

# 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, ζ: ζ:

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

  where L is a lag interval along a profile; ζ = ζ(L).
- The scaling behavior is:

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

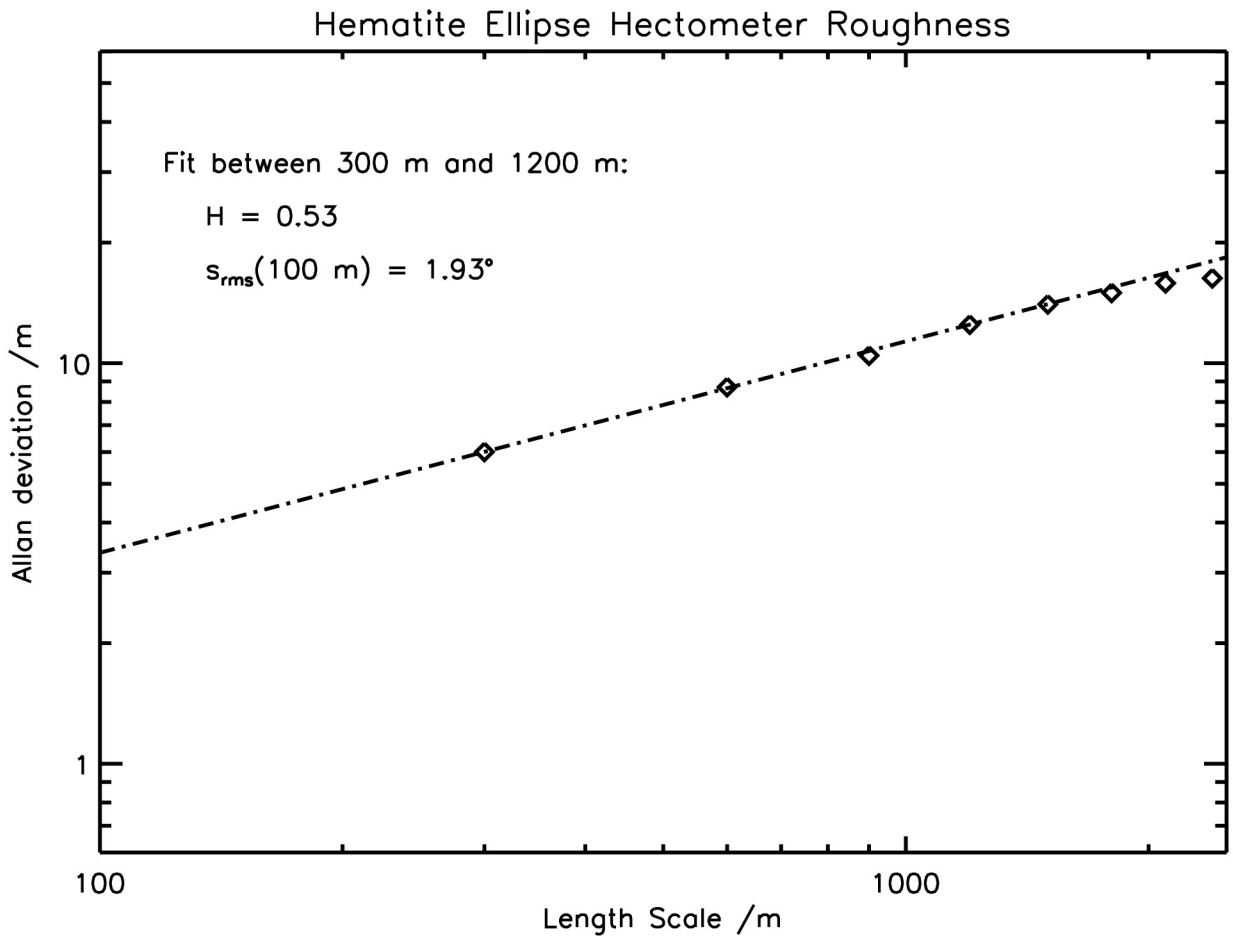
- A log-log plot of ζ vs. L will be linear under the self-affine assumption with Hurst exponent, H, as slope of line.
- The rms slope for lag L is

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

- Use MOLA profiles to calculate ζ(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 ζ(100 m) to get $s_{rms}$(100 m)

