We thank the **reviewer#1** for the useful suggestions to improve the paper. These comments are all valuable and very helpful for revising and improving our manuscript, as well as the important guiding significance to our researches. These changes in the revise manuscript have been **marked red** in the track changes version manuscript, as well as the point to point responses have listed as following:

General comments:

The work is a comprehensive analysis of atmospheric density based on several meteor radar measurements at various latitudes. It is the first study of this kind that provides a near-global view of mesopause density variations based on ground-based instruments. The analysis is thorough and the figures and presentations are very clear. The discrepancies with MSIS and WACCM are especially interesting and should motivate further research to understand them.

Response:

Thank you for your great comments. This will encourage us to improve our manuscript, as well as the important guiding significance to our researches.

Major comment:

One factor that could cause large seasonal variations is different heights the density is inferred from. Although the meteor radar data used are all from 85-95 km range, there is clearly seasonal variations of the vertical distributions of detected meteors, as shown in Figure 2(a). Thus the derived densities are weighted differently in vertical, which may introduce a 'false' seasonal variation. Please address this issue carefully so the comparison with MSIS and WACCM can be more appropriate.

Response:

The number of meteor echoes in vertical might influence the calculation of the ambipolar diffusion coefficients, but the influence is very small and should not cause a seasonal variation in vertical. First, we actually did compare the estimation of Da using different meteor detection in this study. As shown in Figure 2 in the manuscript, we have shown the estimation of Da by using two meteor detections with different number observed by the Davis 33 MHz and 55 MHz meteor radars. Although the number of 55 MHz meteor echoes is much lower than the 33 MHz meteor radar, it still provides a precise estimation of Da. In the manuscript, this indirectly indicates that the seasonal variations of meteor detections should not introduce a 'false' seasonal variation.

In addition, in this response, in order to estimate the bias in daily mean Da caused by the meteor with different numbers, we also estimated the Da using different meteor detections observed by the Mohe meteor radar. As shown in Figure R1a, the mean values of Da at 90 km estimated by using all, 1/2 and 1/4 of meteor detections are quite consistent. The linear correlation coefficients between all and half, and 1/4 meteors are 0.995 and 0.985, respectively. These results in above also indicate that the influence of meteor number is small and should not cause a seasonal variation.

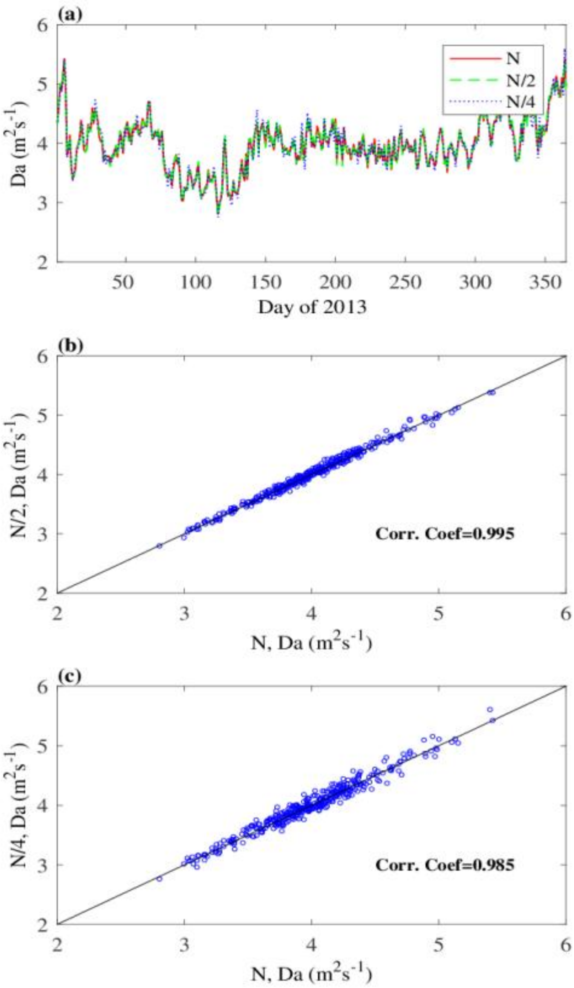

Figure R1. (a) Daily mean ambipolar diffusion coefficients at 90 km in 2013 estimated from the Mohe meteor radar. The red solid, green dashed and blue dotted lines indicate the mean values calculated by using all, 1/2 and 1/4 of meteor echoes in 1 km bin from 89.5 to 90.5 km, respectively. **(b)** Comparison of daily mean ambipolar diffusion coefficients at 90 km estimated from all and 1/2 of meteor echoes. **(c)** same as (b), but for 1/4 of meteor echoes.

Minor comments:

P2 L23: This sentence is confusing. How can a 'maxima of a yearly variation' still has 'temporal variation'? 'as the latitude decreases' seems to suggest the variation is with latitude, not time. Please clarify.

