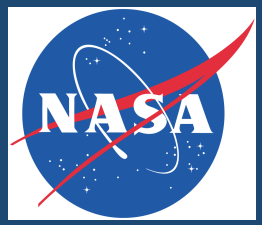
2-D Spatial Pattern Analysis of Transverse Aeolian Ridges (TARs) on Mars

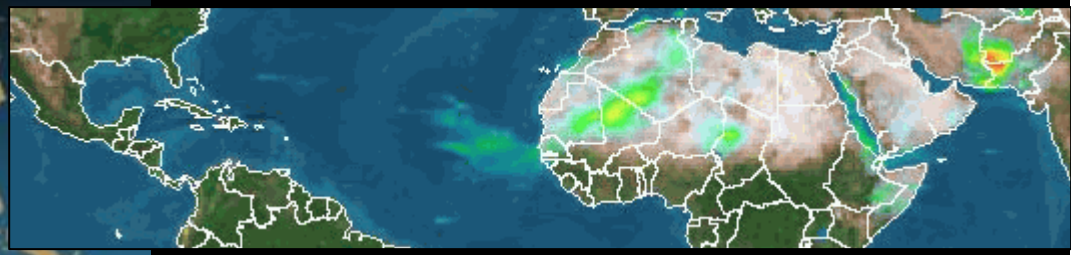
E. Michelle Neely

Mentors: Dr. Jim Zimbelman (Smithsonian), Dr. Nathan Bridges (APL)



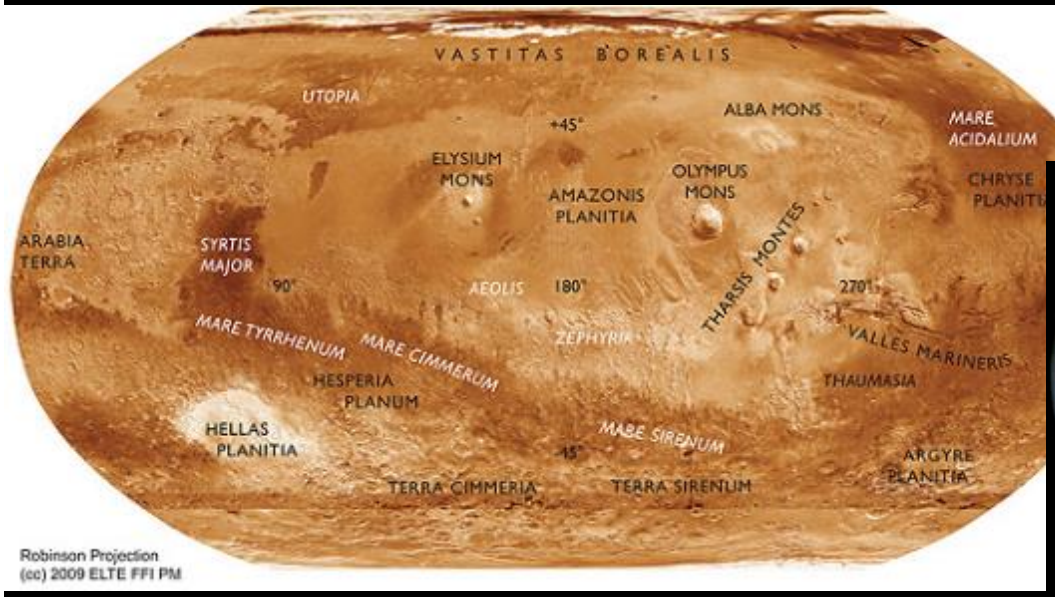
Overview

http://greenfieldgeography.wikispaces.com/IGCSE+and+GCSE+Weather,+Climate+and+Ecosystems



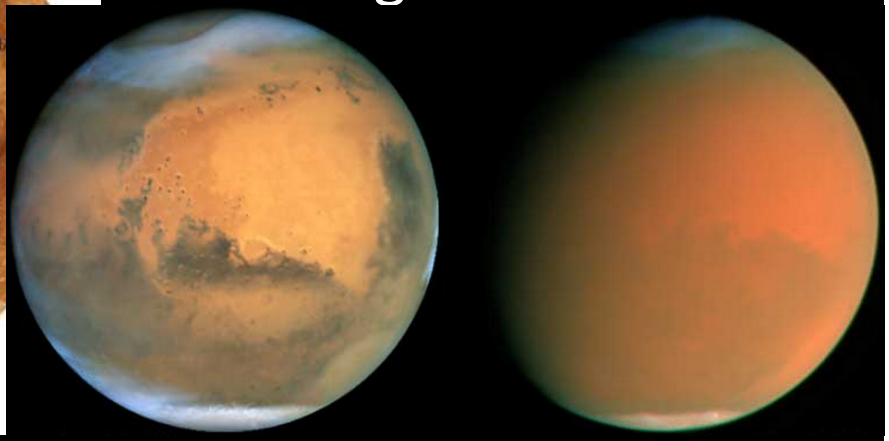
http://science.nasa.gov/media/medialibrary/2001/08/30/ast30aug_1_resources/dustmovie_med.gif

Earth dust transport (1 week)