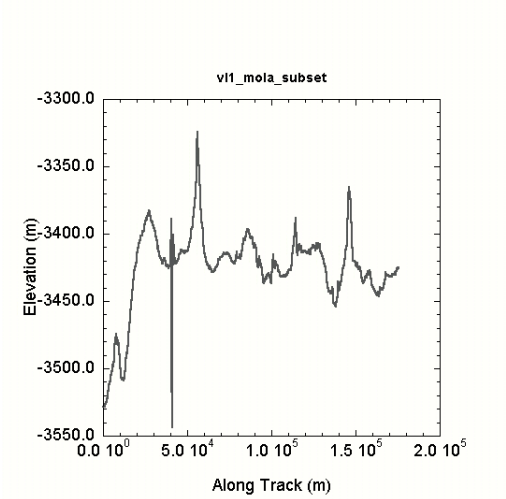
# Example Allen Deviation Fit



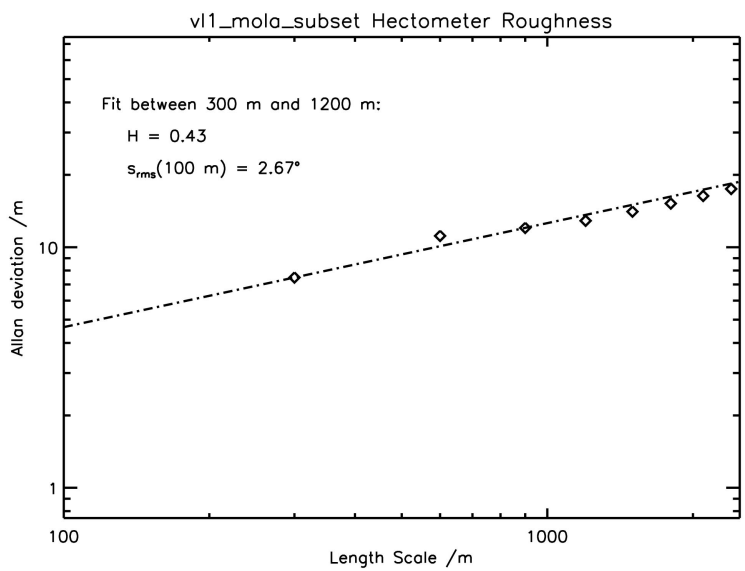


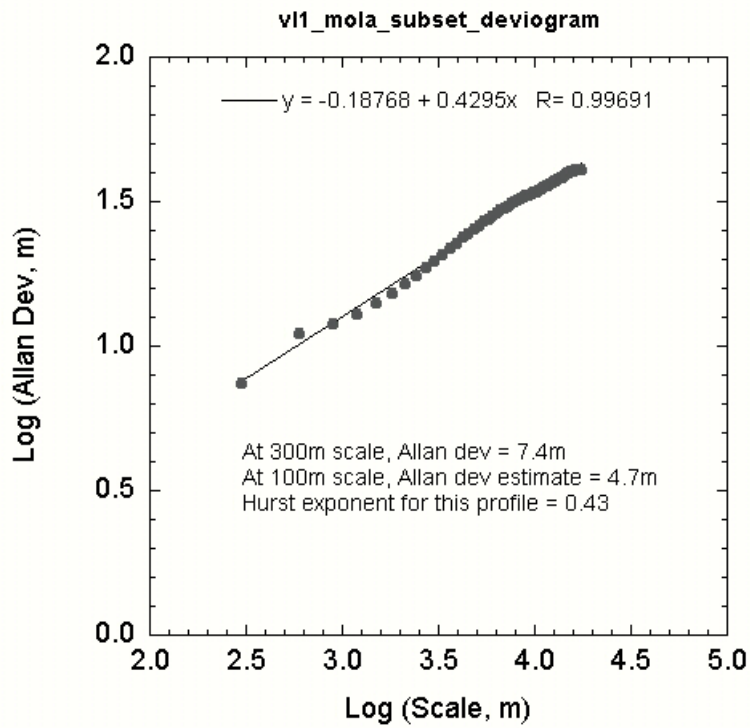
# Method Check






- **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.**



