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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Satellite measurements of the global mesospheric sodium layer" *by* Z. Y. Fan et al.

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This is a nice paper and should certainly be published. I have just a few comments as follows:

The authors state that, from lidar measurements, maximum Na density occurs in April in the southern hemisphere. The 23 S measurements of Clemesha et al. (1979) show a broad winter maximum from May to August.

The authors refer to a "marked difference between the morning and evening profiles" and find that the layer is "strongly depleted" in the morning at 15 N to 30 S, mainly below 95 km. The lidar measurements from 23 S (Clemesha et al., 1982, 2002) show a predominantly semidiurnal abundance variation with maxima at around 0600 and 1800

LT. It is interesting to note that measurements made 20 years apart show substantially the same behaviour. This is very different to the satellite results so needs commenting on. A possible explanation for this difference might be related to the fact that the satellite measurements refer mainly to summer conditions whereas the lidar observations were restricted to winter. On the other hand, there is no evidence for an enhanced semidiurnal tide in winter at 23 S (see Batista et al., 2004).

In section 3 the authors state that the strong downward wind below 100 km predicted by the GSWM, and starting at midnight, should lead to a loss of O, H and Na at lower heights. This appears to be inconsistent with their earlier statement, with reference to high latitudes, that “Conversely, during winter there is strong downward transport...”. It is well known that Na concentration increases on the bottomside of the layer during winter at middle to high latitudes. I do not think the effect of a vertical wind is obvious - it will also depend on wind divergence and the pressure and temperature changes associated with the wind. Since the mixing ratio of O and Na increases rapidly with height, at first sight a downward wind would be expected to cause an increase in their concentration at lower heights. If you want to claim that the downward wind leads to a depletion of these constituents then I think you need to model it properly. Also note that at 23 S there is little change in the sodium below 90 km during the night.

A few minor points:

The authors say that “Figure 8 compares the monthly variation...”. This should be the “monthly profiles” or “month-to-month” variation (cf “diurnal variation” or “annual variation”).

It is stated that “the present data set are the first observations of the Na layer in the equatorial region.” This is not quite true, although they do represent the first extensive set of observations for the equatorial region. The first equatorial observations were presented in Clemesha et al. (1998).

“Conversely, during winter there is strong downward transport by the meridional wind...”

ACPD

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It is not, of course, the meridional wind that causes vertical transport, it is the convergence of the meridional component of the horizontal wind towards the pole which results in a vertical wind.

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