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Interactive comment on "Convective response to large-scale forcing in the Tropical Western Pacific simulated by spCAM5 and CanAM4.3" *by* Toni Mitovski et al.

Anonymous Referee #1

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The paper is well written and the logic is easy to follow. They try to understand what the convection behaviors and its connection to large-scale environment in super-parameterized global model and global climate model. They found the behaviors are quite different in these two systems, with the super-parameterized model closer to the observation. It will provide useful information to design a good convection scheme for global climate model, and will help us to better understand the convection in the observation. I have a few major comments. 1. Why do you set the maximum lasting hour as 12 hour? It seems to me more reasonable if you don't set this one but only set the precipitation rate since there may be some convection events lasting longer than 12 hours. Have you checked that in the simulation, how much of the convection events

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Discussion paper

lasting longer than 12 hours? 2. Here, you checked the near-surface vertical velocity when considering the relationship between convection and large-scale environment. As shown in Song and Zhang (2017) you cited in the paper, the dCAPELSFT is mainly contributed by the vertical velocity and the vertical structure of large-scale vertical velocity is important for the convection development. Hence, could you also check the vertical structure of vertical velocity here? For example, similar to figure 2, could you also show the convective precipitation as function of different vertical velocity? In addition, in figure 2a, when dCAPELSFT is smaller than 50 J kg-1 h-1, convection precipitation is almost independent of near-surface vertical velocity, but when dCAPELSFT becomes larger and larger, the dependence of convective precipitation on the near-surface vertical velocity seems much tighter. It is a quite interesting phenomenon, maybe you can dig it further and check whether it is also the case for different levels of vertical velocity. 3. From Fig. 3, it seems that even for the dCAPELSFT, it is also not a good trigger for convection, since before and after convection (t=0), it doesn't change much (Fig. 3e). How can you set a threshold of dCAPELSFT to judge when the convection occurs. It is quite difficult. Instead, it seems that when convection happens, the tendency of dCAPELSFT becomes positive (d(dCAPELSFT)/dt). Have you further check the relationship between the convective precipitation and d(dCAPELSFT)/dt? 4. As shown in Song and Zhang (2018), the dCAPE-type triggers are significantly scale-dependent. In the higher-resolution models, it doesn't work very well compared to the coarser model resolution, since the relationship between dCAPE and convective precipitation becomes worse when the resolution is increased. Here, the spCAM5 is 4 km and CanAM4 is about 300 km. From figure 2, it seems that the relationship between convective precipitation and dCAPELSFT is much closer in CanAM4. Could you calculate the correlation and make some discussion about this issue. Reference: Song, F. and G. Zhang, 2018: Full Access Understanding and Improving the Scale Dependence of Trigger Functions for Convective Parameterization Using Cloud-Resolving Model Data, Journal of Climate, 7385-7399. 5. Finally, in the spCAM5, dCAPELSFT cannot be regarded as pure large-scale forcing, since it is calculated based on 4km dataset (also see the discussion in Song and Zhang 2018). So how the convection happens in this model should be investigated further, since it provide more accurate description of convection. That will provide more information to the community.

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