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Surface-atmosphere interactions on Mars

M. D. Paton (1), A. –M. Harri (1), T. Mäkinen (1), H. Savijärvi (2) O. Kemppinen (1) and A. Hagermann (3)

(1) Finnish Meteorological Institute, PO Box 503, FIN-00101 Helsinki, Finland (2) Department of Physics, University of Helsinki, PO Box 503, Finland (3) Department of Physical Sciences, the Open University, Milton Keynes, UK

Abstract

Understanding the nature of the Martian surface is required to help explain the variation of volatiles and dust observed in the atmosphere, e.g. see [1]. The surface of Mars is mostly covered in a porous sandy-type regolith that allows variety of heat and mass exchange processes to occur between the surface and atmosphere. The thermal properties of the Martian subsurface plays a key role in rate at which these processes occur and the thermal properties may change over time due to the exchange of volatiles with the atmosphere. In-situ measurements are necessary on planetary bodies to provide ground truths for remote observations, to conduct focused investigations on local scales and working as a network to investigate large scale phenomenon and their relation to local scale physical processes [2].

1. Introduction

The Viking 1 lander arrived on the surface of Mars in 1976 and continued to operate for over three Martian years. During this time it took continuous measurements with its meteorological instruments, together with a temperatures sensor, located on its footpad close to the surface. Here we use a 1-D atmospheric column model (Uni. Helsinki/FMI) with an updated realistic subsurface numerical thermal conductivity scheme that includes composite materials (e.g. dust-rock layers) and temperature dependent thermal properties [3]. Viking 1 surface and near surface atmospheric measurements are compared to the model to constrain the physical properties of the surface material at the Viking lander 1 site and to help understand the role of the Martian surface in surface-atmosphere interactions.

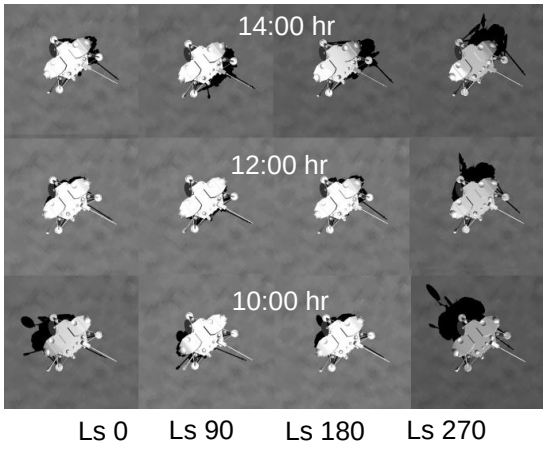

Figure 1: An aerial view of the lander at different seasons and different times of the day. The footpad sensor under consideration is located at the top right corner of the lander.

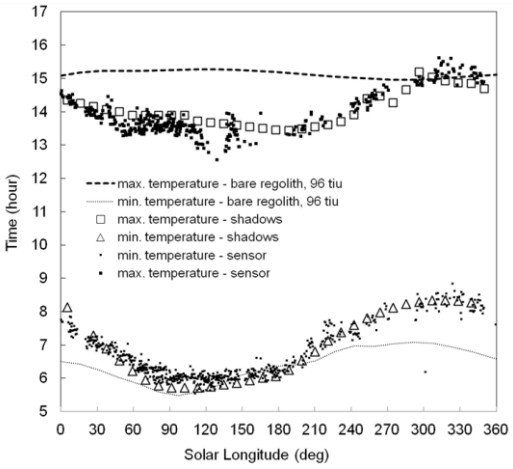

Figure 2: Predicted times for daily minimum and maximum temperatures at a depth of 15 mm using our 1-D model compared with actual times derived from the sensor measurements.

References

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