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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Gravity wave reflection and its influence on the consistency of temperature- and wind-based momentum fluxes simulated above Typhoon Ewiniar" *by* Y.-H. Kim et al.

Anonymous Referee #1

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The paper uses high-resolution numerical simulations of a typhoon to assess the efficiency of methods used to estimate gravity waves from satellite observations. More precisely, it compares direct estimations of the gravity wave momentum fluxes and estimations inferred with a method close to that used to analyze gravity waves from satellite data. This is a very useful exercise, which contributes to setting error bounds on satellite-based estimates of gravity wave momentum fluxes. However, there two shortcomings that deserve to be improved, be it only through more thorough discussions:

1. the comparison that is presented tests only part of the uncertainty. This should be explained more clearly, and suggestions for further work could be made.

2. Downward propagating waves play an important role in the conclusions. An evident source of downward propagating waves is the upper boundary condition. Although this is discussed, and discarded, the arguments presented are not entirely convincing. Sensitivity experiments would have been welcome.

Those two points can be improved upon. The paper is otherwise clearly written, the topic is relevant, and this constitutes a good and useful study. After these two major points are adressed, publication is recommended.

MAJOR POINTS

1. The purpose of the study is to contribute to estimating the uncertainty in estimations of gravity wave (GW) momentum flux from satellite observations. This study is one contribution, and it should be placed in a larger context:

Estimation of gravity wave momentum fluxes from satellite measurements include a number of steps and assumptions, in particular: a. separation of signal into a background and a perturbation, b. estimation of wave characteristics from successive profiles, c. estimation of momentum fluxes, using linear theory and polarization relations, from the above estimation of the wavevector and the amplitude of the perturbation.

The present study addresses the limitations of the assumptions made in step c, i.e. the linear theory and the assumption that all waves observed can be interpreted as upward propagating.

This is a very useful study, but it should be clearly explained that it is examining only one source of uncertainty in the estimation of GW momentum fluxes. Indeed, as the authors explain, the separation of the flow into a background and a perturbation uses full horizontal cross-sections from the model output (more than one has from satellite observations). The identification of wavevectors uses FFTs in the horizontal, again us-

ing much more than is available than when dealing with data. It is known that estimation of GW characteristics is sensitive to this separation (Zhang et al 2004).

Readers may otherwise be confused about the conclusions, and understand them as excessively optimistic: i.e. that estimates of GW momentum fluxes from satellite observations differ only by less than 40% (at z=20-40 km) relative to estimates from knowledge of the full flow.

2. The authors discuss the downward propagating waves in detail, and give rather convincing arguments to suppose that these downward propagating waves are due to variations of the background conditions. If this is the case, such downward propagation should also be found in observations (even more so, as fluctuations of the background can be larger than in a model where details are limited by resolution). Is there any evidence of this from radar or radiosonde studies (where rotary spectrum analysis can give insight into this)? Are there observations exhibiting oscillations in the vertical like those found here?

In any case, the upper boundary condition is such an evident suspect that additional simulations testing the sensitivity to the upper boundary would have been welcome and convincing. I understand that this may not be possible as the study is based on simulations done for another primary purpose.

F. Zhang, S. Wang, and R. Plougonven, 2004: Uncertainties in using the hodograph method to retrieve gravity wave characteristics from individual soundings. Geophysical Research Letters, 31, L11110, doi:10.1029/2004GL019841.

Interactive comment on Atmos. Chem. Phys. Discuss., 12, 6263, 2012.