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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Are mean vertical velocities from PMSE a good representation of mean vertical winds?" *by* Nikoloz Gudadze et al.

Anonymous Referee #1

Received and published: 5 November 2018

General Comments

The paper addresses the issue of whether radars can measure the vertical wind in the polar summer MLT after compensating for the fall speeds of the ice particles responsible for the radar backscatter.

While the paper is basically OK, it reads as if it is addressed to those who already know about the issues involved. A small increase in the length of the paper to provide more background material could lead to a broader readership. For example, measurements are reported for two summer seasons using the so-called MAARSY radar located in Andoya, Norway. Nowhere, however, is the MAARSY radar described, including the operating frequency. The reader should not have to go searching for such basic details.

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Discussion paper

The title of the paper could also be better expressed. Given that the aim of the paper is to show how the true vertical wind can be measured in the presence of the downward motions of the ice particles that dominate the radar backscatter, maybe the title might be better framed as “Can VHF radars at polar latitudes measure mean vertical winds in the presence of PMSE?” In that sense, the first two sentences in the Conclusions best encapsulate the motivations for the paper and it would help the reader if they were repeated up front in the Introduction.

The paper starts (p2) with an incorrect discussion of how the zonal wind structure in the MLT reverses sign. It does not occur through the gravity wave momentum deposition causing a direct “drag” on the zonal winds, with the meridional flow arriving as incidental by-product. It is just the opposite. 1. The eastward (westward) momentum deposition in the summer (winter) MLT drives a meridional summer-to-winter pole circulation. 2. This leads to rising (sinking) motions over the summer (winter) pole with consequential adiabatic cooling (heating). 3. Hence, the zonal-mean latitudinal temperature gradient in the MLT is reversed relative to that in the stratosphere and the zonal-mean zonal winds in the mesosphere change sign through the thermal wind relation. This section should either be modified appropriately or deleted entirely to avoid confusion.

Confusion can also occur through mixing the use of vertical motions and vertical winds. For example, in the caption to Figure 1 the blue and red curves are labelled as “weighted mean vertical wind velocities” when they are actually vertical motions strongly weighted by the sedimentation speeds of the ice particles, i.e. not the the vertical velocity of the neutral atmosphere. It is recommended that the terminology throughout the paper be corrected to ensure there is no misunderstanding of what is a vertical motion and what is a wind.

It is realised that English is probably not the first language of the authors, but the text needs considerable editing and proofreading to improve the readability. Definite articles such as ‘the’ are often used incorrectly, which sometimes makes reading and interpretation of the contents difficult.

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Specific Comments

P1, L12 “Disappearance” not “disappearing”?

P3, L15 Stoke’s drift.

L4, L21 Brackets required around Hoppe and Fritts, 1995b

P5, L27 I do not understand “vertical shear amplitude of 5 m/s”. Should this not be 5 s-1?

P8, L22 I do not understand the sentence starting “They found. . .” Is “continued’ meant, rather than “preserved”?

P9, L5 “threshold” rather than “point”?

P9, 14 “is” before “available”.

P9, L25 “reduced” rather than “slow down”.

P9, L26 “sediment due to gravity”

P9, L32 “Presenting”, not “pretending”.

P10, L5 Remove brackets around Berger and Lübken, 2015.

P10, L34 “downward motions” not “the downwelling”?

Figs. 2, 3 “Positive wind values correspond to”

Fig. 4 Do the 2D histograms represent “vertical wind measurements” or ‘vertical speed measurements?”

What do the dashed blue lines in Fig 4 represent?

Interactive comment on Atmos. Chem. Phys. Discuss., https://doi.org/10.5194/acp-2018-1037, 2018.

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