**Atmospheric
Chemistry
and Physics
Discussions**

Interactive comment on "A new time-resolved model of the mesospheric Na layer: constraints on the meteor input function" by J. M. C. Plane

B. Clemesha (Referee)

clem@laser.inpe.br

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This paper presents what is probably the most realistic attempt to date to model the atmospheric sodium layer in terms of its origin in meteor ablation and the subsequent interaction of the sodium with the ambient atmosphere. It does a good job of presenting the state of the art in terms of chemistry, including the recent discovery (by the author and his co-workers) that $NaHCO_3$ should not act as a sink for sodium because it is rapidly dissociated by solar UV, necessitating the re-introduction of loss by attachment to smoke particles, first proposed by Hunten. It also presents a good discussion of the conflicting estimates of meteor input. The paper is certainly worthy of publication and I have just a few comments, as follows:

Referring to equation 6 it is stated that "The second term represents the energy losses

due to heat capacity (i.e., vaporization, phase transitions, and heating)". In the equation presented there appear to be no terms for phase transitions and vaporization - only heating.

Again in equation 6, the radiative heat loss is given as proportional to the difference between the fourth powers of the particle temperature and the "ambient atmospheric temperature". Since the atmosphere at the relevant heights will be largely transparent to the wavelengths in question, it is not the ambient atmospheric temperature that is relevant, but the Earth's lower atmosphere for slightly less than 2p solid angle, and deep space for the rest. This will, of course, have little effect on the result, since the particle temperature is much greater than the "ambient" temperature.

Also in respect of the radiative heat loss, for small particles, where the particle radius is comparable to or less than the radiating wavelength - say from a few microns down - the radiative heat loss does not follow Stephan's law (see C. F. Bohren and D. R. Huffman, Absorption and Scattering of Light by Small Particles, Wiley, New York, 1983). The absorption/radiation efficiency of the particle will be highly wavelength dependent. For particle radii such that 2pR/l < 1 the radiation efficiency is much less than one. Ignoring this effect will lead to an overestimate of the heat loss from small particles and, thus, an underestimate of the temperature attained by them. As a result of this the statement that "for very small particles, the heat capacity term will be much smaller than the radiative loss term, in which case the meteoroid will not become hot enough to ablate." may not be true.

Finally, with respect to the ablation process, I wonder if it is correct to think of boiling off of the various components of the meteor? At 40 km/sec I should expect some sort of sputtering process to take place, rather than simple boiling.