Thank you for your constructive comments, which were useful to improve our paper. Please see our responses below. The comments are in **bold** *italics* while the responses are in normal type.

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 lasting longer than 12 hours?

We found that by setting the maximum lasting hour to 12 hours, we captured almost all events in CanAM4.3 and spCAM5. For instance, Figure 1(c) shows that less than 0.1 % of the events in CanAM4.3 last longer than 4.5 hours and less than 1 % of spCAM5 events last longer than 5 hours. Therefore, reducing the threshold to 6 hours or increasing the threshold to 24 hours will not affect the results in this paper.

The following text have been added to Section 4.2 in the manuscript:
"and only 1 % of the events last longer than 5 h"
"and only 0.1 % of the events last longer than 5 h"

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?

Additional Figure 2 (below) shows the convective precipitation as function of dCAPELSFT and vertical velocity at various levels, 232 hPa (top panel), 524 hPa, 763 hPa, 887 hPa, and 992 hPa (bottom panel). spCAM5 is on the left and CanAM4.3 is on the right. Additional Figure 2 shows that convective precipitation in CanAM4.3 has no dependency on omega but convective precipitation in spCAM5 it does depend on omega. In general, heavier precipitation in spCAM5 is linked to more negative (upward advection) omega at 992 hPa and less negative omega at 232 hPa. Since omega was computed from the large-scale horizontal winds starting from the top of the troposphere using the continuity equation, a negative omega at pressure p0 is approximately equal to the net column mass convergence above the level p0. Therefore, high rainfall rates in spCAM5 are associated with strong low-level ascent (net column mass convergence) and larger dCAPELSFT.

In addition Figure 2(a) shows that, 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.

Indeed this is an interesting phenomenon. The left side panels in Additional Figure 2 (below) show that when dCAPELSFT is less than 50 J kg-1 h-1 convective precipitation is nearly independent of near-surface omega, as well as omega at other levels. In addition, Figure 2(a) in the manuscript shows that, when dCAPELSFT is less than 50 J kg-1 h-1, precipitation varies between 0 and 1 mm h-1. But also, when the near-surface omega in Figure 2(a) is greater than 80 Pa s-1 (strong subsidence), convective precipitation is also nearly independent of dCAPELSFT and varies between 0 and 1 mm h-1. We can argue that, when one of the variables is in its lowest 25 percentile, convective precipitation in spCAM5 does not exceed 1 mm h-1.

The following text have been added to Section 4.3 in the manuscript:
"In the case when one of the quantities is in its lowest 25 percentile, for instance $dCAPE_{LSFT} < 50$ J kg^{-1} h^{-1} or $\omega > 80$ Pa s^{-1}, precipitation rates do not exceed 1 mm h^{-1}".

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?

We thank you for this very useful suggestion. From our results in Figure 3(a), convection is likely triggered once near-surface omega becomes negative, which is about 30 minutes prior to time=0. Prior to time=0, dCAPELSFT is nearly constant and thus cannot be used to detect initiation of convection. We did, as the reviewer suggested, investigate the relationship between d(dCAPELSFT)/dt and the precipitation. In Additional Figure 3 d(dCAPELSFT)/dt is in red and convective precipitation is in black, both computed using the spCAM5 fields from Figure 3(a) in the manuscript. From Additional Figure 3, d(dCAPELSFT)/dt becomes positive about 20 minutes prior to time=0, and reaches its maximum slightly prior to the precipitation maximum. We have not investigated these findings further, and will leave them for future study. One possibility is that the d(dCAPELSFT)/dt trend might be linked to the trend in the near-surface omega in Figure 3(a).

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.

