Dear Reviewer #1 Thank you for your careful review of our manuscript. Your comments are greatly appreciated and we think this new version of the manuscript satisfactory responds to your concerns and provides an interesting contribution to the study of equatorial waves.

Responses to comments of reviewer #1 notes, are as follows:

1. The zonal spatial filtering to wavenumbers 5-6 is very restrictive.

R: We have broadened the wavenumbers for the analyses to s= 4-6. We also did tests with zonal wavenumbers 3-8, and most of our results in the analyses remain. It means that the 4-6 zonal wavenumber signal is robust over the central eastern Pacific. Even more, we decided to apply EOFs to the 200 hPa meridional wind component with wavenumbers 4-6 without a bandpass filter. After that, we did a spectral analysis of PC1 and PC2 and results showed a spectral peak around 6 days, with high coherence square (0.6) between PC1 and PC2 in the (5 – 8 days)$^{-1}$ frequency range and PC2 leading by around 100º degrees PC1, i.e., they are almost in quadrature which corresponds to a westward phase propagation. The correlation between PC1 and PC2 acts as a means to filter the MRGWs signal in the correlations, for instance.

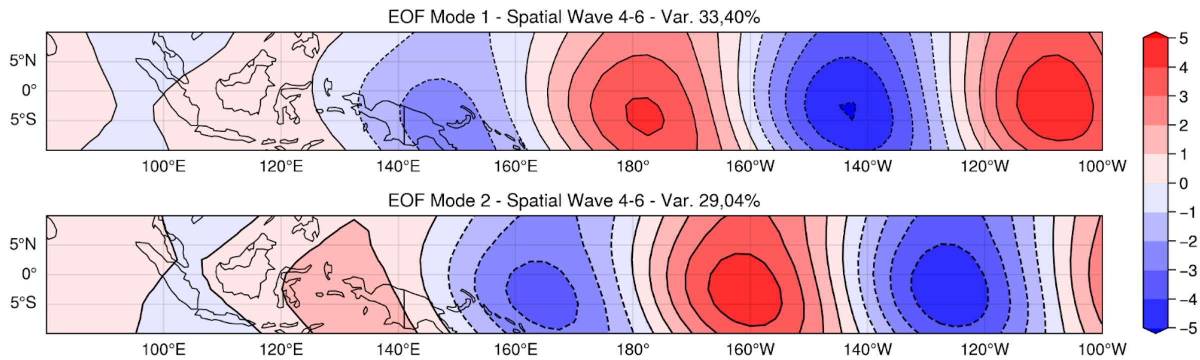

Figure A1 - First and second EOF for the 200 hPa space-time filtered anomaly of the meridional component of the wind field at 200 hPa for the December to February for the 1991 to 2020 period.

Although the results appear to provide clear and robust connections to real signals over the Central Pacific Ocean, the Gibbs phenomenon would extended the filtered signal substantially east and west of the central point. In the real world, the MRG wave signals have a broad spectral footprint, with a peak in the power spectrum extending over planetary to small synoptic scales. Many previous works have shown substantial variance at the target band the authors are using. Yet individual disturbances have their zonal scales evolve across their lifetimes. For example, a disturbance moving westward across the Dateline near wavenumber 4 or 5 might arrive over the west Pacific, slowing down as it moves, ultimately projecting more strongly to narrower wavelengths, better characterized by wavenumbers 6 or 7.

R: You are right. As we broadened the wavenumber domain in the analyses more spatial details appeared. Our case study shows that in the lower tropospheric levels the wavelength of their MRGW shortened and wavenumber 5-6 dominates over the western Pacific. We do not know the reason for this transition. However, over the central-eastern Pacific wavelengths corresponding to zonal wavenumber 4-5 dominate.

