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Atmospheric Chemistry and Physics Discussions

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.

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Reply to Referee 1

We would like to thank the editor Dr. Baumgaertner and the anonymous referees for their constructive comments. They were very helpful, and have contributed to strengthening the paper in many places. Two new figures have now been included in the paper as a result of the suggestions of the referees and so please note that some of the original figure numbers have changed; an updated version of the paper in ACPD format

has been included with this response for reference. A number of points were raised, which have been addressed as follows:

Referee's general Comment: Both the title and discussion mention the behavior of the UFKW in a general way but the analysis is entirely focused on waves with zonal wavenumber 1. Please give some comments about the motivation for this restriction.

Our response: We discovered early on in the investigation that UFKW in the MLT region occur at much greater amplitudes at eastward-propagating wavenumber 1 than at other wavenumbers and so chose to concentrate on the E1 waves. To demonstrate this, Figure 1 of this response (newly inserted into the paper as Figure 7) shows amplitude vs period for E1, E2 and E3 waves. This figure was obtained by splitting the Aura MLS temperatures collected within a 10 degrees latitudinal band centred over the equator into 18 sectors of 20 degrees longitudinal width, and then subtracting the daily mean from each sector, so that a time series (in half-day steps) of temperature perturbations was produced for each longitudinal sector (i.e. similar to the data that was plotted in the Hovmoller figure). A 2D FFT was then taken of this data, which identifies the dominant frequencies (from the time domain) and wavenumbers (from the longitudinal domain). Spectra were obtained for multiple wavenumbers but the largest amplitudes were observed only for E1. The figure shows only E1, E2 and E3 for reasons of clarity. It can be seen in the figure that amplitudes at periods between 2.5 and 4.5 days are much greater for the E1 component than for E2 or E3. We thus restricted the paper's scope to E1 components of the UFKW since these have larger amplitudes.

Referee's minor Comments:

Referee's comment 1) (p. 29480, l. 11) Instead of profiles centred over the equator perhaps you mean maxima centred over the equator.

Our response: This has been corrected, thanks.

Referee's comment 2) (p. 29481) This is not required but it would be useful to include at least a few recent references about the waves that force the QBO. A couple of suggestions are included in the reference list.

Our response: Agreed, we have included the Kawatani (2010) reference in our introduction.

Referee's comment 3) (p. 29485, l. 20) Please be more precise about what is typical of all years. Also, Figure 2 shows only a half-year. Are results in the second half of the year also similar between years? Why do you show only 6 months?

Our response: The six months shown in the figure were chosen as a particularly complete interval of results. There are large datagaps in the second half of that year. We have expanded the text to explain that the intermittency and the reduced activity in April, May and June (when compared to January, February and March) is typical of all years.

Referee's comment 4) (Figures 2, 6a) Please annotate the axis to also show the period in days. This will make it much easier to find features mentioned in the text, which uses these units.

Our response: This has been done as requested.

Referee's comment 5) (p. 29486, l. 1) 'Meridional amplitudes can be significant'. It is clearer if the term significant is reserved for statistical significance. You could substitute large.

Our response: This has been substituted as requested.

Referee's comment 6) (p. 29486) Do you have an explanation for why the GCM amplitudes are more than an order of magnitude smaller than the observations?

Our response: The GCM figure is showing an annual average. When our MLS temperature observations were averaged in the same way the amplitudes were similar to those seen in the GCM, due to the intermittency of the Kelvin waves. This is now

mentioned in the text.

Referee's comment 7) (p. 29488, l. 20; caption to Figure 10) "highest height gate" The height gates have not been defined for MLS. Do you mean the MLS temperatures corresponding to the highest radar observations? Please clarify.

Our response: The Aura MLS temperatures are seperated into 34 height gates based on pressure levels; the gates of interest to this paper are centred at heights of approximately 51.0, 53.7, 56.4, 59.1, 61.8, 64.4, 69.8, 75.2, 80.6, 86.0, 91.3 and 96.7 km. This is now clarified in the text.

Referee's comment 8) I found Figure 18 cramped and hard to read even after blowing it up on my screen. It would be easier to read if you expand the panels in the abscissa direction.

Our response: This figure was reduced in size in order to fit its caption on the same page of the ACPD format of the paper. We expect the figure to be more legible when typeset for the final version of the paper. We will highlight this with the editor.

Thankyou again for your comments.

Please also note the supplement to this comment:
http://www.atmos-chem-phys-discuss.net/11/C14295/2012/acpd-11-C14295-2012-supplement.pdf

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

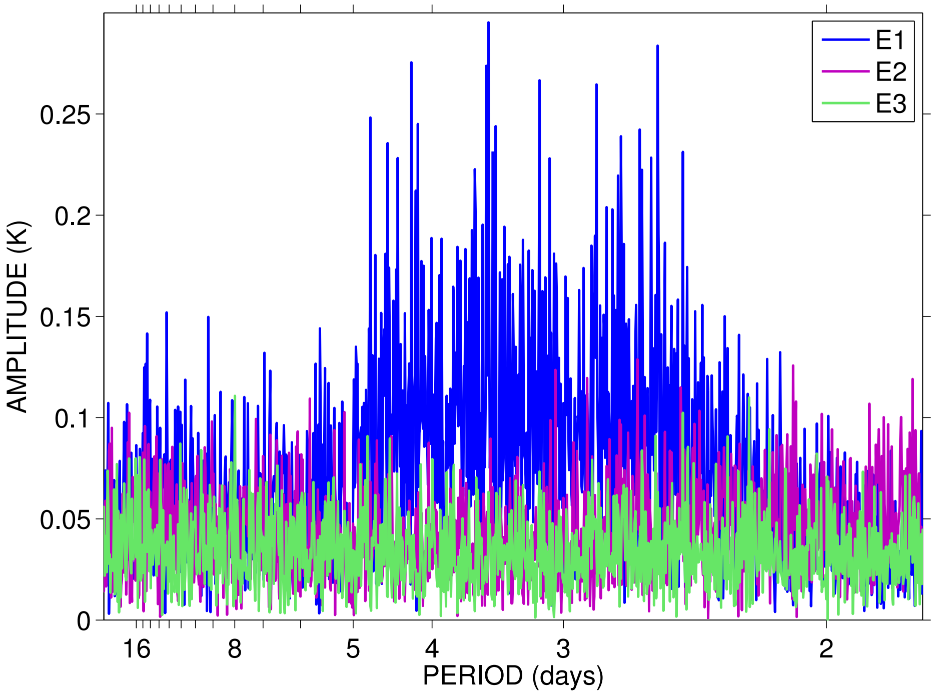

Fig. 1. Spectra showing amplitudes for E1, E2 and E3 wavenumbers resulting from a 2D FFT of the temperature perturbations as a function of time and longitude. The data are for a height of 97 km, 2005 - 2010.