Dear Editor,

We sincerely thank the reviewer for the careful second-round assessment and constructive suggestions. We have revised the manuscript further to address the two remaining points. In particular, we have added a more explicit discussion of the near surface MFs changes and their statistical significance, and we have substantially revised the interpretation of the refractive-index analysis to avoid overstatement. The refractive-index analysis is retained, but it is now presented as a complementary diagnostic of the background propagation condition for resolved planetary waves.

Thank you very much for taking the time to handle our submission.

Best regards,

Reply to Reviewer #1

1) I suspect that the significance has not been assessed for the near surface regions and also, for some regions we see enhanced near surface MFs in the NHE corrected simulation. The only explanation I see for it is a meridional shift of some drag producing near surface circulation configurations. The authors should definitely give a proper attention to this aspect in the manuscript.

Reply: We thank the reviewer for raising this important point. In fact, the statistical significance of the zonal-mean OGWD differences has already been assessed in Fig. 6b, where stippling denotes differences significant at the 95% confidence level. However, because the near-surface signals are located at the very bottom of the latitude-height cross section, their detailed structure is visually compressed and may not be clearly identified from Fig. 6 alone. To address this issue more explicitly, we have further examined the horizontal distribution of the zonal OGWD difference at 850 hPa and added it as a new diagnostic figure, Fig. R1. In Fig. R1a, the stippling indicates regions significant at the 95% confidence level. In Fig. R1b, the same field is shown with the 90% confidence level. We agree that some near-surface anomalies do not pass the 95% test. Nevertheless, the major anomaly regions are spatially coherent and are significant at least at the 90% level.

We have also clarified the physical interpretation of the localized enhancement of near-surface momentum flux in EXP_NHE. Although the NHE correction directly reduces the launch-level surface WMF in the idealized theoretical formulation, the diagnosed near-surface OGWD in the fully coupled CMA-GFS simulations is not controlled by this correction alone. It is also affected by the adjusted low-level wind and feedbacks between the parameterized drag and the resolved circulation. Therefore, the local enhancement should not be interpreted as a contradiction of the NHE correction. Rather, it reflects the interaction between model dynamics and physics, including possible meridional displacement of drag-producing near-surface circulation configurations, as the reviewer suggested. "*Instead, the lower-tropospheric OGWD is also affected by the interaction and feedback between model dynamics and physical parameterizations. Changes in the simulated low-level circulation, including possible meridional displacement of drag-producing flow configurations, can modify the wind speed, stability, and mountain-flow orientation sampled by the OGWD scheme, thereby producing localized enhancement of the near-surface drag in EXP_NHE.*" is added in the revised manuscript.

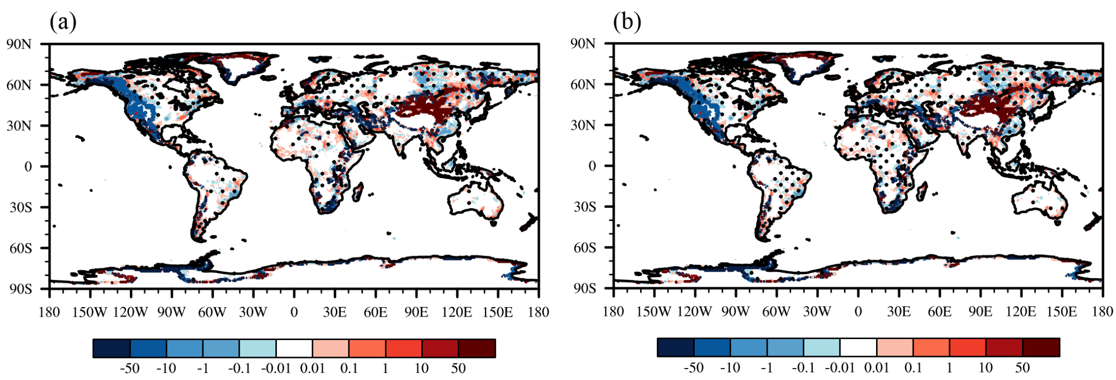

Figure R1. Horizontal distributions of zonal OGWD difference between EXP_NHE and

EXP_CTL (i.e., EXP_NHE minus EXP_CTL) at 850 hPa. Stippling in (a) denotes differences statistically significant at the 95% confidence level. while stippling in (b) indicates differences statistically significant at the 90% confidence level.

