Thick Ice Deposits in Deuteronilus Mensae, Mars: A SHARAD case study

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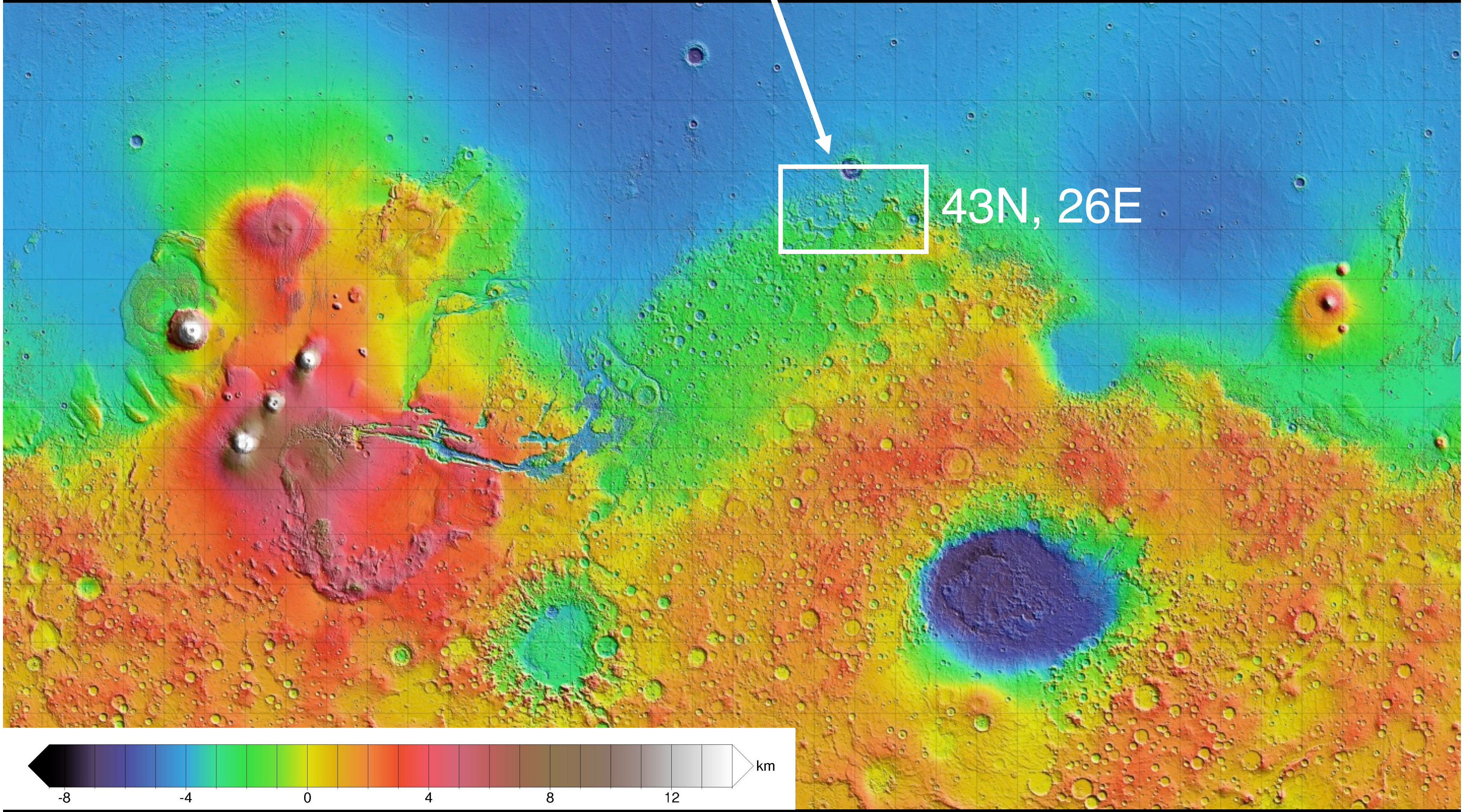
Outline

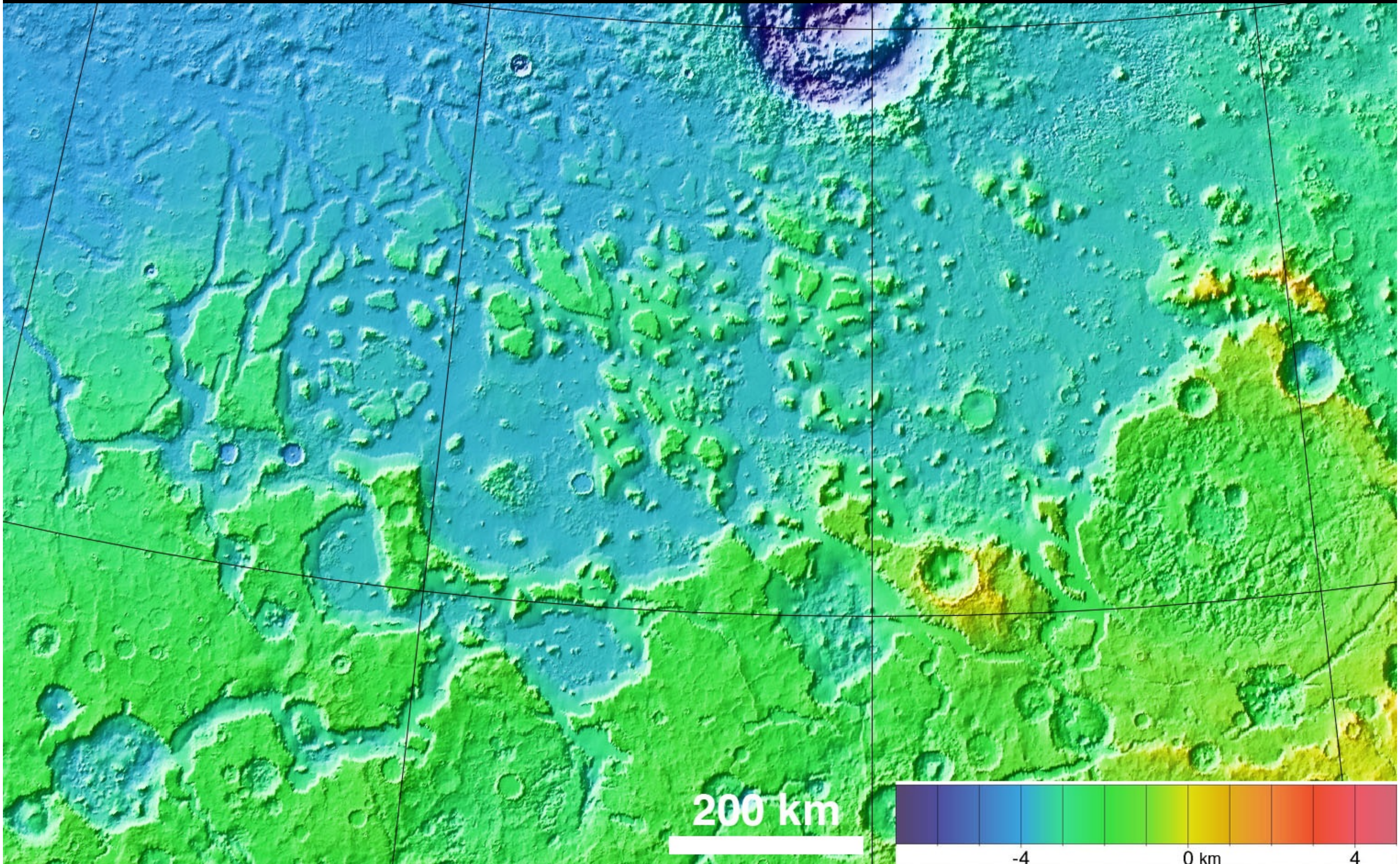
- Review of the Deuteronilus area
- Examples of SHARAD detections
- Mapping criteria
- Occurrence, regional trends, volume estimate

