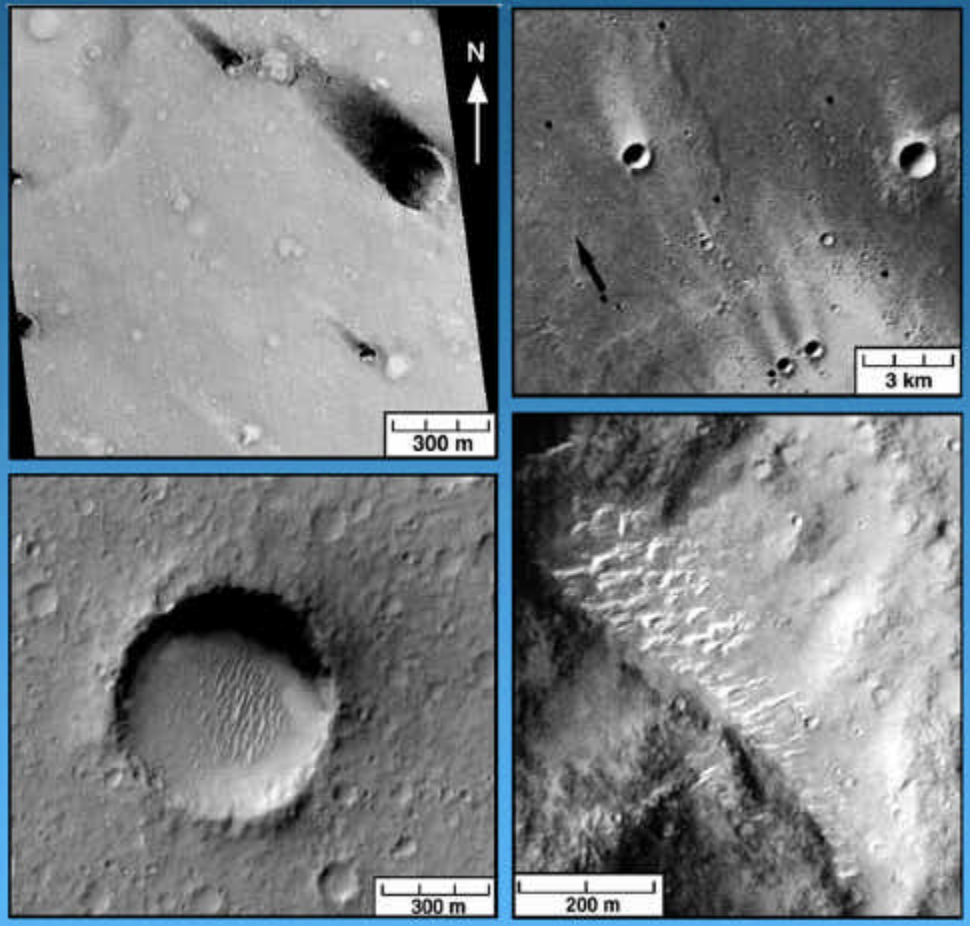
GUSEV CRATER: WIND FEATURES AND PROCESSES



- What are they?
- Where are they?
- When did they form?
- How do they relate to wind models?
- What is the relevance to MER?

Analyses include M-9, VO, MOC, THEMIS, NASA-Ames GCM and MRAMS

WIND-RELATED FEATURES

Observations	Interpretations	Models
• Albedo patterns**		
- Bright wind streaks (craters)*	• Fine particles	• Dust deposition; stable atmosphere
- Dark wind streaks (craters)*	• Exposed "bedrock" - coarse particles	• Erosion, wind > threshold "Fines" removed, lag deposits
- Dark streaks, erratic	• Exposed "bedrock" - coarse particles	• Dust devil tracks; - unstable, afternoon winds
• Topographic features		
- Crescent ridges*	• Barchan dunes	• Sand; consistent winds > threshold
- Ridge sets	• Bedforms (dunes, ripples)	• Sand; consistent winds > threshold
- Aligned knobs	• Eroded "bedrock"	• Friable materials; consistent winds
- Streamlined hills*		

*** Can result from a few microns of dust thickness (Wells et al., 1984)*

** Indicators of wind direction at time of formation*

MARTIAN WIND REGIME: KEY VARIABLES

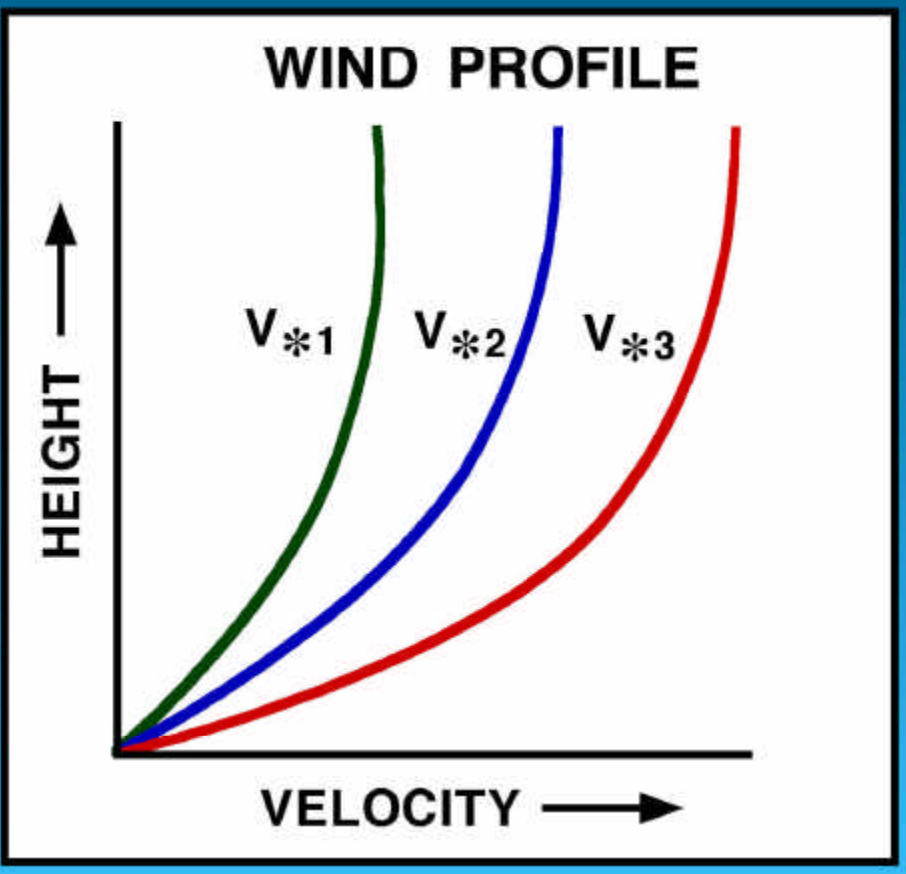
Winds

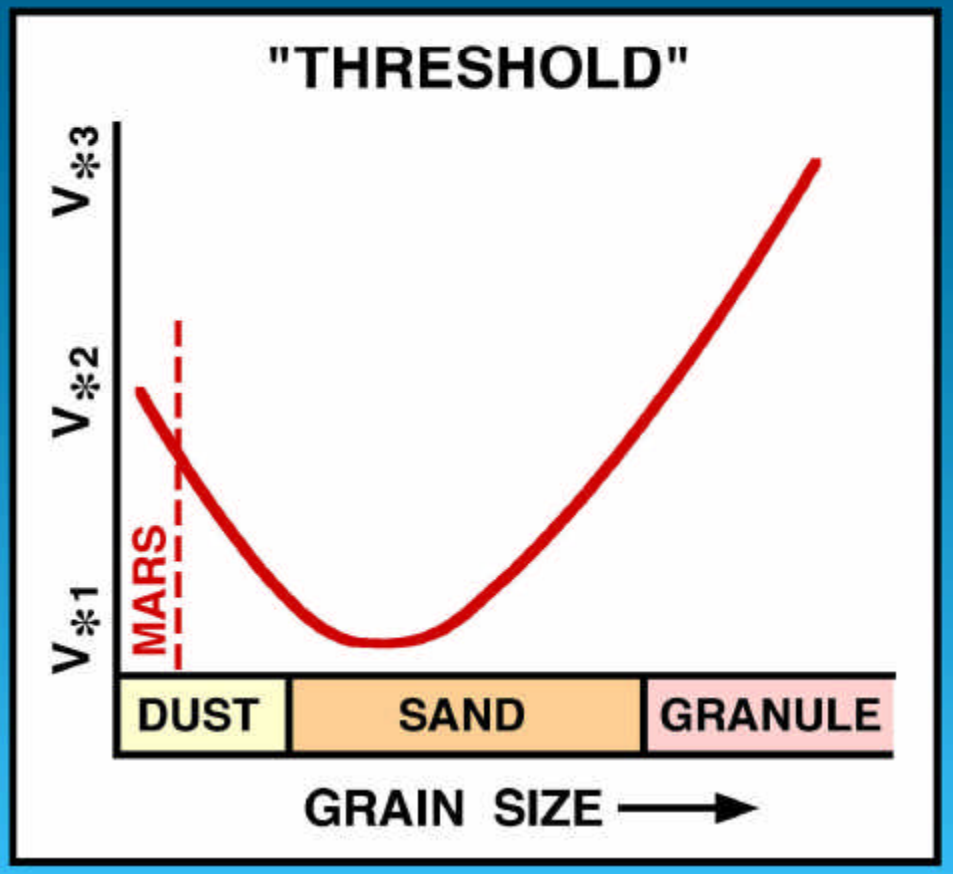
Strength	Season	Region
Direction	Time of Day	Topography
Duration	Atmospheric Stability	Roughness

