

We thank the referee for the insightful comments, which have helped us improve the manuscript. Below, we repeat the reviewer's remarks in red italics, and add our respective responses in normal text.

The authors investigate the long-term impacts of intensified orographic gravity wave (GW) forcing in three hotspot regions—East Asia, Northwest America, and the Himalayas—on middle atmospheric dynamics using the UA-ICON high-top global model. The experiments reveal consistent enhancements of easterly subgrid-scale orographic (SSO) GW wind tendencies within the targeted hotspot regions. The non-orographic (NO) GW drag response is largely modulated by changes in the background zonal-mean zonal wind in the stratosphere and plays a critical role in shaping the net parameterized GW momentum tendency. In all three cases, the added westward momentum suppressed upward and equatorward propagation of planetary waves, strengthening westerlies in the upper stratosphere–mesosphere. Overall, I think this topic is interesting, and the manuscript is well written. I have only one minor comments.

We sincerely thank the reviewer for the positive and constructive feedback, and for recognizing both the interest of the topic and the quality of the manuscript. We greatly appreciate the careful reading and the helpful suggestion, which has improved the clarity of our methods section.

Minor Comments:

Section 2.2 Data: The associated discussions of finite-amplitude wave activity are not easily understandable. It is recommended to provide a more detailed explanation of the method, along with the formula to enhance clarity for the reader.

We thank the reviewer for pointing out that our original description of the finite-amplitude wave activity (FAWA) diagnostic in Section 2.2 could be expanded for clarity. We agree that providing a more detailed explanation and the relevant formula would improve the manuscript and make this diagnostic easier to follow.

In the revised manuscript, we have expanded Section 2.2 to address this point (lines 215-236 of the revised manuscript). The new text more clearly distinguishes FAWA from Eliassen–Palm (EP) flux, explains why FAWA is particularly useful in the context of localized GW forcing, and outlines its theoretical basis and the conditions under which it is well defined. We have included the explicit formulation for deriving FAWA, including the quasi-geostrophic PV and FAWA equations, consistent with Nakamura and Solomon (2010). In addition, we now present the diagnostic relationship between FAWA tendencies and EP flux divergence. We believe these revisions address the reviewer's concern and will make the methodology clearer for readers who may be less familiar with FAWA.

References:

Nakamura, N. and Solomon, A.: Finite-amplitude wave activity and mean flow adjustments in the atmospheric general circulation. Part I: Quasigeostrophic theory and analysis, *Journal of the Atmospheric Sciences*, 67, 3967–3983, <https://doi.org/10.1175/2010JAS3503.1>, 2010