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Interactive comment on "Development and evaluation of spectral nudging strategy for the simulation of summer precipitation over the Tibetan Plateau" *by* Ziyu Huang et al.

Anonymous Referee #2

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General comments: This paper evaluates the spectral nudging scheme implemented in the WRF model in order to evaluated the impact of spectral nudging on precipitation simulation over the Tibetan Plateau (TP). The spectral nudging is scale-discriminated so that only large spatial scales are constrained. The authors found that model simulations show clear improvements in their representations of downscaled precipitation intensity and its diurnal variations, atmospheric temperature and water vapor when spectral nudging is applied towards the horizontal wind and geopotential rather than towards the potential temperature and water vapor mixing ratio. The topic of the paper is interesting and it's a good fit for the scope of GMD. The description of the method is clear. The experiment design that testing nudging strength and nudging variables

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Discussion paper

is appealing and convincing. However, there are still some rooms for the improvement. For example, The evaluation of this study can be improved with some additional information. In the following, some comments are listed for author's revision.

1. The authors used the regional averaged difference between control (not nudged) simulation and several nudged simulations to show the impact of nudging on constrained fields. Please also quantify how well the nudged variables (e.g. T, U, V and Q) matched the ERAI reanalysis.

2. How the simulations of air temperature and water vapor mixing ratio are changed near the "lid" layer where the nudging is restricted toward both variables?

3. The large simulated precipitation bias and high precipitation RMSE over the Himalaya mountain region shown in Figure 2 and Figure 4 are possibly caused by the topographic differences between ERAI and WRF model. What are the impacts of nudging toward geopotential height on simulated results?

4. Please explain whether the nudging coefficient of horizontal winds and potential temperature shows similar results with control simulation.

5. Figure 7 and Figure 8 show the cross section of vertical wind and thus imply the convective processes over the TP and south slope of the Himalaya. I suggest that the authors should also consider the advection and atmospheric circulation in mid-troposphere, which will make moisture lifted by convection to the interior of the TP.

6. Please add more details about the spectral nudging method.

7. Please use a more effective method to display the impacts of spectral nudging on specific humidity or atmospheric water content.

8. What is the accuracy of horizontal wind and atmospheric water transport fields in ERA5 over the TP?

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