Particles

Size(s)	Homogenous	Erosional
Composition	Heterogenous	Depositional

AEOLIAN ACTIVITY = WIND + PARTICLES

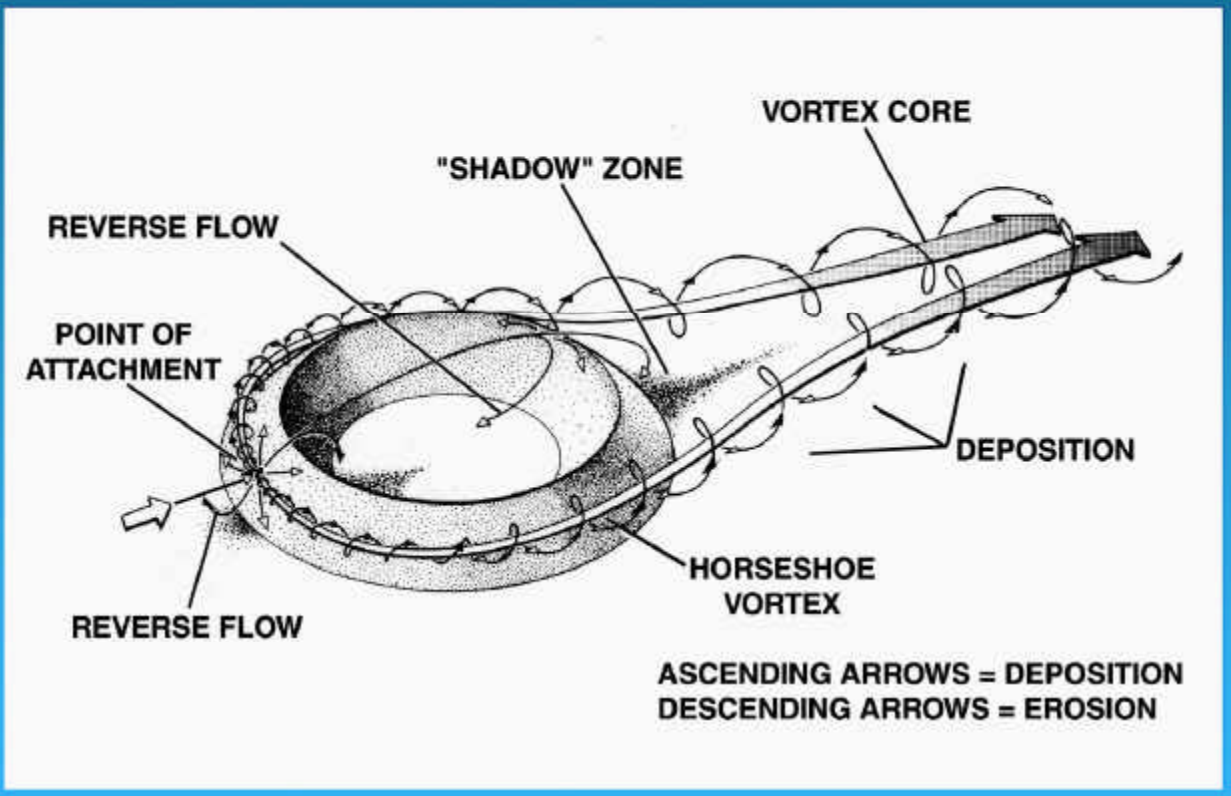




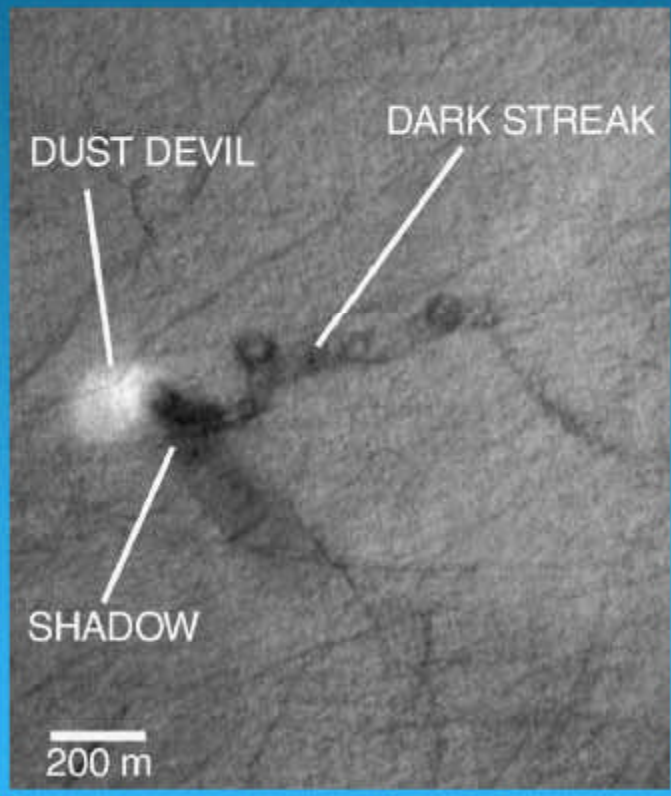
Fine sand is easier to move than dust

