THERMAL INERTIA AT THE MSL AND INSIGHT MISSION SITES ON MARS

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Abstract:

For planetary surface materials, thermal inertia is the critical property that governs the surface's daily thermal response and controls the diurnal and seasonal surface temperature variations. Here we use the ground measurements made by the MSL Curiosity rover and the InSight lander to determine the thermal inertia of two sites on Mars. This study compares the variation of thermal inertia during and after the Large Dust Storm (LDS) of Martian Year (MY) 34. We derive a simple approximation (using energy balance), which utilizes surface albedo, surface energy flux, and diurnal change in the surface temperature for the surface thermal inertia determination. The average thermal inertia in MY34 is about 39.2%, 3.7%, and 3.4% higher than MY35 average thermal inertia for the MSL, InSight (FOV1), and InSight (FOV2), respectively. The thermal inertia at the InSight (FOV1) is consistently lower by about 20 J m–2 s$^{-1/2}$ K^{-1} than the InSight (FOV2) site for all scenarios, indicating notable variation in the region's surface composition. The best-fit surface albedo in MY34 (determined using the KRC model) are about 0.08, 0.05, and 0.03 higher than MY35 surface albedo for the MSL, InSight (FOV1), and InSight (FOV2), respectively. An increase in both surface albedo and thermal inertia during the LDS indicates that the underlying surface is both more thermally resistant and more reflective than the overlying loose dust.

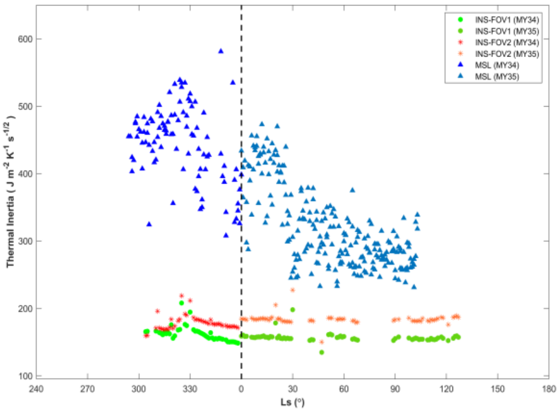

Figure: Estimated thermal inertia using derived formulation and observed surface temperatures. The black dotted line indicates the boundary between MY34 and MY35.

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