EXOSPHERIC SIGNATURES OF WATER INTERACTION WITH THE LUNAR SURFACE. D. M. Hurley[1], P. Prem[1], M. Benna[2], W. M. Farrell[2], R. R. Vondrak[2], A. R. Hendrix[3], and P. G. Lucey[4], [1]Johns Hopkins University Applied Physics Laboratory, [2]NASA Goddard Space Flight Center, [3]Planetary Science Institute, [4]University of Hawaii.

Introduction: The theory of migration of water to lunar polar regions preceded the Apollo program. Migration of water through the lunar exosphere, if an efficient process, could be a significant source of water to the cold traps at the lunar poles. However, whether the lunar exosphere is a significant pathway for delivering water to lunar cold traps is an unanswered question.

Previous water exosphere measurements from LADEE NMS were not spatially resolved. Crucially, revamped measurements of water in the lunar exosphere are critical to understanding if water migrates. These measurements should provide spatial and temporal resolution of the water exosphere to disentangle latitude, local time, and temporal variability of sources.

Model: We present modeling results that connect potential future measurements of water in the lunar exosphere to the sources, including meteoroids and solar wind. We simulate the effects of different activation energies for desorption on the spatial distribution of the lunar water exosphere.

We also present source rates of water that correspond to the upper limit determined by the LADEE NMS instrument. Only a small fraction of the volatiles available are needed to supply the exosphere at the present upper limit, suggesting that conversion to water and release in the exosphere is a minor pathway.

Discussion: The local time distribution is indicative of the source if water is in the paradigm that migration is limited to a single hop. On the other hand, if migration is efficient then the local time distribution reflects the effective properties of the surface interactions. In all cases, comparing data when the Moon is in the Earth's magnetotail to times when it is in the solar wind can quantify the source rate from solar wind. Data from predawn is useful for quantifying the meteoroid source rate. Corresponding measurements of adsorbed water/OH concentration on the lunar surface would provide strong support for exospheric measurements.

Conclusion: Coordinated exosphere measurements and measurements of hydration adsorbed to the surface would provide a powerful corroboration to the picture painted by the exosphere alone. Thus, measurements of the surface hydration that can be decoupled from thermal and photometric effects are important.

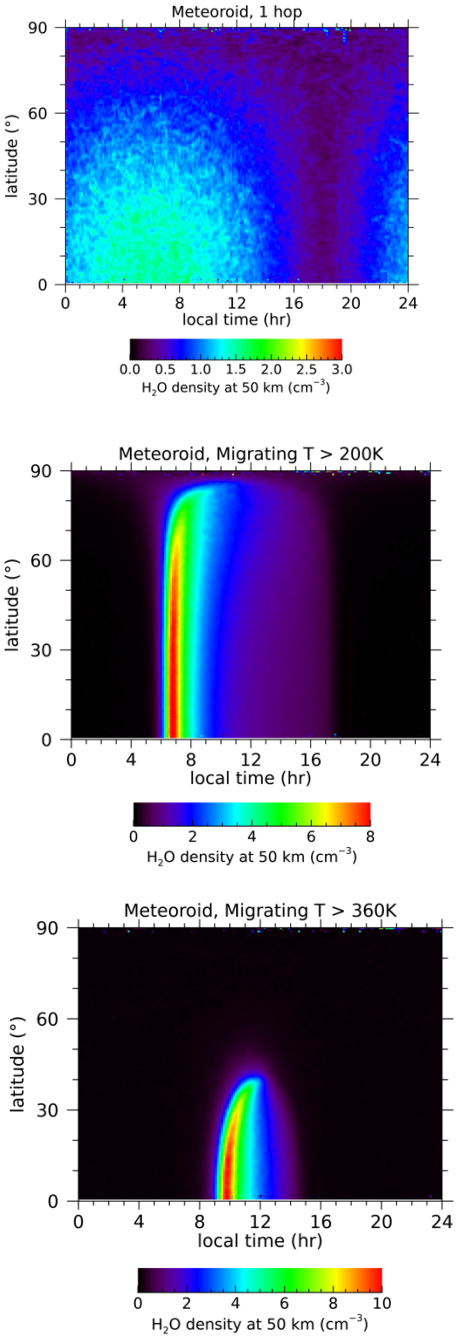

Figure 1. Several model runs are shown for different assumed activation energy.