VORTICES ENHANCE GRAIN MOVEMENT

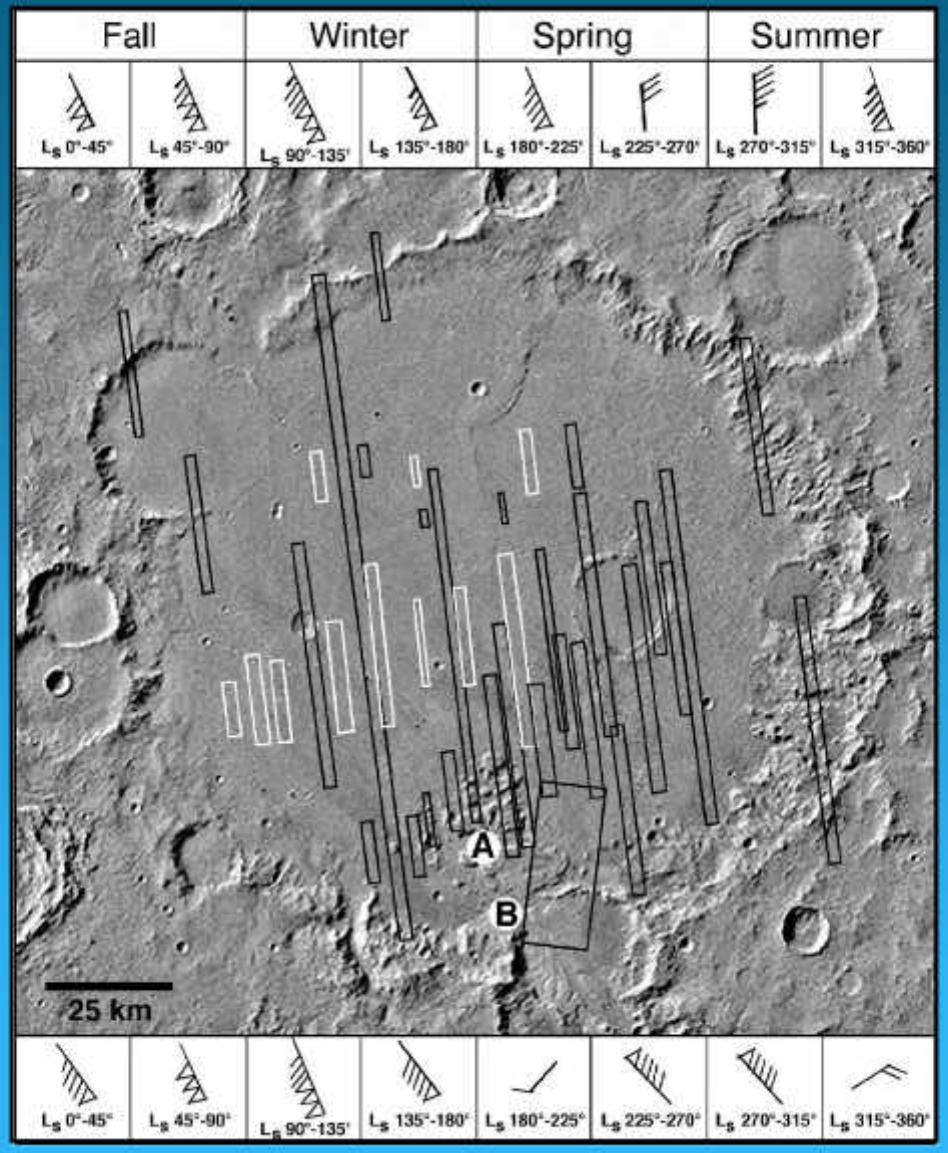
Topography

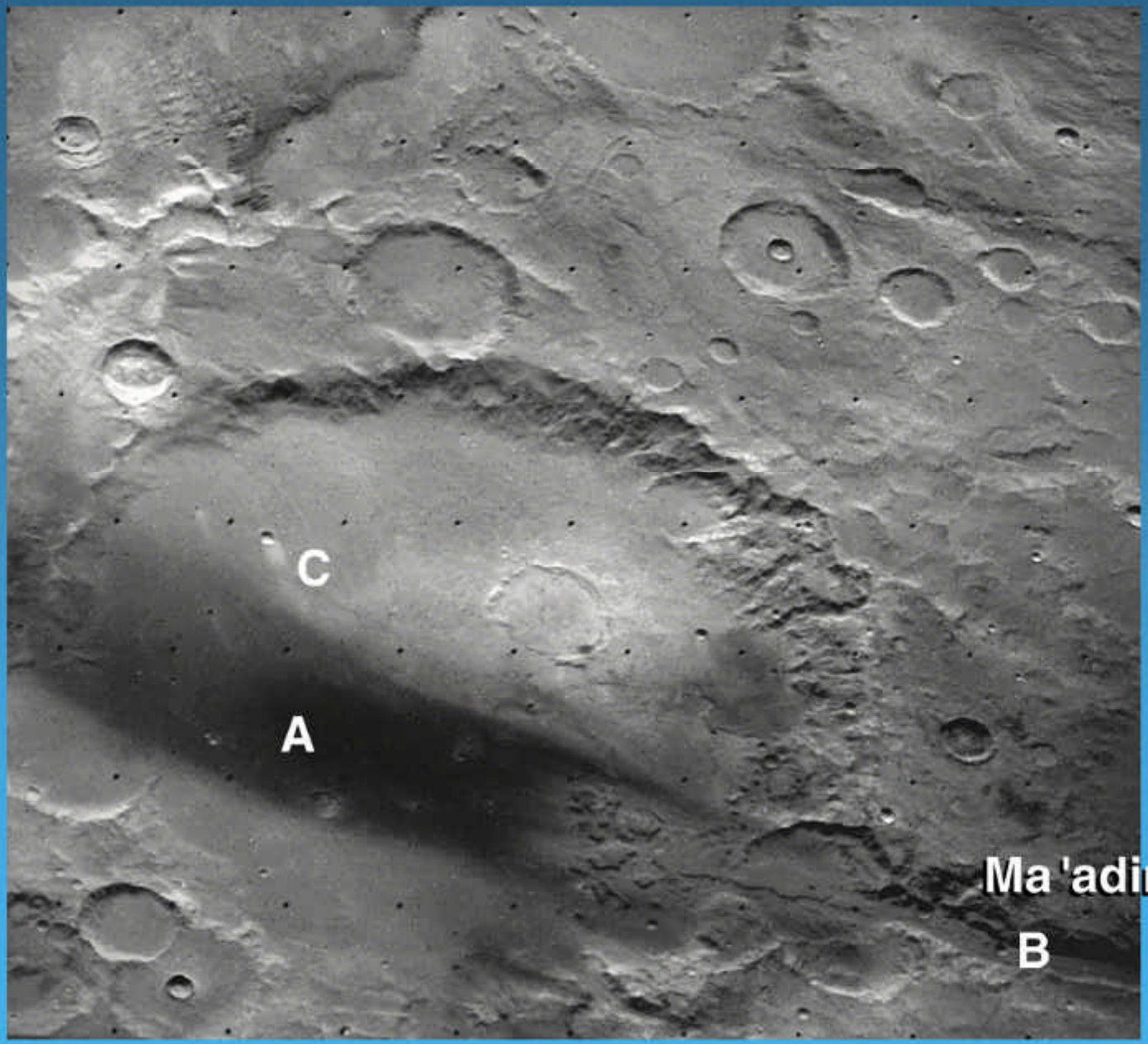


Dust Devils

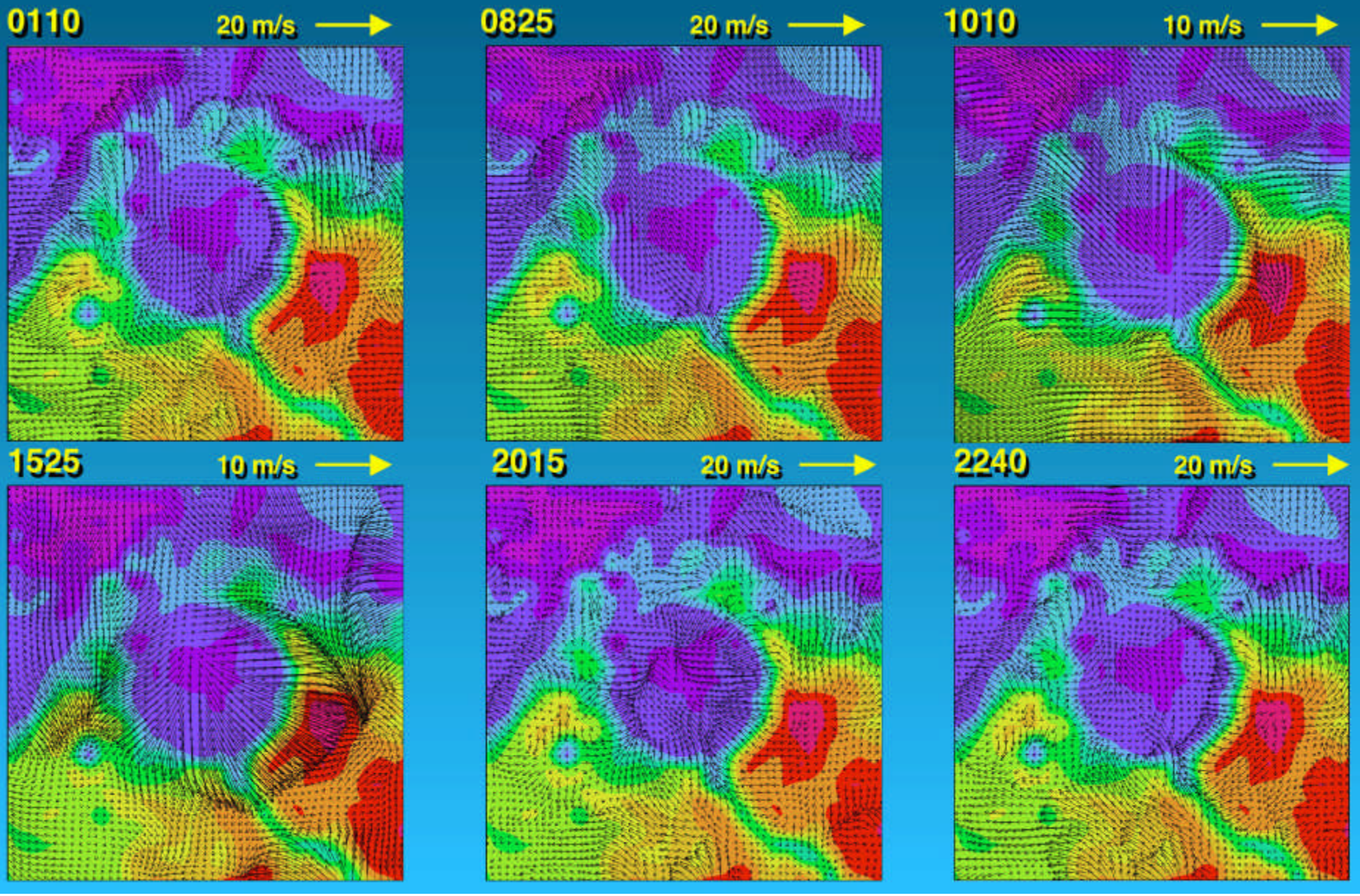


NASA-AMES GCM (Haberle) + MOC