2) The newly added refractive index analysis is by no means conclusive and the results in Fig. 9 do not seem to support the author's interpretation. Instead of a clear difference pattern explaining the differences in the wave activity after the NHE correction, we see in Fig. 9 narrow vertically oriented patches of negative/positive differences, which cannot be interpreted as affecting the PW propagation in either way. The authors should describe and resolve this issue in detail in the next revision.

Reply: We agree with the reviewer that the original refractive-index analysis was not conclusive by itself, and that the patchy structures in the latitude-height difference plots should not be overinterpreted as direct evidence of changes in planetary-wave propagation. The refractive-index analysis is now presented only as a complementary diagnostic of the background propagation condition, while the EP-flux analysis remains the primary evidence for the resolved wave-activity response.

To address the reviewer's concern, we further added zonal-mean refractive-index diagnostic over 50°-80°N (new Fig. R2). This averaging reduces the influence of narrow local patches and highlights the vertically coherent component of the response. The new result shows positive refractive-index differences below about 500 hPa and negative differences above about 500 hPa. This vertical contrast is consistent with the EP-flux response. The lower-tropospheric background condition remains favorable for wave activity, whereas the upper-tropospheric and lower-stratospheric condition becomes less favorable for further upward propagation into the stratosphere. We have rephrased the manuscript accordingly, emphasizing consistency with EP-flux diagnostics rather than claiming that the refractive index alone proves the wave-activity changes.

"*To provide a more robust diagnosis of the bulk propagation conditions, the zonal-mean refractive-index diagnostic averaged over 50°-80°N is further presented* *in Fig. 10. The averaged RFI anomalies are positive mainly below about 500 hPa, whereas negative anomalies dominate above 500 hPa for both wavenumber 1 and wavenumber 2. This vertical contrast is consistent with the EP-flux response in Fig. 8b. The lower-tropospheric environment tends to favor the initial upward propagation of resolved Rossby waves, while the upper-tropospheric and lower-stratospheric background state becomes less favorable for their continued propagation into the stratosphere.*" is added in the revised manuscript.

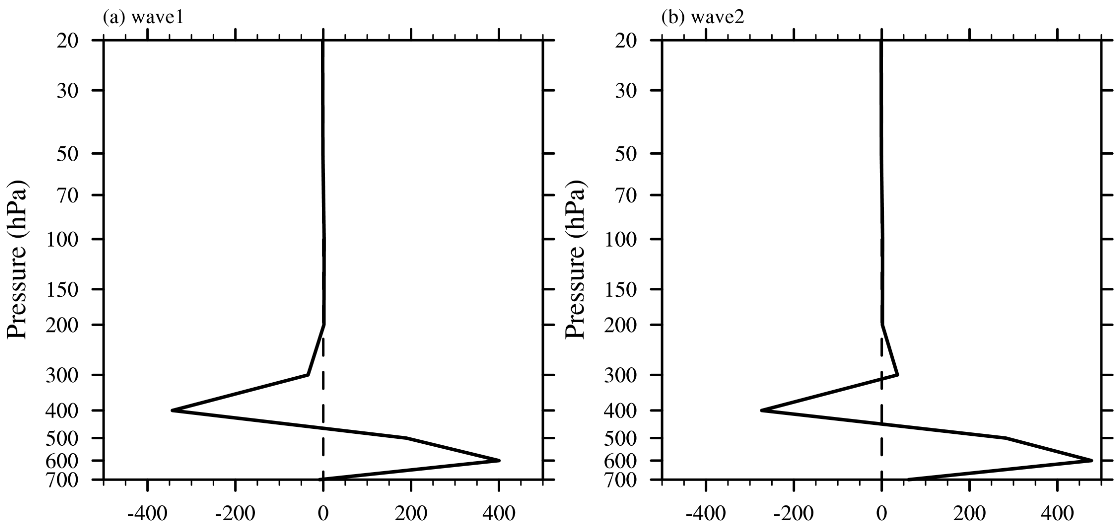

Figure R2. (a) The difference between the refractive indices of wavenumber 1 in EXP_NHE and EXP_CTL (EXP_NHE minus EXP_CTL), averaged over 50°-80°N. (b) as in (a), but for wavenumber 2.