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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Metal layers at high altitudes: A possible connection to meteoroids" *by* J. Höffner and J. S. Friedman

Anonymous Referee #1

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Review of Metal layers at high altitudes: A possible connection to meteoroids J. Höffner and J. S. Friedman, Atmos. Chem. Phys. Discuss., 4, 399-417, 2004.

General Comments The authors present a study of the very topside of the meteoric metal layers (primarily K and Ca) to assess the role of meteors in the formation of the metal layers in the mesosphere. By focusing on the extreme topside of the metal layers (where metal concentrations are ˜ 1% of the peak layer concentrations) the authors present the thesis that meteoric input dominates the characteristics of metal layers above 110 km rather than the more complicated mixture of meteoric input, and subsequent chemical and dynamical effects at lower altitudes in the main body of the metal layers (˜80-100 km). Using a log (rather than linear scale) the authors show that the metal layer concentrations extend to higher altitudes in summer than in winter. The authorsŠ analysis draws on several extensive lidar data sets both comparing the metal

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layers of several species at one site and the metal layers between two sites. This thesis is an interesting and raises a variety of important questions about the formation of the meteoric metal layers.

Specific Comments or Questions 1. The authors do not present any discussion of the uncertainty in the measurements. From the potassium profile in Figure 1 the jitter in the profile above 105 km indicates that the atom density measurement is 2 +-0.5 at 110 km and 0.1 +- 0.04 at 115 km suggesting uncertainties in the atom densities of 25% - 40% in this altitude range. Can the authors assess how uncertainties of this magnitude will effect their analysis or at least include these uncertainties as error bars in Figure 4 ? 2. Is it significant that the potassium atom density on the extreme bottom side of the potassium layer at 75 km in Figure 1 is ˜0.3 atoms/ccm while the atom densities near 113 km are less than this ? 3. Sporadic (or sudden) metal layers are generally reported to be more common in summer than in winter. Can the authors assess how might impact the extension of the topside in summer. The authors note that sporadic metal layers in Ca are uncommon at altitudes above 110 km, However, the seasonal dependence of sporadic metal layers may indicate a change in the topside metal layer chemical equilibrium that is important to this study. 4. The authors claim that the small potassium maximum in January appears too be related to the morphology of the main layer. However, examination of the contour plots in Figure 2 suggests that while the observations at 54 deg N show a narrow summertime potassium main layer with an extended topside (and therefore a decoupled morphology) the observations at 18 deg N show a layer where the topside and main layer become extended together (a more coupled morphology). The authors could take more quantitative approach and show the altitude variation of morphology with altitude by plotting atom densities at progressively higher altitudes against the atom densities at the layer peak or showing the how the variation between different metals (Figure 4) varies with altitude. 5. For completeness could the authors plot the Fe and Na data to show the enhanced topside. This would be of general value to the readers of the paper. 6. Discussion of Figure 3. Can the authors give some measures from the plot such as x% of the y enhancements

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correspond with meteor shows.

Minor and technical points 1. Perseids not ŞPerceidsŤ on page 5. 2. The authors might note the observation by Janches et al. 2003 of meteors arriving near 110 km earlier in the paper. 3. The title ŞMetal layers at high altitudesŤ gives the impression that the authors are discussing new and distinct metal layers above the mesospheric metal layers rather than the (extreme) topside of the mesospheric metal layers. The authors could include the word ŞtopsideŤ in the title to avoids this ambiguity. 4. The sentence ŞAlso, the seasonal variation of the incoherent-scatter radar measured micrometeor flux (Raizada et al., 2003) provides additional support for such a conclusionŤ, is not clear to this reviewer, the authors might clarify this statement. 5. Is the meteor shower list of McKinley (1961) truly definitive or are there more recent compilations of meteor showers ?

Interactive comment on Atmos. Chem. Phys. Discuss., 4, 399, 2004.