Deuteronilus Mensae



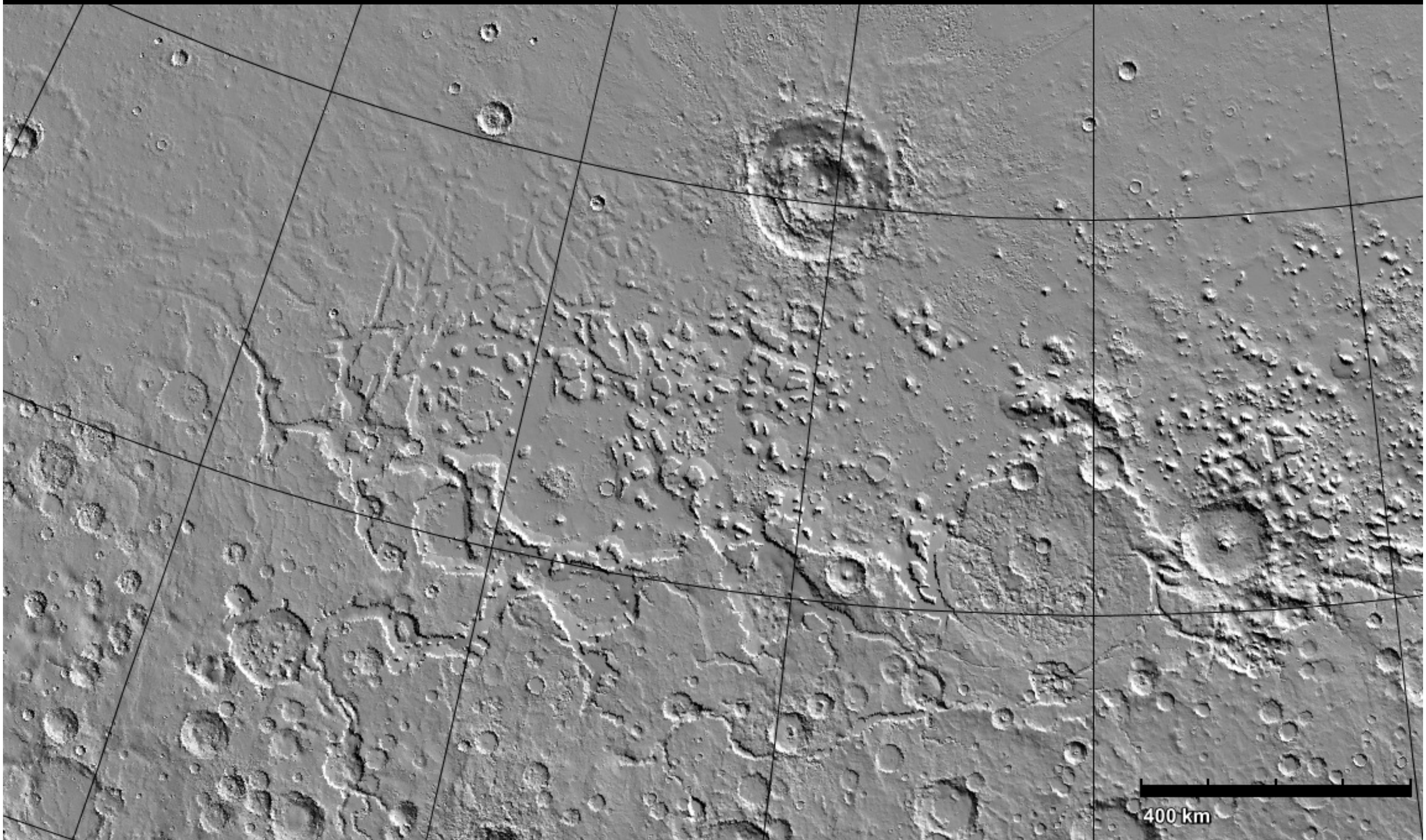
MOLA Elevation – NASA/GSFC

Deuteronilus Mensae

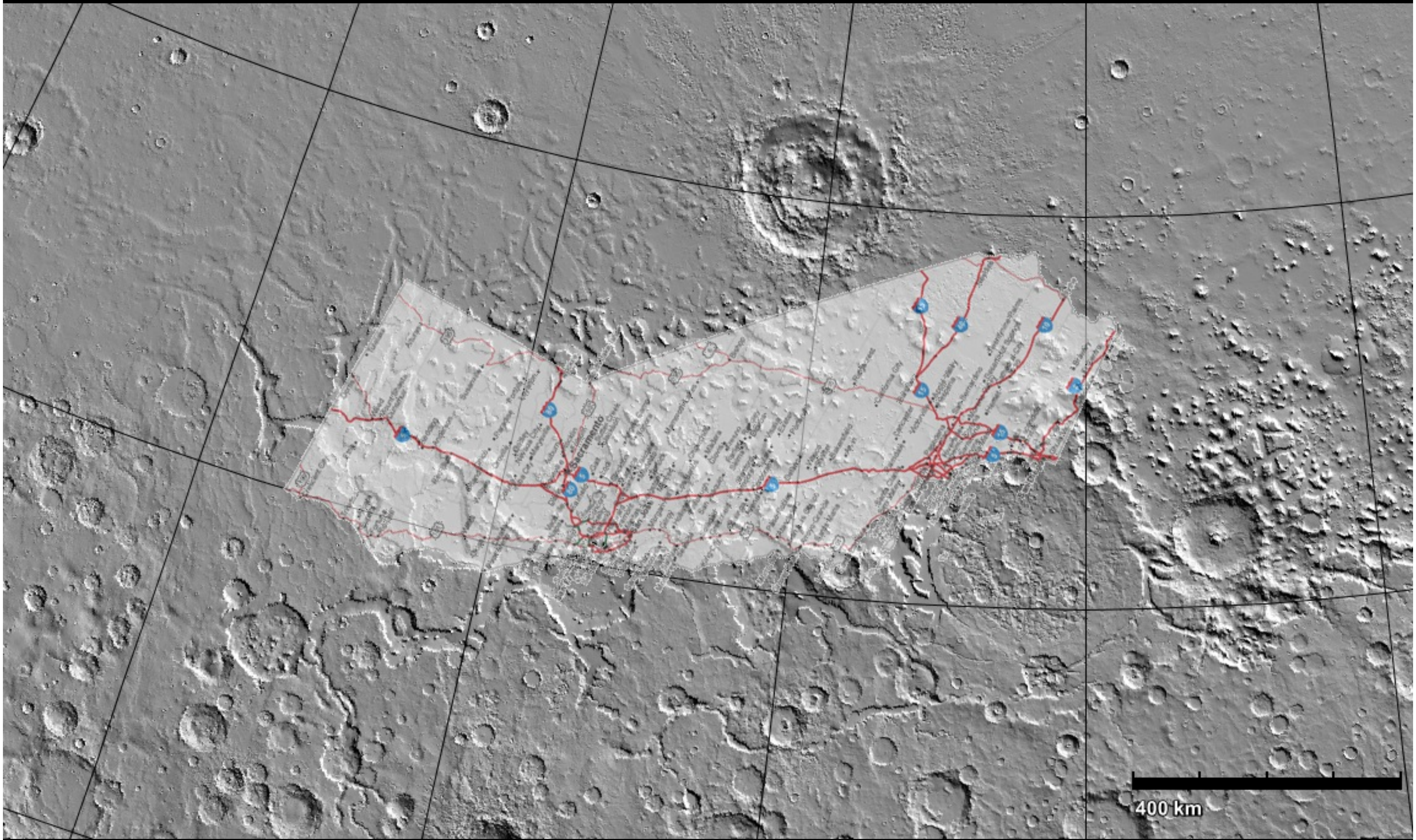