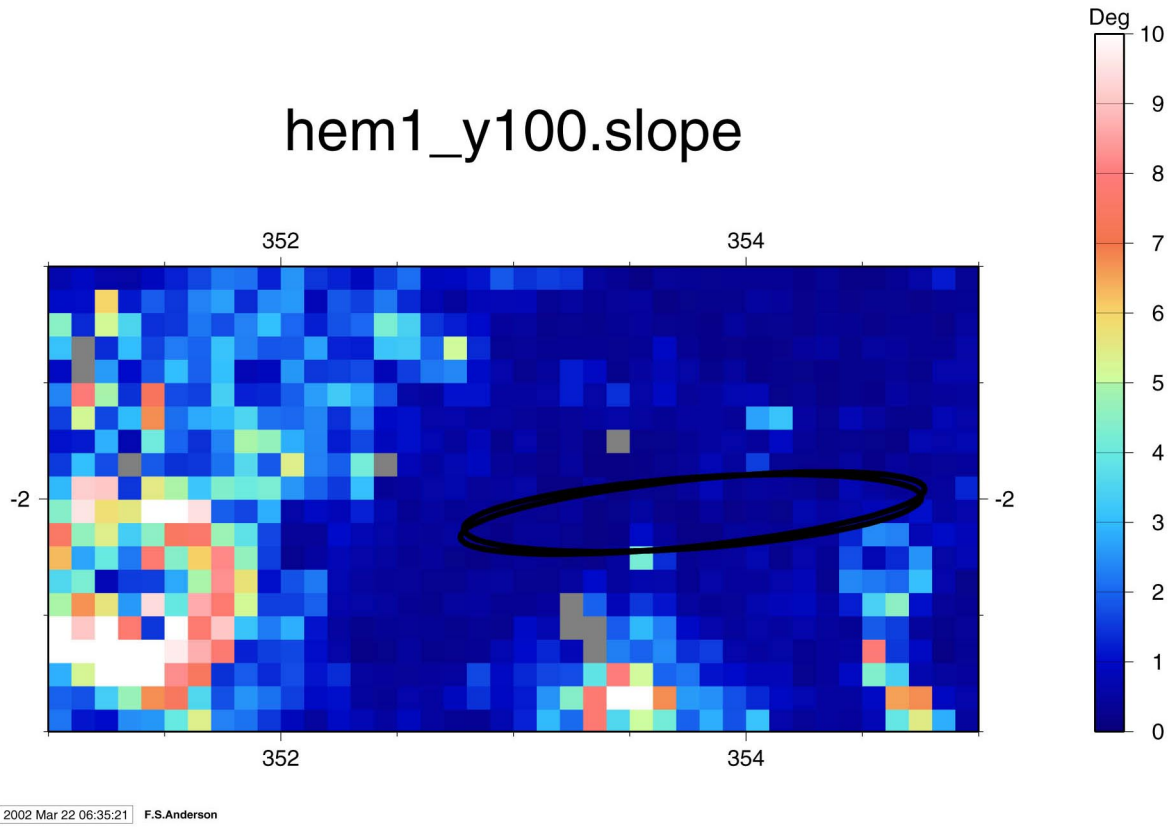
# MER Landing Sites

Mars Exploration Rover

| Site | H | ζ(100 m) /m | $S_{rms}$ (100 m) /deg. | ζ(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 |