http://planetologia.elte.hu/ipcd/ipcd.html?cim=robinson_composite

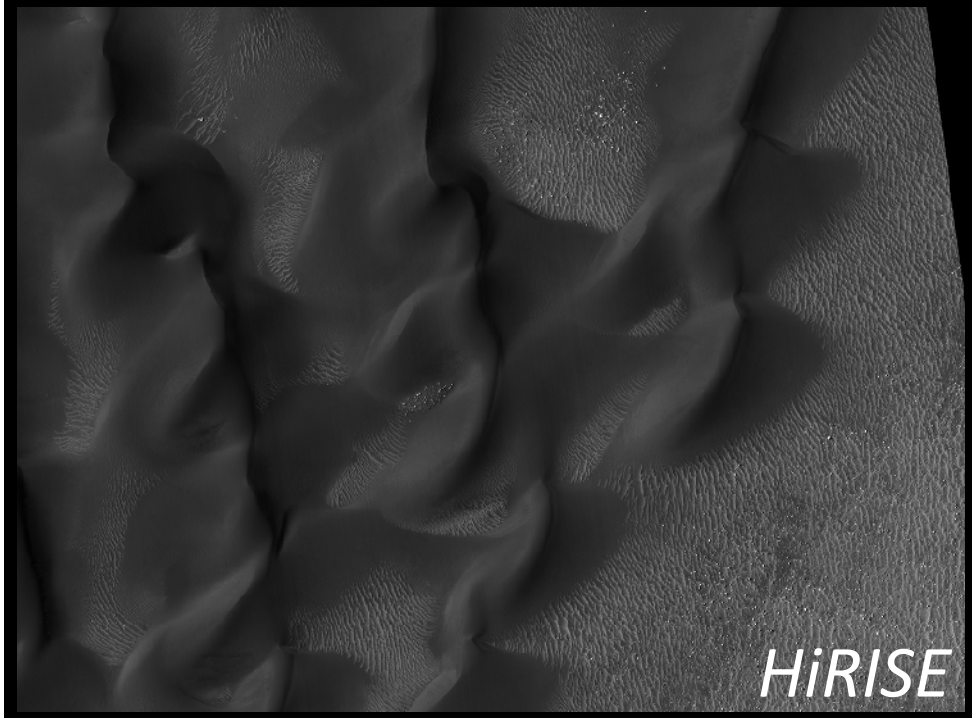
Mars global dust storm

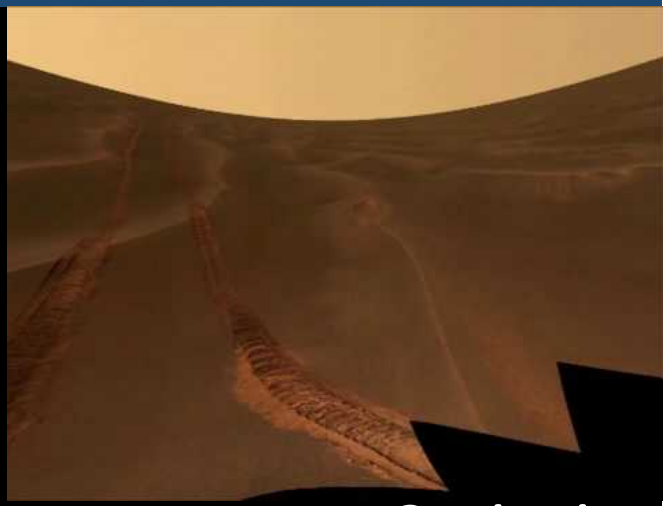


http://science.nasa.gov/science-news/science-at-nasa/2001/ast11oct_2/

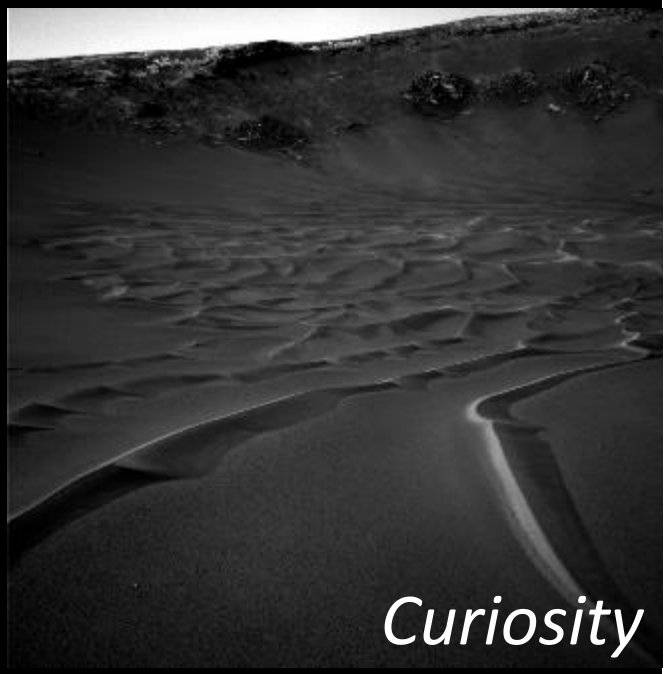
Mars Aeolian Depositional Bedforms

Dunes,
Ripples



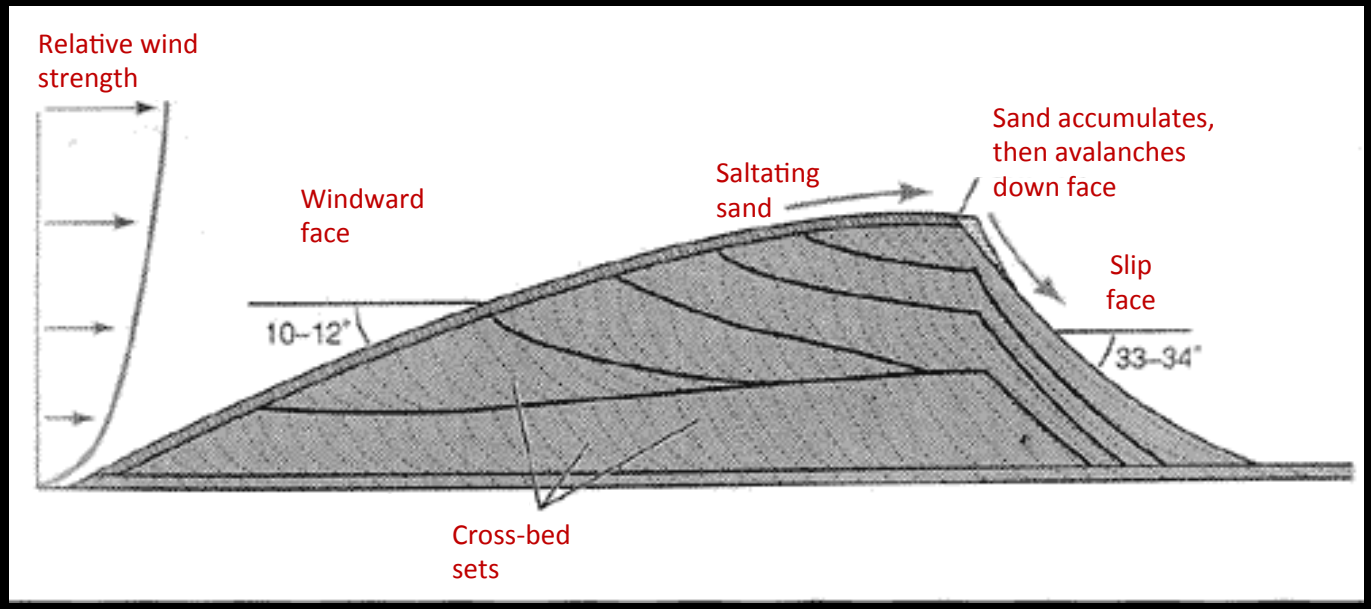


Large Dark Dunes (LDDs),
Transverse Aeolian Ridges (TARs)



http://www.uahirise.org/ESP_011909_1320,
http://article.wn.com/view/2014/02/06/Mars_rover_Curiosity_set_to_ride_biggest_sand_dune_yet/, https://www.thunderbolts.info/tpod/2008/arch08/081105ripples.htm

