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Comment on acp-2021-395

Lei Wang (Referee)

Referee comment on "Weakening of Antarctic stratospheric planetary wave activities in early austral spring since the early 2000s: a response to sea surface temperature trends" by Yihang Hu et al., Atmos. Chem. Phys. Discuss.,
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The manuscript "Weakening of Antarctic Stratospheric Planetary Wave Activities in Early Austral Spring Since the Early 2000s: A Response to Sea Surface Temperature Trends" by Drs. Hu et al. identified a decreasing trend in the September Antarctic stratospheric wave activity since early 2000s and attribute it to the SST trends in the tropics and southern hemisphere. The modelling evidence presented in the manuscript well supports their conclusions and the paper is logically organized. It is thus recommended to be considered for publication after addressing the following comments:

First of all, a positive trend in the September Antarctic stratospheric wave activity is evident before 2000s (Fig.2). It would be a more complete study to also simulate the 1980-2000 period similarly to better attribute and contrast the positive trend to the negative trend in the later period, as previous studies (e.g., Hu and Fu 2009) mostly use statistical methods for the attribution. This might require too much time and resource to complete and is thus only a suggestion.

Second, there is usually a time lag for the extratropical atmospheric circulation to respond to the tropical SST anomaly. The authors might need to justify whether it is reasonable to use September SST to drive the extratropical atmospheric circulation for the same month.

Last, it would be nice to show the simulated EP-flux time series as in Fig.2 but forced by SSTs to visualize how significant that is compared with the EP-flux trends in reanalysis datasets. Previous studies (e.g, Wang and Waugh 2012, <https://doi.org/10.1029/2011JD017130>) found that the extratropical stratospheric wave activity trend is difficult to capture using model simulations with small ensembles. It might help to illustrate the benefit of using large ensembles as in this study.