Answer to SC#1

General response:

The authors would like to thank Dr. Suarez-Gutierrez for the time and effort put into this review. These comments have been useful in improving our manuscript. We have carefully read the comments and provide a detailed response to each comment.

I write this comment because I want to address some aspects that I believe the authors should consider, and would significantly improve the quality and usefulness of their findings.

1. I find there is some lack of context of how the simulations used in this paper compare to those widely used in previous studies. It would be very beneficial to show some type of evaluation of the simulated climate in the two ensembles used here, for example in terms of mean temperature and precipitation anomalies and changes at 1.5 and 2 degrees with respect to preindustrial. Moreover, the authors should describe how the simulated climates in these ensembles compare to those in previous studies; e.g.., Perkins-Kirkpatrick et al, 2017; Sanderson et al. 2017; King et al. 2017; Suarez-Gutierrez et al., 2018; Wehner et al, 2018. These studies are based on a variety of types of ensembles, from CMIP5 to fully coupled ESM large ensembles, and the paper should include a discussion on how these simulations differ in terms of both climate conditions and fundamental design. In particular highlighting both the advances (i.e. higher resolution, targeted to 1.5 and 2 degrees) and shortcomings (i.e. atm only runs, no fully coupled ocean, SST prescribed from short periods) of these data is in my opinion crucial.

Answer: We agree that the inclusion of an evaluation will improve the paper and put the results into context. We will add a discussion of the model chain performance as a supplement to the paper. This will also allow us to put our results into perspective compared to results from other studies. We think a full discussion on the benefits of coupled vs. uncoupled GCM simulations would be beyond the scope of this paper. In this context, we see ourselves as users of a widely discussed dataset. We compare ourselves to other downscaling activities such as EUROCORDEX.

2. The paper does not address the implications of using atmosphere only runs with prescribed SST based on relatively short time periods sufficiently. A finite set of prescribed SST patterns offers a limited range of climate states that does not completely sample ocean-driven variability (see Sanderson et al., 2017; Fischer et al., 2018). In contrast, large ensembles from fully-coupled climate models sample a wider range of ocean states and include the influence of the ocean-borne variability (Hawkins et al., 2016). Furthermore, fully-coupled large ensembles also offer a more realistic representation of heat extremes over land than atmosphere-only large-ensembles, even if the later offer a larger number of independent simulations (Fischer et al., 2018). These issues should be addressed in the main text.

A: We agree that we should mention these shortcomings and we will include this. A full discussion on coupled vs. uncoupled GCM simulations would be beyond the scope of our paper (see answer above).

3. The authors argue that the improved resolution from using a regional model combined with the large ensemble size are mayor improvements. However, previous studies analyze the changes at 1.5 and 2 degrees using similarly large ensembles of fully coupled ESM (100 members x 250 years; Suarez-Gutierrez et al., 2018), so what are the differences or biases that higher resolution vs. no coupled ocean introduce?

A: We argue that extremes can be better estimated using our downscaled information, which has been shown several times in many studies, especially for precipitation. As mentioned earlier, our focus is on downscaling an existing dataset (in this case HAPPI) with a well-established method (dynamical downscaling with a regional climate model). We think the question raised here, is very much related to the comments above and beyond the scope of our paper.

What do the gray areas over land in figures 2, 3, and 4 represent? I thought maybe the white shading was meant to be transparent but there is white in some parts I think?

A: The grey areas over land represent non-significant changes. This was mentioned in the text and will be added to the figure captions (see also our response to referee#2).