MOLA Team

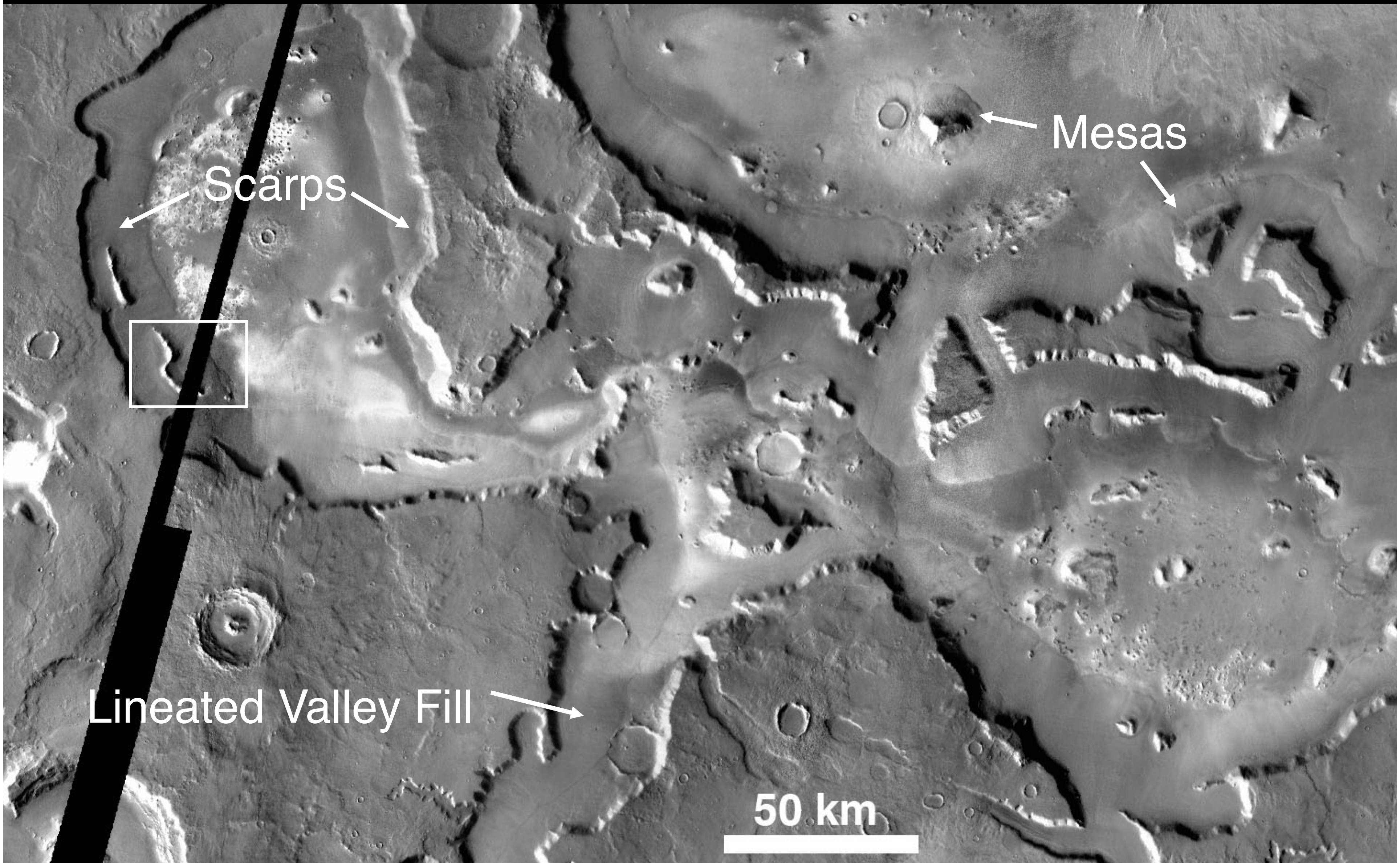
A Big Place



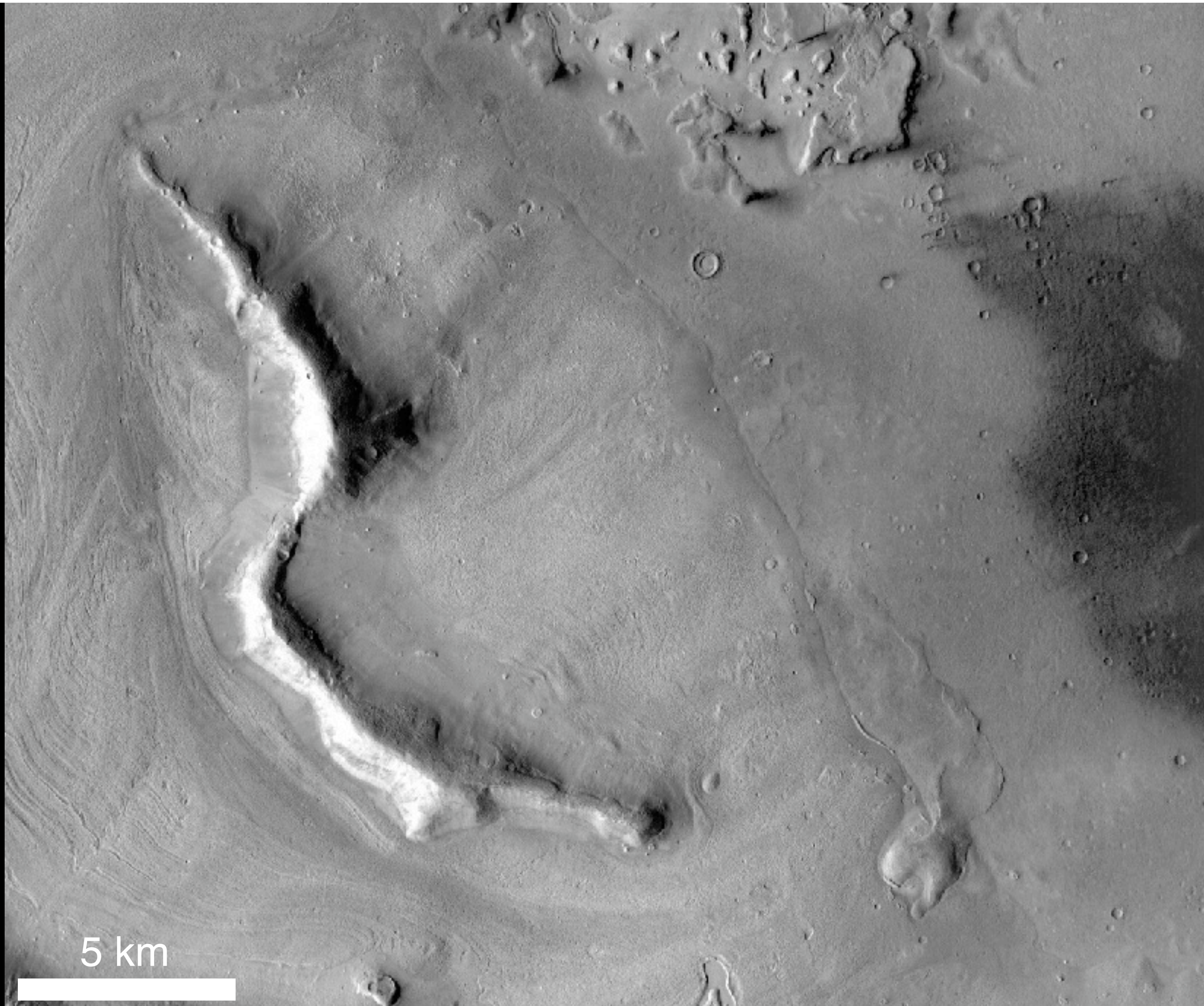
A Big Place



