Atmos. Chem. Phys. Discuss., 9, C5678–C5680, 2009
www.atmos-chem-phys-discuss.net/9/C5678/2009/

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Correlations of mesospheric winds with subtle motion of the Arctic polar vortex" *by* Y. Bhattacharya and A. J. Gerrard

Anonymous Referee #2

Received and published: 6 October 2009

The paper presents study of the relationship between mesospheric and stratospheric winds at high latitudes. Using two winters of data, the authors find a correlation between winds at these levels in the case of displaced polar vortex, and no correlation when polar vortex is not displaced. The authors suggest that further understanding of this relationship will be helpful for forecasting purposes. The issue of coupling between different altitude regions is a relevant and important topic, and the authors use unique mesospheric dataset to address it.

While I agree with the authors that it is an interesting problem and solutions are not easy, due to the lack of data in the mesosphere, I have several reservations about the

study. I hope they can be addressed.

My main concern is that the relationship between different altitudes is not clearly demonstrated. Yes, there is a correlation between mesospheric and stratospheric winds - but correlation between two datasets does not prove a cause-and-effect relationship. The authors need to demonstrate this relationship more clearly - if not with their own data, then at least through discussion of other datasets.

The figures are not visual and do not support authors' arguments as well as they should. For example, Fig.1 causes more questions than answers. The raw (20-mins) mesospheric winds show very large fluctuations for both years, 1995 and 1996, which could represent planetary wave activity or varying tidal amplitudes - or both. In addition, it is not clear if data is always taken at 85+/-5km (i.e. averaged over this altitude range) or the altitude of data varies within these limits. Why are the raw winds shown and how do they support the statements about the relationship between the MLT and stratosphere? To me, they just distract from the main topic of the paper. In addition, there is not enough information about the stratospheric winds. Does the figure show stratospheric winds directly below the mesospheric observations or is it zonally averaged wind? Is it combined in the same manner as mesospheric winds, i.e., both zonal and meridional components, or just one component?

On data analysis: as mesospheric data has periodic 12-h gaps, variations in either amplitude or phase of tides could result in large variations in raw winds and daily averaged winds. The statement on page 16554, lines 2-4, that "we assume that any tidal bias can be treated as random geophysical noise in the Erwin data series" is not sufficient to address this issue.

On Fig.2: as I understand, the figure is supposed to show the difference in polar vortex location between 1995 and 1996 and illustrate distortion and displacement of polar vortex in 1996. Again, this is not very clear on these spatial and temporal scales. There are periods in 1995 when polar vortex is distorted (Nov 25, 1995), and there

are periods in 1996 when polar vortex is directly below the Erwin instrument. It is not easy for the reader to grasp the sequence of events and compare it to the winds in Fig.1. I am not sure how to improve it though - maybe, just show regular and disrupted polar vortex on a larger scale, and provide time series of stratospheric parameters at selected location, with clear indication when exactly the polar vortex was not below the Erwin. This part needs more explanation/discussion.

The discussion part needs to be extended to demonstrate relationship between the winds. For example, the authors point to the period after Dec 7, 1996, saying "the mesospheric winds start to decrease and 2-days later (09 December 1996) the stratospheric winds start to increase". This is not enough to claim the relationship - the data in figure 1 have periods when both stratospheric and mesospheric winds increase or decrease. It is possible that time series with 2-day shift will demonstrate the point better, but current figures and discussion are not too convincing.

Minor points:

p.16553, line 1 - Accuracy of measurements is typically 1 m/s for a single observation.

What integration time was used to achieve this accuracy?

Interactive comment on Atmos. Chem. Phys. Discuss., 9, 16549, 2009.