MER Landing Site Hectometer Slopes

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Self-affine Topography

- Assume all topography on Mars is self-affine: implies that a fractal scaling law can be applied to the rms height deviation, :

$$= < [z(x) - z(x+L)]^2 >^{1/2}$$

where L is a lag interval along a profile; = (L).

- The scaling behavior is:

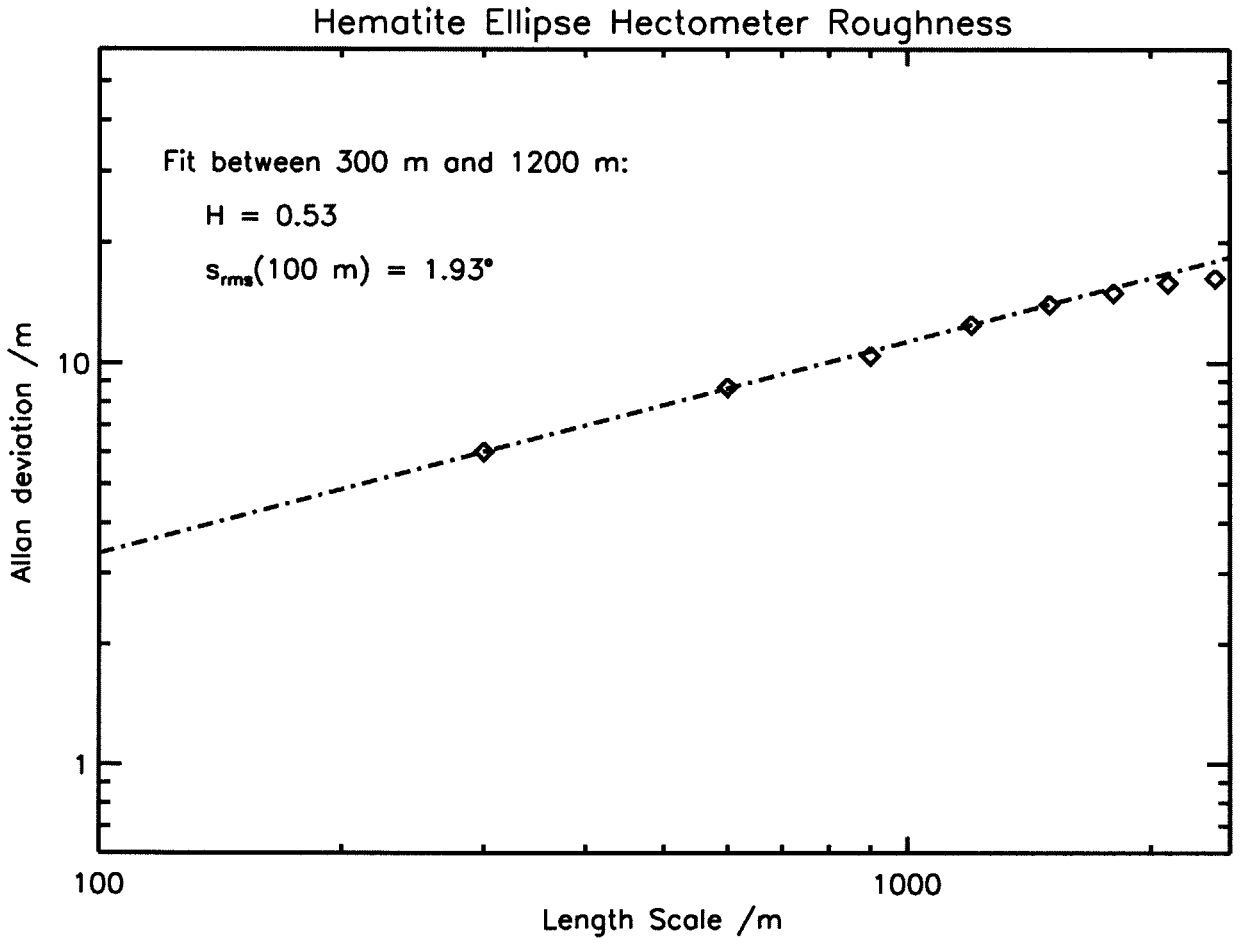
$$(L) = (L_0) [L / L_0]^H$$

- A log-log plot of vs. L will be linear under the self-affine assumption with Hurst exponent, H, as slope of line.
- The rms slope for lag L is

