Determination of Potential Localized Dust Sources and Sinks in Elysium Planitia, Mars

Janus Kozdon, C.S. Edwards

Physics and Astronomy Department,
Northern Arizona University

Introduction; Thermal Emission Spectrometer (TES)

Surface differences are observed
Due to the dust cycle

Increase = more dust
Decrease = less dust

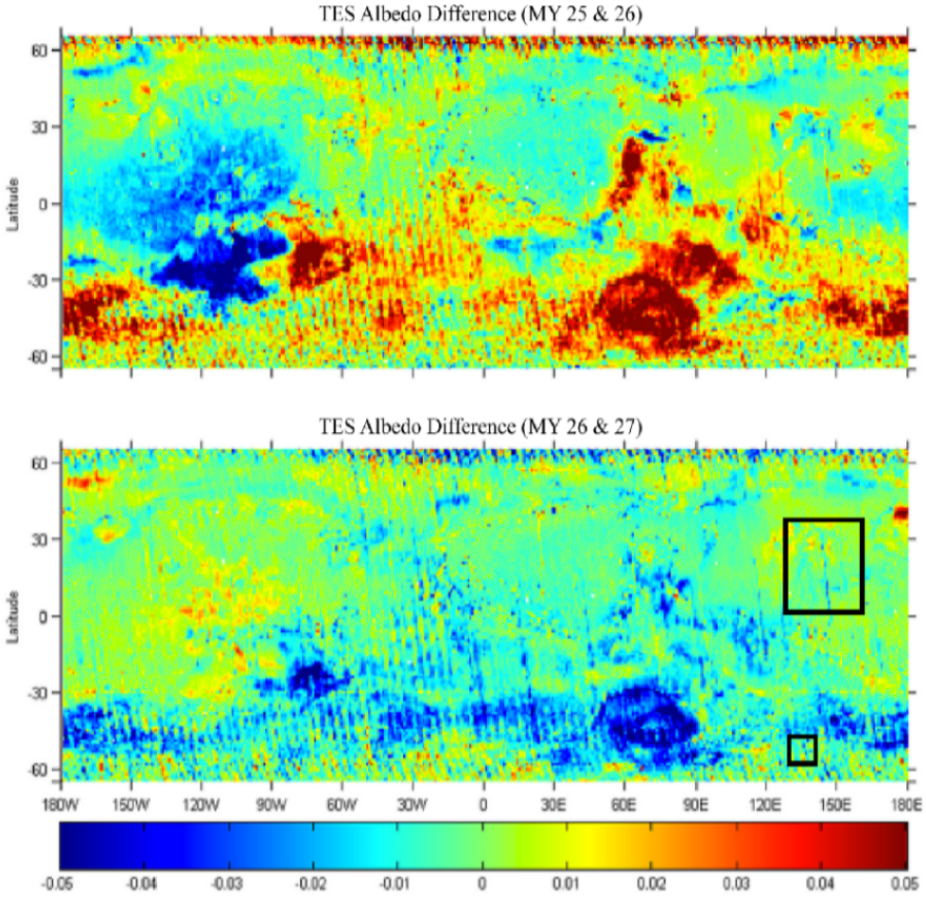


Fig 1. Global maps of Mars albedo changes from TES data between MY 25/26 and 26/27. Boxed areas are the regions of interest (Szwast et al. 2006).