In the temporal domain, the spectral peaks for PC1 and PC2 are around 6 days. Therefore, we decided to broaden the bandpass filtering to 3-8 days, applying a spectral filter to remove oscillations with periods above 90 days (Dec-Jan-Feb) and avoid the Gibbs Phenomenon. Results did not change significantly with respect to our previous analyses. Recurrently, we observed that at the 200 hPa level, the MRGW signal significantly weakened over western Pacific, in the easterly winds regime. There were no indications of a reduction in the wavelength of the MRGW signal at this level.

Figure 1 suggests that the authors' data are overfiltered, thus masking the scale change evident in previous works as the waves move westward.See Figure 12 of Kiladis et al. (2009) for an example. Although the central results of the authors over the middle of the Pacific basin conform well to previous works, Figure 1 does not allow for the disturbance to evolve in its zonal scale, because the wavenumber is over prescribed. It is unclear how this issue will impact the timing and other characteristics of the downward propagation of the disturbance that they diagnose.

R: **We have also made use of EOFs with zonal wavenumbers 3-8 in the 200 hPa meridional wind, and the corresponding PCs have been used to observe the spatial structure of MRGWs at lower tropospheric levels. The analyses do not show a change in the spatial structure over the central-eastern Pacific. It is only in the lower tropospheric levels that a transition to shorter wavelengths occurs as the MRGW propagates to the western Pacific (See figures A3 and A4). It is only in the case study that the dominant wavenumber at upper tropospheric levels is 6, while at lower tropospheric levels (700 hPa) the dominant zonal wavenumber close to the western Pacific is 7 (Fig 9g and Fig. 9j).**

In all Lag Correlations no band-passed or spatial filters were applied to the wind or OLR fields in order to show the importance of the MRGWs in the winds and tropical convection fields. However, the correlations with PC1 or PC2 acts as a temporal and spatial filter of the signal.

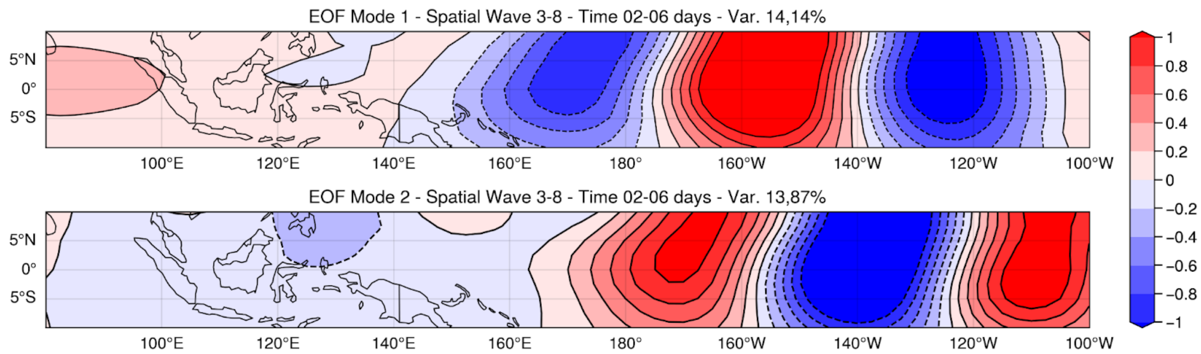

Figure A2 - First and second EOF for the 200 hPa space-time filtered anomaly of the meridional component of the wind field at 200 hPa for the December to February for the 1991 to 2020 period.

