

Atmos. Meas. Tech. Discuss., referee comment RC1
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Comment on amt-2021-124

Anonymous Referee #1

Referee 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-RC1>, 2021

Review of "Atmospheric tomography using the Nordic Meteor Radar Cluster and Chilean Observation Network De Meteor Radars: network details and 3DVAR retrieval" by Stober et al.

The paper introduces a new technique to derive 3D wind fields from networks of meteor radar stations in a tomographic approach. The performance of this 3DVAR retrieval is demonstrated for two meteor radar networks, the Nordic Meteor Radar Cluster in Northern Europe, and the CONDOR network in South America.

Based on several observed events, the benefits of this approach, and the different characteristics of the two radar networks are discussed. As a diagnostic parameter, the Shannon information content is derived. It is found that, as a consequence of its linear arrangement, the CONDOR network is more sensitive to meridional winds over the line connecting the stations, and more sensitive to zonal winds in two patches of enhanced sensitivity parallel to this line.

It is shown that both radar networks are capable to resolve the counter-rotating vortices of breaking gravity wave events that are important for the excitation of secondary waves, which is currently a hot topic in atmospheric dynamics. Horizontal wavelength spectra are derived, and the impact of a minor sudden stratospheric warming in December 2019 is investigated in a keogram analysis.

Overall, the paper is very well written and fits in the scope of AMT.
Publication of the paper in AMT is therefore recommended after addressing my minor comments.

MAIN COMMENTS:

(1) The difference between the absolute wind speeds in Fig.4, left, and Fig.4, right, should be calculated and discussed. This difference can be used as further diagnostics and measure of errors.

(2) The Data Availability section of the paper is missing.

SPECIFIC COMMENTS:

(1) I.29: The reference de Wit et al. (2017) should be included here as an earlier reference for the occurrence of secondary gravity waves over South America.

de Wit, R. J., D. Janches, D. C. Fritts, R. G. Stockwell, and L. Coy (2017),
Unexpected climatological behavior of MLT gravity wave momentum flux in the lee of
the Southern Andes hot spot,
Geophys. Res. Lett., 44, 1182-1191, doi:10.1002/2016GL072311.

(2) I.37: There are also imaging satellite instruments that provide spatially resolved 2D, or even 3D observations of gravity waves. These should be mentioned here:

Randall, C. E., et al. (2017),
New AIM/CIPS global observations of gravity waves near 50-55 km,
Geophys. Res. Lett., 44, 7044-7052, doi:10.1002/2017GL073943.

Ern, M., L. Hoffmann, and P. Preusse (2017),
Directional gravity wave momentum fluxes in the stratosphere derived from high-resolution AIRS temperature data,
Geophys. Res. Lett., 44, 475-485, doi:10.1002/2016GL072007.

(3) Caption of Fig.4 is incomplete. Suggestion:
...Cluster and a Cartesian geographic grid.

->
...Cluster using a Cartesian grid (left) and a longitude/latitude geographic grid (right).

(4) Fig.4:

Please show in an additional panel the wind strength difference between the two representations, and add some discussion. This would give the reader an impression of the robustness of the results. At least in the regions of high measurement content the differences should be small.

(5) Fig.5: Please comment!

Is this a typical event, or a particularly strong event?

(6) I.354: Please add this information:

Do you assume vertical wind to be zero for the data assimilation mode?

(7) Caption of Fig.8 does not match the figure!

Shown is the measurement response, not the wind fields.

(8) I.408/409: Here you state that gravity wave activity would be enhanced at 69-70N.

Please be more specific!

Does this statement refer to Fig.10 where stronger variability is seen in the two panels on the right hand side?

However, the left two panels are domain-averages and should therefore be much smoother, anyhow.

Or does this refer to Fig.11?

In Fig.11 the semidiurnal tide is the strongest mode of variability, and other fluctuations are difficult to see. Could you therefore provide some more guidance to the reader where exactly one should see this effect?

(9) Fig.14: Please add information!

The wind fields are very different. Please state whether this is an effect of the semidiurnal tide.

(10) Fig.14: Question: are the "92km" for the upper left two panels wrong?

Should it read "90km"?

(11) The "Data availability" section is missing!

TECHNICAL COMMENTS:

caption of Table 1: "ALO" does not belong to the Nordic meteor radars.
Nordic meteor radars -> Nordic and ALO meteor radars

I.251: to included -> to include

I.418: periodigrams -> periodograms ???
(periodograms is rarely used)

I.486: Peruvian -> Peruvian