$$s_{rms} = \text{atan} ((L) / L)$$

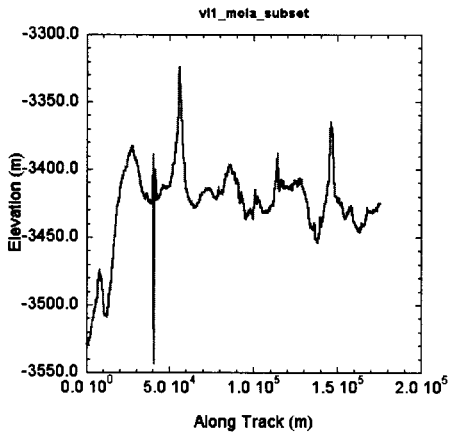
- Use MOLA profiles to calculate (L) for L = 300 m to 3000 m. Fit the linear region in the range L = 0.3 km to 1.2 km and extrapolate back to (100 m) to get s_{rms}(100 m)

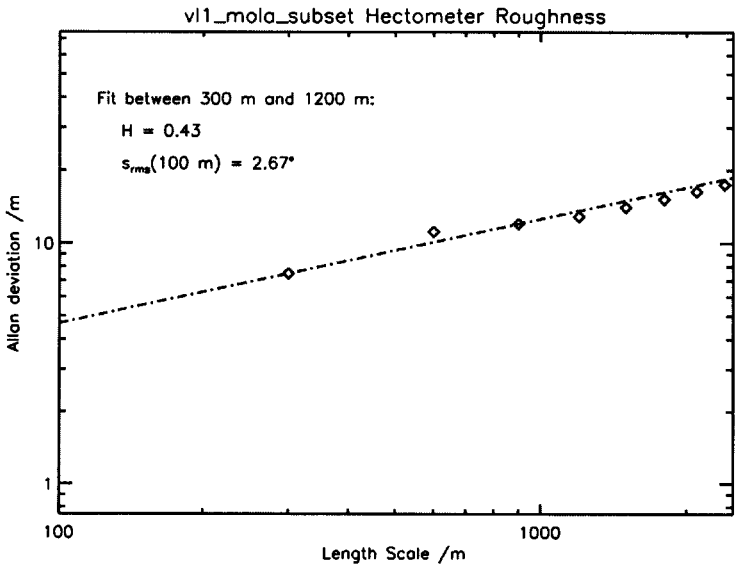
Example Allen Deviation Fit

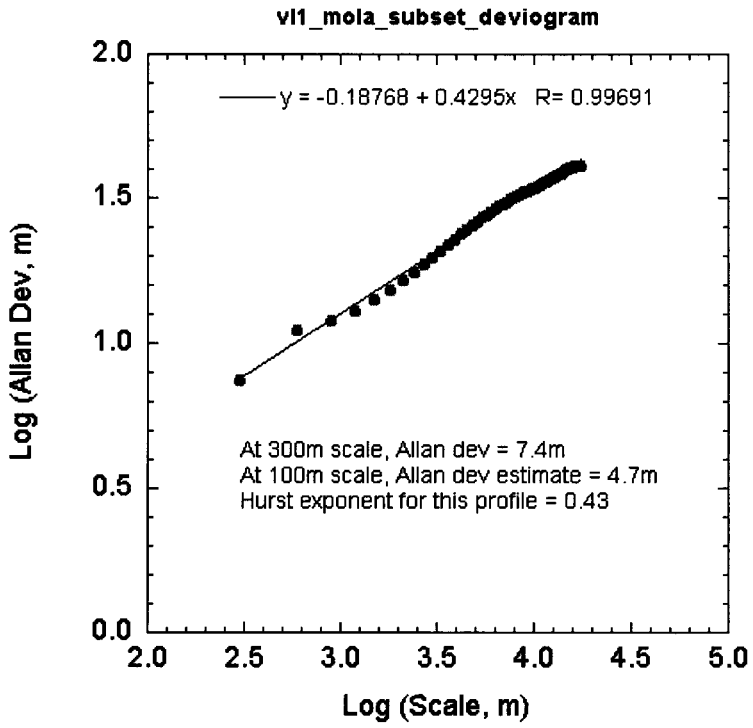


Method Check

- MOLA track no. 1601 from 20.9599ºN to 23.9841ºN.
- Comparison of Shepard and Haldemann processing.
- Allan deviations for each lag are identical; both codes are doing the same things.
- Agreement of fits in this case are fortuitous as Haldemann fits 300 m to 1200 m only, which Shepard fits all profile scales.