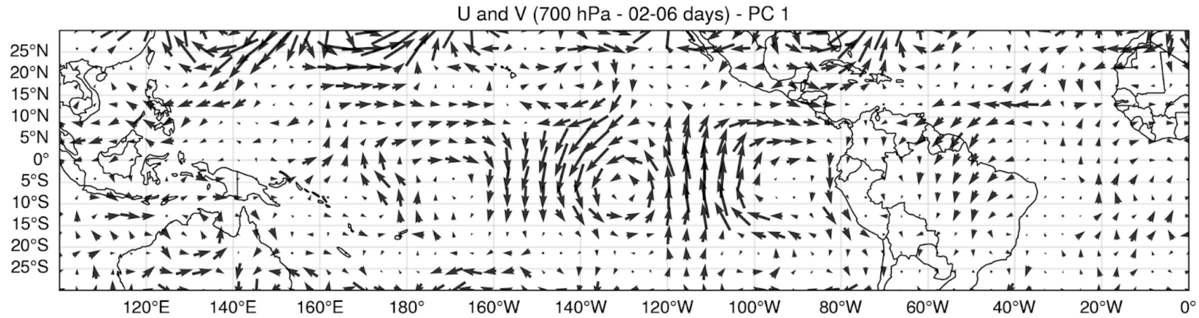

Figure A3 - Composite patterns based on PC1 > 1 conditions, showing band-pass filtered wind anomalies (2–6 day periods) at 700 hPa.

