## Reviewer #1

The authors addressed mostly my main concerns by conducting a further analysis on the eddy height field and the North American weather regime transitions (including the new figures 9 and 12). Although the authors did not discuss the direct relationship between the reflections and the degree of coldness from the dynamical perspective (i.e., eddy-mean flow interaction and enstrophy/energy transfer between wave and mean flow during reflection events), this work is still valuable and to some extent gives important insight into the role of wave reflection events in sub-seasonal wintertime forecasts via a top-down mechanism. I really enjoyed reading this paper, for me this is one of the most comprehensive papers showing the robust statistical link between the wave reflection events and North American weather regimes/cold spells. As such, I recommend that the paper be accepted with a minor revision.

We would like to thank Sandro Lubis for his constructive feedback throughout the review process and his positive outlook on the latest version of our manuscript. We copy below the minor comments in *italics* and our replies in blue.

**Minor comments**

*1. Fig. 12, I think it's better to superimpose the eddy heights with the 2D Plumb's fluxes to better show the downward and upward energy propagation during these reflection events (the energy flux is equal to the group velocity times wave-activity density).*

We have updated the figure as suggested, and now show the vertical and zonal components of the Plumb wave activity flux.

*2. Table A1, can you clarify how many reflection events that occurred after the SSW events? The reason I'm asking this because in some cases the reflections occur after SSW events, not overlapping (i.e., reflective SSW events).*

Only three of the 35 reflection events that do not overlap with a SSW are preceded within 20 days by a SSW (events no. 3, 24 and 25 in Table A1). We picked 20 days as it is the standard SSW event separation criterion (*e.g.*, Charlton and Polvani, 2007). We now mention this in Sect. 6. We believe this does not alter the conclusions presented in the study.

Charlton, A. J., & Polvani, L. M. (2007). A New Look at Stratospheric Sudden Warmings. Part I: Climatology and Modeling Benchmarks, *Journal of Climate*, *20*(3), 449-469. Retrieved Aug 18, 2022, from https://journals.ametsoc.org/view/journals/clim/20/3/jcli3996.1.xml

**Reviewer #2**

The authors did a great job in the revision. I'm satisfied with most of the revisions. Now I only have a few minor comments before the final acceptance.

We would like to thank Pengfei Zhang for his constructive feedback throughout the review process and his positive outlook on the latest version of our manuscript. We copy below the minor comments in *italics* and our replies in blue.

*1. For the discussion of Fig. A4, the authors argue that:*
*In Sect. 3: "The onset of these reflection events is associated with an anomalously strong stratospheric polar vortex (negative Z10 anomalies over the central Arctic, Fig. A4), consistent with the expected favorable conditions for wave reflection."*

*According to the fig. A4, by comparing the change from d-3 to d0 and the following temporal evolution, it seems the polar cap averaged polar vortex is weakening, and the vortex is shifting. The polar cap averaged vortex may be a negative anomaly on d0, but it has already started the weakening variation (see d-3 vs d0). Thus, according to the figures, I think it would be more appropriate to state that the reflection event is associated with a slightly(?) stronger but a weakening of the stratospheric polar vortex. The authors may confirm the time series of zonal mean zonal wind at 60N at 10hPa or polar cap Z at 10hPa (north of 60 or 65N) anomalies to make the final conclusion. Both are conventional indices to measure the overall status of the polar vortex.*

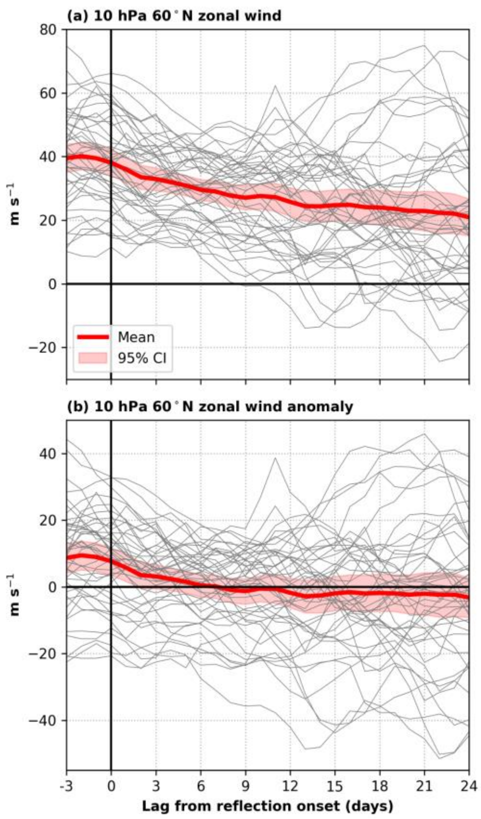

*Figure R1: Evolution of the 10 hPa 60°N zonal-mean zonal wind (a) absolute values and (b) anomalies for the 44 reflection events. The thick red line denotes the average over all events. Red shading indicates the 95\% confidence interval on the mean assessed as described in Sect. 2.*

Figure R1 (added to the paper as the new Fig. A5) shows the evolution of the 10 hPa 60°N zonal-mean zonal winds during reflection events. While the polar vortex does show a weakening at positive lags, it is roughly constant in intensity and stronger than climatology between day -3 and day 0. We thus believe that our statement that the onset of the reflection events is associated with an anomalously strong stratospheric polar vortex holds. We now additionally mention the weakening at positive lags and return to climatological levels in both Sect. 3 and Sect. 6. We further briefly discuss in Sect. 6 that, beyond day +3, there is essentially no signal in zonal wind strength on average during the reflection events. This suggests that reflection events do not induce a specific U10 change as they develop.

*2. The statement in Sect. 6: "Significant negative 10 hPa geopotential height anomalies persist over the polar region for over 10 days following the onset of the reflection events (Fig. A4)."*

*Similarly, I don't think this is a correct argument. If we calculated the polar region averaged Z anomalies at 10hPa, I would guess the values during these 10 days could be negative first followed by near zero or even positive (a transition). The negative anomalies within the vortex actually denote the shifting of the vortex. Shifting is a kind of weakening from the view of the area average over the polar cap or the zonal mean zonal wind at 60N (the overall status of polar vortex).*

As shown in Fig. R1 above, the polar vortex is on average stronger than usual during the onset of the reflection events and up to roughly day +3. The vortex then returns to climatological values and the 10 hPa 60°N zonal-mean zonal wind anomalies remain close to 0 up to day +24. We have now rephrased the text to clarify that there is a vortex shifting and weakening (as measured by the zonal-mean zonal wind). We additionally contextualise this relative to the wave-1 stratospheric pattern discussed in Ding et al. (2022). However, the key point we wanted to make is that the negative Z10 anomalies, albeit shifted geographically, persist even at positive lags and do not resemble the picture typically associated with major SSWs.

Ding, X., Chen, G., Sun, L., & Zhang, P. (2022). Distinct North American cooling signatures following the zonally symmetric and asymmetric modes of winter stratospheric variability. *Geophysical Research Letters*, 49, e2021GL096076. https://doi.org/10.1029/2021GL096076

*3. After the last round of review, I noticed a paper could be helpful for some discussion in the current study. See Guan et al. 2020 (https://doi.org/10.1175/JCLI-D-20-0096.1). (BTW, I'm not the co-author.) Guan et al. (2020) reported a weather regime transition in North America at the subseasonal timescale, which also involves wave reflection.*

Thank you for having suggested this relevant paper. We now cite it in the introduction and discuss it in greater detail in Sect. 6.