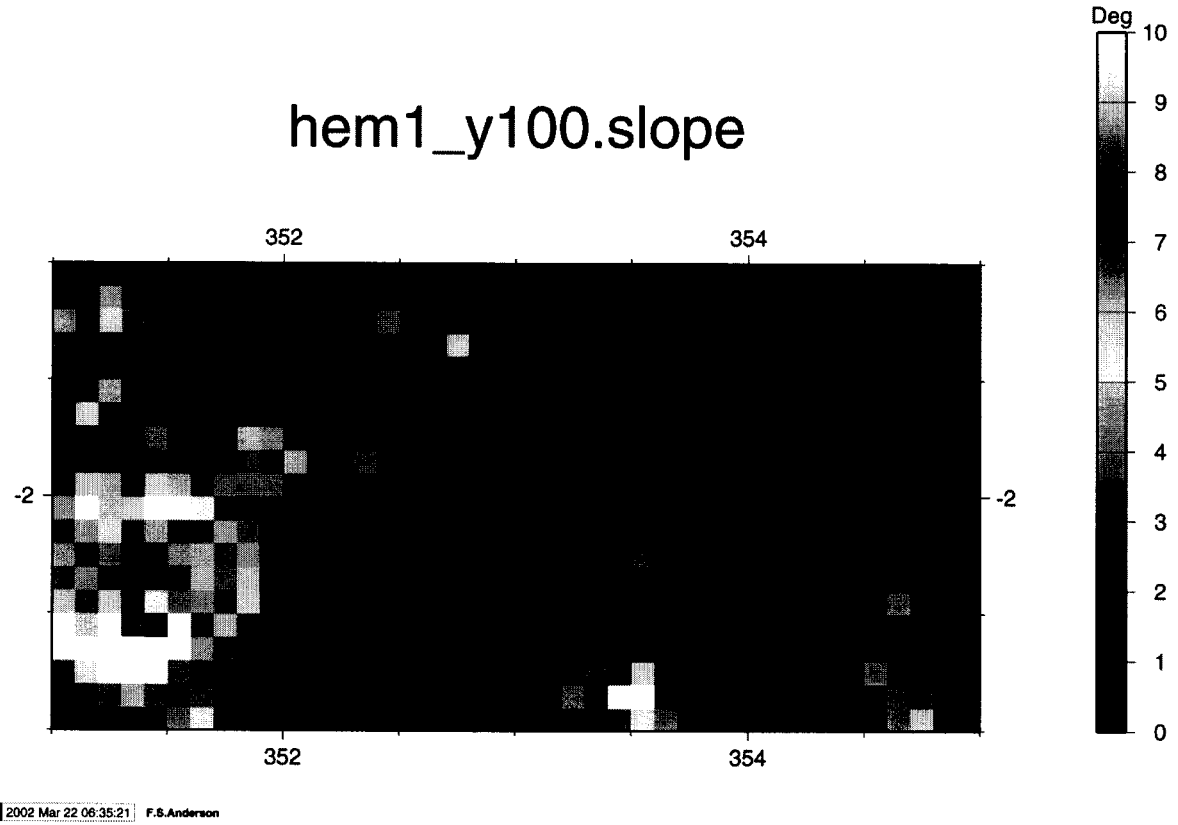




MER Landing Sites

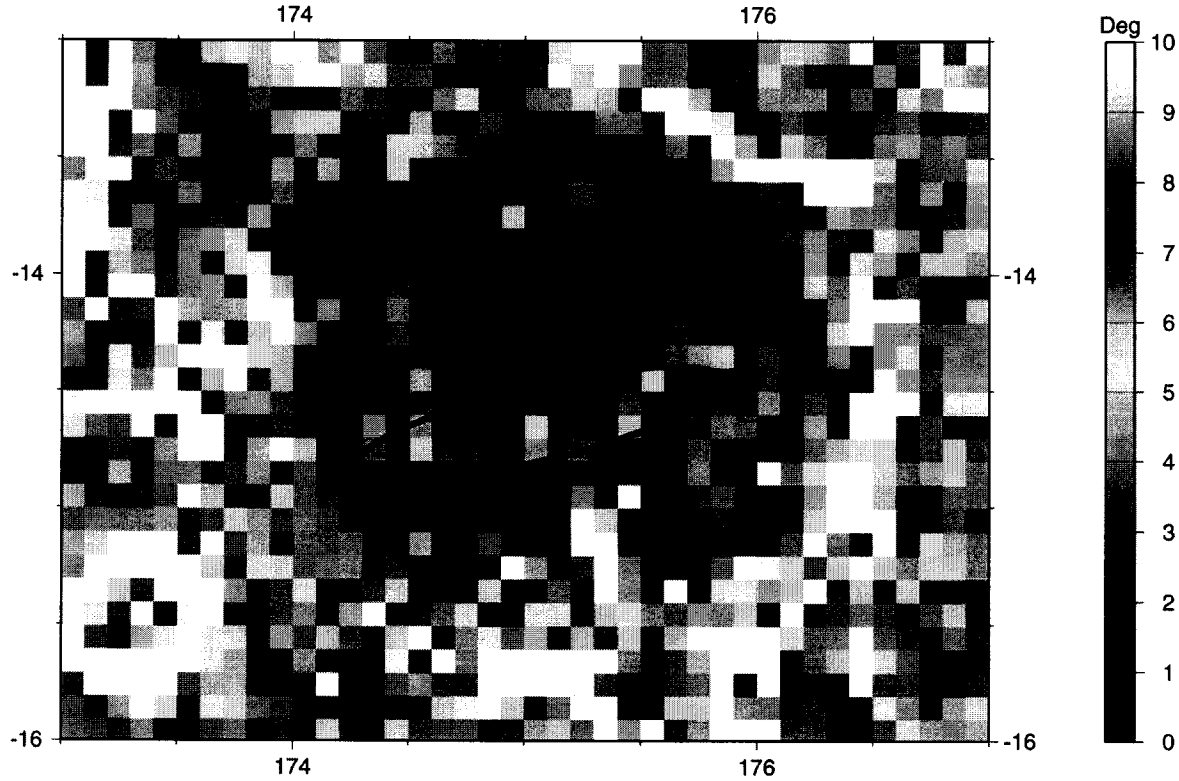
Site	H	(100 m) /m	S_{rms} (100 m) /deg.	(1 m) /m	S_{rms} (1 m) /deg.
Hematite	0.53	3.4	1.9	0.30	16.7
Melas	0.81	9.9	5.7	0.24	13.5
Gusev	0.56	5.8	3.3	0.44	23.8
Isidis	0.51	2.6	1.5	0.25	14.0
Athabasca	0.76	4.3	2.5	0.13	7.4
Eos	n/a	n/a	n/a	n/a	n/a
MPF (326.4°E,19.3°N ± 0.2°)	0.37	5.0	2.9	0.92	42.6
MPF (0.5° "radius")	0.77	5.0	2.9	0.15	8.5
VL1 (311.8°E,22.3°N ± 0.2°)	0.53	1.8	1.0	0.15	8.5