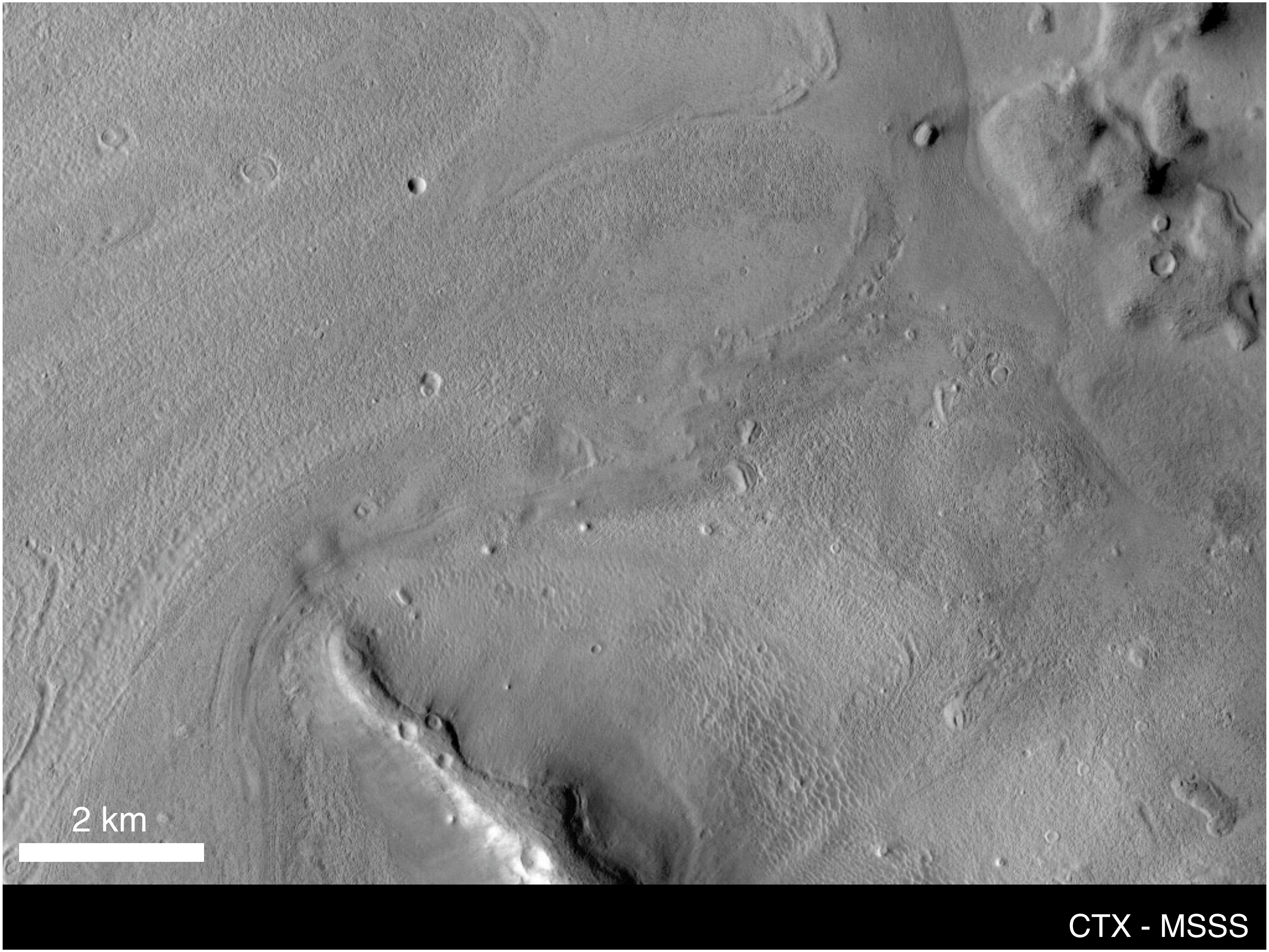
Geomorphic Settings of Lobate Aprons



THEMIS Day IR - ASU

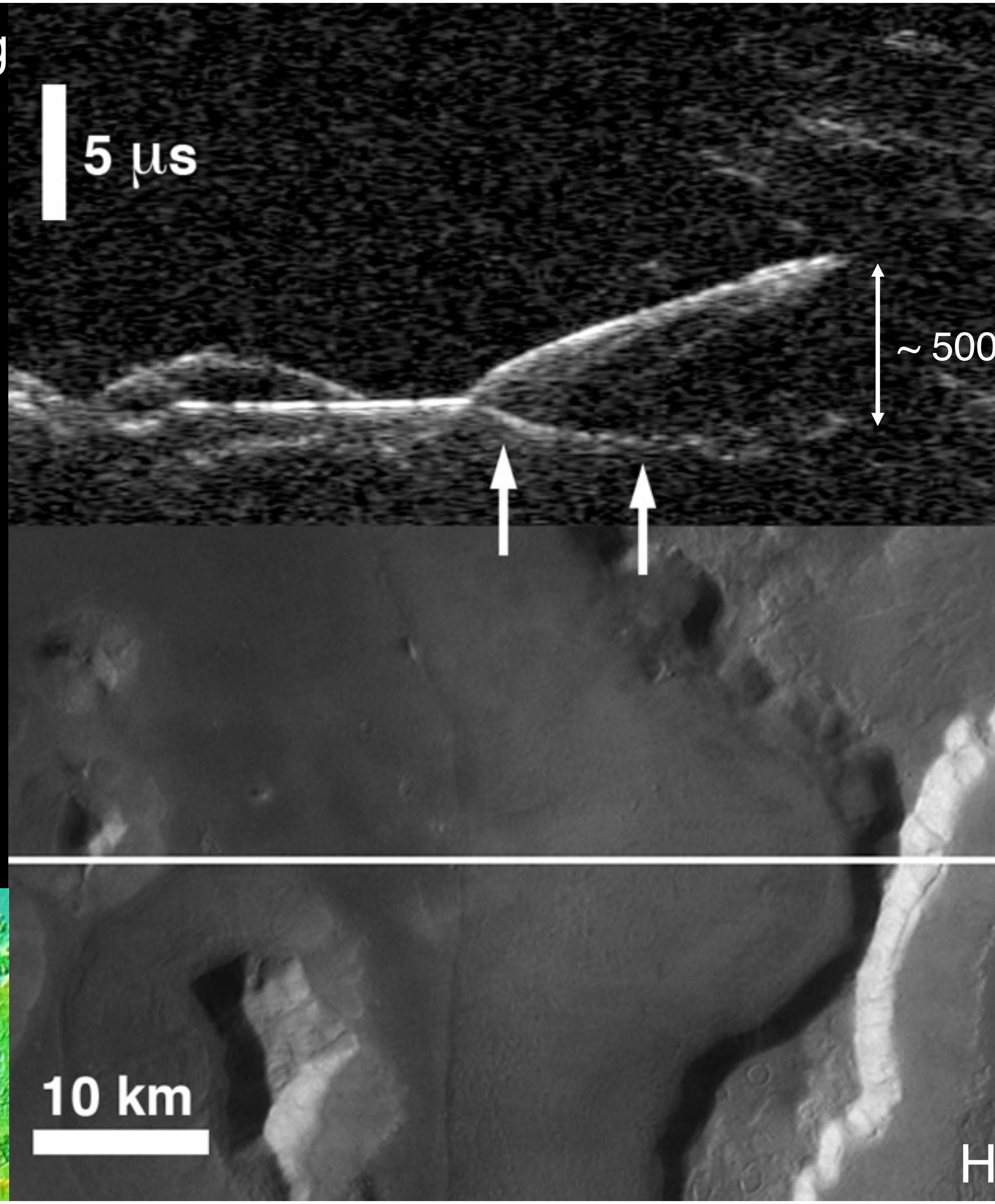


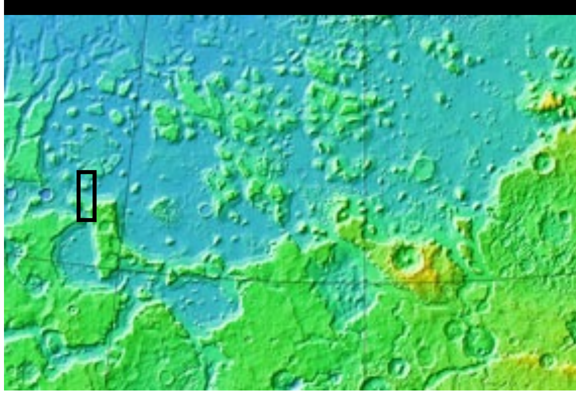