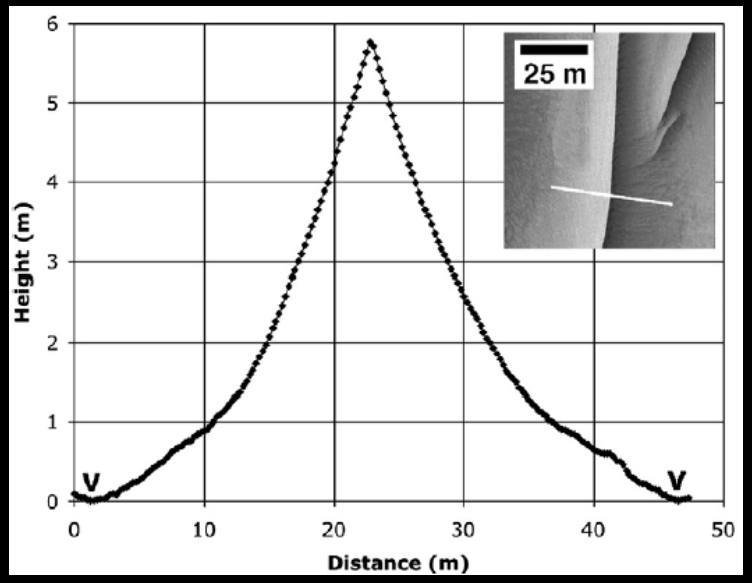
Transverse Aeolian Ridges (TARs)



http://www.fao.org/docrep/003/y1899e/y1899e06.htm

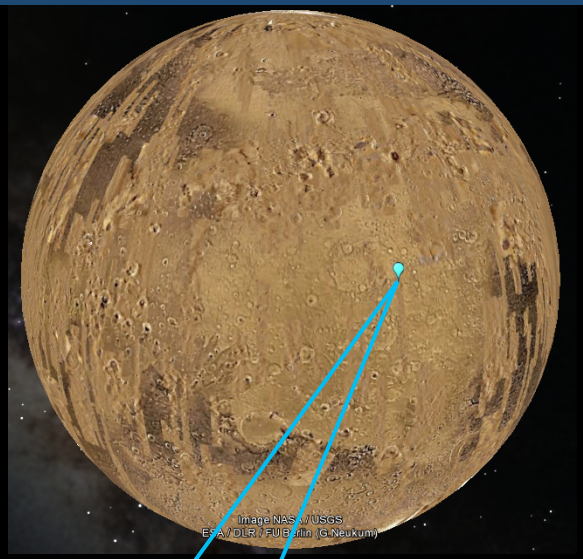
Dune profile

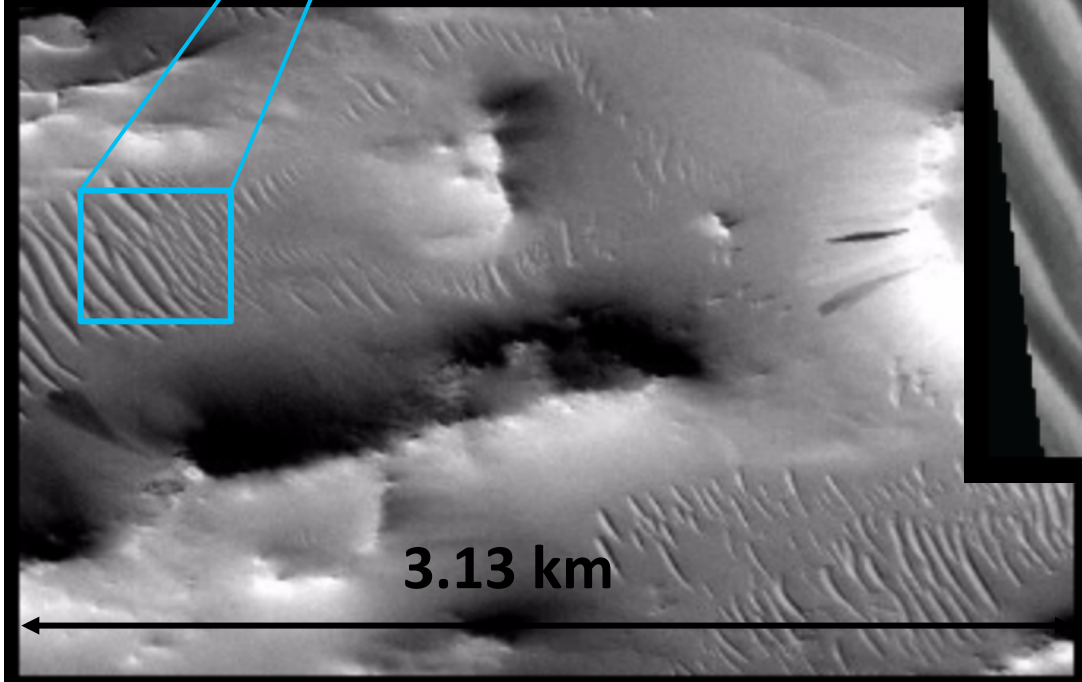
TAR profile



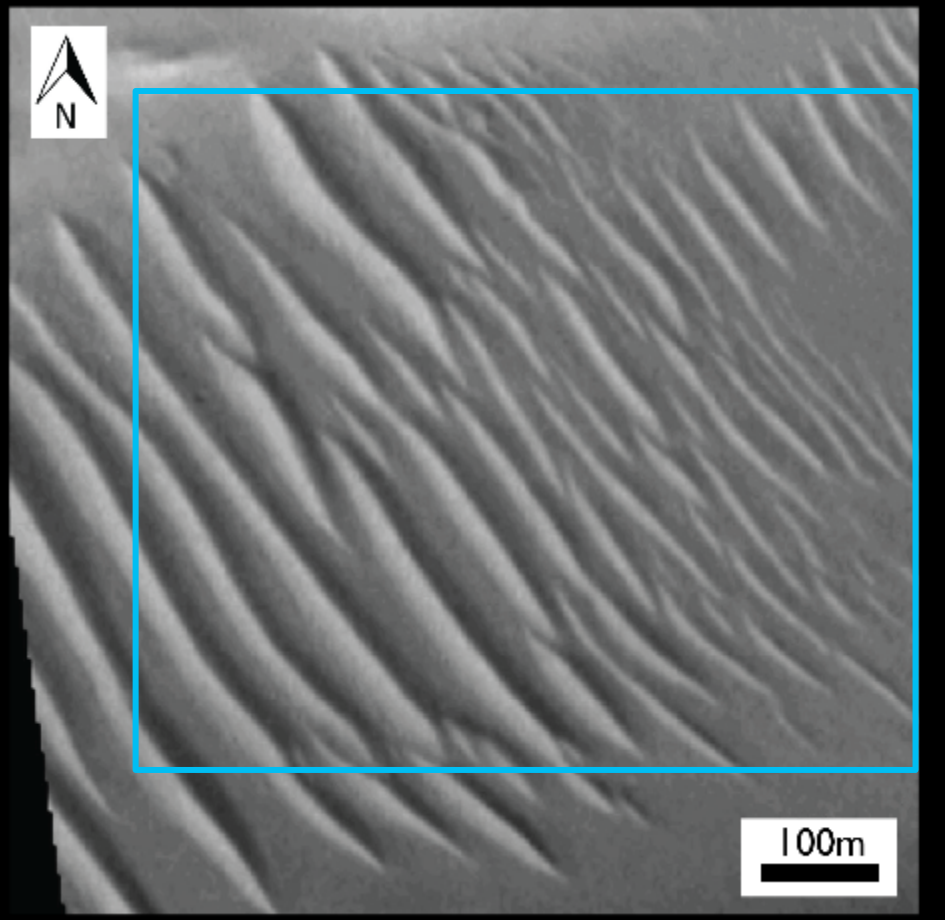
Zimbelman, 2010

Transverse Aeolian Ridges (TARs)