Site Hectometer Slope Map: Hematite



Site Hectometer Slope Map: Gusev

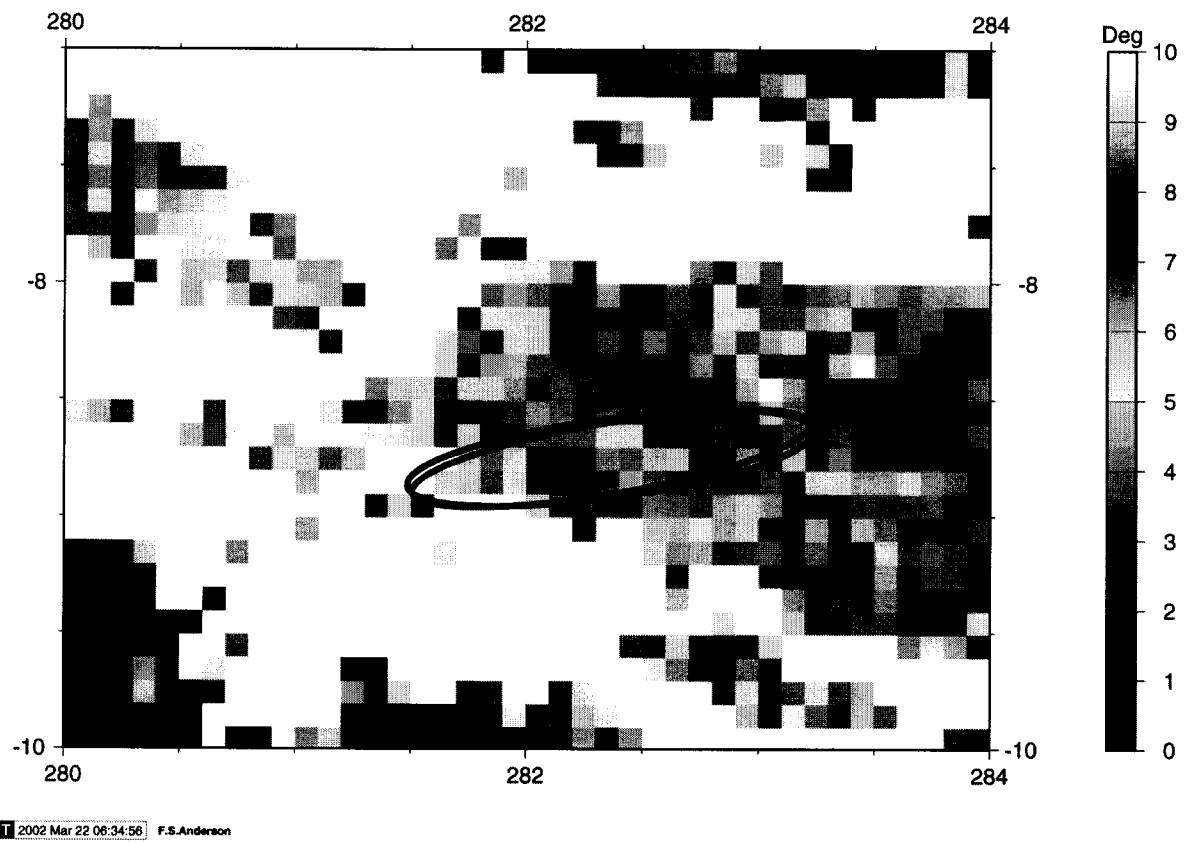
gus_y100.slope



GMT 2002 Mar 22 06:34:44 F.S.Anderson

