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Interactive comment on "Tropospheric eddy feedback to different stratospheric conditions in idealised baroclinic life cycles" *by* Philip Rupp and Thomas Birner

Anonymous Referee #2

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In this manuscript, the authors use an idealized model to investigate the role of the stratospheric polar vortex on influencing the tropospheric jet. Specifically, they test the sensitivity of the NAM-like equatorward jet shift associated with a weak or reversed stratospheric polar vortex to the height of the vertical winds in the polar jet, and to the magnitude of surface friction. They find that the tropospheric response is sensitive to changes in winds in the lower stratospheric polar vortex, but not to winds in the upper stratosphere. Additionally, they find that surface friction enhances the tropospheric response to stratospheric vortex changes, and that friction acts to bring nearly barotropic anomalies all the way down to the surface.

Although the findings in general agree with previous studies, the consolidation of the impacts of surface friction and lower-stratospheric anomalies using a coherent model framework produces a compelling standalone study with implications for our dynamical understanding of sudden stratospheric warmings. The manuscript is well-written, well-organized, and the scientific questions well-constructed, and I only have a couple minor comments and questions. Most of my corrections and minor questions can be found in the attached manuscript.

The main additional question I have is if the authors think this study can provide insight into the observed differences in timing between "Displacement" type sudden stratospheric warming events, and "Split" type sudden stratospheric warming events. Specifically, Splits are observed to show an almost-instantaneous NAM-like response to SSWs, whereas for Displacements, the response tends to occur with a significant lag on the order of weeks. Could this be related to a difference in the vertical structure of the polar vortex in Displacement versus Split events? For example, is it possible that Displacement events show anomalies that start higher up in the stratosphere and work their way downwards, while Split events produce a strong signal in the lower stratosphere almost immediately? I am not sure why or how surface friction could play a role, since I can't imagine any way in which surface friction could depend on the type of vortex breakdown.

Please also note the supplement to this comment:
https://wcd.copernicus.org/preprints/wcd-2020-35/wcd-2020-35-RC2-supplement.pdf

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