

We thank the referees for the very useful suggestions for improving the paper. Our point-by-point responses to the referees' comments are detailed below in blue text, and the changes are shown in the version of the manuscript with track changes.

Response to the Reviewer #1:

Minor comments:

1. page 2, line 13 ... could be well fitted by the radars

This sounds strange. I would suggest: ... could be well observed by the radars ...

Changed.

2. page 2, line 14 unclear formulation:.... might be overestimated overestimated by the model or by the observations?

what is the reason for the overestimation? The data analysis?

It means that the three-point fitting results of non-migrating tides obtained from WACCM winds are larger than the whole longitudes fitting so the non-migrating tides derived by three meteor radars might be larger than real tides. The unclear formulation has been corrected in revised manuscript.

The reason for the overestimation might be the spatial aliasing that power from high wave numbers can leak into lower ones (Murphy et al., 2006). We have complemented the analysis of using three random longitudinal locations to decomposed tides, which shows that the overestimation of non-migrating tides by three-point fitting exists generally.

Murphy, D. J., Forbes, J. M., Walterscheid, R. L., Hagan, M. E., Avery, S. K., Aso, T., Fraser, G. J., Fritts, D. C., Jarvis, M. J., McDonald, A. J., Riggan, D. M., Tsutsumi, M., and Vincent, R. A.: A climatology of tides in the antarctic mesosphere and lower thermosphere, *J. Geophys. Res.-Atmos.*, 111, 1–17, <https://doi.org/10.1029/2005JD006803>, 2006.

3. page 2, line 18 unclear: ... slightly different ...

is it again an underestimation of the amplitudes by the model ?

Corrected. It should be the DE3 amplitudes in January-February are slightly different between CTMT results.

4. page 3 , line 13 : ... to fit migrating and ...

I think “fit” is the wrong formulation since the observations are not fitted to the sine waves. The sine waves are fitted to the observations! Here I would write:

... to derive migrating and ...

Thanks for your suggestion. These formulations have been corrected in the revised manuscript.

5. page 3, line 20 ... also demonstrated ...

better: ... also derived

Corrected.

6. page 3 Introduction: I am missing 1-2 sentences about the complementarity of tidal measurements from ground and space Why are ground-based observations necessary?

Thanks for your suggestion. We have complemented a few sentences about why the ground-based observations are necessary in revised manuscript.

7. page 7 line 15 ... zonal wavenumber greater than or equal to two cannot be considered ...

How can you derive SW2, DE3 and SE2 which have wavenumbers greater equal 2?

This is a formulation mistake, which has been corrected in revised manuscript. It should means that the tides with zonal wavenumber greater than or equal to two cannot be well decomposed with the function (2), while a least square fitting of longitudinal harmonic functions with preassigned zonal wavenumber to observations from different longitude (e.g. Murphy et al., 2006, function (1) in revised manuscript) could well decomposed migrating components and preassigned non-migrating components.

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Function 1:

$$\begin{aligned}
 u(z, \lambda, t) = & u_0(z) + c_{1,1}(z) \cos\left(\frac{2\pi}{T}t + \frac{2\pi}{2\pi}\lambda + \varphi_{1,1}(z)\right) \\
 & + c_{1,-3}(z) \cos\left(\frac{2\pi}{T}t - \frac{2\pi \times 3}{2\pi}\lambda + \varphi_{1,-3}(z)\right) \\
 & + c_{2,2}(z) \cos\left(\frac{2\pi \times 2}{T}t + \frac{2\pi \times 2}{2\pi}\lambda + \varphi_{2,2}(z)\right) \\
 & + c_{2,-2}(z) \cos\left(\frac{2\pi \times 2}{T}t - \frac{2\pi \times 2}{2\pi}\lambda + \varphi_{2,-2}(z)\right), \quad (1)
 \end{aligned}$$

where u represents either the zonal or meridional wind; z represents altitude; t represents time; λ represents longitude (rad); T equals 24 hours; u_0 represents zonal mean zonal wind; $c_{1,1}$, $c_{1,-3}$, $c_{2,2}$, and $c_{2,-2}$ represent the amplitudes of DW1, DE3, SW2, and SE2, respectively; $\varphi_{1,1}$, $\varphi_{1,-3}$, $\varphi_{2,2}$, and $\varphi_{2,-2}$ represent the phases of DW1, DE3, SW2, and SE2, respectively.

Function 2:

$$\begin{aligned}
 u(z, \lambda, t) = & u_0(z) + \sum_{n=1}^3 \sum_{s=-7}^7 c_{n,s}(z) \cos\left(\frac{2\pi n}{T}t + \frac{2\pi s}{2\pi}\lambda + \varphi_{n,s}(z)\right) \\
 & + \sum_{s=-7}^7 c_{4,s}(z) \cos\left(\frac{2\pi}{2T}t + \frac{2\pi s}{2\pi}\lambda + \varphi_{4,s}(z)\right), \quad (2)
 \end{aligned}$$

where u represents either the zonal or meridional wind; z represents altitude; t represents time; λ represents longitude (rad); n represents temporal wavenumber; s represents zonal wavenumber; T equals 24 hours; φ represents phase; u_0 represents zonal mean zonal wind; the second section represents tidal components comprising 24-, 12- and 8-hour oscillations; and the third section represents quasi-two-day oscillation components.

8. page 11 line 28 The CTMT is a 2-dimensional model

By the way it seems to be three dimensional (time, height, latitude)

Corrected.

9. Section 4 is quite long and covering different topics. I would make 2-3 subsections so that the structure of the discussion becomes more visible

Thank you for your suggestion. We have made 3 subsections (“Accuracy of the method used to derive tides”, “Comparing the observation results with the CTMT” and “Response of tides to the 2006 SSW event”) in the revised manuscript, and the discussion for the accuracy of the method has moved to “Data and Methods”.