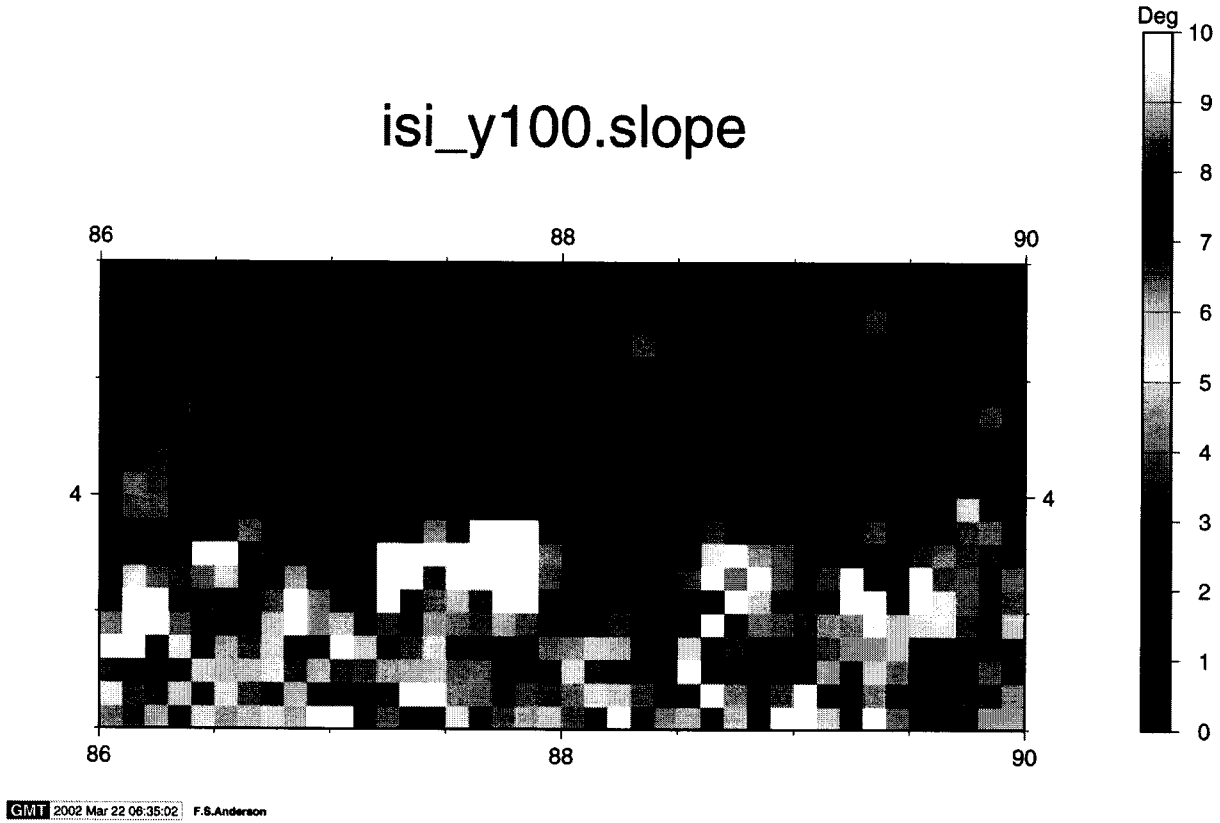
Site Hectometer Slope Map: Melas

mel_y100.slope



Site Hectometer Slope Map: Isidis

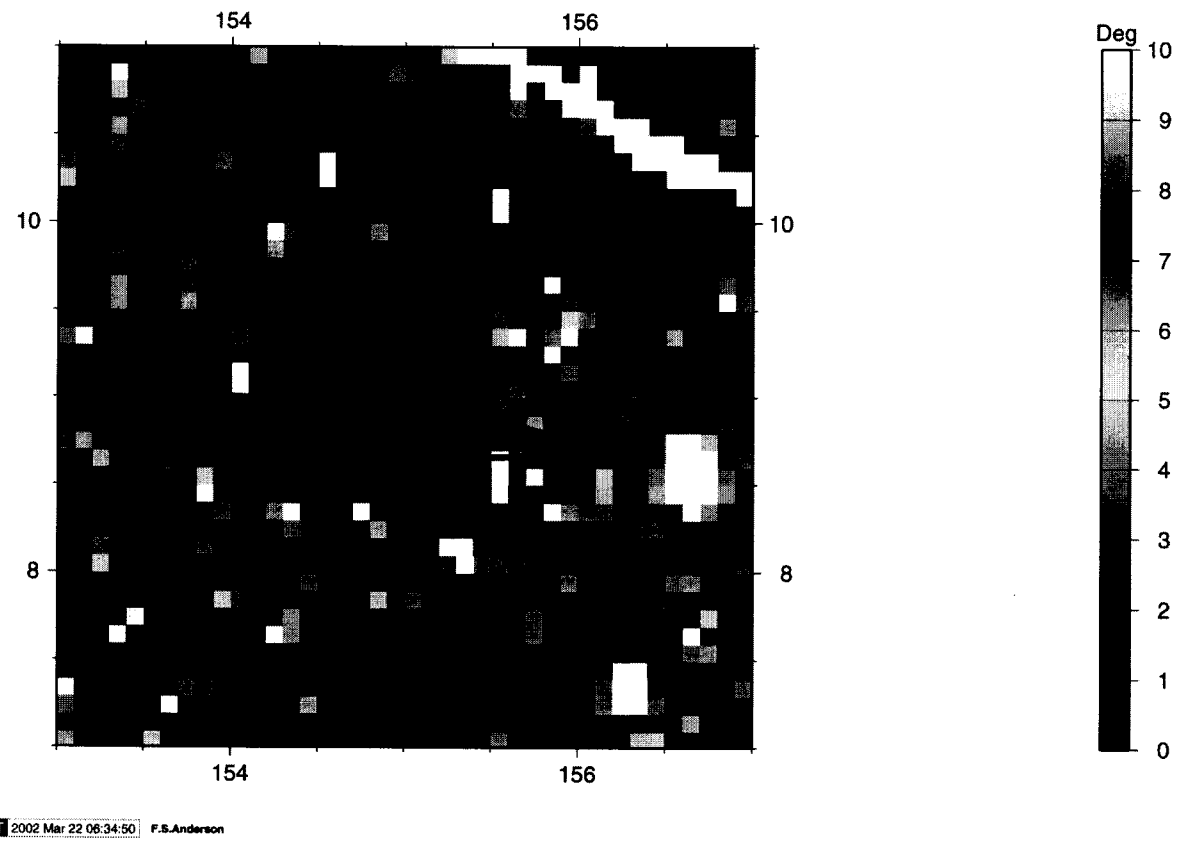