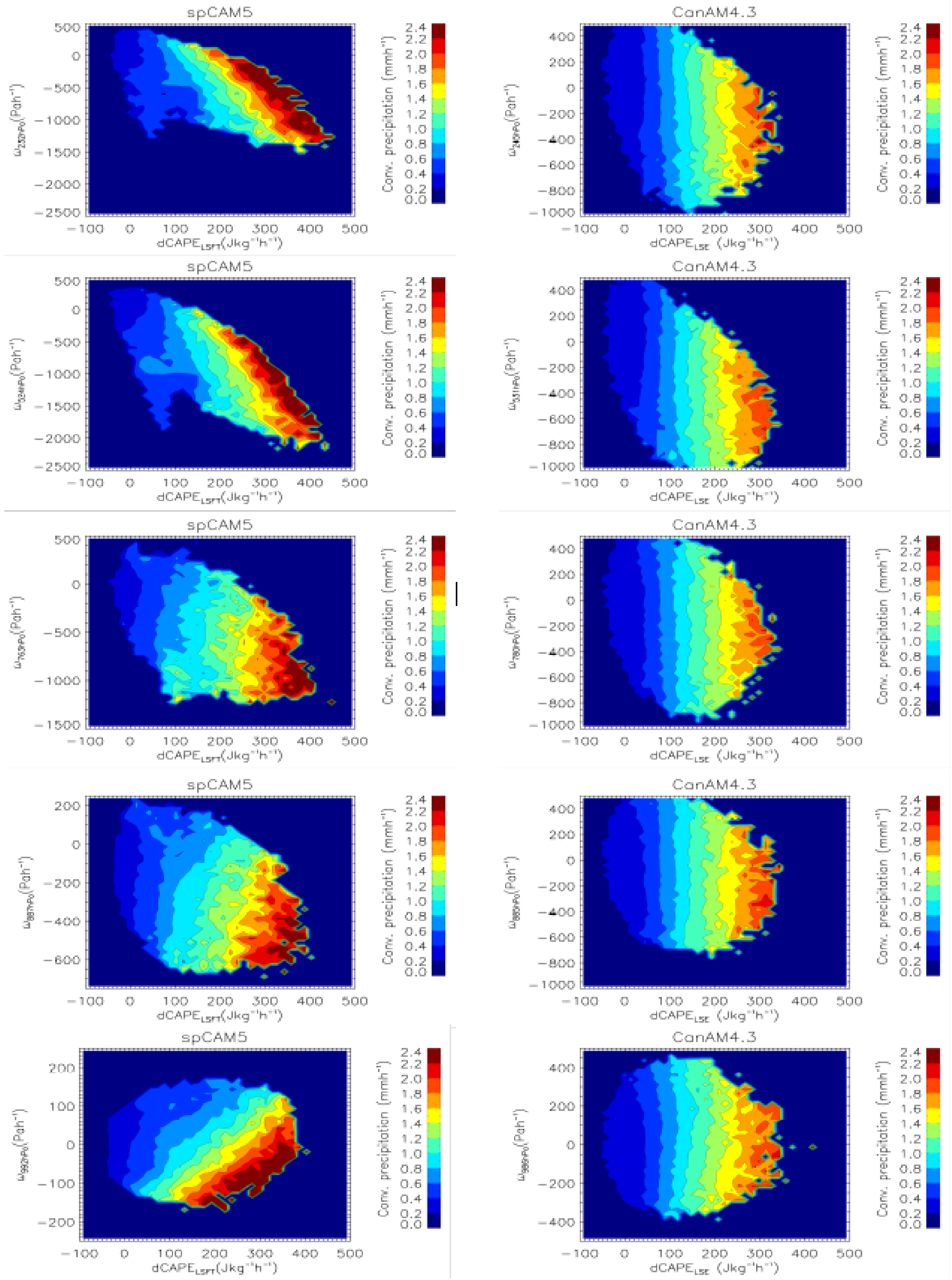
We used all 32 CRM columns to compute an average spCAM5 convective precipitation and compare this "low-resolution" precipitation to CanAM4.3 convective precipitation. We have not investigated the dependence of spCAM5 precipitation to the number of CRM columns used to compute an average convective precipitation, because that is out of the scope of this paper. We did, however, compute the linear Pearson correlation coefficient between dCAPELSFT and the convective precipitation and we found that the correlation is higher in CanAM4.3 (0.68) than in spCAM5 (0..44).

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.

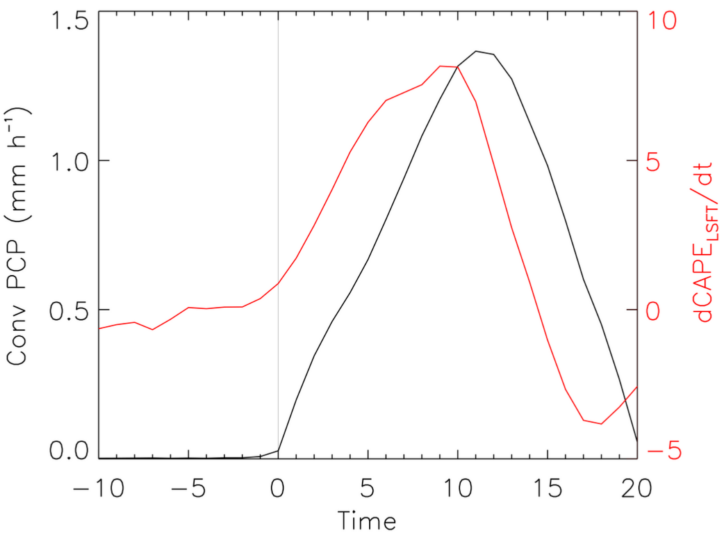
DCAPELSFT was computed using the large-scale T and Q fields and the large-scale T and Q spCAM5 tendencies. It is true that the large-scale tendencies include small-scale tendencies due to various processes that occur within the CRM (4-km) columns, but we should clarify that our goal was to try understand the overall effect of these 4-km small-scale tendencies on the convective precipitation in spCAM5. The overall effect of these small scale tendencies are therefore directly comparable with the overall tendencies generated within the Zhang-McFarlane convection scheme employed in CanAM4.3. The manuscript shows the differences between the overall precipitation and large-scale forcing fields between the two models.

We added the following text to Section 4.3 in the manuscript:

“Therefore, a transition from a large-scale subsidence to large-scale ascent may be important in triggering convection. A near-surface omega tendency has been previously used as a trigger in the Donner convection scheme (Donner 1993; Donner et al. 2001; Wilcox and Donner 2007) in a version of the Geophysical Fluid Dynamic Laboratory (GFDL) Atmospheric model, version 3 (AM3) GCM. In their model, convection is triggered when near-surface omega becomes positive and exceeds a specified value and convective inhibition is less than 100 J kg-1.”.



Additional Figure 2



Additional Figure 3