Introduction Mars Climate Sounder (MCS)

Temperature Changes
Higher = less dust
Lower = more dust

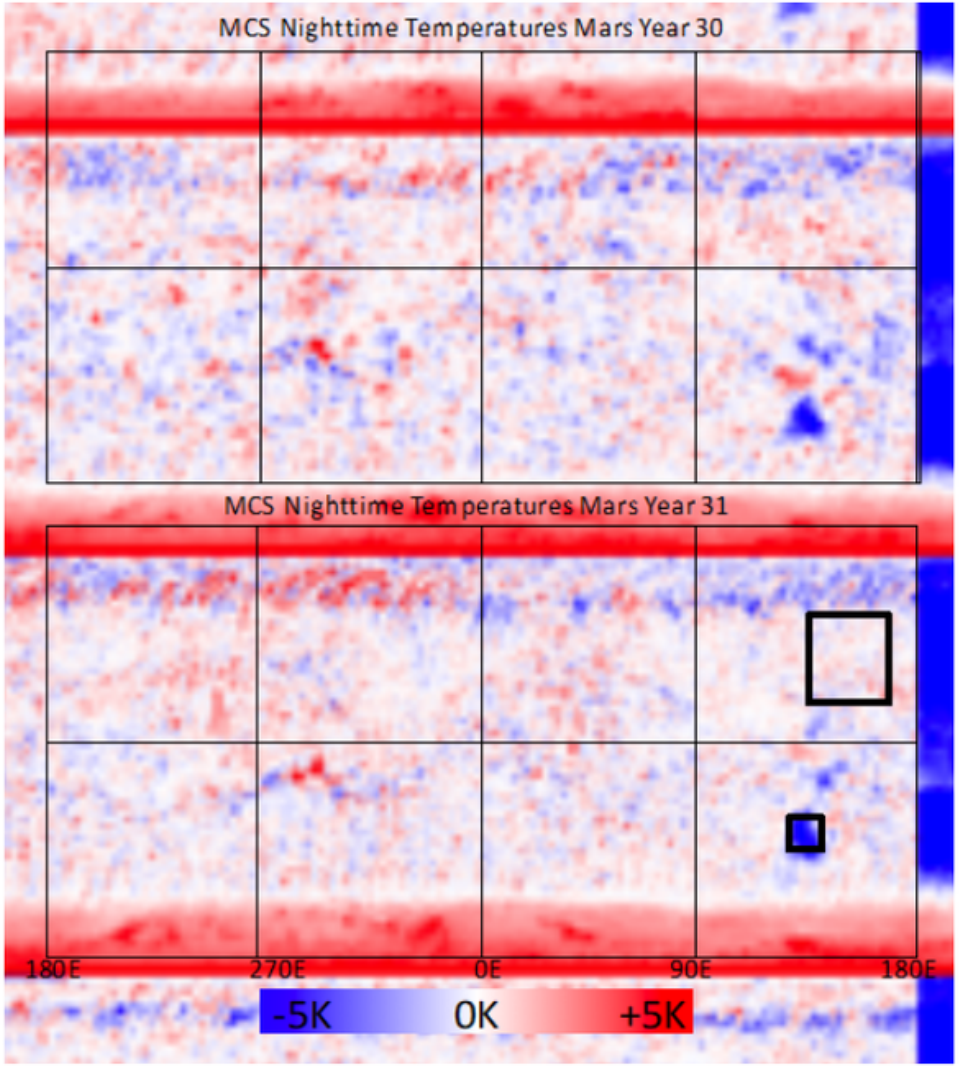


Fig 2. Global maps of Mars nighttime temperature from MCS data between MY 30 and 31. Temperature differences from the median 3AM temperatures are shown.

Does dust have an Effect?

0.01cm thick of dust can cause ~1-2K difference
It does have a considerable effect
Temperature differences can be correlated to differential dust thicknesses