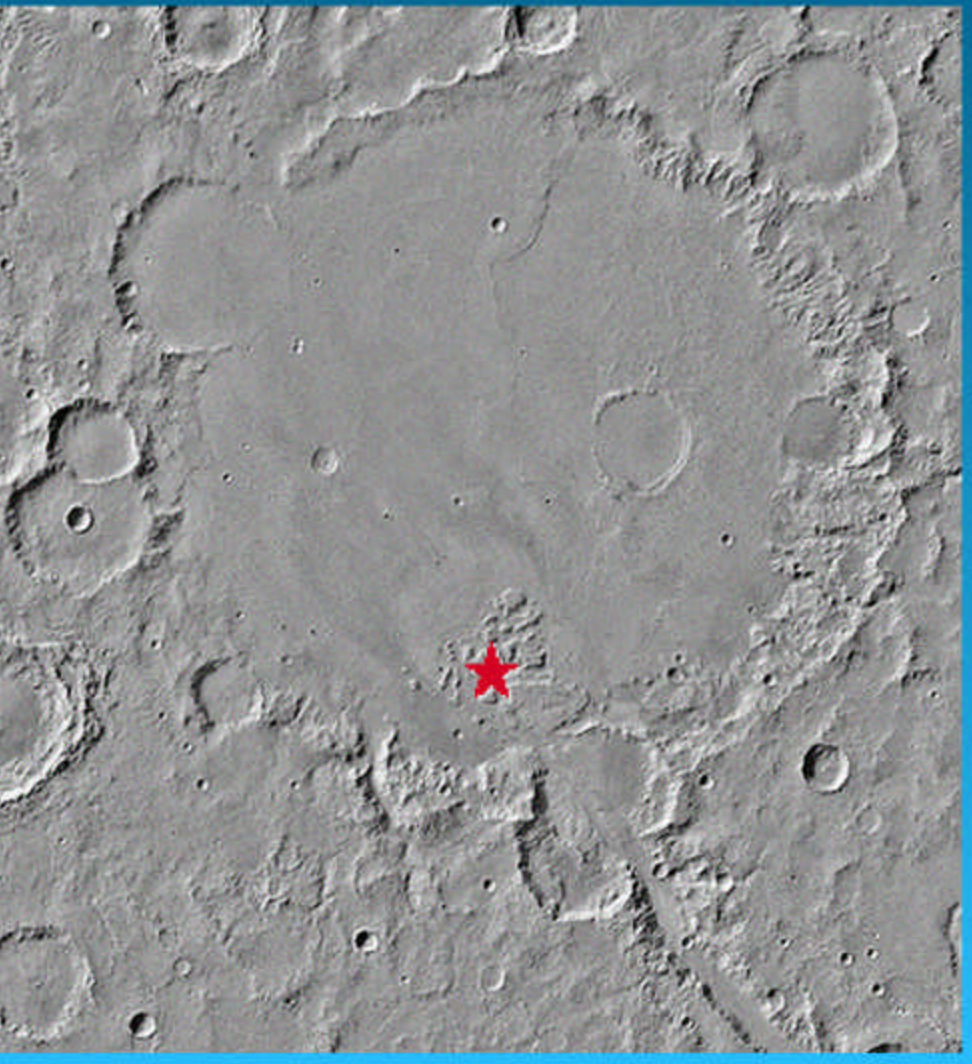


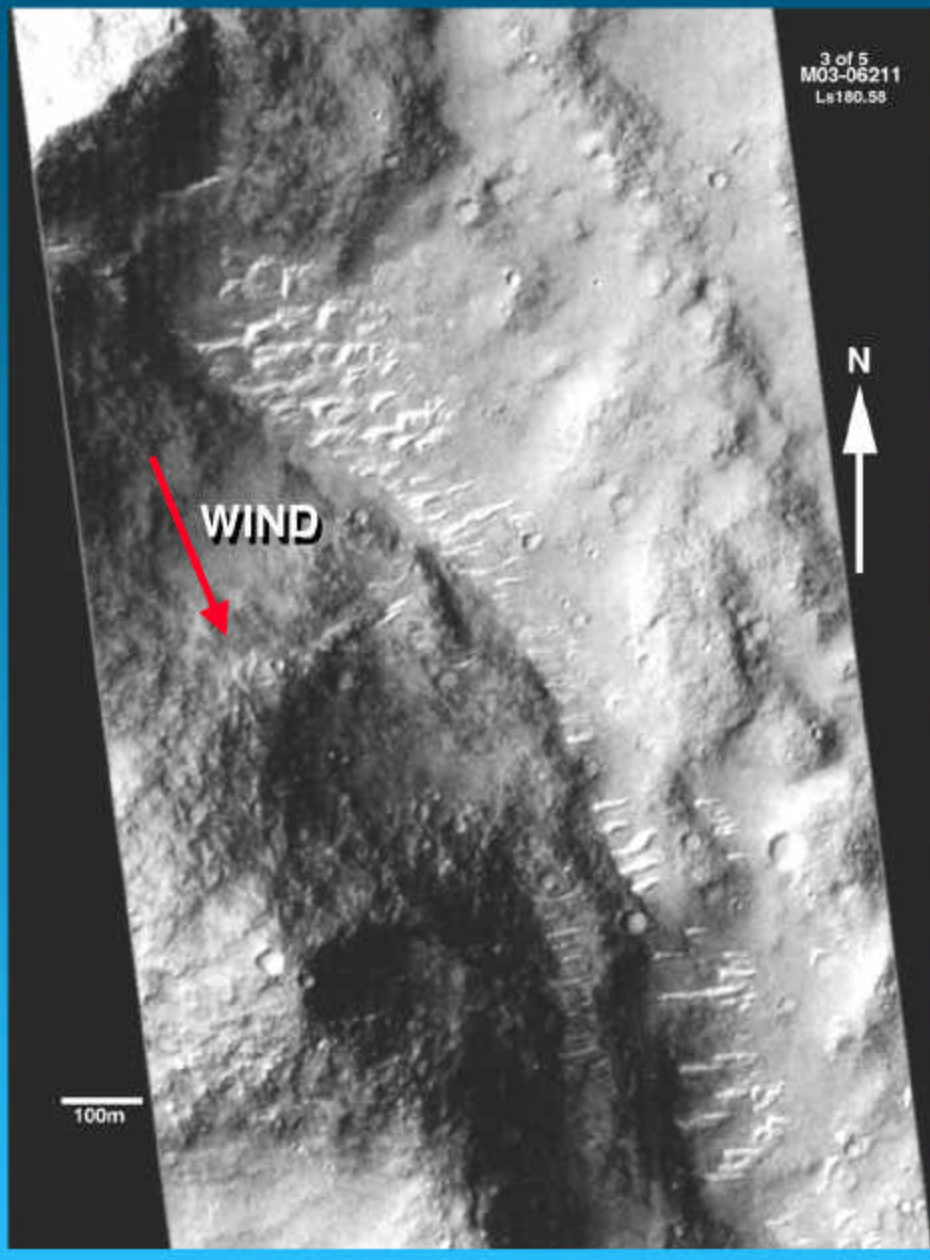

C
A
Ma 'adim
B

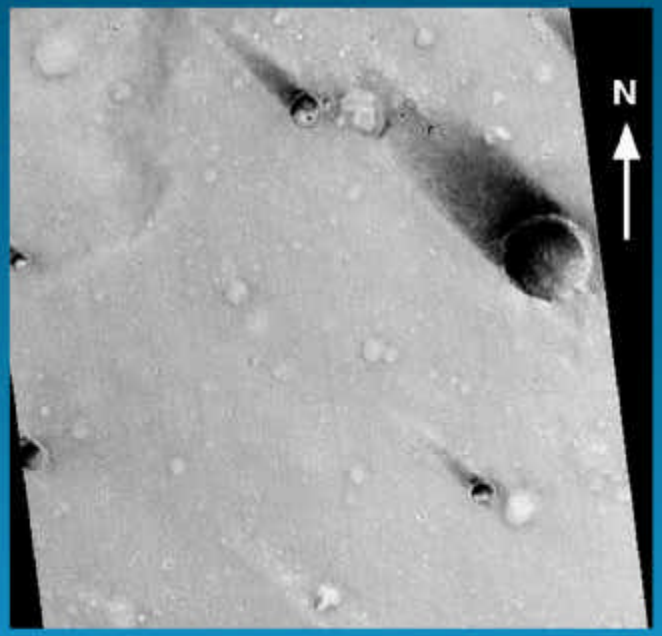
MRAMS (Rafkin), L_s = 143°



GUSEV CRATER



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