A 3D Thermal Model for Lunar Surface Using COMSOL Multiphysics® Software: Validation and Results

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Abstract

A comprehensive three dimensional finite element thermal model has been developed using COMSOL Multiphysics® software to understand the thermo-physical behaviour of the uppermost regolith layer of the moon. The model can simulate variable layers, layer thickness and dimensions and can account for complex geometry, different size, irregular meshing, parametric based variation in physics and boundary conditions. The model assumes heat transfer phenomenon in solids and porous media with conduction and radiation as the modes of heat transfer representing a situation similar to that of the lunar regolith. The model results have been compared with experimental results conducted on analogous soil under simulated lunar environment. Within experimental uncertainties, the model results are in good agreement with that obtained from the experiment. The model results have also been validated against in situ data from Apollo missions and the earlier models and the results are consistent. Description of the model, experimental setup for model validation and results will be presented.

Figures used in the abstract

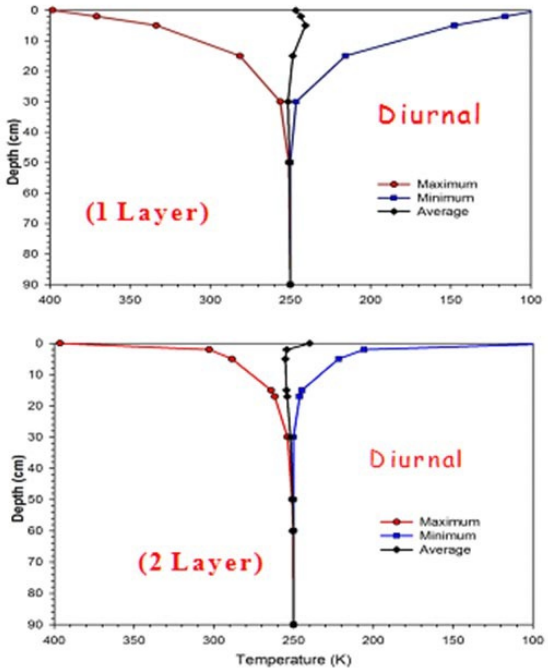

Figure 1: Diurnal Variation of Thermal Skin Depth for Lunar Equator obtained from the Model.