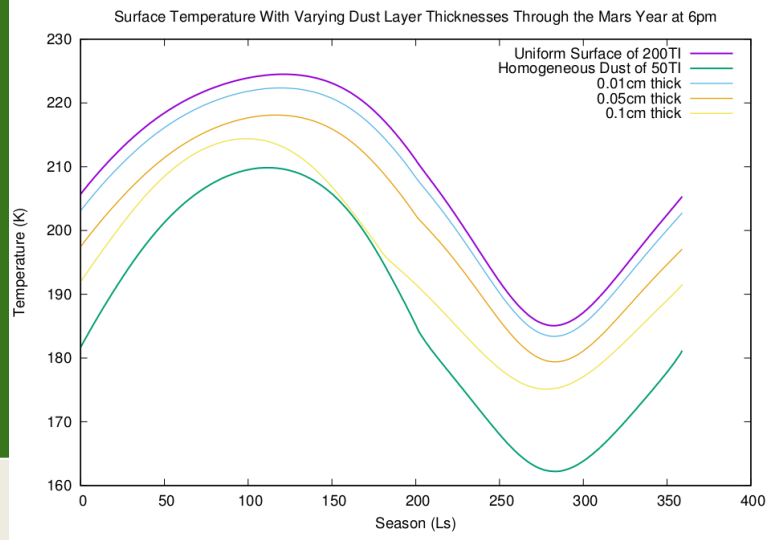


Fig 3. (top)
Plot illustrating the effects of homogeneous dust (50TI) layers over a uniform