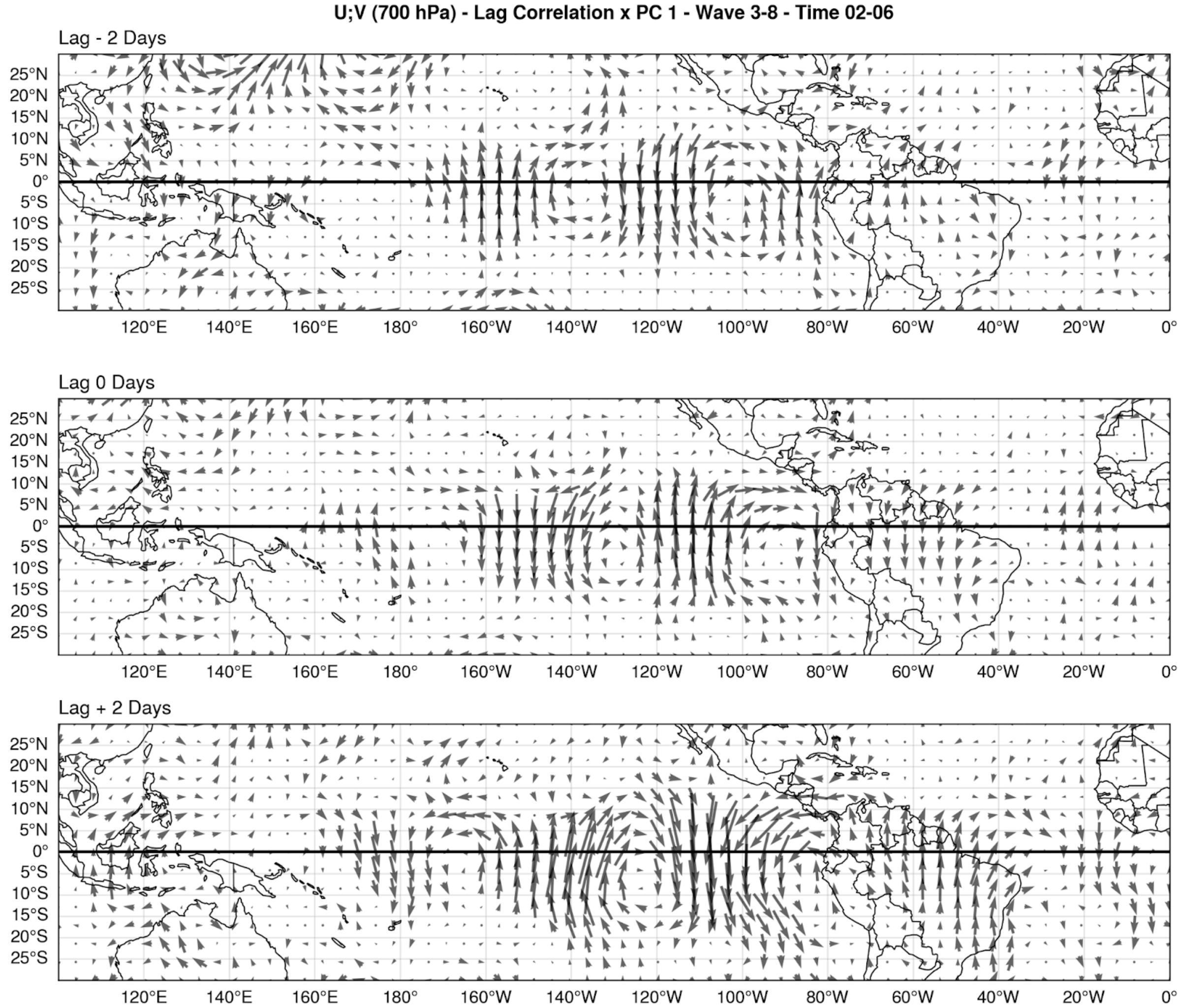

Figure A4 - Lagged cross-correlation between the first principal component (PC1) of the 200 hPa meridional wind along anomalies in the 700 hPa wind field (vectors) , during the December–February period.

The authors should broaden their wavenumber filter and repeat their analysis to assess the extent of the difference associated with the narrower scales that are evidently important as the disturbances move to the West Pacific. The filtering is likely not the only way the algorithm constrains results zonally. Even using a broader wavenumber filter, the EOF analysis will constrain the results to a particular range of zonal scales, but it will allow the zonal widths of the anomalies to vary geographically. Data filtered for a broad band along the MRG spectral peak ultimately expresses in several EOF pairs, each higher EOF pair explaining progressively smaller zonal scales. This means that one pair of EOFs is not sufficient to describe the whole population of waves.

R: The existence of a westerly duct during the Austral summer imprints special characteristics to the MRGWs. Specifically, the amplitude of these waves at upper tropospheric levels is larger over the westerly duct and the intensity of the MRGW band passed filtered wind anomalies is large as well, of the order of 2 ms^{-1} at 200 hPa and 1 ms^{-1} at 700 hPa. However, when unfiltered anomalies are used, the signal of the MRGW is present, with wind anomalies of the order of 10 ms^{-1} and 5 ms^{-1} at 700 hpa. Total wind associated with the MRGW for the case study at 200 hPa is around 50 ms^{-1}, and 10 ms^{-1} (See Figure A5). Therefore, the signals of MRGWs obtained in the analyses are not the result of over-filtering. In any event, you are correct, the signal in the filtered and unfiltered wind field associated with MRGWs at lower tropospheric levels propagating into the western Pacific show a smaller wavelength that over the eastern Pacific at 200 hPa. Its is not the objective of this study to explore shorter wavelengths that are not necessarily part of the MRGWs (For instance when they tends to result in tropical cyclones). It is interesting though, to specifically study the transition to shorter wavelengths particularly at lower tropospheric levels over the western Pacific. With a broader spectrum of zonal wavenumbers there may be smaller scale details in the analyses, in higher EOFs, but they may not necessarily have a simple physical meaning, and may be just an result of the orthogonality of the method.