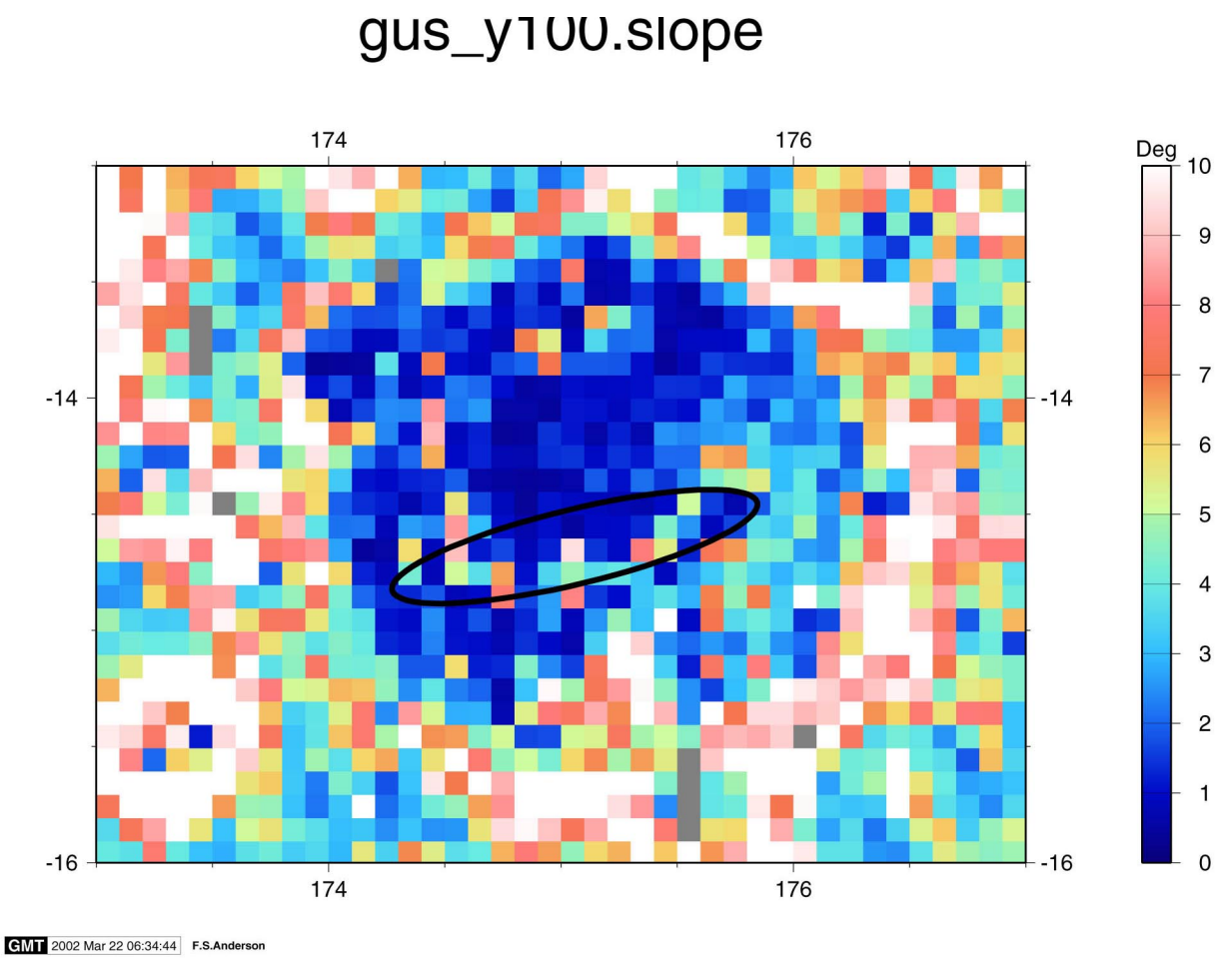
# Site Hectometer Slope Map: Hematite





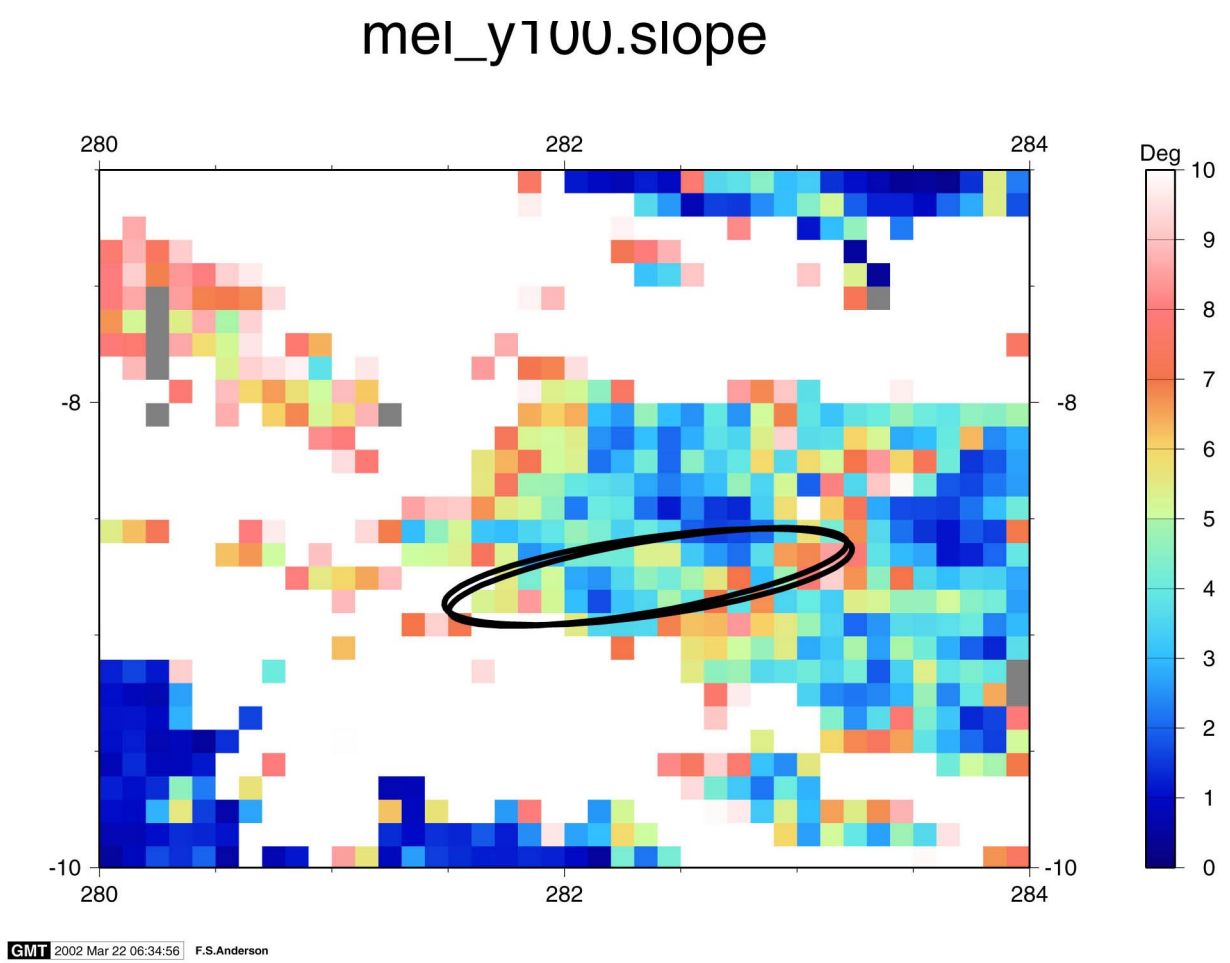