Mars surface (200TI) over the course of a Mars year.

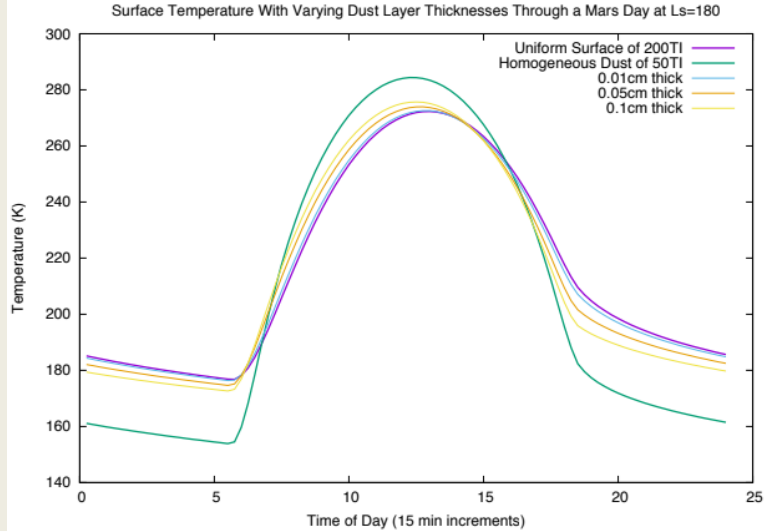
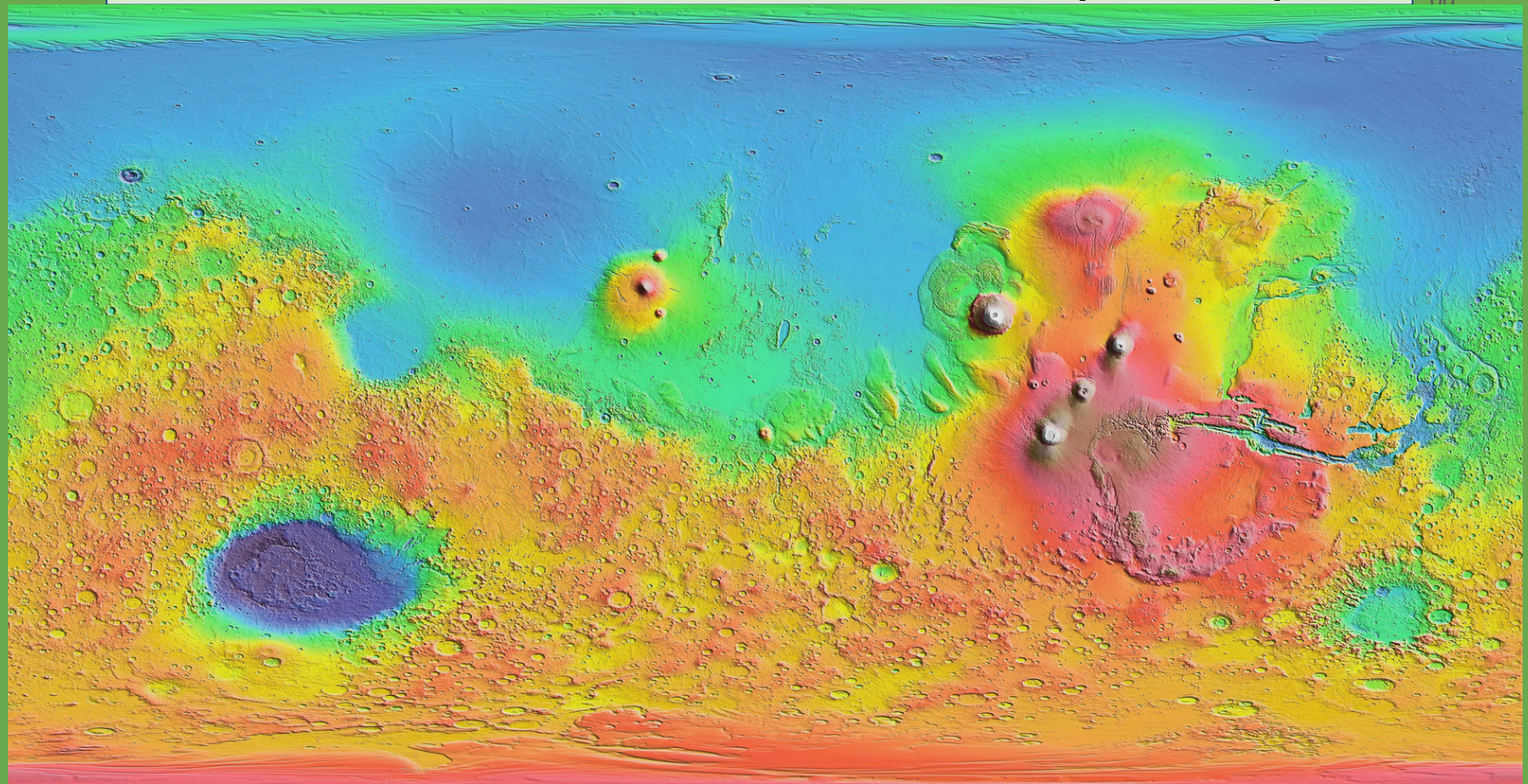


