

Interactive comment on “A long-term comparison of wind and tide measurements in the upper mesosphere recorded with an imaging Doppler interferometer and SuperDARN radar at Halley, Antarctica” by R. E. Hibbins and M. J. Jarvis

Anonymous Referee #1

Received and published: 13 July 2007

The comparison of winds and tides derived from different observations in the upper mesosphere and lower thermosphere (MLT) remains a still existing challenge up to now. Besides this general task, the authors of the submitted paper are dealing with additional issues. The most serious problems are caused by the use of one observation technique, namely the SuperDARN radar without real height information using a relatively broad vertical resolution around an assumed mean height. Additionally difficulties arise from measurements at very high latitudes. Finally, the large data sets have been used to estimate long term changes of winds and tides.

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Interactive Discussion

Discussion Paper

Generally, the paper is well organized in a straightforward form. The authors started very carefully with comparison of data rates, height regions, hourly averages and came then up to comparisons of daily mean values of winds and tides and finally to long term variations. However there are some weaknesses which have to be addressed before the article will be published in ACP.

Specific comments:

1) The authors should clearly specify the main aim of this paper. One of them is to take care applying and combining different techniques. The second question that comes up after reading the paper and must be addressed by the authors: How reliable are the winds in the MLT region derived from SuperDARN radar measurements which are primarily used to record coherent scattering from F-region plasma irregularities.

2) The description of the radars, especially of the SuperDARN radar is too short. Some parts are written twice, in the introduction (p. 6575, line 23-25) as well as in Sect 2.1 (page 6576, line 17-20), but more details on the resolution, meteor rates, averaged times, especially on the measuring volumes of both radars and their separation are necessary. I recommend to add a map of the observing geometry comparable to Fig. 2 in Arnold et al., (2003). Without additional literature like the above cited article by Arnold et al., it is hard to evaluate the data used in this paper. This problem concerns also to explain more precisely a) why the zonal component of the SuperDARN radar is noisier than the meridional component; and b) the possible effect due to the back lobe of the SuperDARN, which is mentioned at first in Sect. 4 on page 2582, line 1-2.

3) I recommend urgently to consider the following paper by Thayaparan and Hocking, "A long term comparison of winds and tides measured at London, Canada (43°N, 81°W) by collocated MF and meteor radars during 1994 -1999", JASTP, 64, p. 931 - 946, 2002. Here the authors are using a relatively large data set of two different radars and received conclusions partly similar to this submitted paper, however with larger differences in the meridional winds compared to the zonal component, vice versa to

the results presented here. Another reason to cite this paper is caused by the applied statistical methods for the comparison of two observational data sets with differing accuracies (for details see Hocking et al., Adv. Space Res., 27, 6-7, pp. 1089-1098, 2001) which may be superior to the here applied RMA method by Sokal and Rohlf (1981) assuming the errors in each technique are similar, which is obviously not the case here.

4) The comparison of hourly meridional winds results in a poor correlation in contrast to the daily mean meridional winds. Unfortunately, the authors speculate only that one possible reason for that poor agreement is caused by the different sensitivity of both radars to the gravity wave spectrum. Some more explanations for this statement are necessary. On the first view, as stated by the authors, the maximum of the correlation coincides with the maximum of the annual and diurnal variation of the IDI-echo occurrence, are there any reasons for that? How sensible are the correlation of hourly averages to the applied selection criteria, especially to variations of the necessary minimum number of echoes and of the thresholds of the echo's signal strength used for the averages and fits?

5) In general, the comparison of hourly values as well as of daily values of wind, semidiurnal and diurnal tides leads to the basic necessity to estimate statistical and systematic errors. The discussion of the poor agreement in the diurnal tides due to the diurnal variation of the number of echoes is a step in this direction. On the other side if the amplitudes of the tidal components (especially of the diurnal components at high latitudes) are small, than the comparison of amplitudes and phases will automatically result in weaker correlations.

6) Comparisons of hourly and daily values are made only for the meridional winds because the derived zonal wind components of the SuperDARN radar are noisier than their meridional component (see 2). But starting with the climatology and its discussion, the behavior of the zonal winds (6b and 7) is included without any additional explanations.

7) The discussion of differences of mean winds derived with both radars for years with high and low solar activity (Fig. 9) is very instructive. It is only questionable; whether Table 1 and Fig. 8 are still necessary, considering the author's opinion on page 6584, line 5, that detailed discussions of the long term trends are beyond the scope of this paper.

8) If there are only uniformly distributed statistical errors, than the long term measurements of both measurements should not differ of each other. If there are differences like those in the meridional wind climatology during the SH-summer months (Fig.9) then there are systematic errors and possible reasons should be discussed. One direct question arises here: Do the mean heights of the meteors depend from the solar activity? Other possibilities for the differences are the well known, but not shown here, stronger gradients of the winds during the summer months in connection with the uncertainties of the mean height of winds derived with the SuperDARN radar.

Minor remarks:

1. The statement in the abstract that climatology of the 12-h tidal amplitude and phase in both the zonal and meridional components derived from both techniques are in "excellent agreement" seems to be slightly overdrawn because figure 4 and 5 show only correlations coefficients up to about 0.4 for the daily amplitudes of the semidiurnal meridional component.

2. In Fig 6a) no HWM 93 meridional wind results are shown. If they are overlap (as mentioned in the Figure caption), then the authors must specify the corresponding component.

Interactive comment on Atmos. Chem. Phys. Discuss., 7, 6573, 2007.