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Reply on RC2

Gunter Stober et al.

Author comment on "Atmospheric tomography using the Nordic Meteor Radar Cluster and Chilean Observation Network De Meteor Radars: network details and 3D-Var retrieval" by Gunter Stober et al., Atmos. Meas. Tech. Discuss., <https://doi.org/10.5194/amt-2021-124-AC4>, 2021

We thank the reviewer for the valuable comments on our paper. The manuscript will be revised according to the suggestions. A more detailed point-by-point reply with all the changes is going to be prepared after the public discussion is closed.

Comment:

Line 38. The Na Doppler lidar has been an important ground-based instrument, and has many important contributions to the MLT dynamics, due to its capability of day and night-time simultaneous measurements of temperature and horizontal winds [Krueger et al., 2015]. Due to its horizontal wind capability, it can derive the intrinsic properties of GWs. It is unfortunate that the author misses this important instrument.

Reply:

Some Na - Doppler lidars are indeed capable of measuring horizontal winds but often assume $w=0$ m/s. We will expand this part of the introduction and add more specific information on different Na- lidars and include citations to the proposed publications. However, we have to note that due to the imaging capability of the 3DVAR algorithm there is no need to measure temperature to derive the intrinsic gravity wave properties. The intrinsic horizontal wavelength is directly assessable from the images and the phase velocities can be inferred from successive images (see also Stober et al., 2014, Stober et al., 2018). Gravity wave properties from lidar observations are often analyzed applying a hodograph analysis, which requires temperature measurement to derive unambiguously the intrinsic gw properties.

Furthermore, NA-lidar winds could in principle be used and included similar to all other types of radial observations. The 3DVAR algorithm has a build-in tool to permit the usage of different data sets.

Comment:

Line 44-45. There are actually many of this collaborative investigations between the Na Doppler lidar and airglow instrument. So, I suggest the author replace "only a few" with

many. The problem with such Na Doppler lidar – Airglow investigations is that they are mostly focusing on single case studies, such as Yuan et al. 2016, Cai et al., 2014, and, thus, cannot provide statically large numbers of cases to build robust database of these intrinsic properties of GWs.

Reply:

Thanks for the recommendation in rewording the issue. The revised manuscript is going to be changed and the suggested reference is going to be added. However, we have to point out that the 3DVAR retrievals are 24/7 observations. Case studies will be possible, but the scientific emphasis is certainly more towards statistical GW effects and their seasonality. We are going to rephrase this aspect and use more precise wording to express these differences.

We thank the reviewer also for all the technical corrections, which are going to be included in the revised manuscript.

References:

Stober, G., Sommer, S., Rapp, M., and Latteck, R.: Investigation of gravity waves using horizontally resolved radial velocity measurements, *Atmospheric Measurement Techniques*, 6, 2893 – 2905, <https://doi.org/10.5194/amt-6-2893-2013>, <http://www.atmos-meas-tech.net/6/2893/2013/>, 2013.

Stober, G., Sommer, S., Schult, C., Latteck, R., and Chau, J. L.: Observation of Kelvin–Helmholtz instabilities and gravity waves in the summer mesopause above Andenes in Northern Norway, *Atmospheric Chemistry and Physics*, 18, 6721–6732, <https://doi.org/10.5194/acp-18-6721-2018>, <https://www.atmos-chem-phys.net/18/6721/2018/>, 2018b