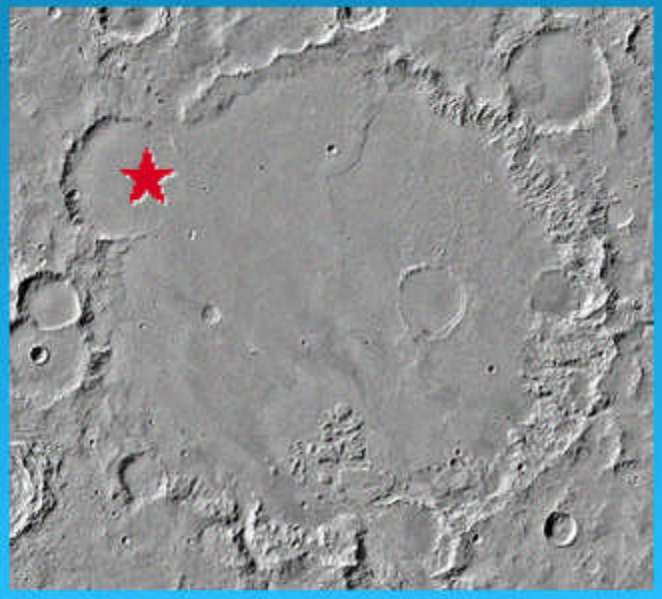
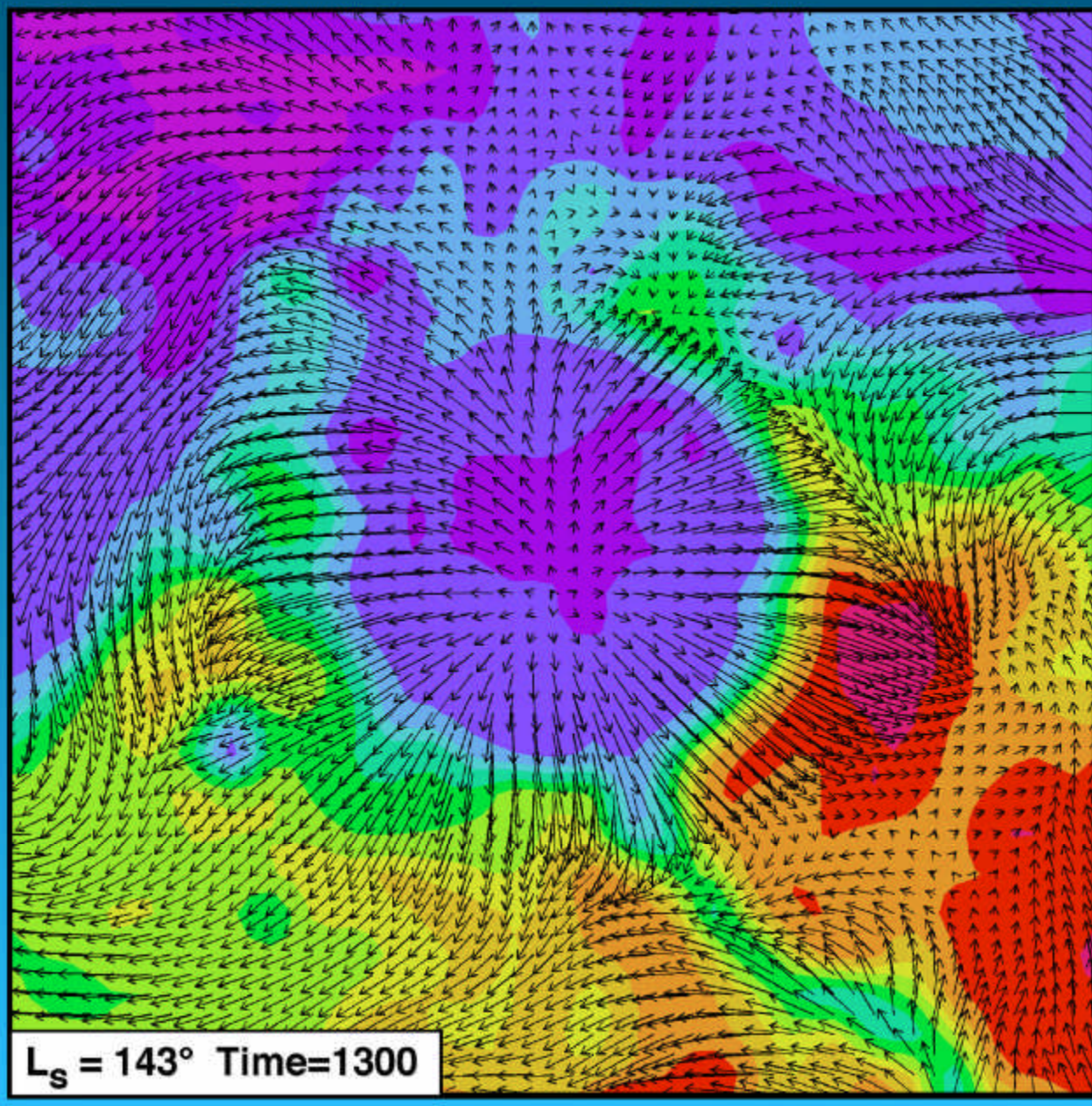
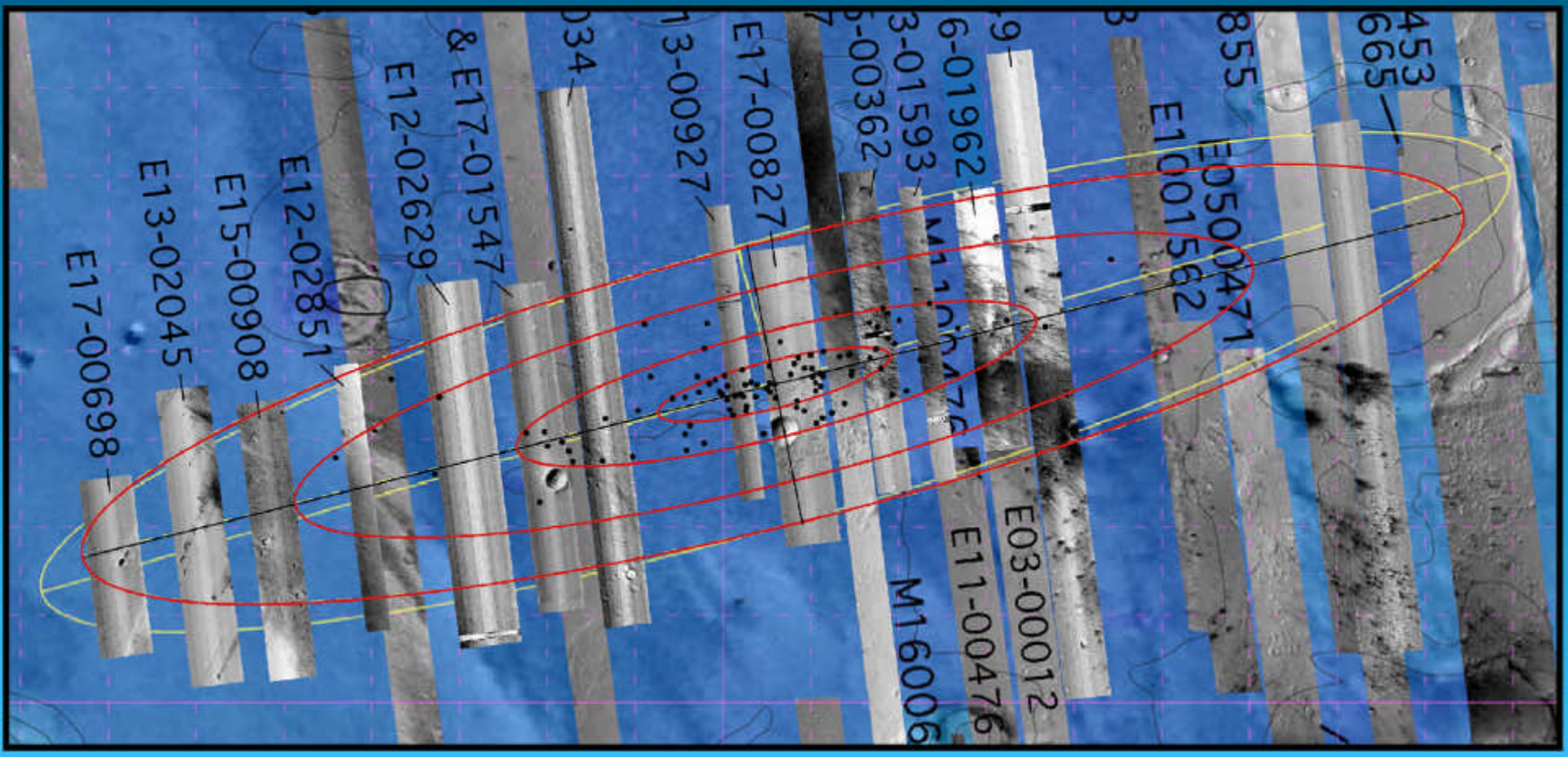


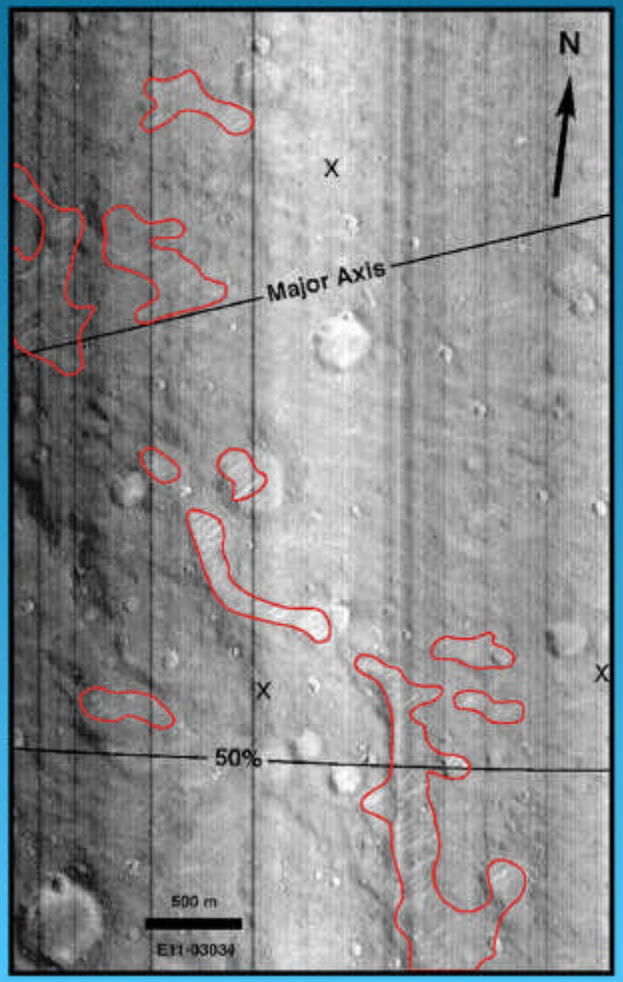

L_s = 143° Time=1300

GUSEV CRATER : RANDOM "TOUCH-DOWNS"