# Site Hectometer Slope Map: Gusev





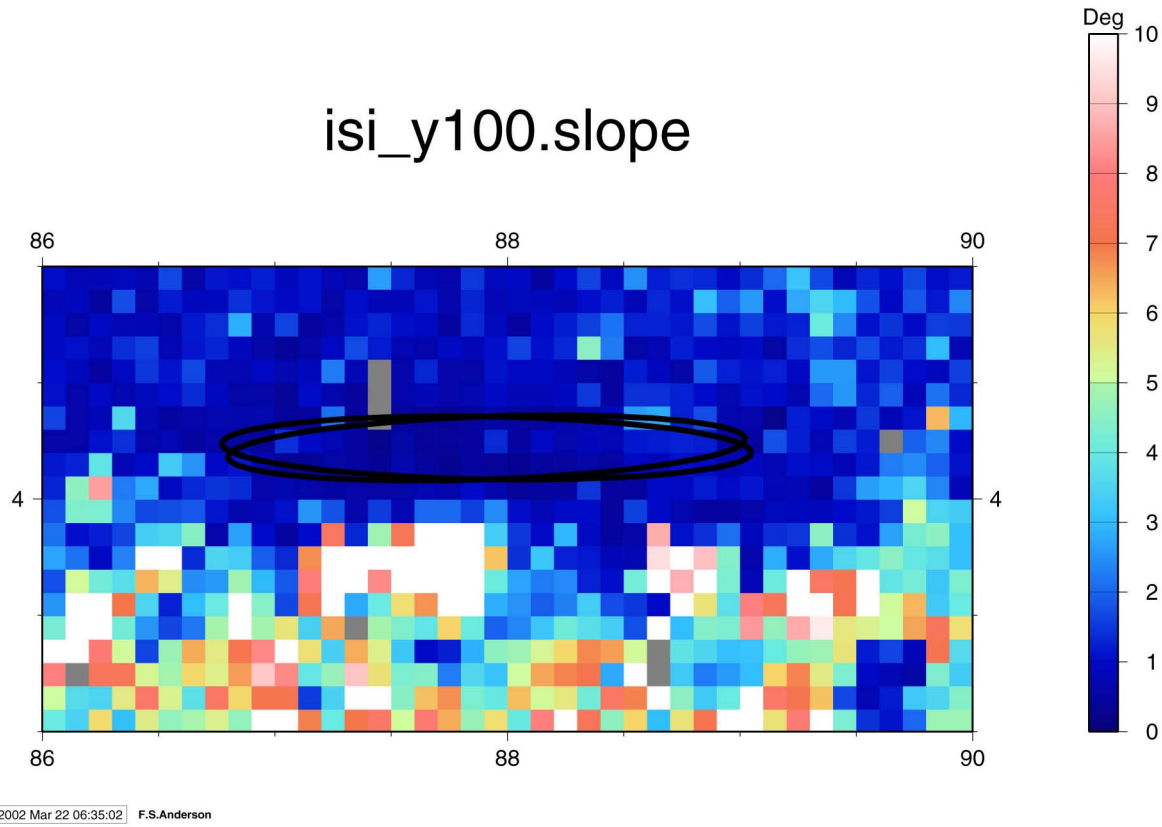
# Site Hectometer Slope Map: Melas





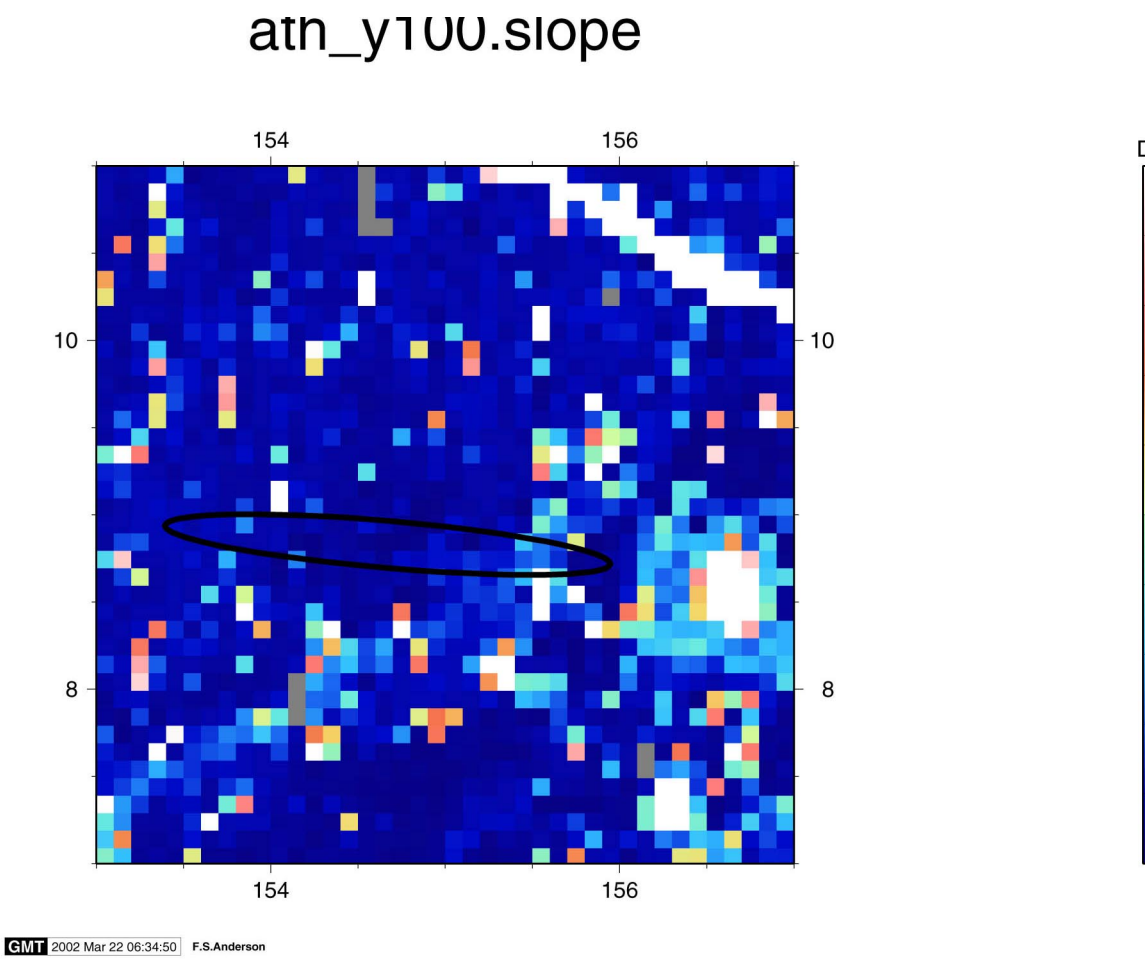