Fig 4. (bottom)
Plot illustrating the effect of homogeneous dust (50TI) layers over a uniform Mars surface (200TI) over the course of a Mars day

Geologic context

Mars Orbiter Laser Altimeter (MOLA)

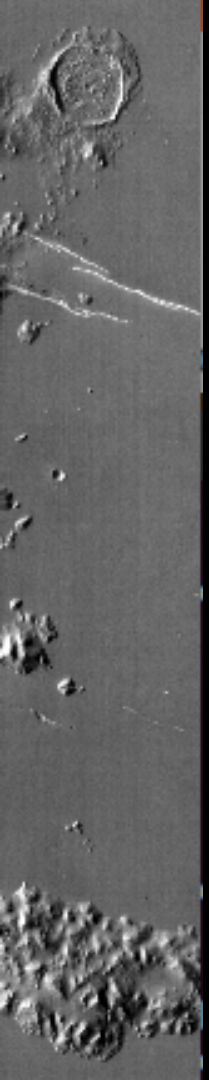
https://marsoweb.nas.nasa.gov/globalData/images/thumbnails/MOLA_cylin.jpg

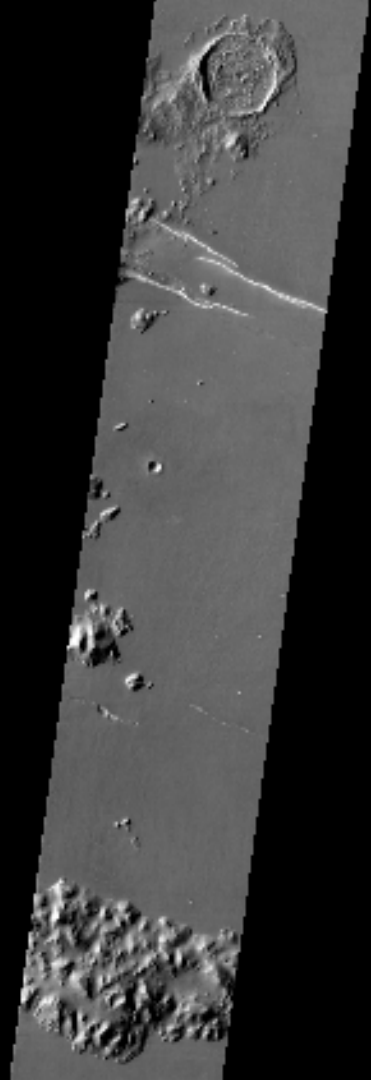


Methods

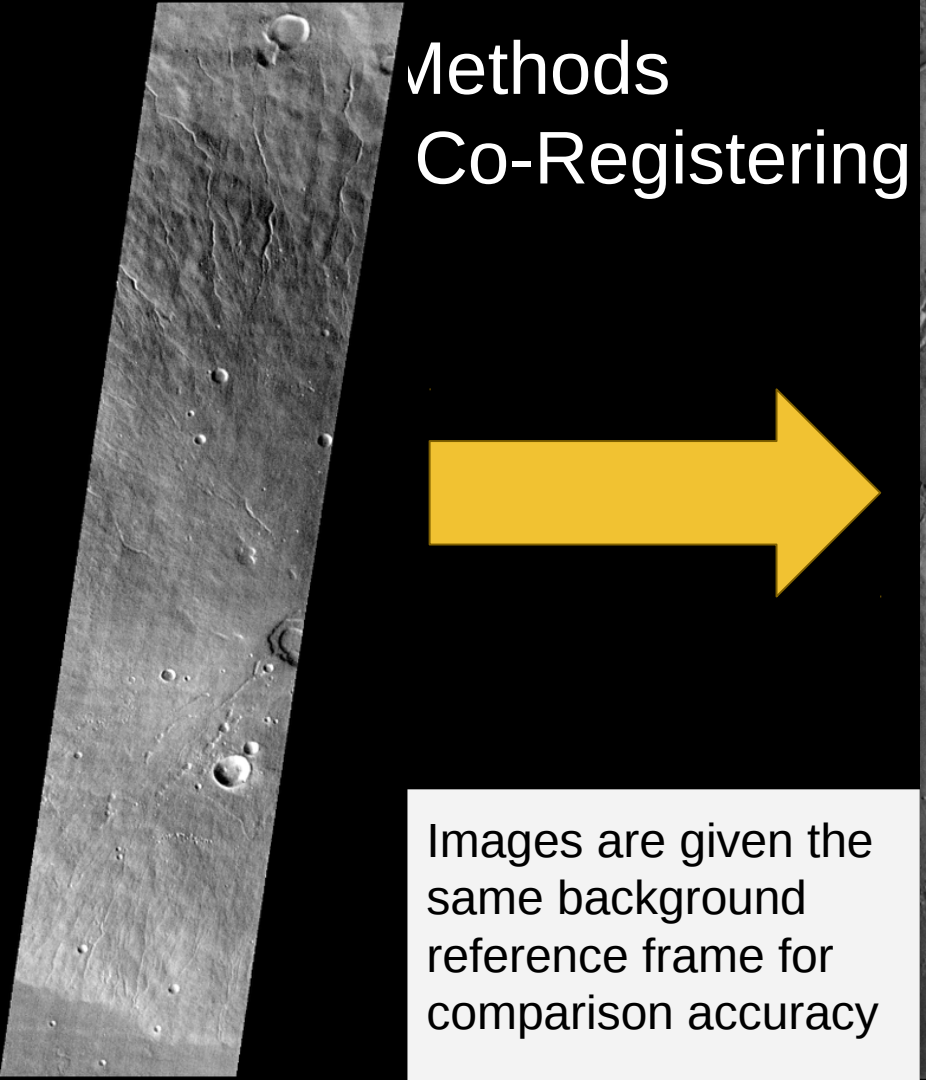