CTX - MSSS


2 km
CTX - MSSS

SHARAD Sounding of Lobate Aprons

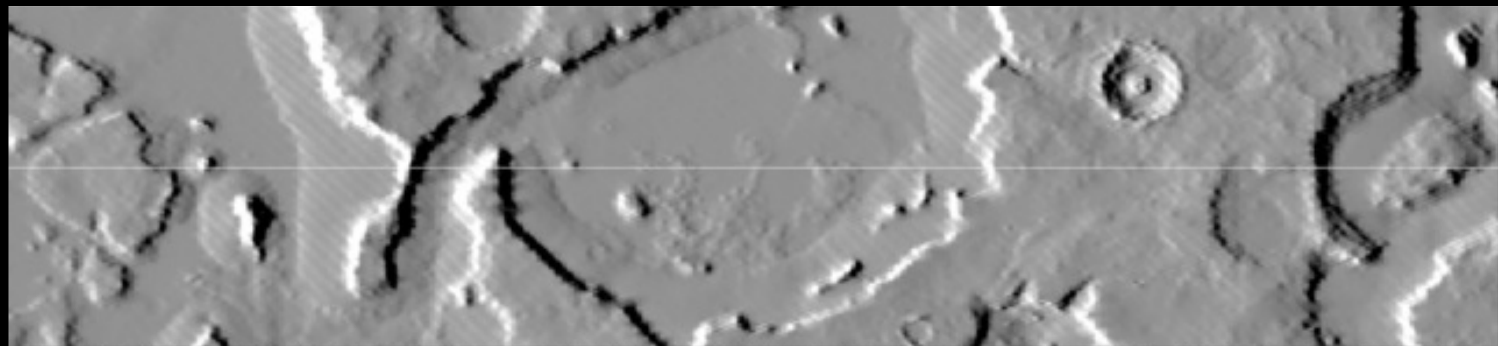
2145_01

