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Atmospheric Chemistry and Physics Discussions



# *Interactive comment on* "Mean winds, temperatures and the 16- and 5-day planetary waves in the mesosphere and lower thermosphere over Bear Lake Observatory (42deg; N 111deg W)" *by* K. A. Day et al.

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Dear Referee 2,

Firstly, we would like to thank the referee for their suggestions about improving our paper. We have revised our paper in light of their helpful comments and comments. We feel that our paper is stronger as a result.

Specific comments Some climatology is presented for the prevailing winds. Parameters of the year-to-year variability were not estimated in spite of the fact that the authors

perform a comparison with the URAP model, for example. There are no estimations of parameters of the seasonal course. There are climatological models for the prevailing wind and tides. Therefore, it seems more consistent to study at first the prevailing winds and tides and then planetary waves. With only a few years of date available we do not think that it is meaningful to statistically anyalse the data to quantify the inter-annual variability. We have thus restricted ourselves to a more qualitative discussion of inter-annual variability and only high-lighted quantitative differences in a few cases, such as the strength of the monthly-mean meridional winds in summer. Nevertheless, we have expanded the text describing the inter-annual variability in the results section. P10 L25 to P11 L18

This paper does not include tides because we are planning a separate paper on tides and to include them here would make the paper very long.

For a given planetary wave (a given zonal wave number and a wave period) height-latitude distributions of temperature and wind perturbations are different. Therefore, it is not clear why one can expect significant correlations between oscillations in temperature and wind taken at one and the same altitude and latitude. Moreover, it is not clear why the oscillations in wind and temperature discussed in the paper are resulted from the same waves. There is no any discussion about it. At a particular latitude it would be expected that there should be a correlation between the wind and temperature perturbations from a particular planetary wave (e.g., the 16-day wave should cause simultaneous perturbations in wind and temperature etc.). In our study the wind and temperature fluctuations reported are of the same period and occur simultaneously and are therefore interpreted as signatures of the same planetary wave. P16 L-24

Another point is the use of the variance of the band-passed time series (Fig.6). During a SSW one can observe both a strong long-period oscillation and a sudden decrease and recovering of the prevailing zonal wind. A discussion is necessary whether one can consider the variance calculated in the last case as a proxy of the 16-day wave activity. The referee raises a very good point and we agree entirely. We have added



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a figure showing Sudden Stratospheric Warming events in the Northern hemisphere and discussed the implications that such events have on damping planetary-wave variances by comparing Figure 6 with the SSW figure. P15 L20 to P16 L11 and a new figure, now figure 7.

The performed comparison with the URAP model does not look useful. This is in fact a comparison between zonal mean winds and local winds. The authors gave a few reasons for the differences. As a result it is not clear what can be inferred from this comparison. We have used URAP as a benchmark for comparing the data. The model is particularly useful as it is a relatively recent data set of homogenous observations and is easily available online. It provides a comprehensive reference description of the stratosphere and mesosphere. A particular advantage of URAP is that it is based on data from a single instrument.

Abstract "Our zonal wind observations.." It sounds a bit strange that the observations are more weakly eastward. We agree and the paper has been changed accordingly with the word '"weakly" removed.

Introduction The Brewer-Dobson circulation is a model of the hemispheric scale meridional circulation in the winter stratosphere with air moving upward in the tropics. Rossby waves of tropospheric origin dominate the wave driving of this circulation. The zonal-mean meridional circulation in the MLT region is primarily driven by gravity waves. The authors state that the Dobson-Brewer circulation implies a connection between the MLT temperatures and meridional winds. A corresponding explanation seems to be quite necessary. We agree and this has been expanded on in the paper introduction and discussion. P4 L4-11 and P20 L10-11, respectively.

Results P.30388. L.28. The authors states that the lag of about two weeks between meridional wind and temperature minima is seen. Please, provide a calculation of this lag and its error. It seems that 5-point time series is short for a definite conclusion. We agree and a further statistical analysis of the data has been carried out. This is de-



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scribed in the paper. Briefly, a correlation analysis of the meridional wind and temperature time-series has been carried out using a 16-day smoothing to remove the effects planetary waves (if we did not use this smoothing we would get correlation caused by the coherent wind and temperature perturbations of any planetary waves). A full description is given in the text. This analysis shows that, at least in the composite-year, there is no lag and the coldest temperatures occur at the same time as the strongest equatorward winds. Abstract, Results, Discussion and Conclusion changed, P1 L9, P9 L22 to P10 L12, P20 L14 and P24 L4, respectively.

P.30392 L.15 Please, explain the term “wavenumber” for the Morlet wavelet transform. We agree that more detail is required and an explanation and reference has been added to the text. P12 L6-7

P.30394 L.25 Please, clarify the height which was used for the correlation analysis. Why did the authors take the zonal winds for the analysis? Meridional winds seem to be more relevant for such an analysis. Are the correlations statistically significant? Can the authors calculate the correlations for the meridional winds? The height used was 90 km, this height was chosen because it is the height where most meteors are detected and so the wind data is most accurate. This has ben clarified in the text. Zonal winds were chosen when bandpassing the data as the 16-day PW is larger in the zonal than the meridional winds as seen in Fig. 6. The data has been analysied for the meriodinal winds and summary of the results have been added into the paper but the figures have not been add for space reasons.

P.30394 L.13-17. There are 16-day oscillations in Fig,6. in January of years 2009 and 2010. There is no winter 2008. We agree and the text has been adjusted.

P.30395 L.16. There is no sense to write about the zonal-mean amplitude for a wave of a particular zonal wavenumber. This explanation of the data handling has been rewritten to explain the method and temperature amplitudes with references to the method and other papers where it has been used.



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P.30398 L.4 Please, provide a reference about the measurement biases. Portnyagin et al. 2004 reference added.

Figures 4,5, 7-9 Please, provide reasons for the choice of the 90km height. See above, response to comment P.30384 L.25.

Please, provide errors for the wind and temperature values shown in the paper. We have not attempted to show uncertainties in all the figures because this would make many of them very confusing. However, the uncertainty in planetary wave amplitude when calculated using the method of Wu et al. is $\sim$ +/-0.6 K and the uncertainty in monthly-mean winds is generally less than +/- 1 m/s. This is now mentioned in the paper.

Thank you,

Kerry Day

Please also note the supplement to this comment:
http://www.atmos-chem-phys-discuss.net/11/C14559/2012/acpd-11-C14559-2012-supplement.pdf

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Interactive comment on Atmos. Chem. Phys. Discuss., 11, 30381, 2011.