Google Mars, MOC image M1104208



TARs on Mars

Berman, et al., 2011

Purpose and Scope

Objective

Use remote imagery from the High Resolution Imaging Science Experiment (HiRISE) aboard the Mars Reconnaissance Orbiter (MRO) to obtain 2-D spatial measurements:

- Crestlines
- Wavelengths
- Sinuosity angles

This work supports larger project to infer formational wind processes by comparing TAR patterns to terrestrial analog bedform and wind patterns.

Methodology

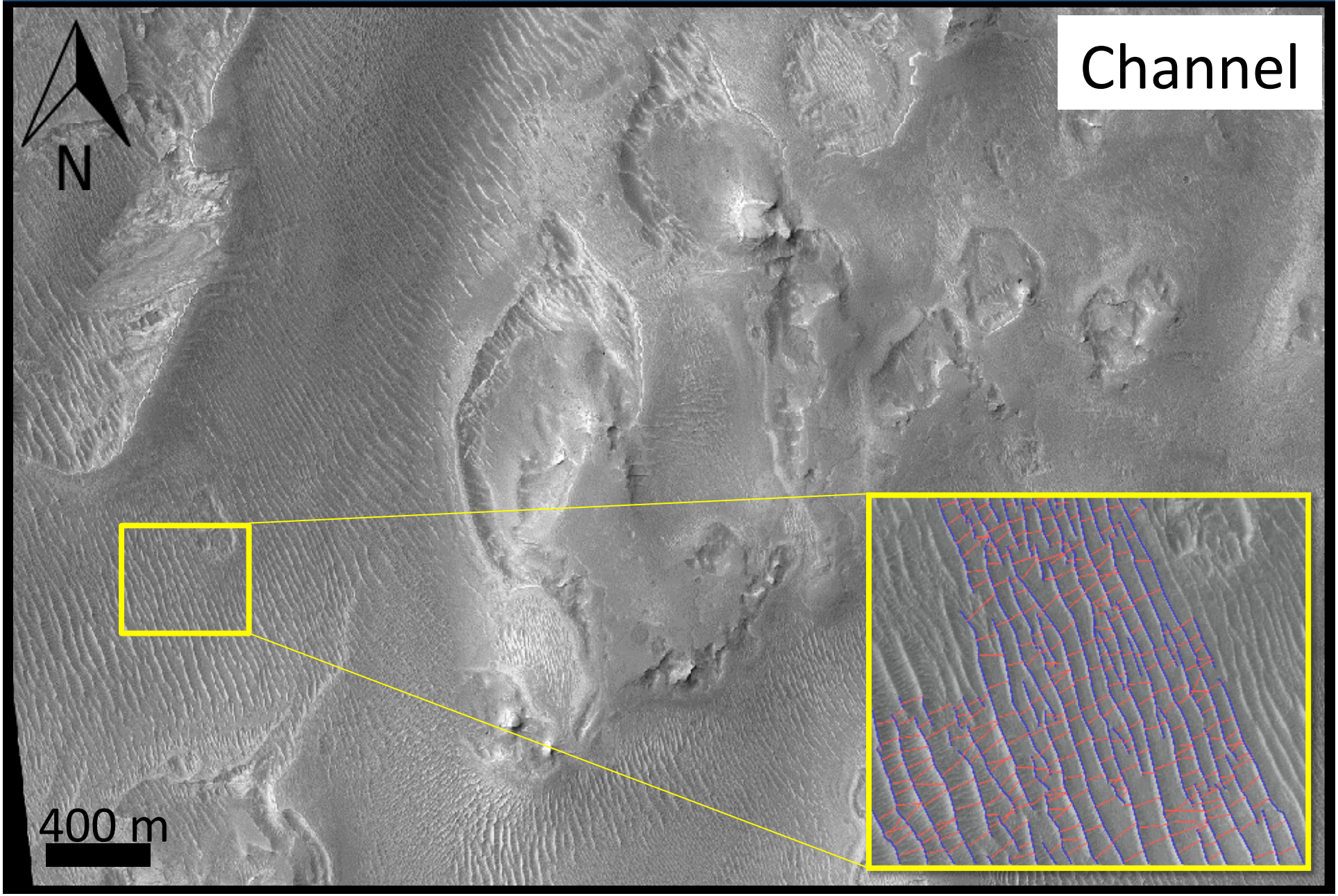
TAR Field Site Selection

- Wide channel
- Narrow valley

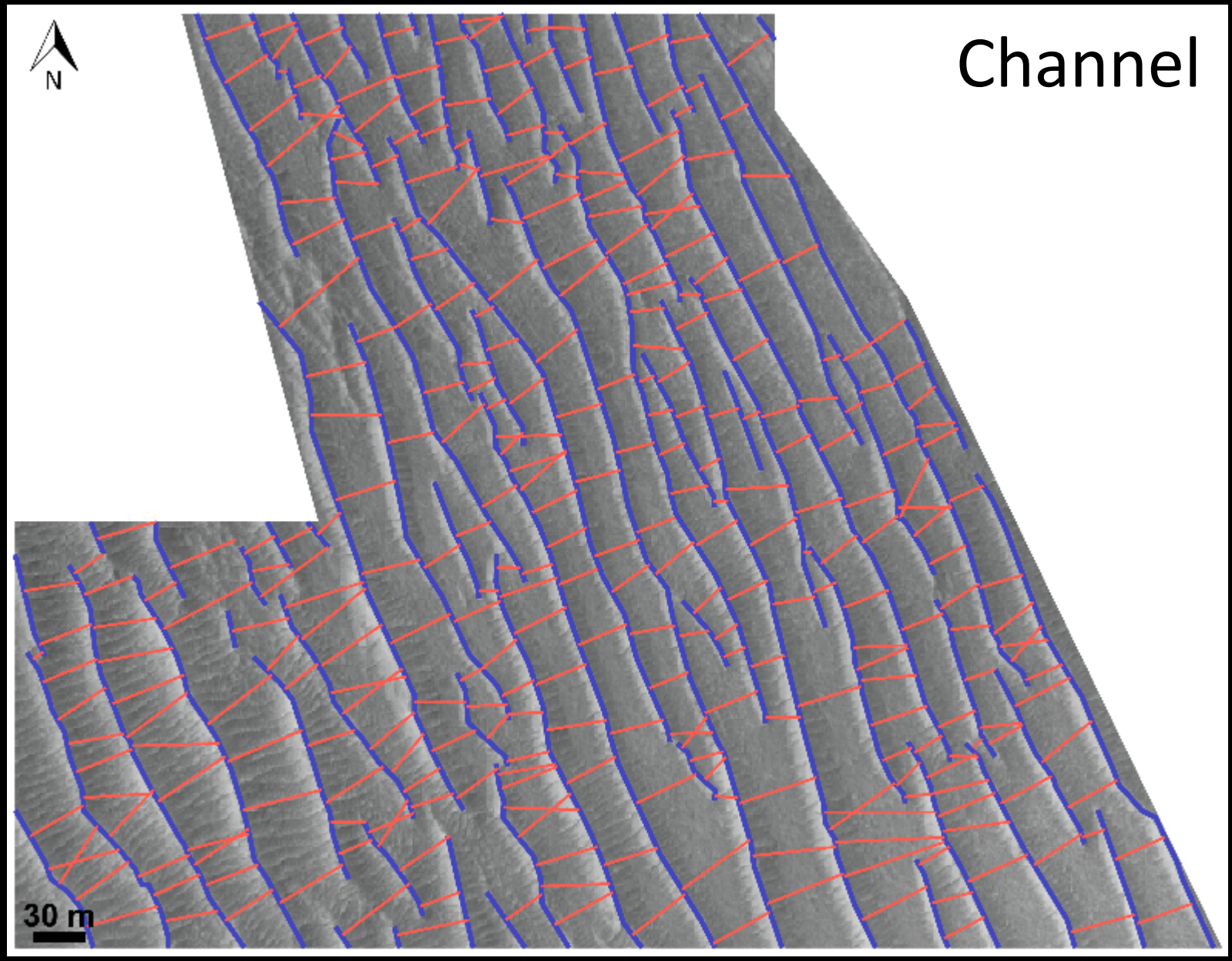
Methods

1) Crestlines digitally traced using the Online Line Segment Detector (OLSD)
2) Manually-traced crestlines compared with OLSD
3) Wavelengths manually measured and digitized
4) Data plotted with rose diagrams
5) Angles between crestline segments measured (sinuosity)