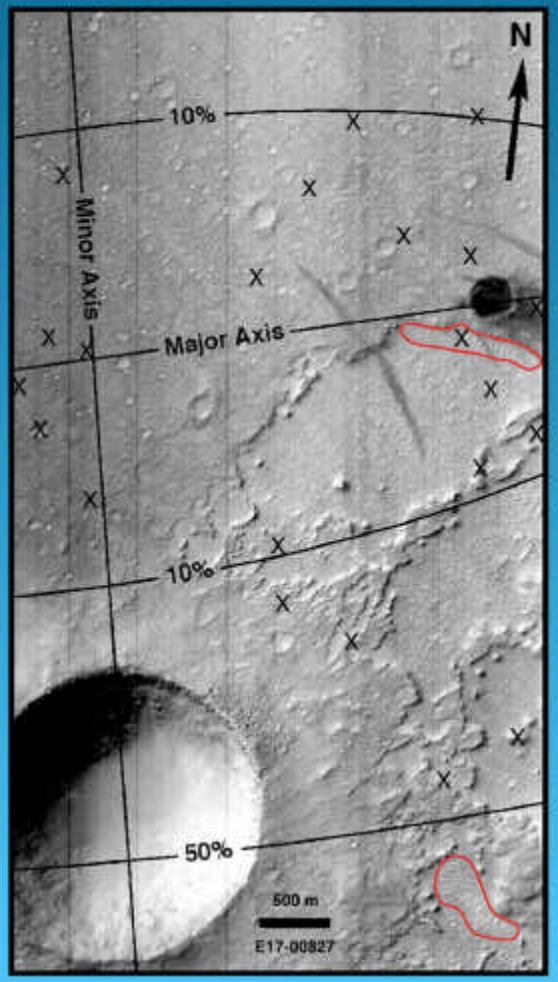


GUSEV CRATER : RANDOM "TOUCH-DOWNS"