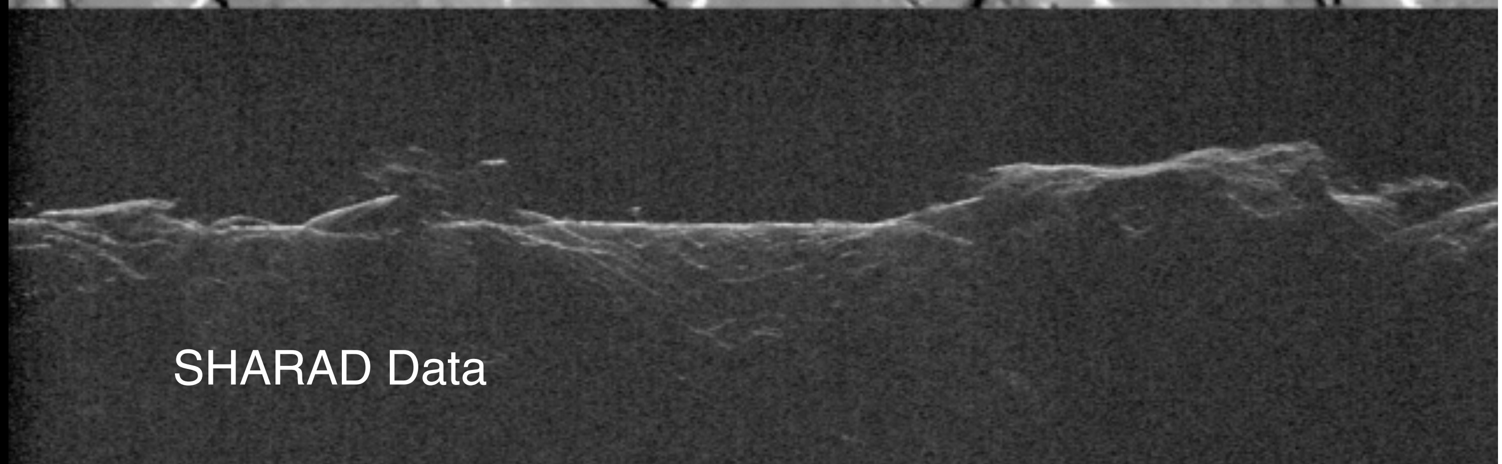


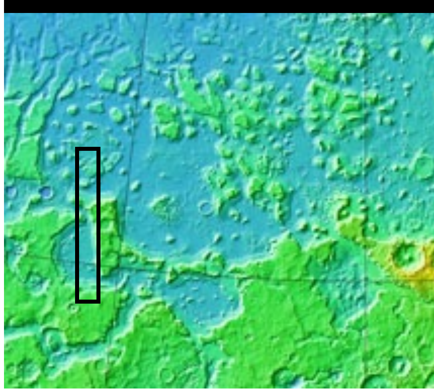


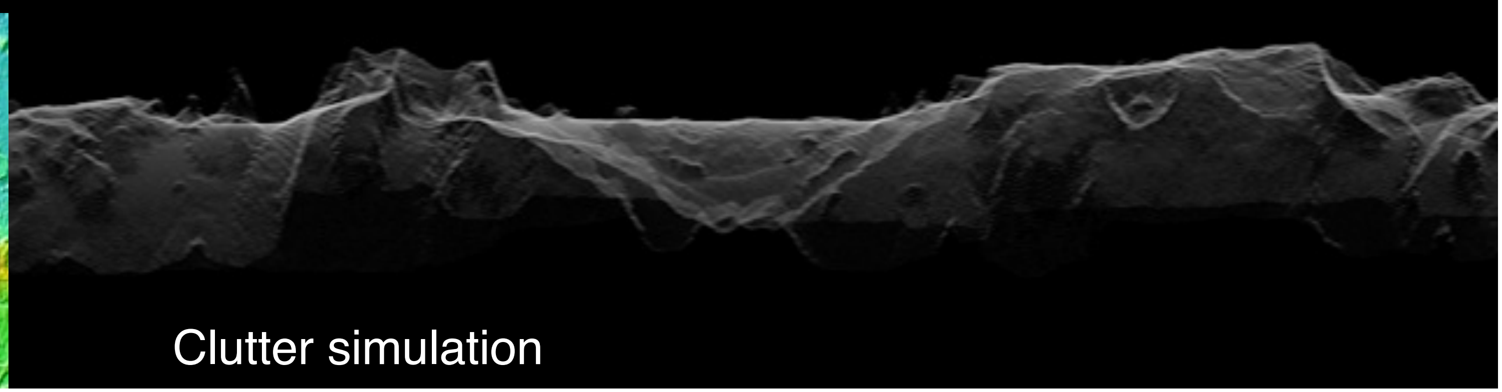
HRSC

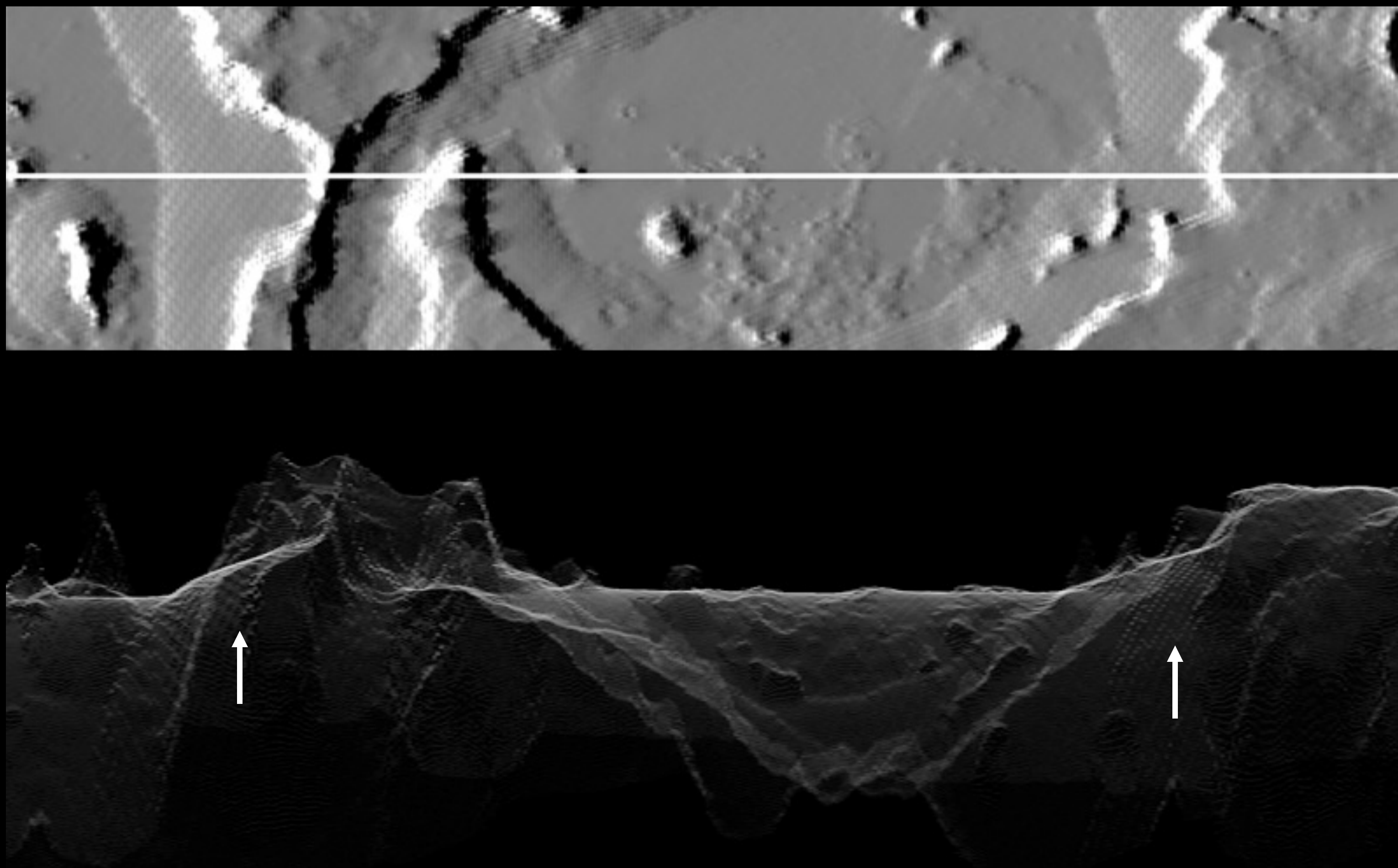
