

## General comments:

I thank the authors for their detailed responses to the reviewers' comments. The revised version shows significant improvement and satisfactorily addresses my previous concerns. I have just a couple of suggestions regarding interpretation of the wave reflection and some terminology. I believe these points should be clearly clarified before publication.

## Major Comments:

### 1. Interpretation of wave reflection

The mechanism linking different tropospheric responses to wave reflection appears to be primarily inferred from negative Fp anomalies. However, reduced upward EP-flux does not necessarily imply actual wave reflection (i.e., downward propagation). A more rigorous diagnosis of reflective behavior (e.g., refractive index or wind shear reversal, Hu & Tung 2002, Harnik 2009) would be required to substantiate the use of terms such as 'wave reflection' or 'wave reflection surface'.

#### Reference:

Hu, Y., and K. K. Tung, 2002: Interannual and Decadal Variations of Planetary Wave Activity, Stratospheric Cooling, and Northern Hemisphere Annular Mode. *J. Climate*, 15, 1659–1673, [https://doi.org/10.1175/1520-0442\(2002\)015<1659:IADVOP>2.0.CO;2](https://doi.org/10.1175/1520-0442(2002)015<1659:IADVOP>2.0.CO;2)

Harnik, N. (2009), Observed stratospheric downward reflection and its relation to upward pulses of wave activity, *J. Geophys. Res.*, 114, D08120, doi:10.1029/2008JD010493

### 2. Interpretation of the 'initial intensity'

The manuscript concludes that the 'initial intensity' of the SSW is less important than the lower-stratospheric anomaly in determining the surface response. Given that the correlation remains relatively strong ( $r \approx -0.71$ ), the statement regarding the limited role of intensity should be more cautious. In addition, the metric used to represent 'initial intensity' is a two-week mean of U10, based on absolute values rather than anomalies. Given that it does not consider how abnormal it is relative to climatology (i.e., anomaly), and the fact that it also reflects the persistence of SSW, this metric is not strictly an instantaneous measure of SSW amplitude. The terminology should be made more precise, and the interpretation should better reflect what this metric actually represents.

## Specific comments:

1. L133-140. As the spin-off setup 'guarantees that each ensemble member captures the chosen SSW identically.' I wonder whether this is because the tuning factor results in very small perturbations in the stratosphere, or whether the perturbation was only applied to the troposphere. A brief clarification would be helpful.

2. L183-185. According to Eq(1), a positive  $\nabla \cdot F$  should lead to a positive zonal wind tendency, thus the acceleration. Please double check.

3. L217. Should it be Fig. 2a?

4. L230. The spread in the tropospheric GPH anomaly in SSW and non-SSW group are exactly the same. Does this imply that the variance is primarily driven by tropospheric processes?

5. L252. According to the figure caption and following analysis, should the 'on the day of the selected event' be 'first two weeks'?

6. L257. This is related to my major comment 2. While the authors introduced the events in the upper left and right as the 'weak warming events', giving that it is the 2weeks' average U10, it does not necessarily indicate a weak warming event. For example, it can be a strong but rapidly recovered SSW. It might be better to describe it more accurately.

7. L301. Similarly, is it accurate to use the term 'initial vortex strength'? In addition, 0.71 still seems to be a high correlation. How about the statistical significance?

8. L324. How were the 18 SSW events selected? In Figs. 11 and 12, the LS and no-LS groups appear evenly split (9 vs 9). However, the selection criteria for the 18 events are not fully explained. Please clarify this.

9. Figure 12. The figure caption seems uncompleted.

10. L351-353. The introduction about the use of EP flux was explained again in later paragraphs, which is sufficient. So you might want to delete here to avoid repeat.

11. L367 and onwards. Here the analysis is based on the EP flux anomalies. As discussed in my major comment 1, the negative Fp anomalies do not indicate wave reflection. Please check carefully with the appropriate metric (i.e., refractive index, refractive surface).

12. L449-451. The wording here suggests a causal link from zonal-mean flow changes to blocking frequency. However, earlier (L340-341) the causality was described as uncertain. Please ensure consistency in the interpretation.

13. Please ensure that all supplementary figures are explicitly cited in the main text.