Response: Thank you for pointing this out. We have changed in the revised manuscript.

The sentence is changed as: The maxima of the yearly variations in mesopause densities have a clear latitudinal variation, across forward the spring equinox, as the latitude decrease; these latitude variation characteristic may relate to the latitudes changes of the gravity wave forcing.

P2 L28 (and other places). The 30-60 days oscillation found is similar to that of MJO, but there is no evidence in this analysis that it is actually due to MJO. It is only speculation so claiming that it is "related to' MJO is too strong a claim.

Response: Thank you for your suggestion, we have made a change in the abstract.

The sentence is changed as: In addition to the AO, the mesopause densities over low latitudes also clearly show an intraseasonal variation with a periodicity of 30-60 days.

In addition to the intraseasonal variations in Darwin density, as shown in Figure R2 and R3, we also find obvious intraseasonal variations in zonal mean wind observed by the Darwin meteor radar and the periodogram in density is consistent with zonal mean wind. However, this is beyond the scope of this paper, and a more detailed discussion of this intercomparison will be described in a forthcoming paper.

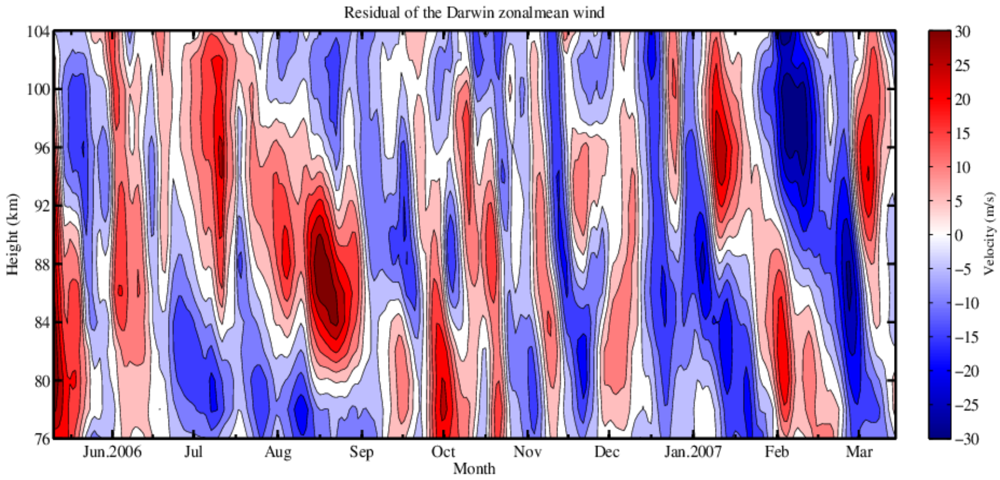

Figure R2. Residual of zonal mean wind observed from Darwin meteor radar.

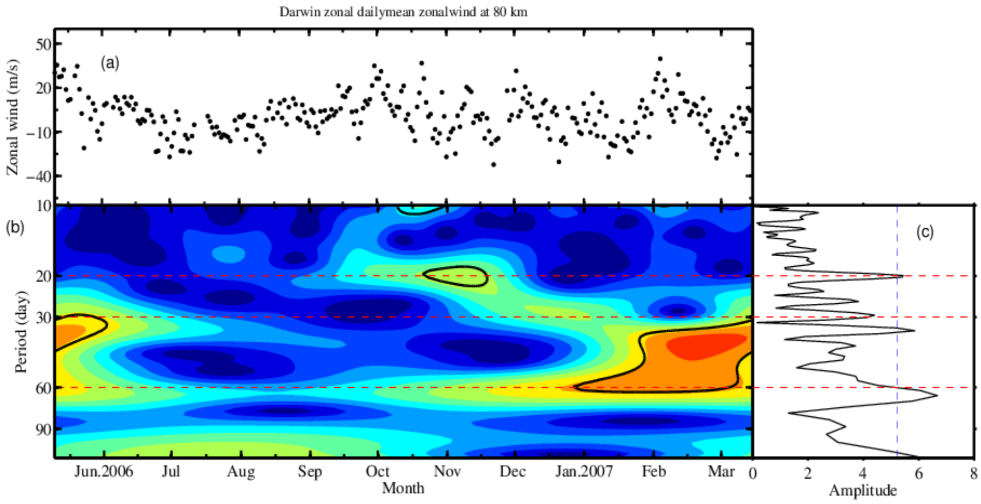

Figure R3. (a) Residual of zonal mean wind at 80 km observed by the Darwin meteor radar. (b) Wavelet power spectrum of the zonal mean wind. The black solid contours denote the regions of the wavelet spectrum above 95% confidence level. (c) Lomb-Scargle periodogram for the zonal mean wind. The blue dashed line represents the 95% significance level of the Lomb-Scargle periodogram.