# Site Hectometer Slope Map: Isidis





# Site Hectometer Slope Map: Athabasca



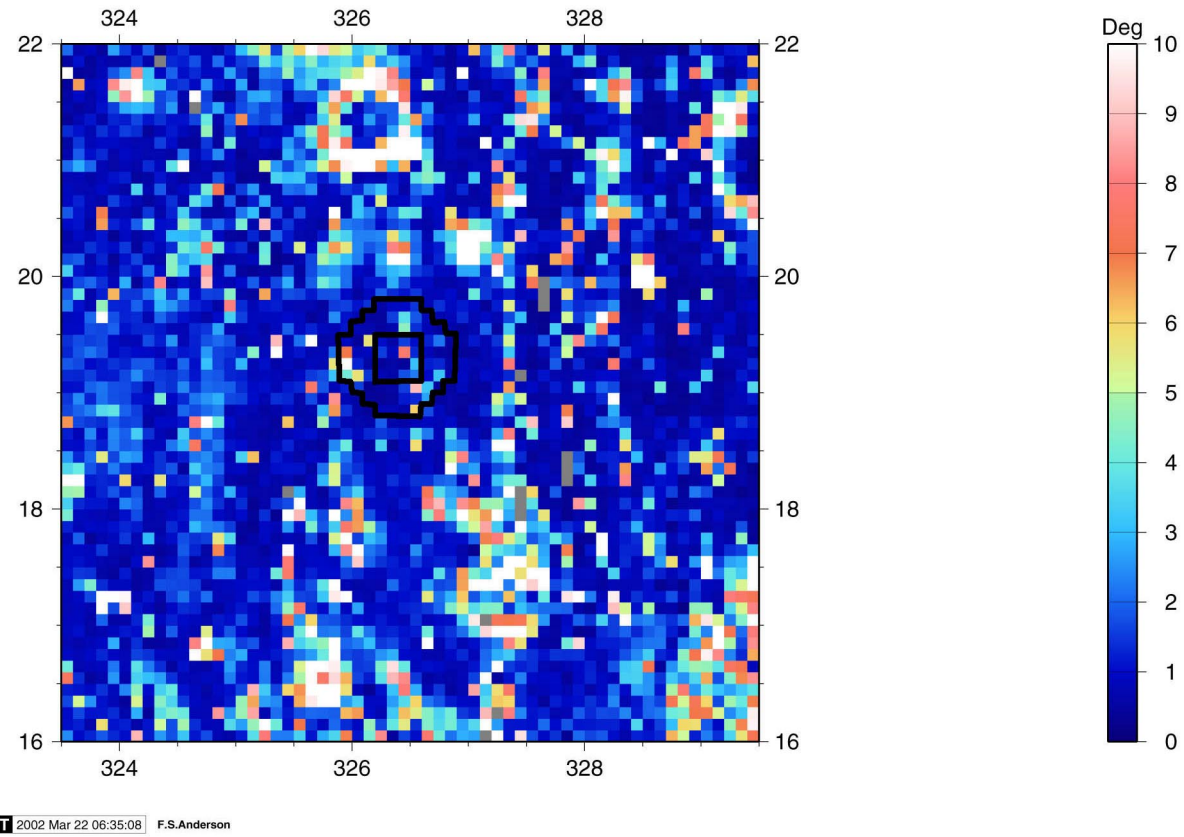


# Site Hectometer Slope Map: Eos

# Site Hectometer Slope Map: Pathfinder



mpf_y100.slope



# Site Hectometer Slope Map: VL1