THEMIS Standard Processing

Undrift
Dewobble
Rtilt
Deplaid
Destreak
Temperature Conversion

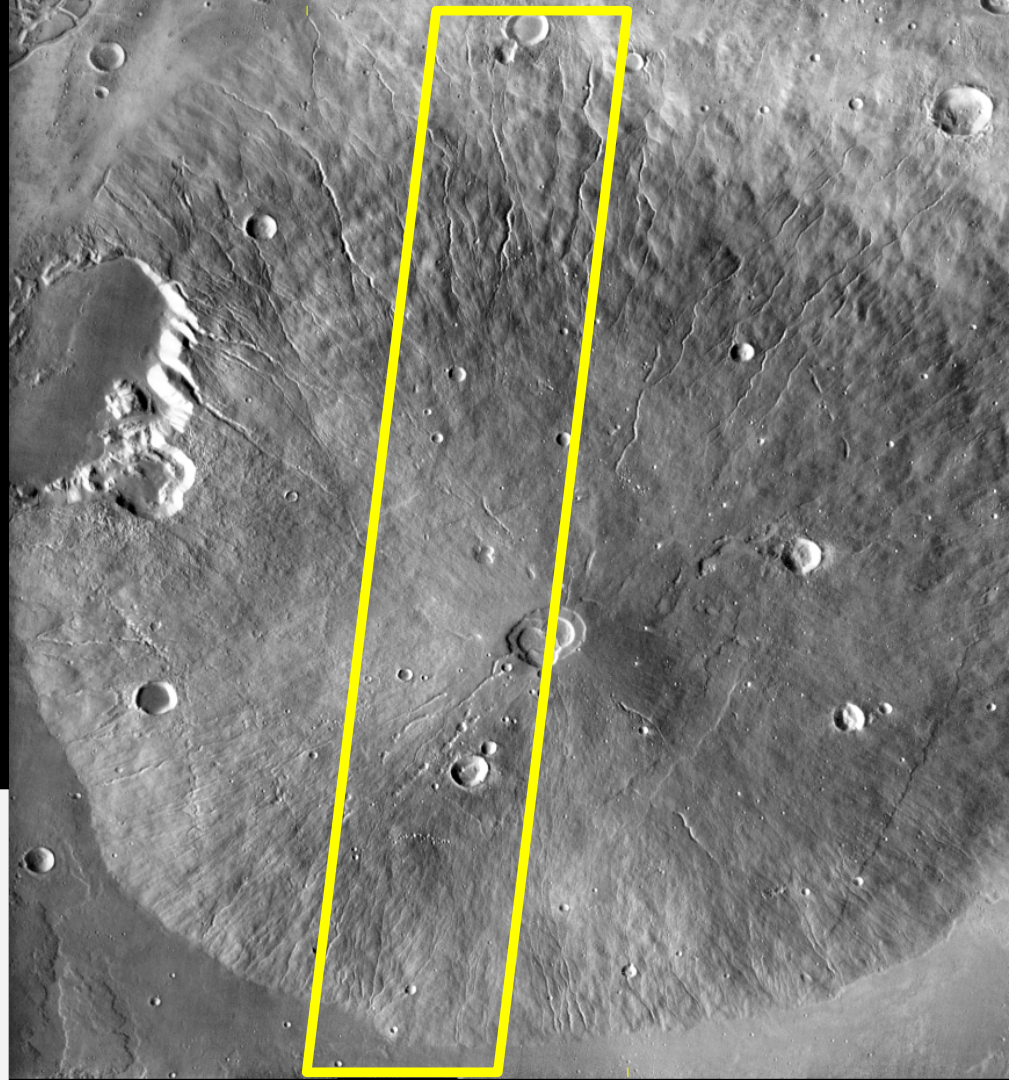




Methods
Co-Registering



Images are given the same background reference frame for comparison accuracy



Methods

Normalization

Same average
Same standard deviation

Image 1	Image 2
MY= 30	MY= 26
Ls= 85.7	Ls= 95.9
Local time= 16.6 hr	Local time= 16.1 hr
min: 192.0	min: 194.1
max: 251.0	max: 247.3