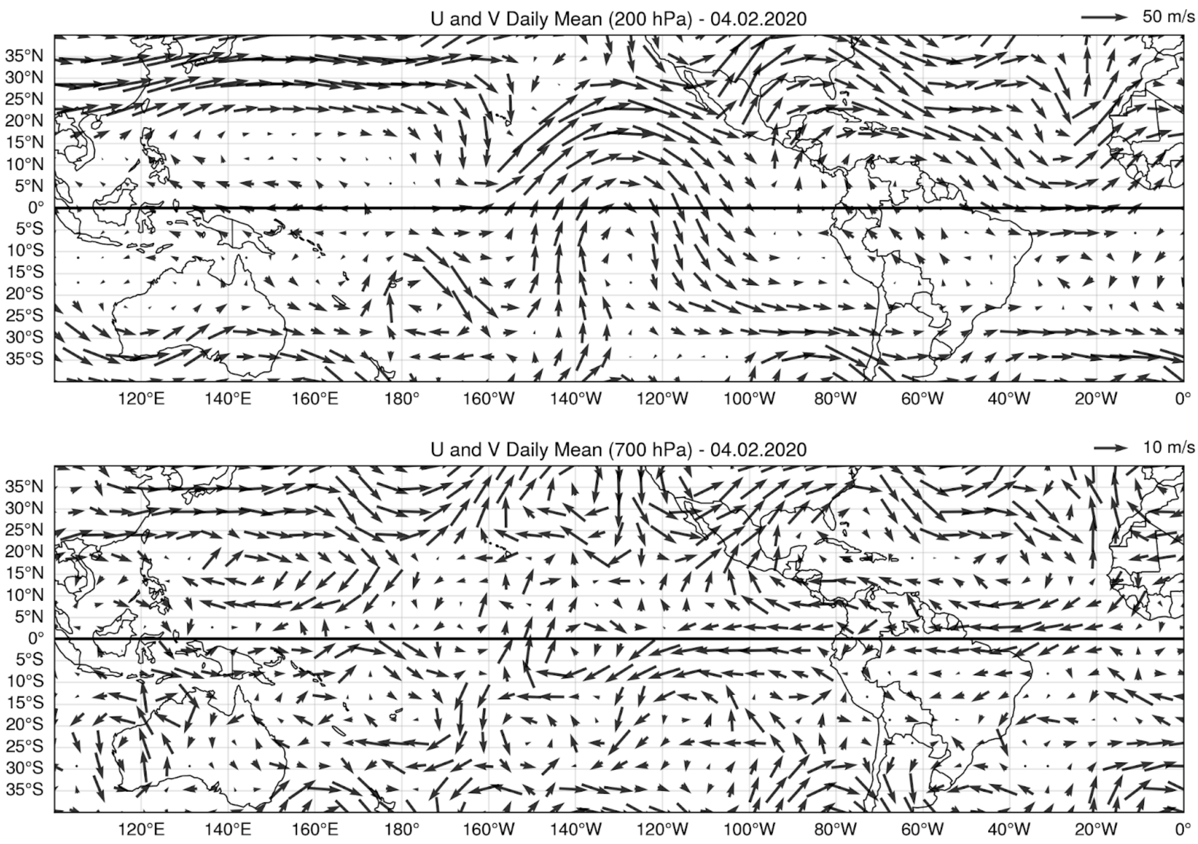

Figure A5 - Case Study total wind vectors 04.02.2020.

There is nothing wrong with the authors emphasizing a particular range of these scales through selecting a single pair of EOFs, but they should acknowledge that MRG energy also occurs at longer and narrower wavelengths than those that they show here.

R: We have added a brief sentence on the transition of the wavelength at lower tropospheric levels as an interesting problem to be explored. L.298-303

EOFs based on data filtered for a broader band of wavenumbers will still have leading modes concentrate at wavenumbers 4, 5, or 6 over the central Pacific, but the individual modes will associate with signals at narrower scales as the disturbances move westward.

R: We are now using zonal wavenumbers 4 to 6 for the EOF analysis.

2. The MRG wave exhibits eastward group velocity, not westward. The manuscript appears to state that the group velocity is westward.

R: We appreciate the correction and have changed to "Eastward" on L.177 (Now L182).

The wavenumber filtering and the EOF analysis selects for wave scale in a particularly narrow way, which will mask the development of the group velocity in their results. If the authors filtered for a broader wavenumber band, a pair of EOFs would still select for a particular narrow range of wavenumbers (even though the patterns would allow the same disturbance to be characterized by different wavelengths in different regions). In that case, analysis of multiple pairs of EOFs of MRG filtered data retained together would reveal the group velocity as the interference pattern that emerges from including wave signals propagating at different phase speeds over a range of zonal wavenumbers.

R: The broadening of zonal wavenumbers to s = 4 – 6 allows a more adequate description of the group velocity from the eastern equatorial Pacific towards the Atlantic ocean.