Mars Exploration Rover



Site Hectometer Slope Map: Athabasca

Mars Exploration Rover

ath_y100.slope

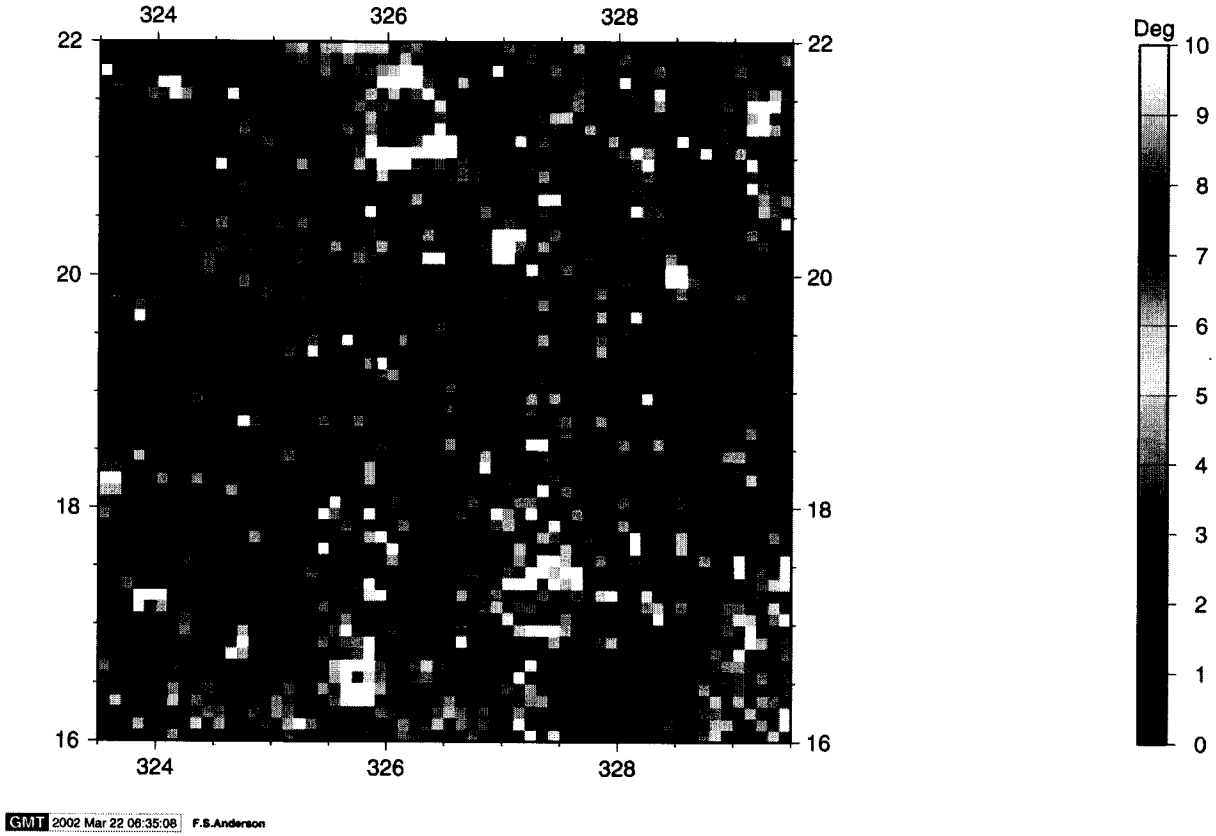


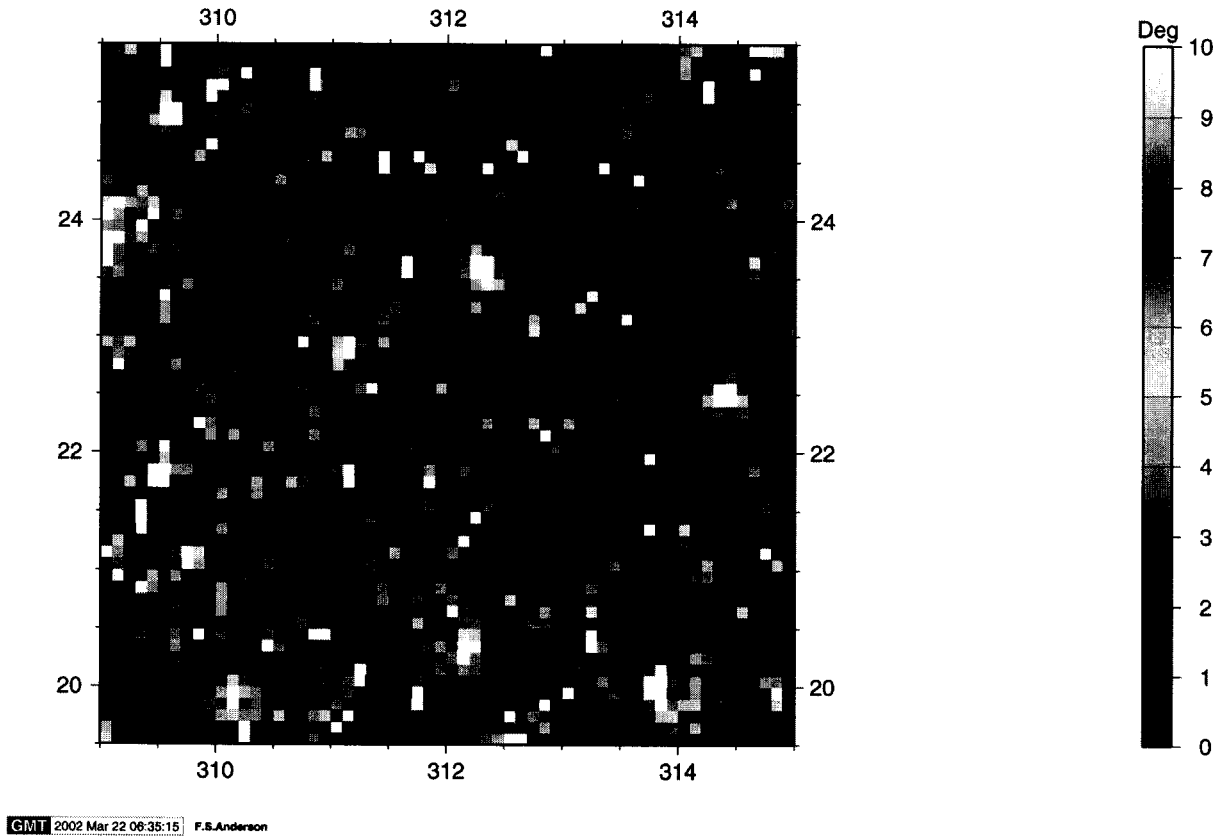
Site Hectometer Slope Map: Eos

Site Hectometer Slope Map: Pathfinder

Mars Exploration Rover

mpf_y100.slope



Site Hectometer Slope Map: VL1

vl1_y100.slope