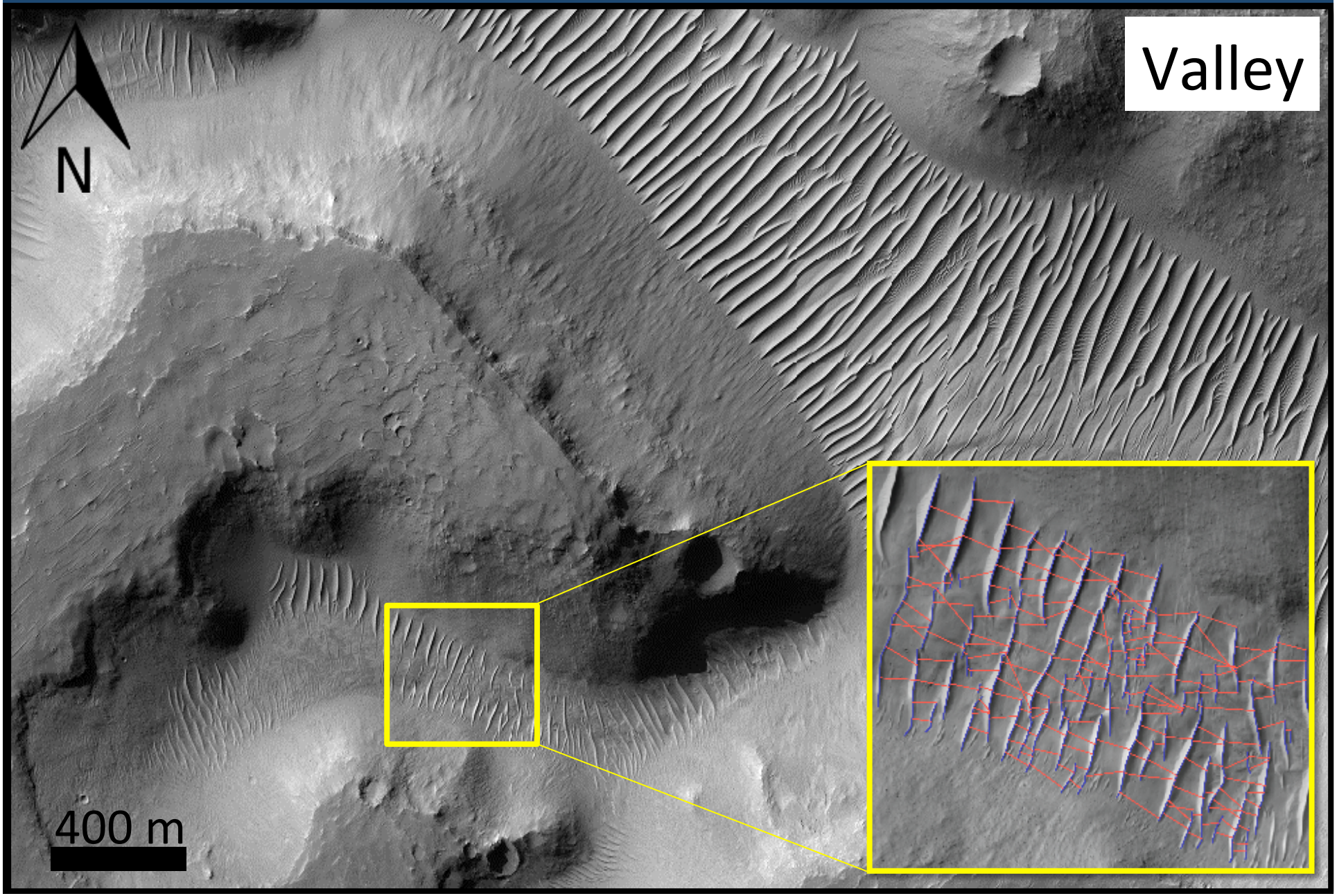
Methodology



Methodology



Methodology



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