncertainty associated with the experiments. The authors should clarify the issues provided below before the manuscript is considered for publication in HESS.

Major concerns:

1. More information of the Hebei model and the calibration of its parameters should be given. What is the advantage of using the Hebei model in the study area? What are the parameters calibrated in section 3.2 and how are they calibrated? Why choosing the 7 floods in Fuping and 6 floods in Zijingguan to calibrate the model? What are the values of the calibrated parameters finally used in the coupled system?

2. I think the gridded Hebei model is a semi-distributed model. The main goal of establishing the gridded Hebei model is to match the rainfall simulation from the NWP system. Hence, the Hebei model does not consider the spatial variability of the underlying condition of the watersheds. If so, I do not quite understand why the soil storage capacity and the infiltration capacity is discretized across the grid cells?

3. The errors of the coupled system generally come from two parts: the NWP system and the hydrologic model. Since the WRF model is used (the rainfall error of which is normally quite considerable), I believe the accuracy of the simulated rainfall is the main factor affecting the performance of the coupled system (although there might also be uncertainties from the hydrologic model). Could the authors specify the rainfall errors from each storm events and quantity how much the system errors come from the rainfall simulations? A further question is, how to improve the simulated rainfall from the NWP system in order to improve the performance of the coupled system. For example, some grid-based observations, such as QPEs from the weather radar might be helpful.

4. I agree that Cv is used to describe the evenness of rainfall for both spatial and temporal distributions. However, a critical value of 0.40 for evenness in space and 1.00 for evenness in time, is hard to follow. Explain how the threshold is obtained. You can say event 1 has relatively even distributed rainfall according to Cv rather than using the

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value of 0.4 as a threshold.

5. It is concluded from the study that for storm events with uneven rainfall distributions, a finer coupling scale can lead to a better performance of the coupled system, however, the coupling scale shows less impact on the system for events with uneven distributions. To my opinion, these conclusions are highly dependent on the case studies. Considering the study only focusing on two semi-humid and semi-dry watersheds with limited storm events involved, it is better to point out that the results are some kind of site-specific. More case studies are needed before more general conclusions can be achieved.

Spelling and grammar mistakes should be checked carefully throughout the manuscript.

Page 2, line 5 and line 9: “atmosphere-hydrologic” should be “atmospheric-hydrologic” Page 5, line 11: “Based on the historical storm events in the study area, and using 5% as a cutoff” should be “Based on the historical storm events in the study area by using 5% as a cutoff” Page 10, line 21: “Grid center coordinates. . .for driving the hydrologic model” should be “The coordinates of the grid cell centers . . .to drive the hydrologic model” Page 11, line 22: “. . .three grid sizes led to different simulation results for different rainfall events” should be “. . .different rainfall events have different simulation results with the three grid sizes”. Page 12, line 4: “Considering the spatial distribution characteristics of the rainfall. . .” should be “Considering the characteristics of the spatial rainfall distributions. . .” Page 12, line 29: “. . .the WRF model had the ability to reflect the spatial distribution of the rainfall” should be “. . .the WRF model was able to capture the spatial patterns of the simulated rainfall. . .” Page 13, line 4 “. . .similar simulation results with three different grid sizes. . .” should be “. . .similar simulation results of the three different grid sizes. . .”

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