Subsurface, not Clutter



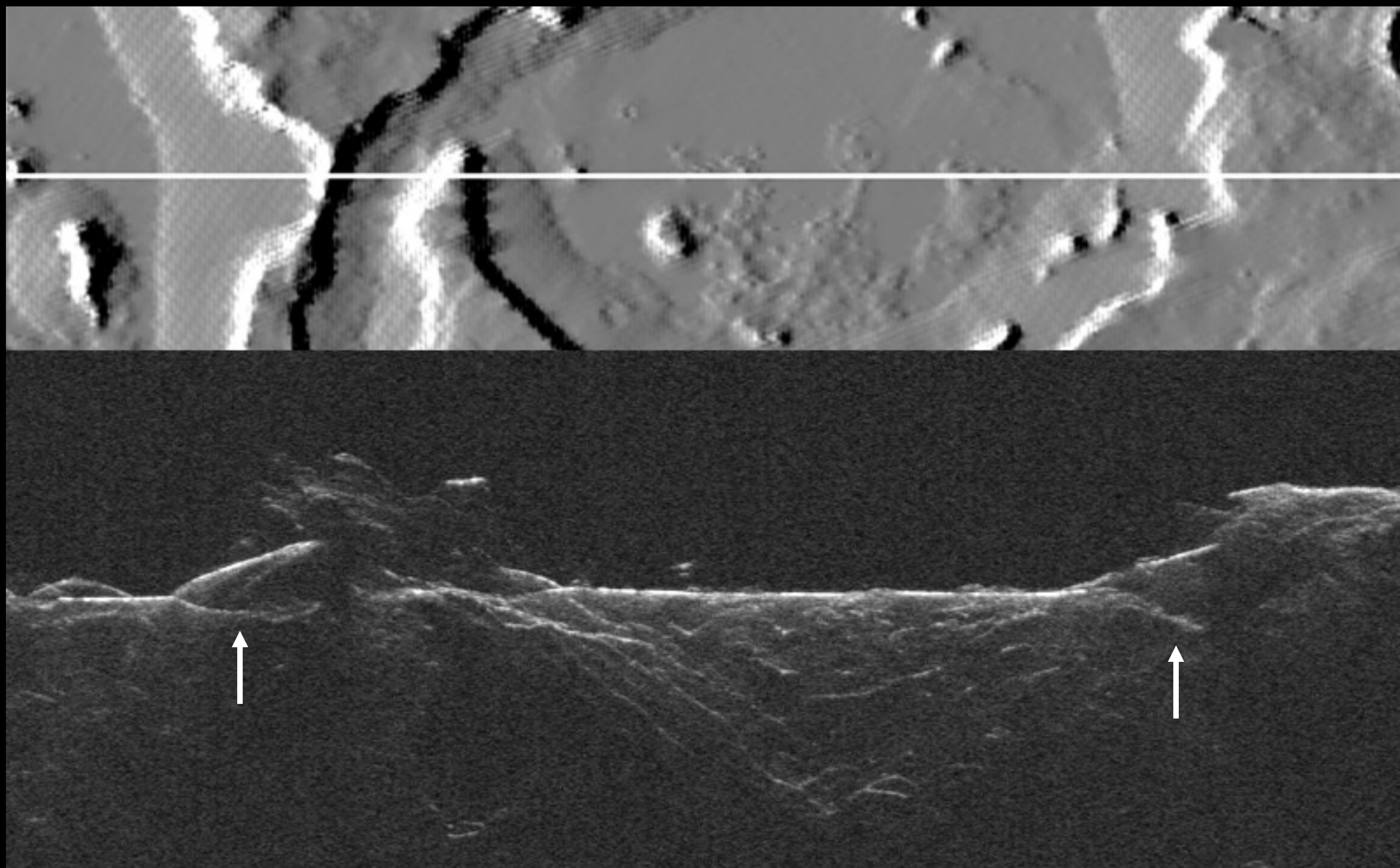






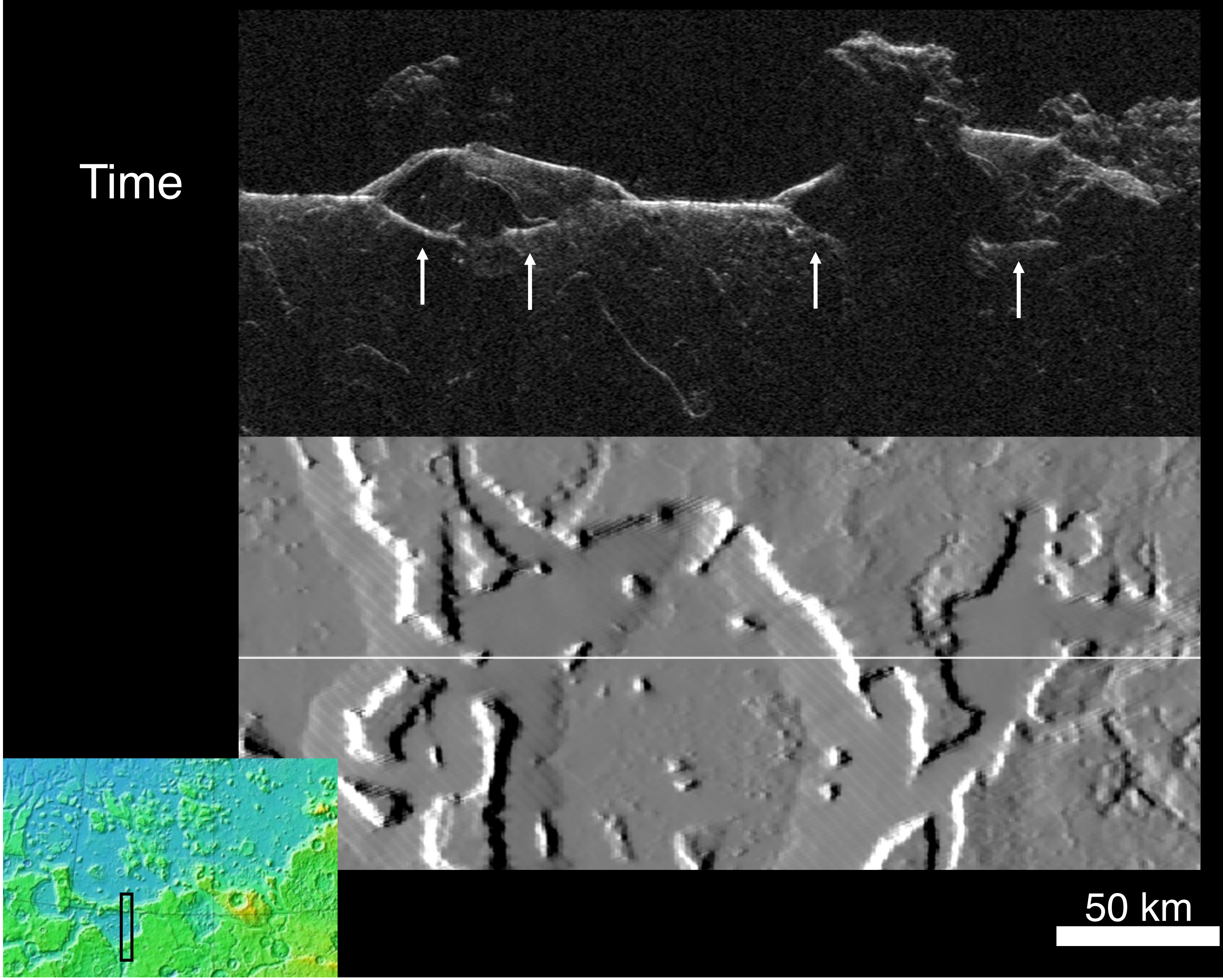


Clutter simulation

