Weather Clim. Dynam. Discuss., referee comment RC1
https://doi.org/10.5194/wcd-2021-58-RC1, 2021

Comment on wcd-2021-58

Anonymous Referee #1

Referee comment on "Stationary wave biases and their effect on upward troposphere–stratosphere coupling in sub-seasonal prediction models" by Chen Schwartz et al., Weather Clim. Dynam. Discuss., https://doi.org/10.5194/wcd-2021-58-RC1, 2021

This is a nice paper that is a pleasure to read. I think it will be ready for publication following minor revisions. I have one question about the definition of the stationary waves that should be addressed before going forward, I request a little more detail be added to the figure captions, some minor tweaks to figures, and I have some suggestions for further investigation on the coupling between western Pacific convection and the tropics-extratropics Rossby wavetrain.

Lines 15-78: The introduction is comprehensive and well written.

Line 96-98: Would you please be more specific about how the stationary waves are calculated?

Is the time mean geopotential height that is removed while calculating the stationary wave only a one-week average?

Is the climatological (multi-year) zonal mean geopotential height removed to calculate the stationary wave?

Is a November to February temporal mean removed to calculate the stationary wave? If so, this definition of the stationary wave may not control for annual cycle variability. The stationary wave structure does evolve throughout the winter.

Line 110: ERA-Interim is introduced to the reader on this line. I think a line should be added to the Methods section stating that ERA-Interim will be used as the "truth" that the hindcasts will be compared to. Please add a citation for the reanalysis as well.

Figure 1: This figure is nice. In its caption, please state what the contour intervals are for the wave-1 and wave-2 contours.

Figure 1: On panels (i) and (l), the filled contours are not filled where the anomalies are lower than -60 meters. I have come across this as well while plotting. If you are using python and matplotlib, the …extend = 'both'… part of the code below will fill these contours:

contour = m.contourf(x, y, vort,
latlon=True,cmap=cmap1,**extend='both',**levels=levs1,vmin=vmin,vmax=vmax)

Figure 2: Please consider changing your contour colors to something that is more inclusive to people who are colorblind. This article provides guidance: https://www.nature.com/articles/d41586-021-02696-z

Figure 2a: ERA-I is shown with dashes. Why are there multiple dash contours? Is this ERA-I over different time periods? If yes, please state this in the Figure caption.

Line 129: Please replace "observations" with "reanalysis."

Line 125 – 126: I like that the focus is on these three key regions. Figure 2b gives the impression that there is considerable variability amongst the modeled stationary waves at 200E also. Do you have any hypotheses on why this would happen?

Figure 4: Typo in second line of Figure 4 caption.

Figure 4: Please list the contour intervals for the stationary wave and for the zonal wind.

Line 165 – 166: Is Figure 5c being referenced here? I cannot make out a PNA signal in panel 5c.

Line 180: There is a missing word in this sentence.

Line 191: Does either of these studies provide a physical explanation for what causes the biased ridge? If so, please add one line on this.

Line 284 – 285: Should we expect that the convection over the eastern Pacific is associated with the western North America ridge? The impression I have from Garfinkel et al. (2020) is that the ridge forms due to the nonlinear interactions amongst the "building blocks" that their study focuses on, not tropical convection.

Figure 9a: The connection between tropical convection, subtropical descent, and the East Asia trough is plausible. I feel like the investigation of if tropical convection/subtropical downwelling impacts the stationary wave pattern could be a little more thorough. I think this study could be improved by further investigating the sources of the stationary wave biases.

Have you considered the Rossby wave source? Scaife et al. (2017) did a similar analysis – analyzing the relationship between tropical precipitation and tropics-extratropics Rossby wavetrains. See their Figure 6. Here are some suggested plots: (1) subtropical Rossby wave source as a function of tropical omega; (2) North Pacific trough bias as a function of subtropical Rossby wave source bias; (3) Rossby wave source maps; (4) North Pacific trough bias as a function of 200 hPa subtropical velocity potential bias.

Scaife, A. A., Comer, R. E., Dunstone, N. J., Knight, J. R., Smith, D. M., MacLachlan, C., ... & Slingo, J. (2017). Tropical rainfall, Rossby waves and regional winter climate predictions. *Quarterly Journal of the Royal Meteorological Society*, *143*(702), 1-11.

Figure 9a: Schwartz and Garfinkel (2020, JGR, MJO study) showed that there is more eddy heat flux entering the mid-latitude stratosphere 1-3 weeks after MJO phase 6/7, suggesting that there is an anomalous tropics-extratropics wavetrain producing the transient eddy heat flux. The convection center during phase 6/7 is between 140E and 180E. Figure 9a looks at *subtropical* omega between these same longitudes. Assuming that the subtropical descending branch of the meridional circulation between these longitudes is “feeling” what is taking place in the tropics, to what extent is MJO variability present in Figure 9a? Does the Figure 9a correlation improve by compositing by MJO phase?