

***Interactive comment on “Seasonal variations in
the horizontal wind structure from 0–100 km above
Rothera station, Antarctica (67° S, 68° W)” by
R. E. Hibbins et al.***

Anonymous Referee #2

Received and published: 19 August 2005

GENERAL COMMENTS

This short paper presents an ingenious combination of radar, falling-sphere and radiosonde observations to derive a monthly-mean climatology of zonal and meridional winds over Rothera in the Antarctic from 0 - 100 km.

Studies such as this are important because, although the circulation of the polar mesosphere is poorly understood, it nevertheless plays an important role in the transport of minor species and in controlling the temperature of the mesosphere.

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The paper is mostly well written and clear in its presentation of the data and its use in constructing the mean-wind climatology.

The paper falls within the scope of Atmospheric Chemistry and Physics and is worthy of publication after a relatively minor revision.

I have only one significant concern, which relates to Section 4 and the use made of the results from that Section in later parts of the paper.

SPECIFIC COMMENTS

The presentation of results in Section 4 is rather confusing in places and needs more discussion to provide some context and to caution about the limitations of the comparisons made and the techniques used - a serious omission in the draft. Problems associated with MF radar observations at the upper heights mean that including data to 99 km is rather optimistic. Some measurements are compared against similar measurements made in the Arctic and some are not. The reasons for choosing to make or not to make Arctic/Antarctic comparisons should be stated.

In more detail, two particular omissions of Section 4 should be addressed. These are:

1. Comparisons with other Antarctic radars. The Rothera MF-radar results are compared to the observations made over Mawson (MF radar) and Molodezhnaya (meteor radar) described by Portnyagin et al. (1993) - but these are from 1984 - 1986 and 1967 - 1986, respectively (not mentioned in the text). There is a very real possibility that at least some of the differences identified are due to interannual variability. In this context it should be noted that Portnyagin et al. reported a significant year-to-year changes in annual mean wind over Molodezhnaya and other stations.

2. Comparisons are made between meteor-radar and MF-radar observations and the MF-radar observations are taken to 99 km. It is now well known that there can be significant differences between observations made by the two techniques and that these differences vary with height and season (see for example Manson et al., Mesopause

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dynamics from the scandinavian triangle of radars within the PSMOS-DATAR Project, Ann. Geophysicae, 22 (2): 367-386, 2004; Hocking W. K. and T. Thayaparan, Simultaneous and colocated observation of winds and tides by MF and meteor radars over London, Canada (43 degrees N, 81 degrees W), during 1994-1996, Radio Sci., 32 (2): 833-865, 1997). In particular, MF radars appear to record weaker winds than other techniques at heights above ~ 90 km. This effect may well account for the structure of the summertime zonal winds of Figure 2, where the strong wind shear evident at lower heights declines above ~ 90 km. Here we should note that Arctic observations made by a number of meteor radars suggest that - at least in the Northern hemisphere - the summertime shear continues upwards and that the winds are therefore stronger as one approaches ~ 100 km. The reasons for such differences are poorly understood, but the authors should mention that such problems exist and carefully qualify their observations as a result.

Comparisons are made with the Molodezhnaya results, I believe this system was a meteor radar operating without height finding. The winds recorded are therefore representative of the vertical distribution of meteors. Although this will be reasonably close to what would be observed with a height gate a few km deep centred near 95 km, there will inevitably be some differences. This should be mentioned.

Overall, this Section needs an expanded and more critical discussion.

A zonal wind climatology is given in Section 6. Why is a meridional wind climatology not presented?

MINOR POINTS

In Figures 3 and 4, are the error bars the standard deviation or the error on the mean? For making comparisons with the model, the error on the mean would be more appropriate.

The thin and sometimes overlapping lines of Figure 5 are rather hard to distinguish.

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The final note in Section 7 about gravity-wave fluxes over the Antarctic peninsula needs to be expanded or removed.

ACPD

5, S2174–S2177, 2005

Interactive comment on *Atmos. Chem. Phys. Discuss.*, 5, 4291, 2005.

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