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Atmospheric Chemistry and Physics Discussions

Interactive comment on "A study of the dynamical characteristics of inertia–gravity waves in the Antarctic mesosphere combining the PANSY radar and a non-hydrostatic general circulation model" *by* Ryosuke Shibuya and Kaoru Sato

Anonymous Referee #1

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General comments: This study investigates the dynamical characteristics of mesospheric gravity waves focusing on the Antarctic region. The importance of a better understanding of mesospheric gravity wave dynamics is very well introduced and the authors managed to put their work into context by giving a detailed yet focused introduction with appropriate references. Their approach is novel in that they evaluate for the first time observational radar data that is able to resolve gravity waves of small vertical wavelength. Secondly, they perform the first high-resolution and high-top simulation of one of our state-of-the art nonhydrostatic models over several months, and show

convincingly that this model is suitable for studying mesospheric gravity wave dynamics. The authors use appropriate analysis techniques und draw insightful conclusions about the implications of their results, for example, that traditional gravity wave parameterization would fail at producing realistic gravity wave features in the high-latitude mesosphere. The text is well-written und mostly clear and could be published after some minor clarifications.

Specific comments: 1) It is not clear to me how bar(u'w') and similar quantities were computed. What is the temporal resolution of the model output? Was a Fourier transformation performed? Related to this, in equation 4, if tilde(w) is the Fourier transform of w, then what does the average bar(tile(w)) mean? Please define your averages, e.g., over a wavelength und over a wave period? And please explain what averages over Fourier-transformed variables mean.

2) Gravity waves with frequencies 2pi/30h are discussed, but the inertial frequency is 2pi/12.7h. Omega must be greater than f, as the authors write themselves. So how is this consistent? Is it because of Doppler shifting? If so, this should be calculated and justified. To avoid confusion, omega could be called the ground based frequency in the figure captions where omega < 2pi/12.7h is shown.

3) Each section looks at different months. The gravity wave analysis uses JJA, Figures 5 and 6 use May, Figure 4 April and May, Figure 3 April, Figure 2 May. It may be good to say at the beginning that different months are chosen for different comparisons and give the reason for it.

4) Every now and then semi-diurnal non-migrating tides with s=1 are mentioned. What is s?

Typos: Figure 2: duplicate (a) Page 10 line 9: which -> which is Page 11 line 22: cumulous -> cumulus

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C3