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Interactive Comment

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.

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We thank the reviewer for the constructive and helpful comments which are important to improve our paper.

1. The reviewer is correct in pointing out that WKB assumptions and the assumption of upward propagating waves are only part of the total error budget for inferring GW momentum flux from space-borne temperature observations. In fact, for current-day instruments these error sources present only a minor contribution. This point will be

clarified in the Introduction in the revised manuscript. This study was, however, inspired by potential new infrared limb imagers which would result in largely reduced errors (Preusse et al., 2009). We will include some discussion of this issue in the Introduction and also refer to this point in the Conclusions section.

2. As the reviewer commented, we argue that the downward propagation of GWs are due mainly to variations in the background condition, although the artificial reflection from the upper boundary also is responsible for a part of the waves. The existence of the downward propagating GWs in the stratosphere has been revealed by several observational studies using radiosonde, radar, and falling sphere (e.g., Eckermann and Vincent, 1989; Sato et al., 1997; Yoshiki and Sato, 2000; Yamamori and Sato, 2006; Sato and Yoshiki, 2008). They detected downward propagating GWs along with dominant upward propagating GWs, using the hodograph method, rotary spectrum, or 2-D vertical wavenumber–frequency spectrum. Furthermore, the node structure in vertical cross-sections (e.g., in our Fig. 2c) was also seen clearly in the stratospheric inertio-GW study using radar observation by Sato et al. (1997) (see their Fig. 5a,b), although it is not mentioned in their paper.

However, the partial reflection mechanism is hard to be addressed in studies using conventional sounding observations by radar or sonde. As emphasized by the reviewer, it is non-trivial to distinguish between GWs and background states (Zhang et al., 2004). This makes it very hard for the sounding measurements to detect rapid vertical changes in the background atmosphere which are required for the partial reflection mechanism. In fact, in many observational studies mechanisms of the downward propagation of GWs have not been discussed, except for GWs near polar regions. Note that near the polar regions, generation of GWs near the polar night jet could be proposed as a mechanism of the downward propagation (Yoshiki and Sato, 2000; Sato and Yoshiki, 2008). However, near the polar night jet also, Sato et al. (2012) showed that the partial reflection by a rapid change in N^2 could be a mechanism of the downward propagation of GWs, using a high-resolution GCM. The difficulty in linking the GWs to the partial reflection in conventional sounding observations will be discussed in the revised manuscript, as well as the references for observed downward propagating GWs mentioned above.

The artificial reflection from the upper boundary also is responsible for a part of the downward propagating GWs, as mentioned. Unfortunately, additional simulations testing the sensitivity to the upper boundary are not possible at this moment. However, we are now solving the Taylor–Goldstein equation for a dominant wave in our study in order to see the sensitivity of the solution to the N^2 profile, and we also expect to see the sensitivity to the upper boundary condition in the equation.

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