

## ***Interactive comment on “On the representation of major stratospheric warmings in reanalyses” by B. Ayarzagüena et al.***

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REVIEW of "On the representation of major stratospheric warmings in reanalyses" by Ayarzagüena et al.

**SUMMARY:** This paper discusses the representation of SSW events in different reanalysis products. This is an important contribution given the increased use of SSWs for long-range prediction of surface quantities, which are often initialized from and compared against different reanalysis products. This is a timely contribution for the S-RIP project of comparing reanalysis products for the stratosphere.

**OVERALL ASSESSMENT:** The paper is well written and addresses an interesting and worth-while problem. I have some comments that I hope will improve the manuscript,

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see below.

## SPECIFIC COMMENTS:

### Page 1:

Line 22: “surface fingerprint”: does this refer to the signature after the SSW event? Please specify.

Line 26: “lead to”: this is not a causal effect, but effects that are linked through thermal wind balance

Line 31 – 34: The literature is rather split about this issue, see e.g. Birner & Albers 2017, Sjoberg & Birner, 2014.

### Page 3:

Line 12: “analyzes the SSWs the momentum budget”: unclear

### Page 4:

Lines 24 – 28: since K. Shibata is a co-author, it would help to clarify the algorithm used in the manuscript in case it's not (yet) published.

### Page 5:

Line 25: anomalies from climatology?

Line 17: The deviation in the results of NCEP from other reanalysis products is not surprising. There's an artificial trend in the stratosphere – we found it in Badin & Domeisen, 2014 (pages 1498/1499). I could imagine there's also an S-RIP publication that documents this problem?

### Page 6/7:

I'm wondering if it would be helpful to list the classification for all events, not just the ones that are common

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Page 7:

Line 8: “can be traced back to the PNJ”: this does not sound like an explanation, rather a symptom

Lines 15/16: given the large uncertainties in the pre-satellite period this is difficult to state. However, there are indeed changes in decadal variability of SSW frequency in Domeisen, 2019, JGR, maybe this is helpful?

Page 8:

Lines 1-6: maybe it would be helpful to indicate the changes in stratospheric representation btw the different NCEP reanalysis tools, or maybe refer to the Hitchcock, 2019 paper?

Lines 24 – 26: yes, indeed, this is why it is so difficult to trace waves from the troposphere to the stratosphere. This is not so counterintuitive given the literature on the stratospheric contribution to SSWs.

Line 29: at which level?

Page 11 / Figure 7 / Page 23, line 31: are these differences significantly different from each other? i.e. not just significantly different from climatology?

MINOR COMMENTS:

Page 1:

Line 30: I would suggest using Charlton et al (2007) as the authoritative reference here.

Page 2:

Line 8: Martius et al (2009) seems like the perfect reference here, it's already included in a different place in the manuscript

Lines 10 – 16: would it make sense to include the classification into reflective and

absorptive events here (Kodera et al, 2016)?

Line 18: given the very limited number of studies of stratospheric effects on the ocean I would not call the assessment of oceanic phenomena based on the stratosphere a “common metric”

Line 21: leave out “interestingly”, and “largely”

Line 22: “assimilation data sources”: do you mean the data used for the assimilation of observational data into the reanalysis products?

Line 27: “than in the second one”. Do you mean “than during the satellite era”?

Page 3:

Line 6: is made on > is given to

Line 26: do you mean “across different reanalysis products”?

Page 4:

Line 29: “similarly”: do you mean the identification was similar or it was also included in the table?

Page 5:

Line 28: I’m not sure what is meant by “discrepancies” (also: page 6, line 14)

Page 8:

Line 9: ones -> SSWs

line 19: “reanalysis deviation”: not clear what this means

Lines 23 – 26: be more clear which terms this corresponds to in the equation

REFERENCES: Badin, G. and D.I.V. Domeisen (2014): A search for chaotic behavior in Northern Hemisphere stratospheric variability, Journal of the Atmospheric Sciences,

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Charlton, A., Polvani, L., Perlwitz, J., & Sassi, F. (2007). A new look at stratospheric sudden warmings. Part II: Evaluation of Numerical Model Simulations. *Journal of Climate*

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