Reply to the referee comments

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

Referee #1
We have significantly extended the data analysis in the paper with a particular focus on the interannual variability. The major changes we have made include the following:

1. We have replaced the URAP climatological wind with the actual UKMO winds for each month. Where no accurate long-term global observations exist of mean winds above the UKMO data set (i.e. the mesosphere) we have not presented winds at all. Winds are thus only used where we have an accurate measure of them.

2. We have calculated stratopause heights from the MLS temperature data throughout the data set, thus providing an accurate estimate of the stratopause height in the monthly means presented. The method used to calculate the stratopause height is that of McDonald JGR 2011 dio:10.1029/2010JD01479.

3. We have added an extra element to our consideration of interannual variability and inter-hemispheric ducting. In particular, we have examined the relationship between the amplitude of the wave in the winter stratosphere and that observed simultaneously in the summer-time MLT of the opposite hemisphere. As described in the text, a small correlation is evident.

4. We have clarified in the text where are results are novel.

To respond to the major points made by the referee we note the following:

We do not agree that the results are within already established knowledge. As we have explained in the paper the great majority of observations of the 16-day wave have been made by meteor and or MF radars at mesopause heights. The ability to measure the wave in the lower mesosphere and stratosphere allows us to examine its climatology and interannual variability in genuinely novel ways. If the referee is aware of work that presents similar results we would be very pleased to have it drawn to our attention.

With regard to the more minor points raised by the referee:

The size of Figure 8 (now known as Figure 7) has been increased and rearranged to make the figure clearer.

The analysis technique used has been explained in more detail with references and examples given of four other published papers where it has been used. We thus believe the analysis technique provides results which are robust.

The referee drew our attention to the effect of SSW's. We are particularly thankful to the referee for pointing this out and agree that we need to consider their effects. We have now added to our results a consideration of the impact of SSW and in particular their impact on the wave amplitude. We have also included references to a number of publications examining SSW impacts on the MLT, e.g. Chshyolkova et al. JASTP 2006.

The referee reminds us of the effect of SSW on stratopasue heights at high latitude. Again, we fully agree with the referee that this is an important consideration that we had overlooked. We have therefore plotted the stratopause height (determined as described above) on all of the appropriate figures. We have also redefined the height ranges we have taken to represent the stratosphere and mesosphere so that they are unambiguously within each region. We note that our original observation of a local wave amplitude minimum around the stratopause usually still stands.

As noted above, the UARS monthly-mean zonal winds have been removed and replaced by UKMO monthly-mean zonal winds which correspond with the data set from Aura.

Point 9 has been removed – we agree.

We have revised our analysis of the QBO modulation of the wave in the summer-time MLT. We now believe our results indicate no significant QBO modulation during the interval observed. We have rewritten the text to make this clear.

The referee asks about the different phase of the QBO in the stratosphere and mesosphere. We actually examined the correlation considering the QBO at heights from 10 - 70 hPa. However, we have chosen to present the results for 10 hPa because this level was used by Espy et al. GRL 1997 and Hibbins et al. JGR 2009 in their studies and so makes possible a direct comparison with our results.

The referee suggested shortening the introduction. We agree and have reduced it accordingly.

Referee #2
We have done significant further analysis of our data.

We agree with the referee that the URAP winds are not appropriate for use in this study. We have therefore replaced them throughout with UKMO winds for the appropriate month and year etc.

The referee asks whether our results indicate a summer-time maximum. We have clarified the description of our results to make it clear that they do not show a secondary maximum in the summer MLT, but rather show that the wave persists throughout the summer at MLT heights (e.g. Fig. 7). We have changed the text to reflect this.

We have completely redone the QBO modulation analysis.

The referee questions the length of the data set as a bases for investigation of QBO effects. We agree that a longer data set would be preferable, but MLT data sets are generally rather short (as, for instance, is the case with the observations of Espy et al. GRL 1997, Hibbins et al. JGR 2009 etc.). Nevertheless, were a strong modulation to take place it should still be detectable in the relativity short data set available. We therefore think this is an interesting subject to study.

The referee suggests using the UKMO data to study the QBO dependence. However, this is not possible because the reports of a QBO modulation relate to the wave in the summer MLT, which is too high to be accessible with the UKMO data.