avg: 222.9	avg: 222.9
stddev: 5.17	stddev: 5.17
sum: 197537508.1	sum: 197537508.1

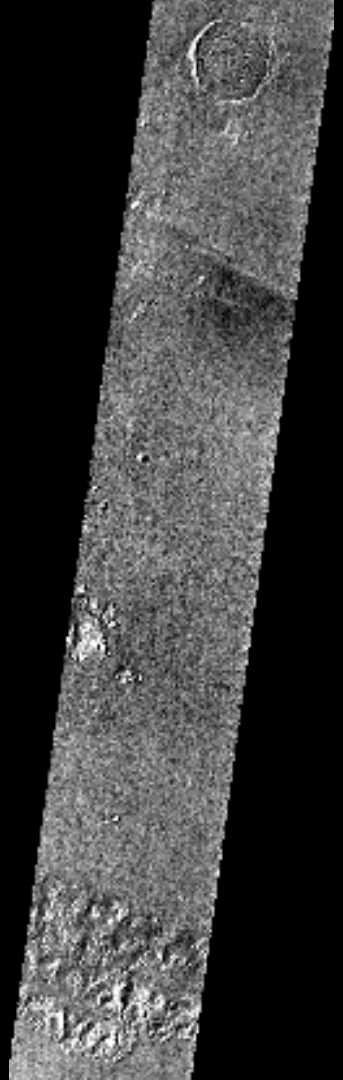
Results

Image1 - Image2 =
Difference Image

This is strictly what changed in the timeframe between images

Difference Image

min: -14.2
max: 12.4
avg: 2.21e-09
stddev: 1.14
sum: 0.001907348633



Results

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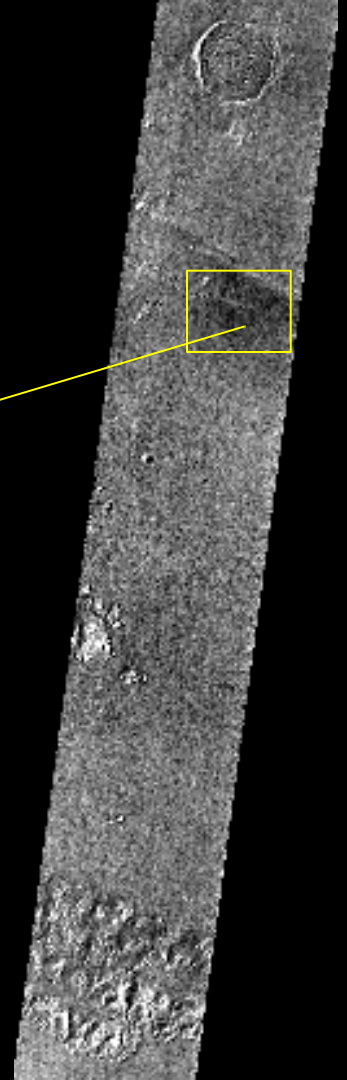

