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Interactive comment on “The diurnal and semidiurnal tides over Ascension Island (8 S, 14 W) and their interaction with the stratospheric QBO: studies with meteor radar, eCMAM and WACCM” by R. N. Davis et al.

Anonymous Referee #2

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Single-station observations of winds in the MLT, such as those reported here for Ascension Island, are becoming rather out-dated. Even though tidal parameters are compared with outputs from two climate models there is little attempt made to place the outcomes, particularly the QBO-related results, in a wider context.

A difficulty with the tidal amplitude and phase comparisons is the small size of the diagrams (e.g. Fig 7). The figures are cluttered and will be become even more so when reduced in size for publication. It would be better to show output for just four months representative for each season e.g. March, June, September, and Decem-

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ber. The comparisons themselves are interesting in that the model outcomes show quite different behaviour, especially for the diurnal tide. WACCM, in particular shows amplitudes that are too small and the behaviour with height that indicates interference between up- and down-going waves. For example, In August, the WACCM meridional component shows a node near 90 km and a corresponding 180-degree phase shift at this height. In the paper, these rapid phase shifts have been simplistically interpreted as representing tidal modes with short vertical wavelengths (Table 1). Similar comments can be made about the semidiurnal amplitudes and phases, where, for example, CMAM shows some evidence for modal interference effects (e.g. July). Presumably the presence of downward propagating modes in the models is the result of inadequate damping in the model thermospheres. Where interference effects are evident it is not possible to assign a single wavelength by just taking the phase difference between the upper and lower boundaries at 100 and 80 km. Complete revision is required.

Similarly, more nuanced discussions of the differences between observed and modeled amplitudes and phases and their behaviour with height are required. It is not surprising that there is considerable difference between the absolute phases (discussion on page 13); it would be surprising if there were not, since the forcing and propagation conditions in the models are different to those that pertain in the real world.

On page 17 in the discussion of the possible impact of the QBO on MLT tidal amplitudes it is not clear what pressure level is being used to define the phase of the QBO, although the caption to Fig 12 suggests that it is 10 hPa.

On page 18 the discussion is confusing of how the gaps in the observed tidal perturbations were dealt with. It is stated that seven-month running means were used to smooth out short-term perturbations but then it is indicated that at least four months of tidal amplitudes are required. I do not understand how these data lengths can be reconciled. How were the missing data handled, e.g set to zero or to the mean value?

It should also be remarked that high correlation does not imply causality, as is strongly

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implied on page 19. Fig 14 shows that the anti-correlation at 50 hPa is nearly large in magnitude as the positive correlation at 10 hPa and could just as easily imply a connection between the QBO winds at 50 hPa and the MLT tidal amplitudes. See also the discussion on p 24. Incidentally, on p 24 the word “effect” is used when I think it should be “affect” i.e The greater affect of the QBO on the meridional diurnal amplitudes compared with the affect on the meridional . . .”

Finally, there is insufficient critical discussion of the QBO-like variations in the diurnal tidal amplitudes. The AI meteor wind results appear to show an equal effect at both the March and September equinoxes, whereas both ground-based (e.g. Vincent et al, 1998) and satellite measurements (e.g. Burrage et al, 1995 and Xu et al, 2009) show a pronounced effect only in March/April when the QBO is in its eastward phase.

Minor matters

There is an inconsistent use of geographic coordinates. In the main, degrees W are used, but on page 9 output from WACCM is given for degrees E. To avoid confusion it would be best to refer to coordinates in the same way.

Interactive comment on Atmos. Chem. Phys. Discuss., 13, 4785, 2013.

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