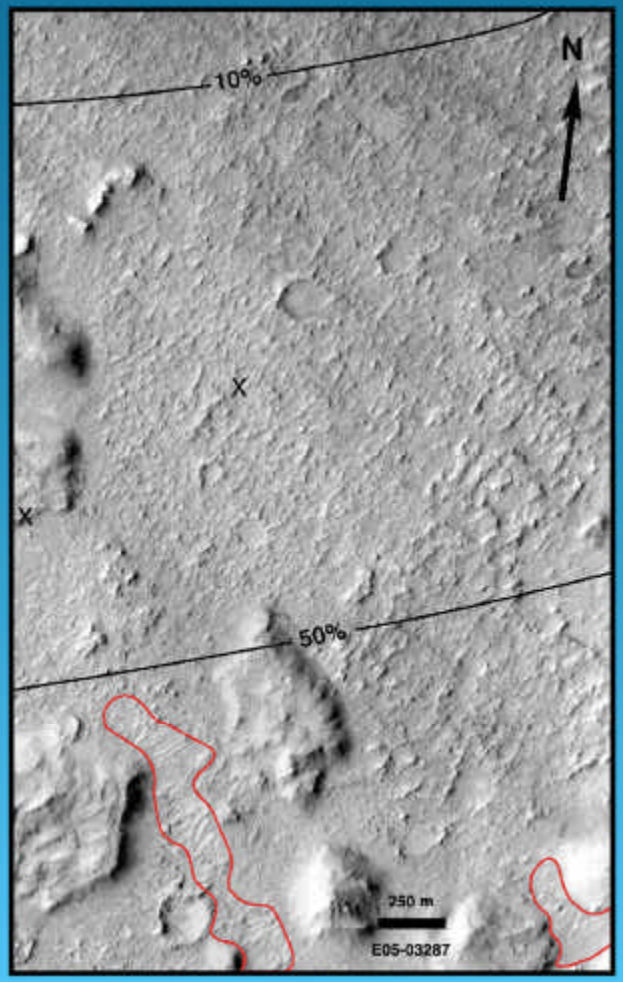
X *landing points* *Aeolian bedforms*



E11

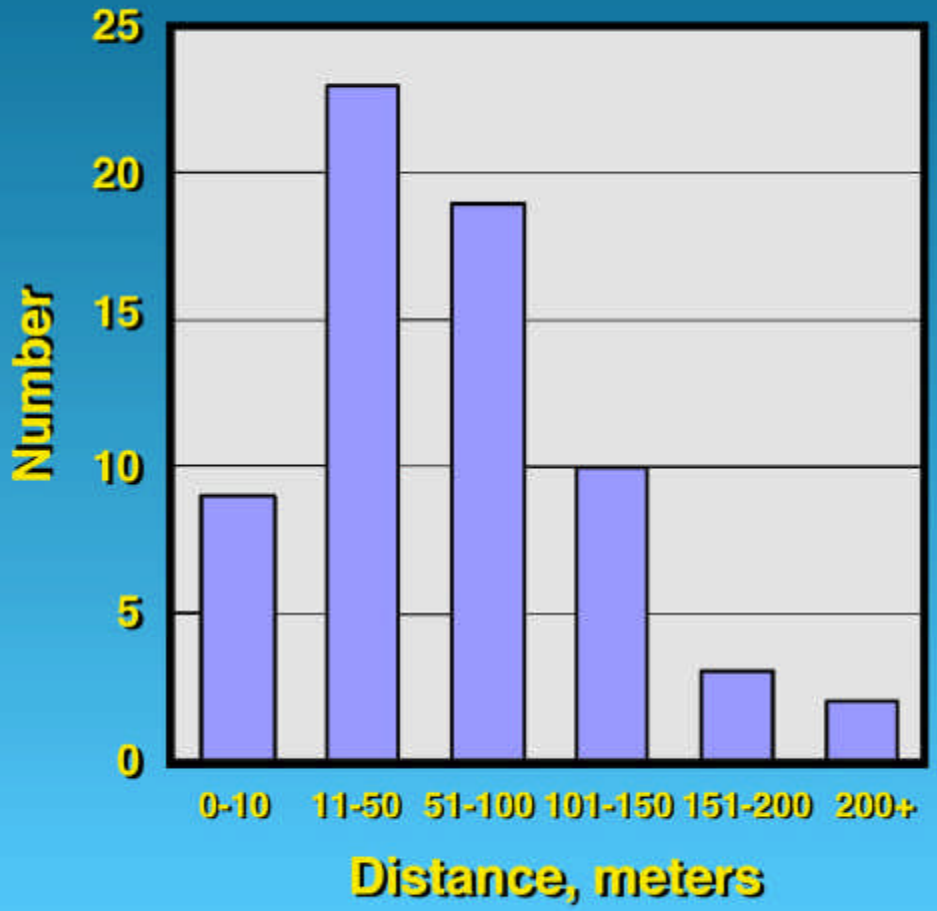


E17



E05

GUSEV : PROBABLE DISTANCE TO NEAREST ROCK



Probable rocks

- Fresh crater rim
- Knob
- Scarp

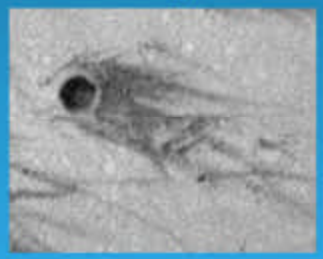
GUSEV: MER SCIENCE POTENTIAL

3 Morphology

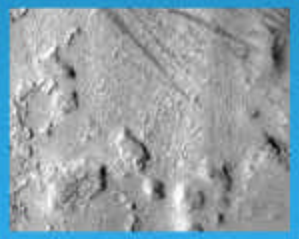
2 Dust-free surface

2 Dust-free surface

3 Surface process



1 Outcrop



1 Rock access
- Ejecta
- Knob
- Scarp

95% within 150m

1 Test hypotheses of origin
- Lake
- Wind
- Volcanic

Full Athena

2 Calibrate/validate remote sensing
- TES
- THEMIS
- Future

APXS, MS, M-TES

3 Surface processes
- Wind
- Water
- Tectonic
- etc.

Pancam MI
RAT, Trenching

MER HEMATITE SITE

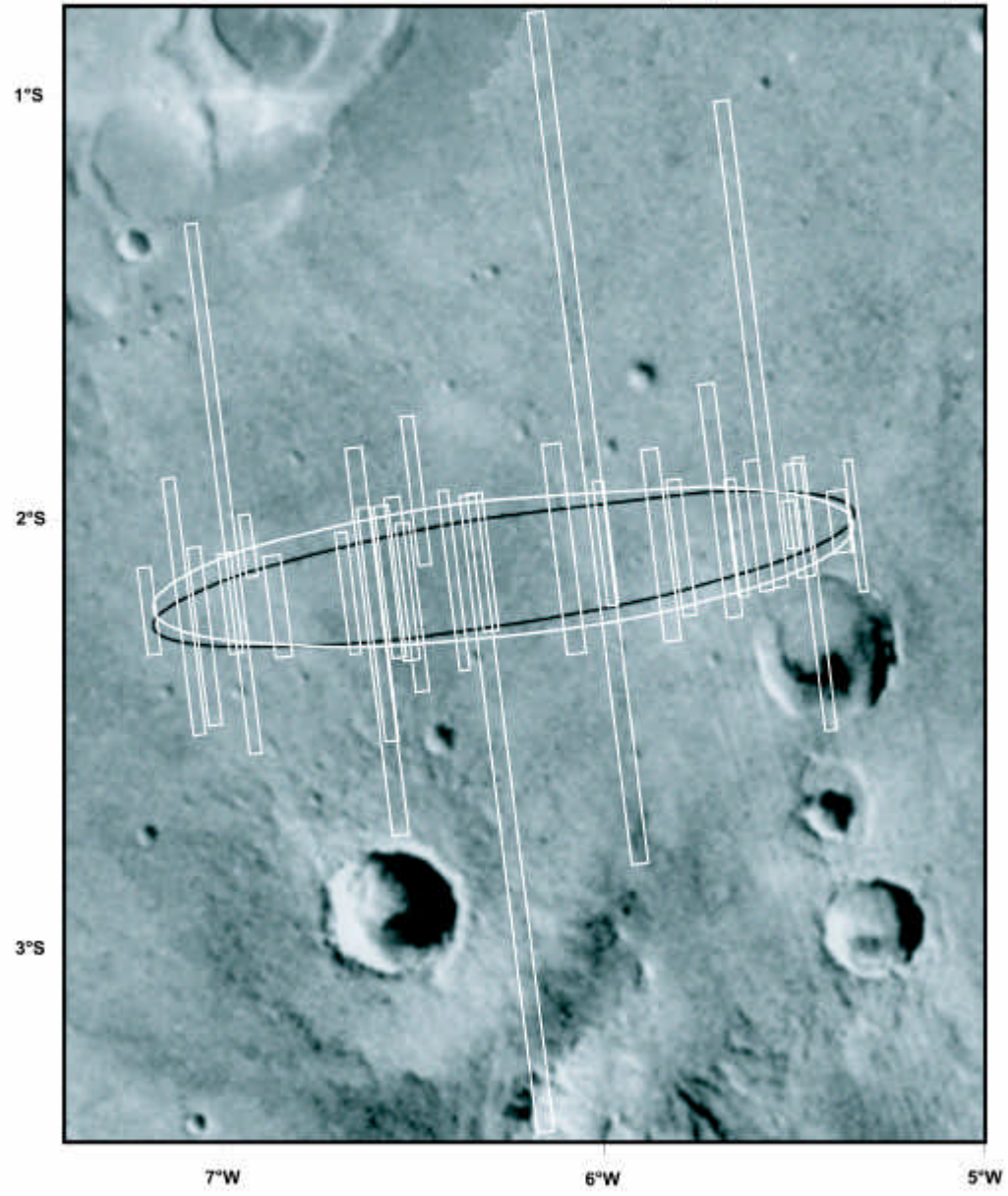
Ron Greeley

- **Wind-related features**
  - **Bright streaks**
  - **Dark streaks**
  - **Barchan dunes**
  - **Transverse (?) dunes**
- **GCM predictions**
- **MRAMS predictions**

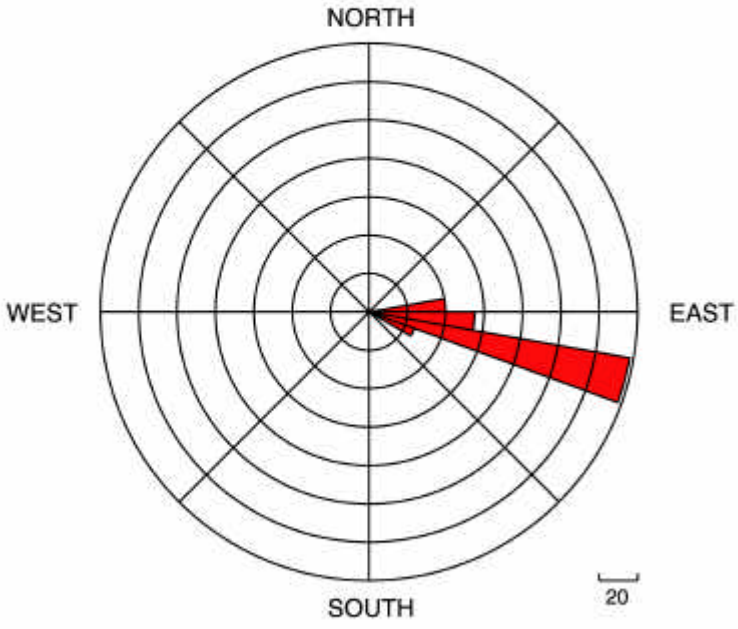
HEMATITE LANDING SITE

MGS MOC image exploration
of the MER-A/B landing ellipse
Graphic contains contexts of MGS orbits: M00 - E20

