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Atmospheric Measurement Techniques Discussions

Interactive comment on "Advanced hodograph-based analysis technique to derive gravity waves parameters from Lidar observations" *by* Irina Strelnikova et al.

Anonymous Referee #3

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Advanced hodograph-based analysis technique to derive gravity waves parameters from lidar observations Irina Strelnikova, Gerd Baumgarten, and Franz-Josef Luebken

The paper investigates the use of a hodograph analysis for the detection and characterization of gravity waves in the middle atmosphere. The study employs 30-70 km lidar wind and temperature profiles that were acquired by Rayleigh lidar over 2.5-days of nearly-continuous measurements. The combination of this analysis and this data set provide a unique opportunity to both characterize gravity waves as well as provide a basis for understanding gravity wave retrieval methods and physical interpretations from other measurements. The study should be of interest to a variety of researchers

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Discussion paper

interested in detection, characterization, and interpretation of atmospheric waves from observations.

The paper is suitable for publication in the discussion forum. However, I have some specific comments that I hope the authors address as they undergo subsequent peer-review.

1) GW Polarization The authors present gravity-wave polarization relations, relating zonal and meridional wind fluctuations (Eqn 2), and temperature and zonal wind perturbations (Eqn 3). In equation 3, the authors claim to use the follow Hu et al., 2002 (Hetal02) and Geller and Gong, 2010 (G&G10). In Hetal02 the authors have a (1/2H) term added to the (I'm) term. In G&G10 the authors suggest that their derivation of a polarization relationship relating relative temperature perturbations to pressure perturbations is based on the assumption that the relative temperature fluctuations are identical to the relative potential temperature fluctuations. Do the authors know how these relationships compare to the formulation based on the ideal gas law that relates relative pressure, density, and temperature perturbations directly? If the authors find insignificant differences, particularly for the inertia-gravity waves in this study, then they could explicitly state that.

2) Intrinsic and Observed Frequencies The authors have complete wind measurements that allows them determine both the observed and intrinsic frequencies of the waves. Can the authors add the observed frequency of the waves to the list of results for the three waves in Table 1. In general, can the authors comment on the relationship between the observed and intrinsic frequencies for the waves they have characterized.

3) Identifying Waves The study reports 4507 quasi-monochromatic waves. However, if I understand it right the study has found 4507 snapshots of some number of waves based on hodograph analysis of $\sim$240 profiles. The authors discuss that the individual waves persist in their presentation of temperature fluctuations and intrinsic periods in Figures 10 and 11. Can the author quantify the life-time of the waves in the data

set? There have been discussions in the literature about how many gravity waves are present and the intermittency of gravity waves. This study has the opportunity to address the life-time of gravity waves, particularly relating it to the spatial and temporal scales of the waves, that would address a variety of questions about wave dynamics and evolution.

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