Difference Image

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max: 12.4
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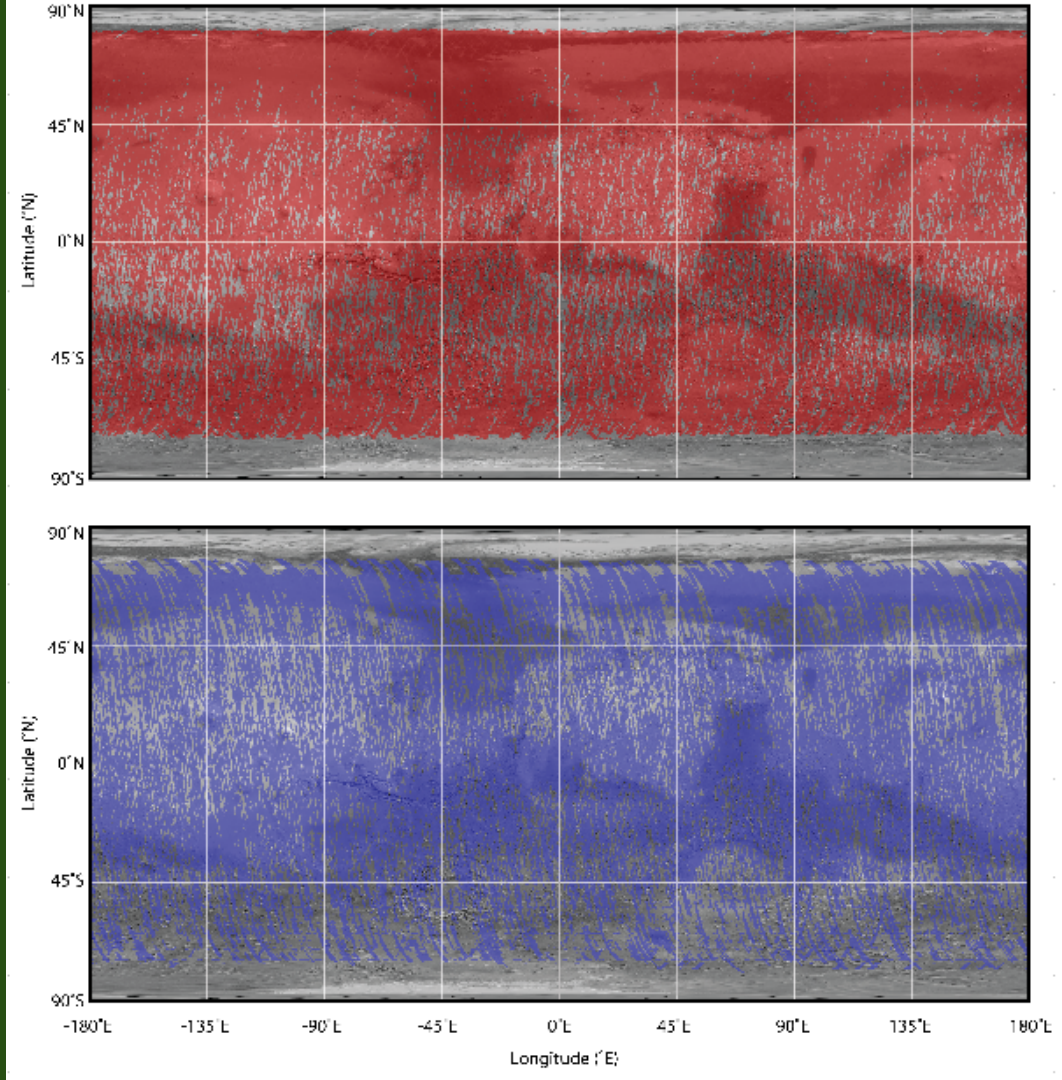
sum: 0.001907348633

Going Forward

Temperature differences to dust thicknesses conversions
Continual analysis over the same area of interest will help determine the location’s contribution to the dust cycle
Temperature vs. Time plots
Pair analysis for global coverage

Image Pairs

Overlapping sections of THEMIS daytime (top) and nighttime (bottom) image pairs acquired within 1 hour local time and 20˚Ls of one another. Furthermore they have have a minimum of 100km2 overlap. Images acquired the same MY were eliminated.



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Szwast, M. A., M. I. Richardson, and A. R. Vasavada (2006), Journal of Geophysical Research, 111(E11).