Atmos. Chem. Phys. Discuss.,
doi:10.5194/acp-2016-813-RC1, 2016

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Quasi 12 h inertia-gravity waves in the lower mesosphere observed by the PANSY radar at Syowa Station (39.6 °E, 69.0 °S)" *by* Ryosuke Shibuya et al.

Anonymous Referee #1

Received and published: 16 November 2016

Paper Summary

This paper identifies quasi 12-h inertia gravity waves in observations made using the PANSY radar at SYOWA during March 2015. The NICAM model is then used to simulate the atmosphere at that time (started with initial conditions just prior to the observing period and allowed to free run). Inertial gravity waves similar to those observed are apparent in the model and, in two cases are analysed to identify their sources. This analysis identifies envelope functions for the wave packets and follows them down through the model. The results are compared to standard ray tracing. It is found that one of the waves is generated by an imbalance in the mid-latitude flow near 10 km. The other has its source in the mid stratosphere. The vertical structure of wave energy

and momentum flux for the inertial waves is presented.

General comments.

The manuscript uses a well designed combination of observations and modelling to investigate inertia gravity waves and their sources. Ray tracing techniques, including an envelope tracking method that is discussed below, are used to identify source regions. The dynamical state of the source regions is shown to be consistent with gravity wave production.

In general the manuscript is sound, but some areas of improvement are noted below.

Specific Comments

On Page 7, the discussion starting at line 10 should include reference to the paper by Reid and Vincent 1987 doi:10.1016/0021-9169(87)90110-3. This reference considers the sensitivity of the radar system to waves of varying horizontal wavelengths for the velocity extraction method they use, and so is relevant here.

There are aspects of the "manual wave packet tracing" that are not clear. The description of how the position of the packet is determined (P17, L18-21) and should be expanded.

In addition, the envelope function does not seem to be extracting an envelope as I would expect. In Figure 11, where both the zonal velocity and the envelope function are displayed, the envelope seems to mostly be the absolute value of the velocity. This is not the case in Sato et al. (2013). Is it possible that the direction in which the envelope function is applied is not optimal? At present, the function is not convincing.

The use of "manual wave packet tracing" is novel and seems to have merit but some comments on why it is used and what advantages it brings would be valuable. The comment on line 13 of Page 18 that the manual and idealized ray tracing agree is contested because in Fig 13d, the idealised ray travels at right angles to the manual ray. This should be noted and commented on.

The description of the compositing that leads to Fig 10 is unclear. What is being composited? Can the maps being composited be moved N-S or just E-W in the process of forming the composite.

Interactive comment on Atmos. Chem. Phys. Discuss., doi:10.5194/acp-2016-813, 2016.