

Interactive comment on “Observations of lunar tides in the mesosphere and lower thermosphere at Arctic and middle latitudes” by D. J. Sandford et al.

Anonymous Referee #2

Received and published: 4 August 2006

General comments:

The paper presents long-term and homogeneous data sets of wind measurements in the upper atmosphere at middle (53° N) and Arctic (67° N) latitudes. Based on these data the seasonal variation of the characteristics of the lunar M2 tide (amplitude, phase) at middle and high latitudes is determined. The height-resolved data at Arctic latitudes provide also information about the vertical wave lengths. A convincing discussion emphasises the reality of the lunar M2 tide in presence of the stronger solar semidiurnal tide. The analysed data are carefully compared with other observations at high and middle latitudes as well as with model results.

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The paper improves the knowledge about the lunar tide in the upper mesosphere. The authors give credit to relevant publications. The paper is worthwhile for publication in ACP with minor changes.

Specific comments:

4646 – Data analysis: The first part of this section should be modified. The reference Muller et al. (1995) should be supplemented by a more recent reference (Beldon et al., J. Atmos. Sol.-Terr. Phys. 68,655-668, 2006) where the radar frequency of 36.3 MHz and location of Castle Eaton are explicitly stated. The description of the Esrange radar (Mitchell et al., 2002) should directly follow with a reference to Fig. 3 which presents the height distribution of the meteors detected at 32.5 MHz. The meteor layer peaks at about 90 km with a weak seasonal variation. This allows the direct conclusion that the winds derived with the UK radar at a slightly higher frequency are representative for a comparable height region centred at 90 km. The very indirect estimate of the height region of the UK radar using the tidal characteristics of the GSWM model has to be omitted.

4647, I8: Range and height resolution of the radar are mixed up. The range resolution of the Skiyomet radar is 2 km resulting in a slightly better height resolution of the individual meteor.

4647, I19: The reference C. Beldon, private communication can be replaced by the reference mentioned above.

4653–4654: The section about the determination of the vertical wave length of the M2 lunar tide requires revision. The determination of the vertical wave length should be done on the basis of reliable phase data alone. Irregular phase variations with altitude are obtained in case of low tidal amplitudes (about $<1\text{m/s}$). The November data are a good example for this behaviour. In addition, the 80-km height bin should not be used. In nearly all month the tidal amplitudes are very low. This is related to the low meteor count rates at 32.5 MHz at altitudes below about 82 km (see also Fig. 3,

Mitchell et al., 2002). The restriction to a smaller height range for the vertical wave length determination can result in a greater inaccuracy for larger wave lengths (60-100 km) or in missing data but this will be a better statement as to use the term localised vertical wave length.

The discussion of the comparison between model results and the Esrange observations is different from the data presented in Tab. 1. The observations do not show negative values in agreement with the dominant downward phase progression as shown in Fig. 7.

The restriction to reliable phase data will also improve the seasonal phase plots presented in Fig. 8. Here, the agreement between measurements and model data is worse in summer and not quite good as stated in 4654, l13.

4655, l19: The comparison with the Saskatoon/Adelaide data from Stening et al. (1994) should be restricted to the 90-km altitude as the MF radar observations at the height of 99 km are related to nominal heights which are influenced by group retardation resulting in less reliability of the data.

Technical corrections:

4647, l6: replace 'receiver' by 'receiving'

4648, l10: supplement 'component' after (north-south)

4650, l28: replace 'Stenning' by 'Stening'

4658, l12: replace 'has' by 'have'

4663: The unit of the vertical wavelength is missing.

4664: Caption of figure 1: change '17 years' to '16 years' (one year of data is missing in the period 1988-2005)

4667: The labels 'a)' and 'b)' are missing in figure 3 as used in the reference to this

figure on 4650, I10 and 4651, I1.

Parentheses in references are incorrectly used several times.

The year alone has to be set in parentheses at 4645, I8; 4646, I26; 4647, I4; 4648, I16 & I25; 4659, I14.

Interactive comment on Atmos. Chem. Phys. Discuss., 6, 4643, 2006.

ACPD

6, S2297–S2300, 2006

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