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Atmospheric Chemistry and Physics Discussions

Interactive comment on "A new model of meteoric calcium in the mesosphere and lower thermosphere" *by* John M. C. Plane et al.

Anonymous Referee #1

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This is the latest in a series of papers, led by the University of Leeds group, which describe the results of global modeling of the meteoric metals. This paper addresses the detailed chemistry and modeling of mesospheric Ca and Ca+ using the Whole Atmosphere Community Climate Model (WACCM) developed at the U.S. National Center for Atmospheric Research. This is perhaps the most important test of these WACCM metal models as it explains quite convincingly the extremely low abundance of Ca relative to Na, as well as the seemingly contradictory large Ca+/Na+ ratio. Na and Ca have similar elemental abundances in chondritic meteorites but the measured Ca abundance in the mesosphere and lower thermosphere (MLT) is depleted by more than a factor of 100 relative to Na while the Ca+ abundance is depleted by less than a factor of 10. The authors show quantitatively that these contradictory observations are a consequence

of substantial differences in the ablation rates, ionization rates and chemical loss rates of Ca and Na. The detailed chemistry is described and the model is then compared with lidar measurements of Ca and Ca+ at Kühlungsborn and Arecibo and rocket measurements of Ca+ and Na+ at several sites. The agreement between the model and observations is impressive. This is an important contribution to our understanding of the metal chemistry and of the impact of dynamical transport on these species in the MLT.

The paper is succinct but informative and exceptionally well written. The figures are all essential and well crafted and the text is adequately referenced. I recommend the paper be published as is.

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