MER-A = Black ellipse; MER-B = White ellipse

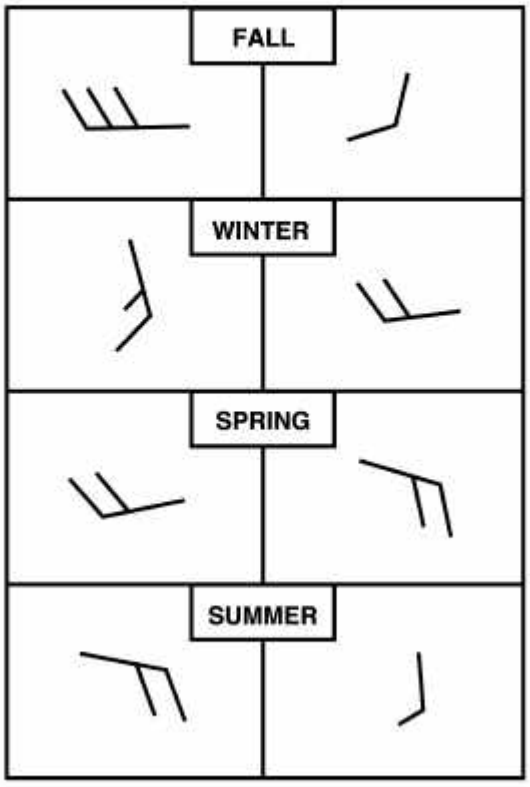


MER HEMATITE SITE: BARCHAN DUNES

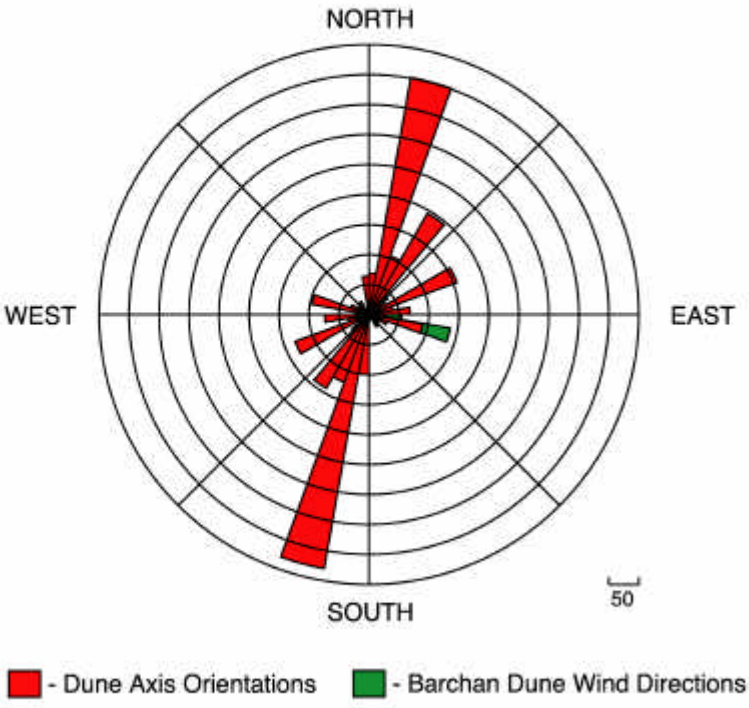


Total # of dunes: 257

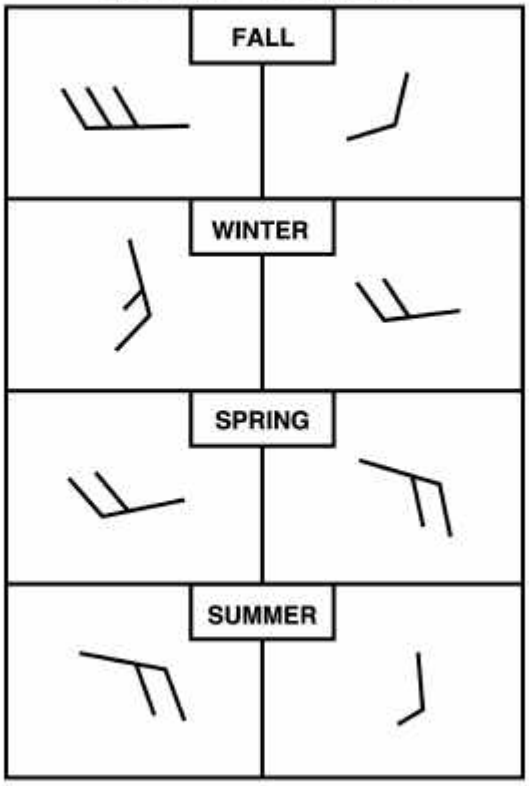
GCM PREDICTIONS



MER HEMATITE SITE: DUNE AXES

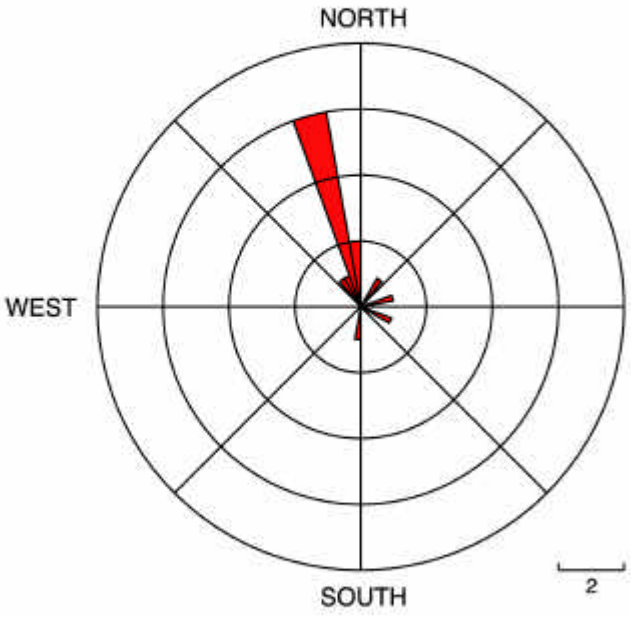


GCM PREDICTIONS

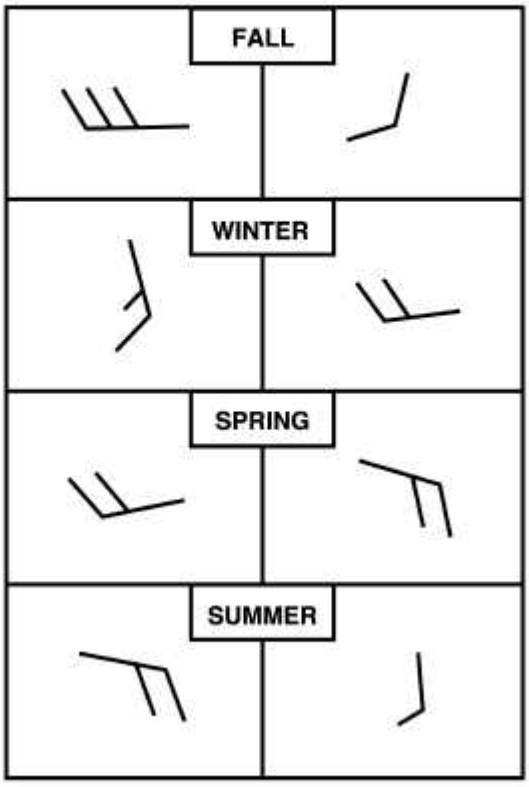


Total # of dunes: 2698

MER HEMATITE SITE: DARK STREAKS

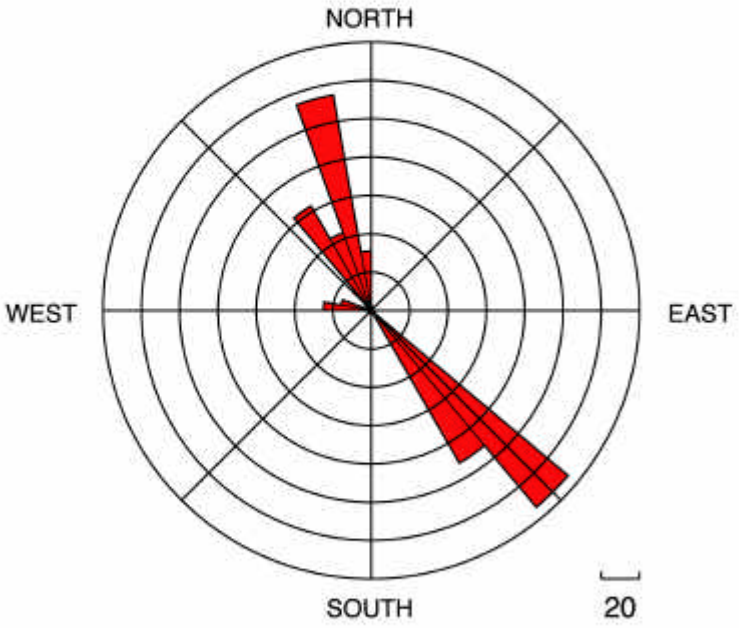


GCM PREDICTIONS



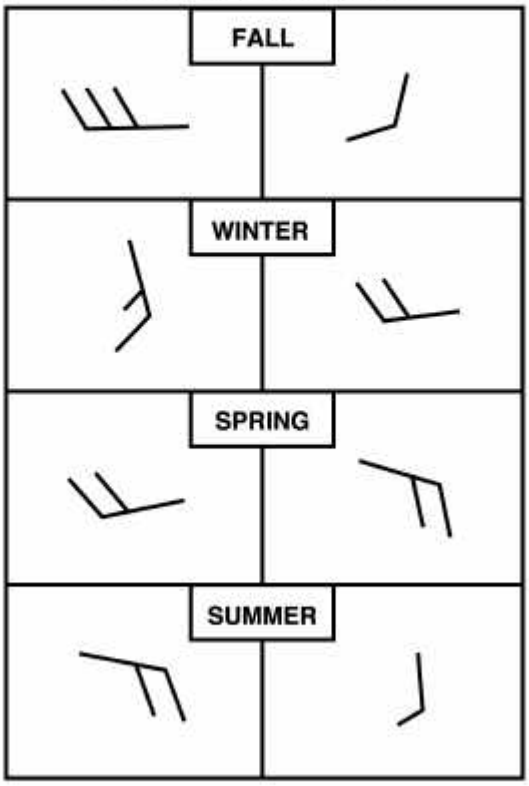
Total # of streaks: 14

MER HEMATITE SITE: BRIGHT STREAKS



Total # of streaks: 324

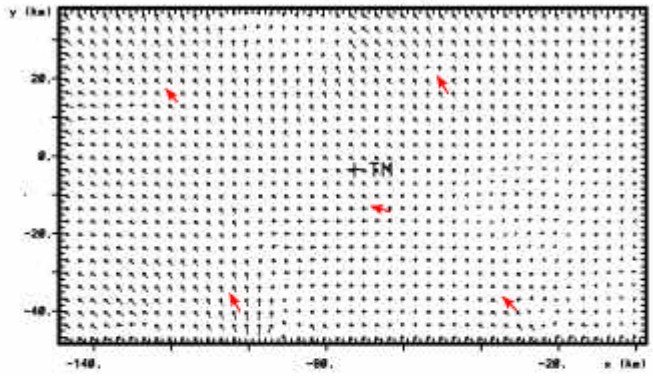
GCM PREDICTIONS



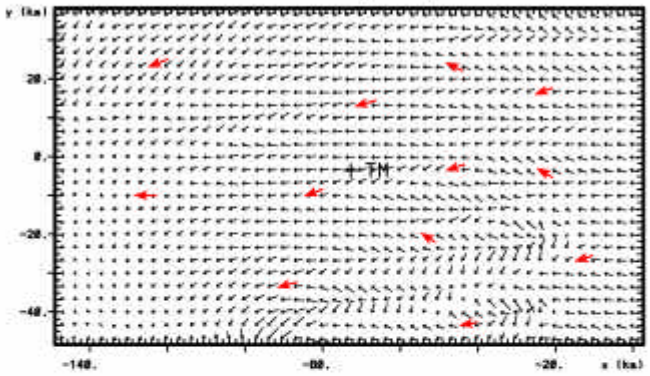
MRAMs FOR L_S 320 AT HEMATITE SITE

→ 5 m/s at 14.7 m height

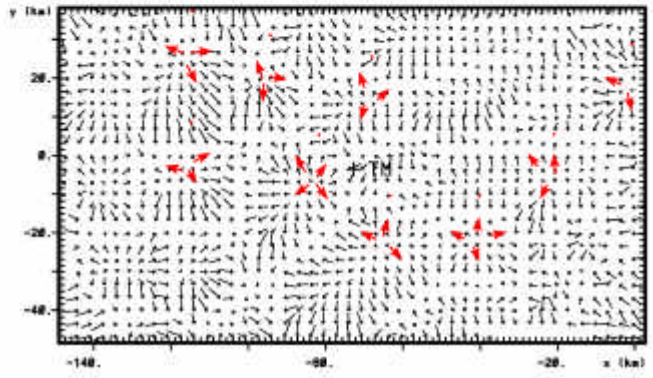
0000 UTC (midnight)



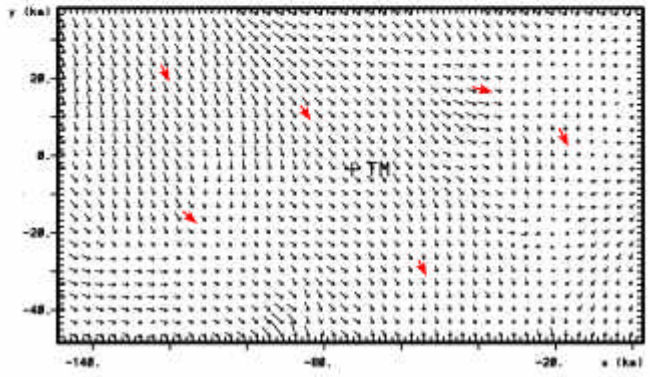
1200 UTC (noon)



1400 UTC



1800 UTC



(From Rafkin)

MER HEMATITE SITE

- **Duneforms (e.i., dune axes) probably represent *transverse* dunes**
- **Best GCM correlation is with barchan dunes (summer and strongest winds from the west)**
- **MRAMS predicts no strong directional winds for Ls of landing; pattern suggests local upwelling – downwelling in late afternoon**
- **Dark wind streaks**
  - **Inferred to be erosional, or lag deposits of coarser particles**
  - **Little indication of directionality**
  - **Consistant with MRAMS**