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Interactive Comment

Interactive comment on "The climatology, propagation and excitation of ultra-fast Kelvin waves as observed by meteor radar, Aura MLS, TRMM and in the Kyushu-GCM" *by* R. N. Davis et al.

Anonymous Referee #2

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Manuscript #ACPD-2011-711 Review on "The climatology, propagation and excitation of ultra-fast Kelvin waves as observed by meteor radar, Aura MLS, TRMM and in the Kyushu-GCM" by authors R.N. Davis, Y.-W. Chen, S. Miyahara and N.J. Mitchell

This paper is an extensive study of the ultra-fast Kelvin wave (UFKW) of zonal wavenumber 1 (E1) observed in the neutral wind measured by a meteor radar at Ascension Island (8oS, 14oW) and in the temperature measurements from the Aura MLS instrument. Full 6 years of measurements between 2005 and 2010 are used for obtaining the climatological features of the UFKW. The observations are compared with

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the Kyushu-GCM and a good agreement is found between the observations and the model. The authors found a longitudinal dependence of the wave amplitudes that indicates some relation to the tropospheric convective activity however the detailed analysis did not reveal a clear link. The authors obtained also that the UFKWs make a small contribution to the equatorial eastward acceleration of the mean flow, as well as that the UFKW amplitudes and associated mean-flow accelerations vary with periods of intraseasonal oscillations (∼25-60 days). This study is based on three important components: (i) a GCM that provides predictions for the main features of the UFKW E1; (ii) satellite measurements with global coverage which provide opportunity for a detailed investigation of the spatial features of the UFKW E1, and (iii) single station ground-based measurements with excellent time resolution for studying the temporal variability of the considered waves. When the climatology of a given wave (with known period/period range and zonal structure) has to be studied the leading data set is usually satellite one; in this case the considered wave can be separated from the data and its vertical and latitude structures can be investigated in detail. When the main spatial features of the considered wave are determined then it is easy to search for such wave in the single station measurements. We have to take into consideration that the single station measurements are too complex; they may contain not only UFKW E1, but also E2, E3 and some westward waves with periods 2-3 days (as the authors considered waves with periods between 2.5 and 4.5 days), as well as low-frequency inertia-gravity wave components. I have feeling that the authors have just the opposite attitude to the data, pay more attention to meteor radar data and make conclusion for some feature if the satellite result confirms the meteor radar one. The topic of the paper is certainly very appropriate for the journal. This is a well written paper. The abstract adequately presents the obtained in the paper results. Therefore, I recommend this manuscript for publication after the response of my comments. I have two general and a couple of specific comments and questions below for the authors' consideration.

General comment: âĂć When a given wave has to be studied from observations first we have to prove that this wave is really present in the data. For this purpose we use

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spectral analysis. While the authors show some spectral results for the meteor radar measurements (Fig. 2, but this is only an example; this is not a climatological spectral result) they do not present such results for the satellite data. I strongly recommend the satellite results to start with period-wave number spectrum or function of wave period vs height (or latitude) E1 wave (similar to Fig. 3) obtained from all 6 years data. If you obtain a period-wave number spectrum, then you convince the reader from the beginning that such wave (UFKW E1) is really present in the considered data and the spectrum defines its prevailing period. When the prevailing period of the UFKW E1 for the considered period of time (2005-2010) is known then you can separate this wave from the satellite data for each altitude and latitude by using Wu et al. (1995) method and in this way you can find the latitude and altitude structures of the UFKW E1. As you are interested in climatological feature (this is written in the paper title) then the average, for the considered 6 years of measurements, latitude and altitude structures have to be calculated. The latitude structure has to prove that this is an equatorially trapped mode while the altitude structure has to indicate that this is vertically upward propagating wave with a given vertical wavelength. âĂć My second general point is only recommendable: I think that any data analysis paper in general needs a quantitative errors analysis. Least squares fitting approach provides an error estimate (see Bloomfield, P., Fourier Analysis of Time Series: An Introduction, 1976).

Specific comments: âĂć P. 6, Fig. 1: Probably the low-pass filtered red line is not necessary as the 3-4-d wave in zonal wind and ∼2-d wave in meridional wind are well outlined. Probably an example for Jul-Aug will be also useful because then the UFKW are particularly strong in the zonal wind (according to Fig. 5a) and the quasi-2-d wave are relatively weak in the meridional component âĂć P. 7, Fig. 2: As you are interested in climatology of the UFKW please, present mean spectra for the zonal and meridional winds calculated from all meteor radar data. As the meteor data have many gaps probably it will be better first to obtain the composite year data and then to calculate the spectra for both wind components. âĂć P. 9, last paragraph: how long window do you use for extracting the UFKW E1 from the data? âĂć P. 10, Fig. 9: Yes,

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this plot shows average, i.e. climatological latitude structure of the UFKW E1as it is obtained by averaging 16 events observed between 2005 and 2010. If you however carefully considered the latitude structure of the wave amplitudes at each altitude may notice that most of the amplitudes maximise not just over the equator, but at 5-10oN. This is an indication for a slight phase change with latitude therefore this is not purely equatorially trapped mode. âĂć P. 11, Fig. 10: I cannot understand well how the altitude structure of the phase can be obtained when the period is not fixed. The considered period range of 2.5-4.5 days is too large then at different heights you may consider different waves. âĂć P. 11, last paragraph: "……..are in months February and July-August,. . .." âĂć P. 17: paper Chen and Miyahara (2011) is not for UFKW E1; it is for fast Kelvin E1 wave s with periods between 6 and 10 days.

Interactive comment on Atmos. Chem. Phys. Discuss., 11, 29479, 2011.

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