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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Quantifying the variability of the annular modes: Reanalysis uncertainty vs. sampling uncertainty" *by* Edwin P. Gerber and Patrick Martineau

Anonymous Referee #1

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This manuscript looks at how annular modes are represented across reanalysis products, and in particular, quantifies uncertainties in sampling vs. reanalysis uncertainty. In the context of troposphere-stratosphere coupling, it would have been useful to see more Southern hemisphere analysis, particularly associated with the final warming. It seems curious that satellite observations are necessary for representing the SAM but not the NAM, one wonders why. Detailed comments that the authors might wish to consider are below.

P2 L20 The correlation between jet responses to global warming and annular mode persistence was not clear in the CMIP5 models (Simpson and Polvani 2016). In fact,

since the annular modes are not system modes, it is possible that the overly persistent annular more timescales in comprehensive climate models may have no implication for their response to global warming (Sheshadri and Plumb 2017). P3 L15 Please check grammar P3 L 30 Should one reasonably expect tropospheric jet variability that extends equatorward of your 65° definition (e.g. Madonna et al. 2017; Woollings and Blackburn 2012)? Fig. 3 Has this been smoothed? If so, it would be useful to people will might try to replicate this result to mention the details. P6 L18 Do you have theories as to why this would be the case? P9 L4 How do you deal with final warming (FW) events while defining strong and weak vortex events? It might be useful to examine the downward influence of FWs in both hemispheres across reanalyses, particularly since this might be of relevance to the effects of the ozone hole on tropospheric circulation in the SH. FWs are an aspect of stratosphere-troposphere coupling that have conventionally been studied using annular modes, that this manuscript completely ignores. Also, in general, stratosphere-troposphere coupling is thought to be strong at the end of winter and into early spring in the SH. P9 L19 It is somewhat inaccurate to refer to it as a downward propagating signal, as the word propagation is typically associated with the propagation of waves. Downward "influence" or "migration" might be a better choice. P11 L2 There have been follow-up studies on the eddy feedback arguments of Lorenz and Hartmann that might be worth mentioning (e.g. Byrne et al. 2016), as these indicate that the persistence of the first annular mode might not really be the right way to think of eddy feedbacks. P11 L6 Could you expand on how timescales are computed, since you do not use an EOF-based definition of the annular mode?

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