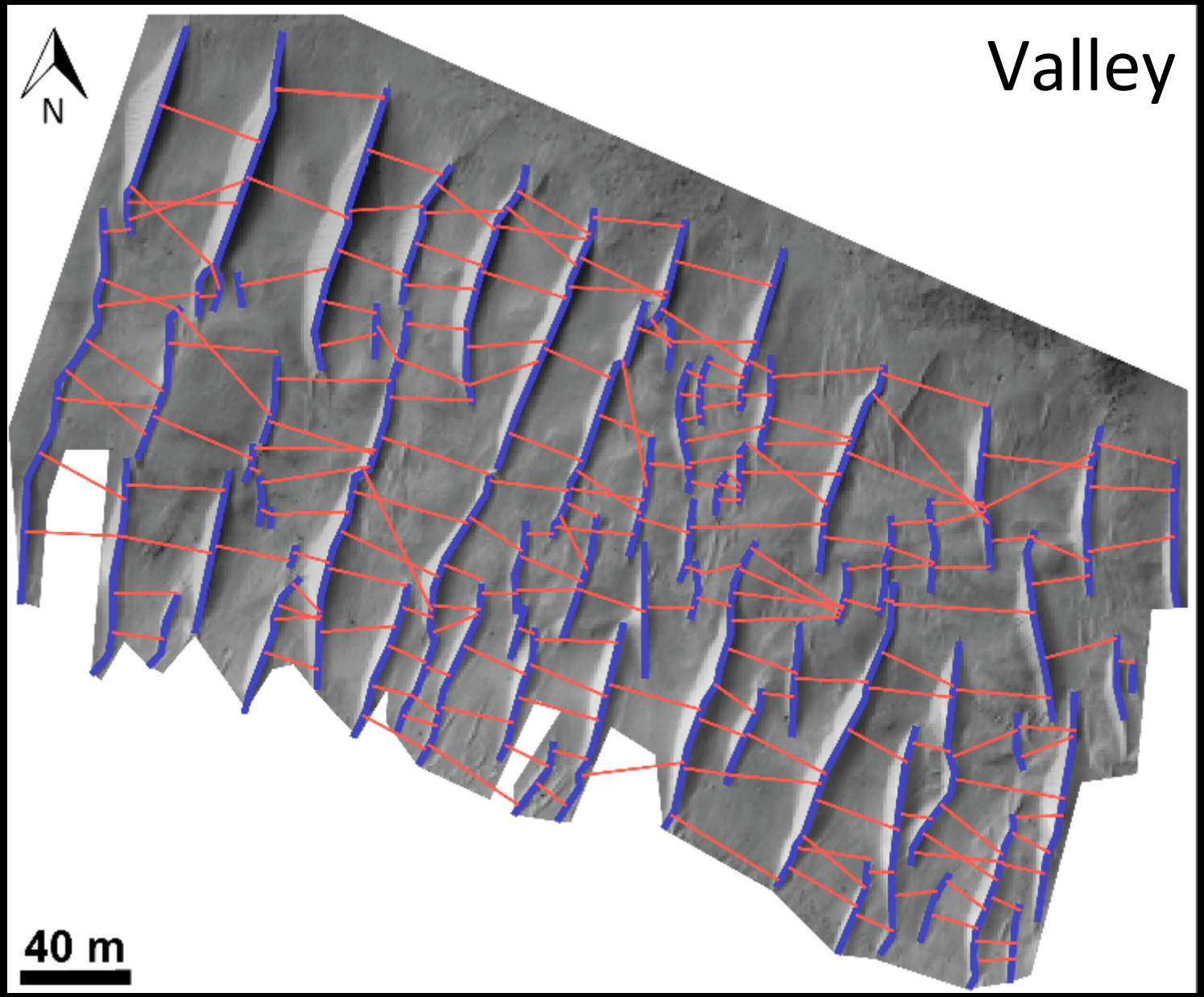
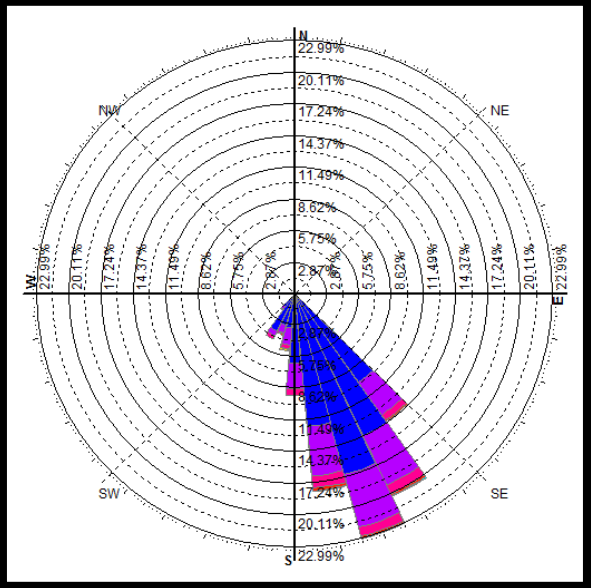
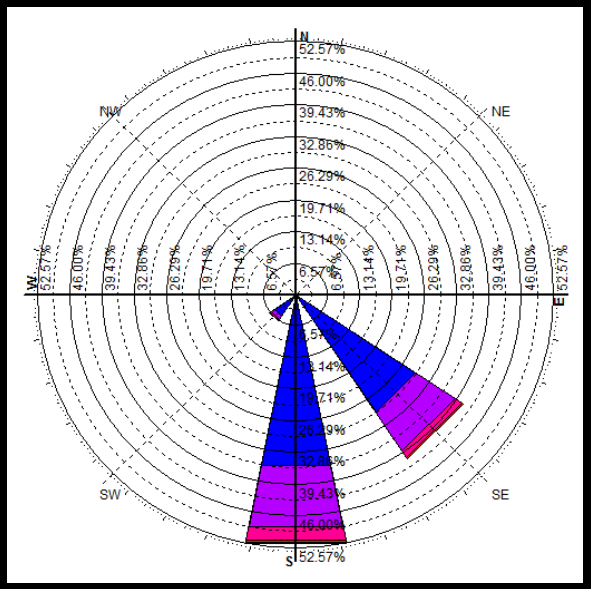
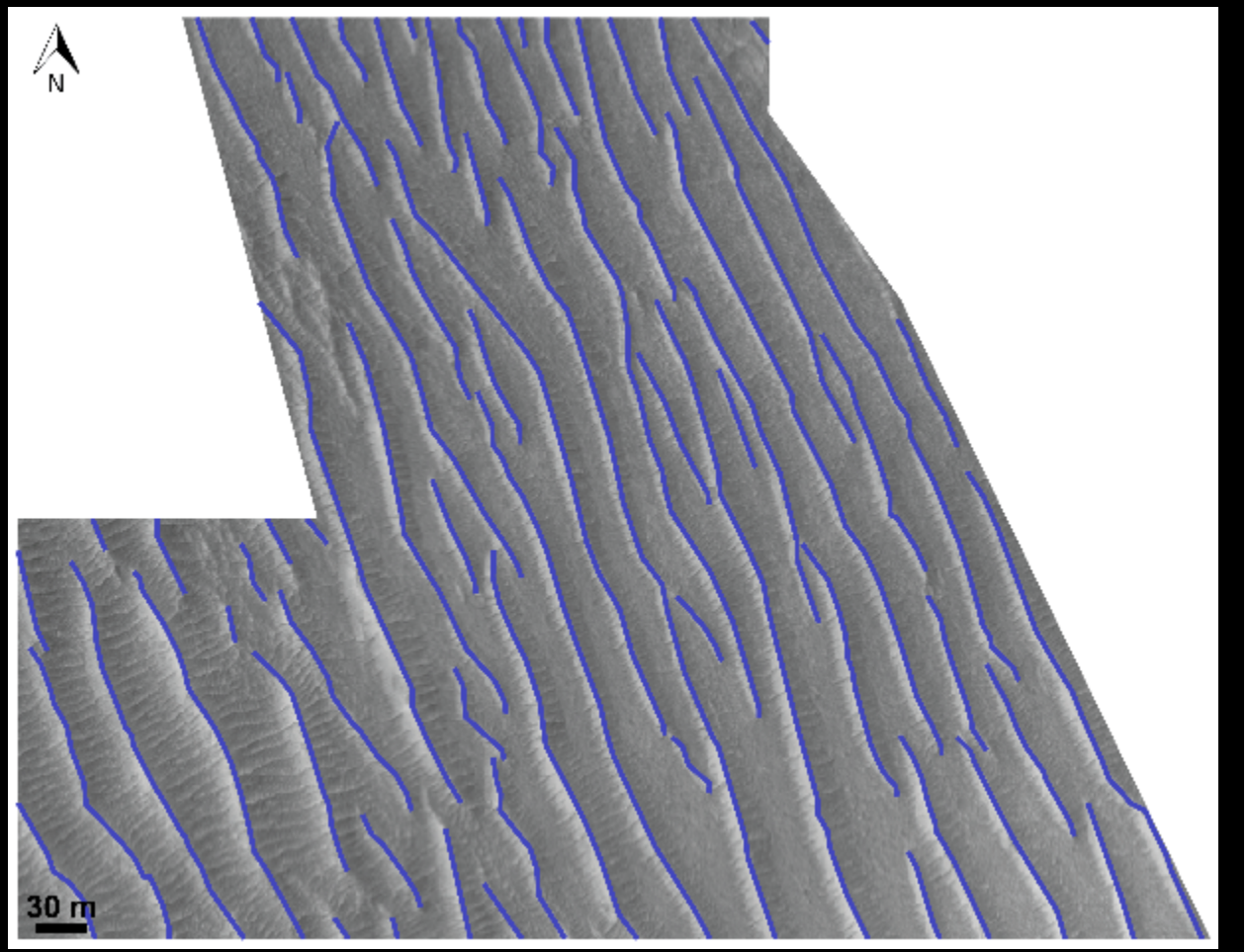


Results

Channel

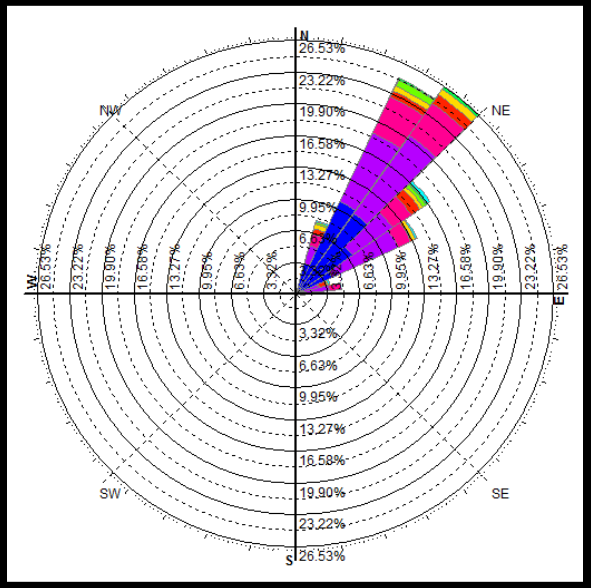


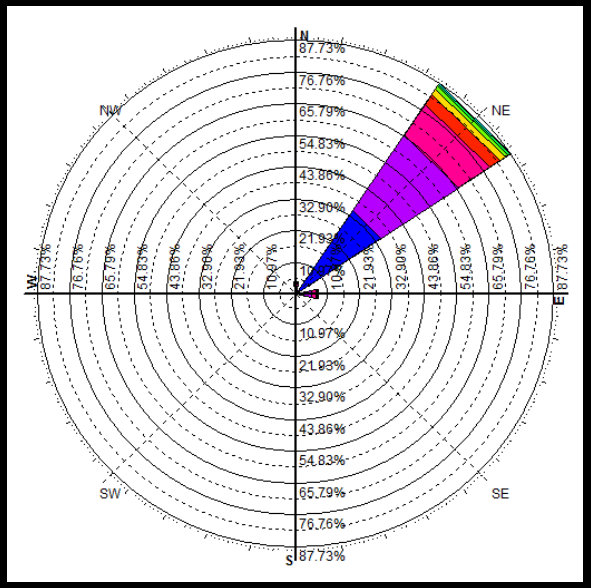


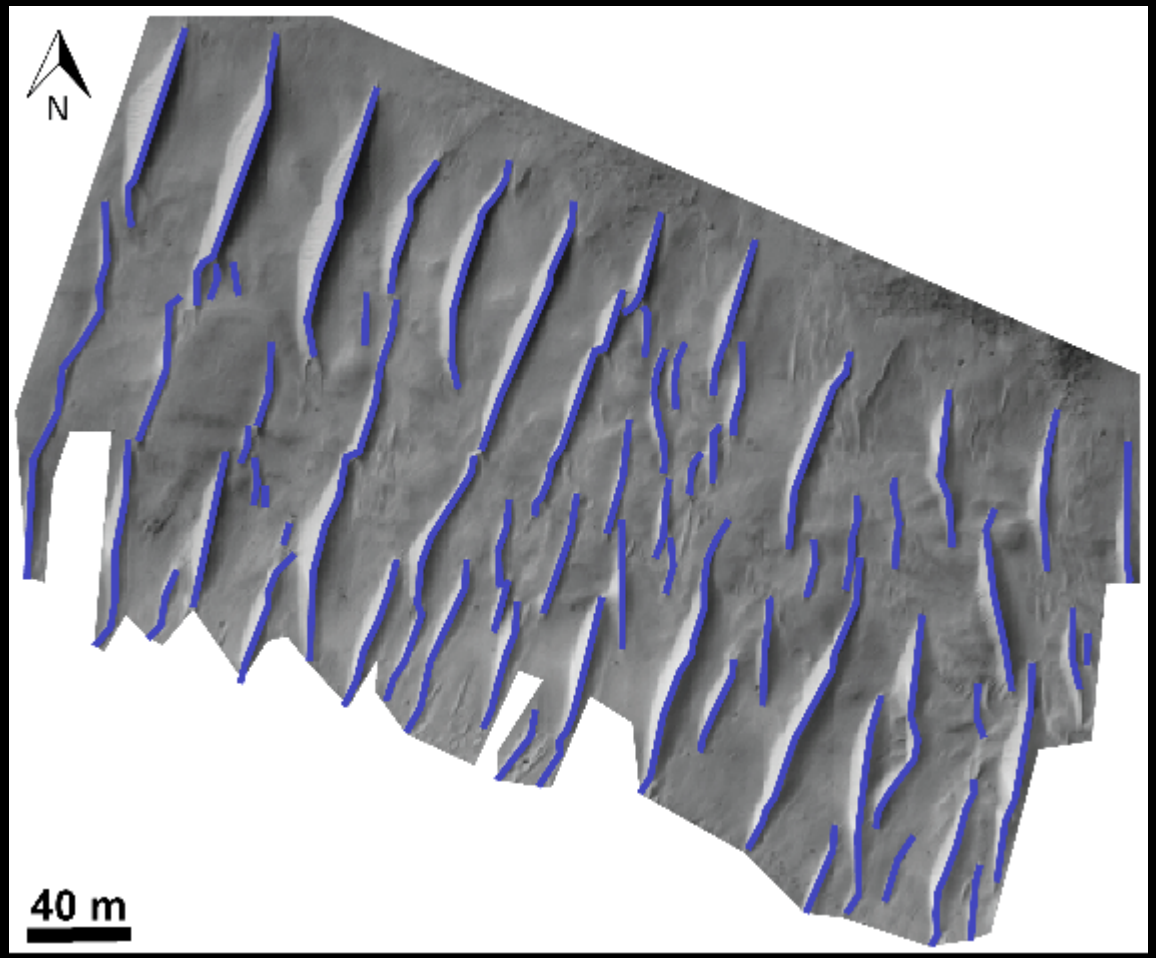


Results

Valley







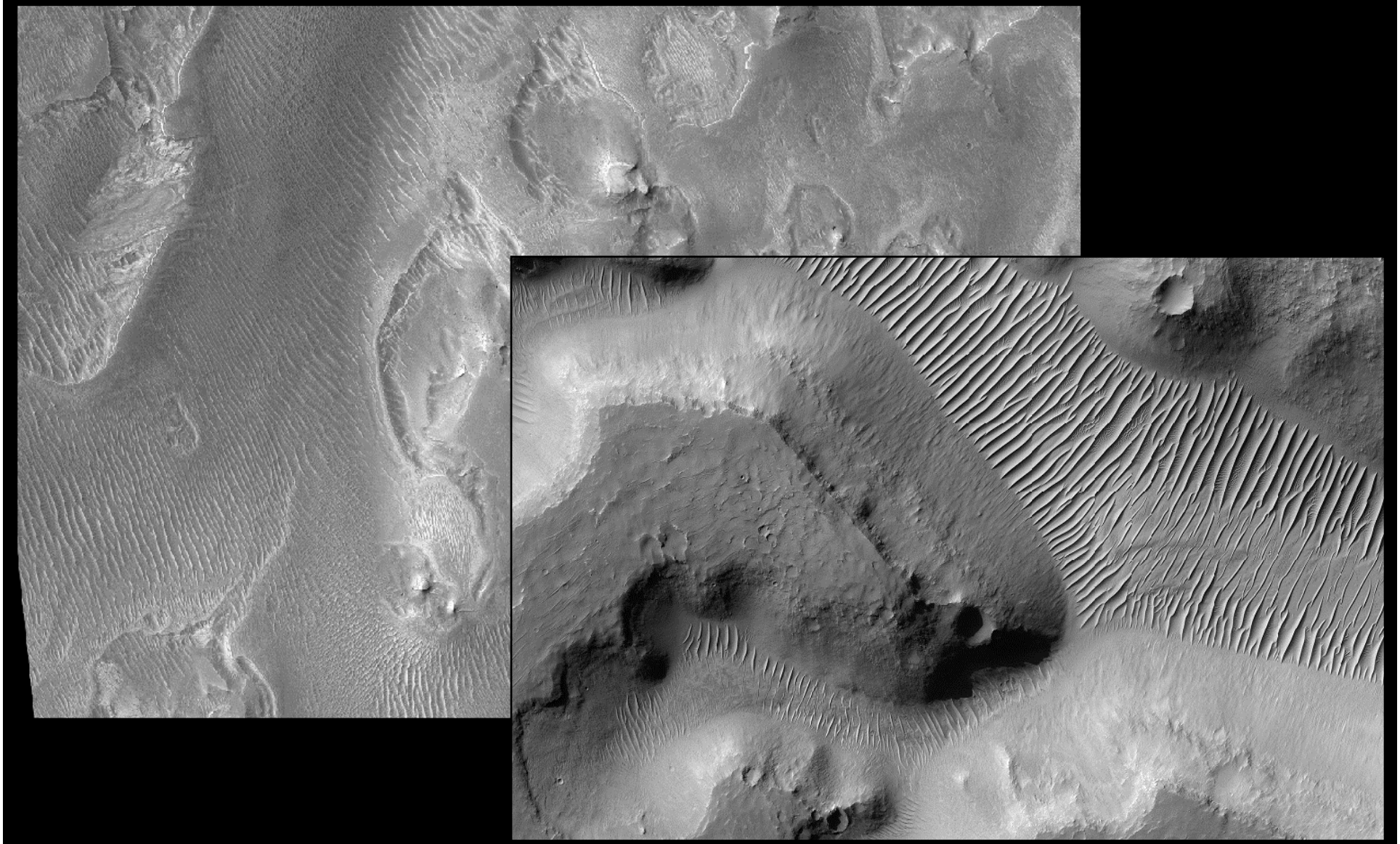
Results

TAR FIELD SPATIAL MEASUREMENTS

	Measurement	Channel	Valley
Site	Site width	1.194 km	0.236 km
	Site length	1.816 km	1.040 km
Crestlines	Average crestline segment length	15.7 m	12.4 m
	Crestline length / site width	1.31%	30.5%
	Crestline length / site length	0.86%	6.94%
	Primary crestline orientation(s)	N-S, NW-SE	SW-NE
	Inter-crestline angle (sinuosity)	45^{o}	N/A
Wavelengths	Average wavelength	26.7 m	19.5 m
	Wavelength / site width	2.24%	8.22%
	Wavelength / site length	1.47%	1.87%

Discussion & Future Work

Bi-directional wind regimes vs. topography as formational controls



Acknowledgements

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Mentors Drs. Zimbelman and Bridges

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