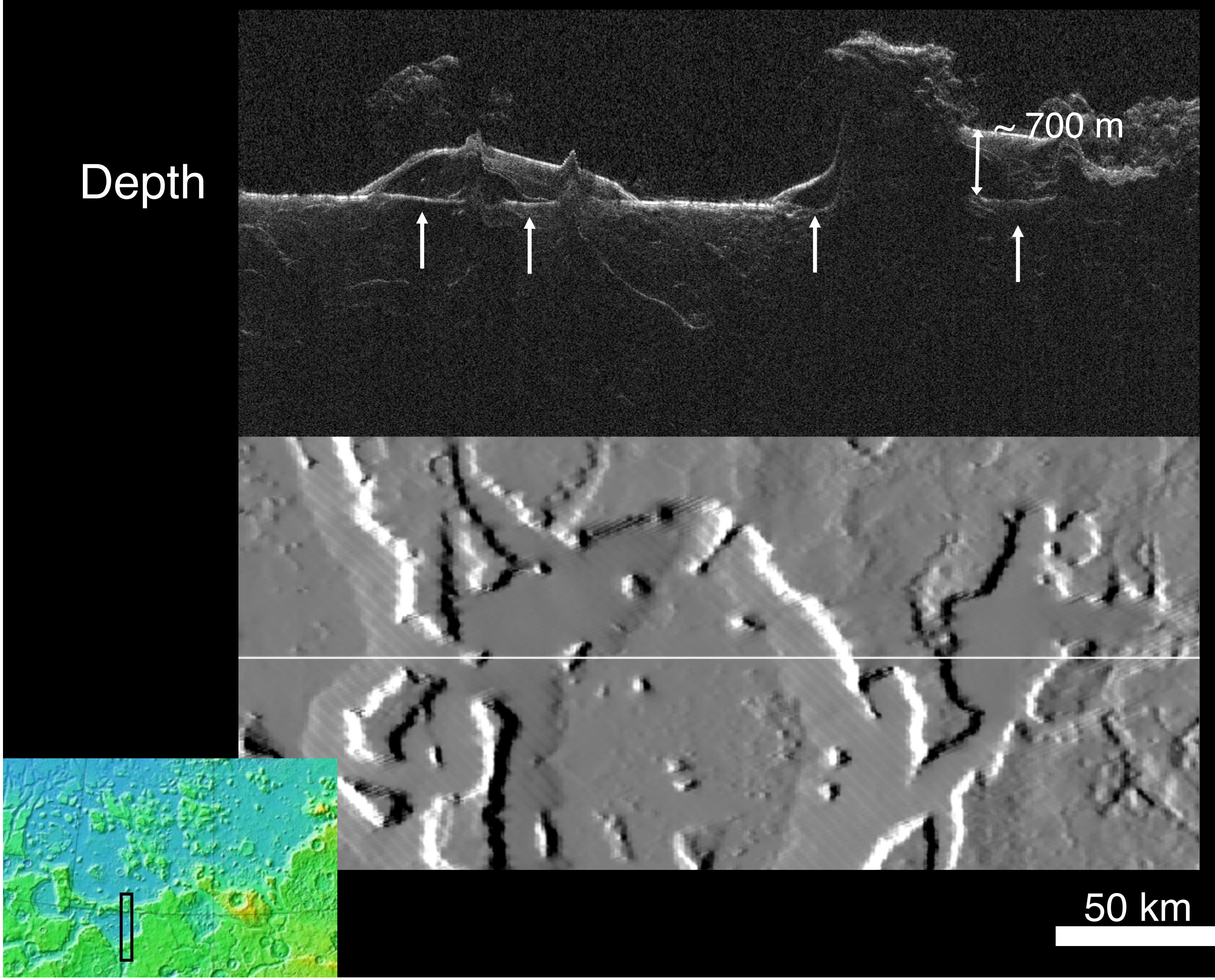


SHARAD Data

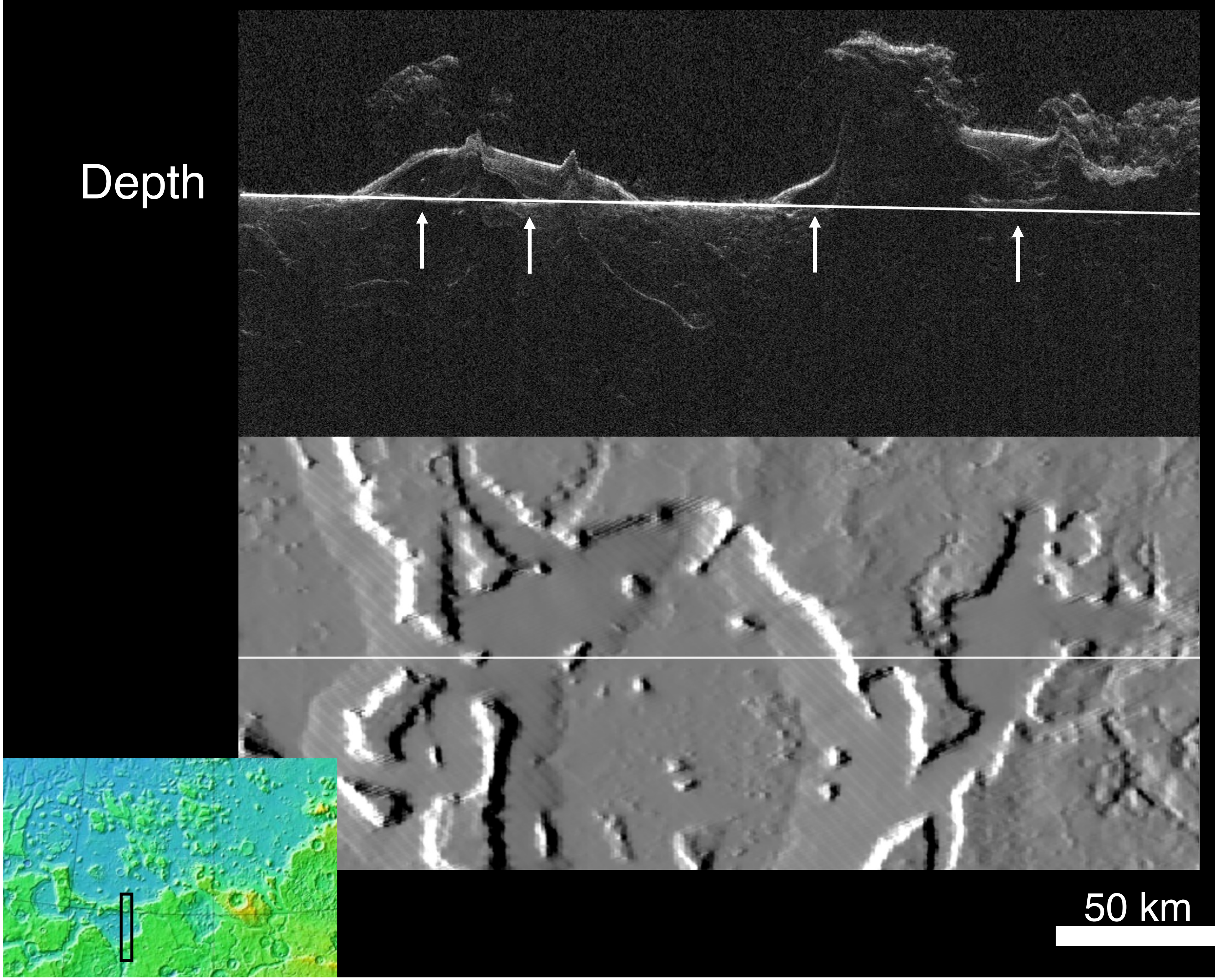
Converting Time to Depth



Converting Time to Depth

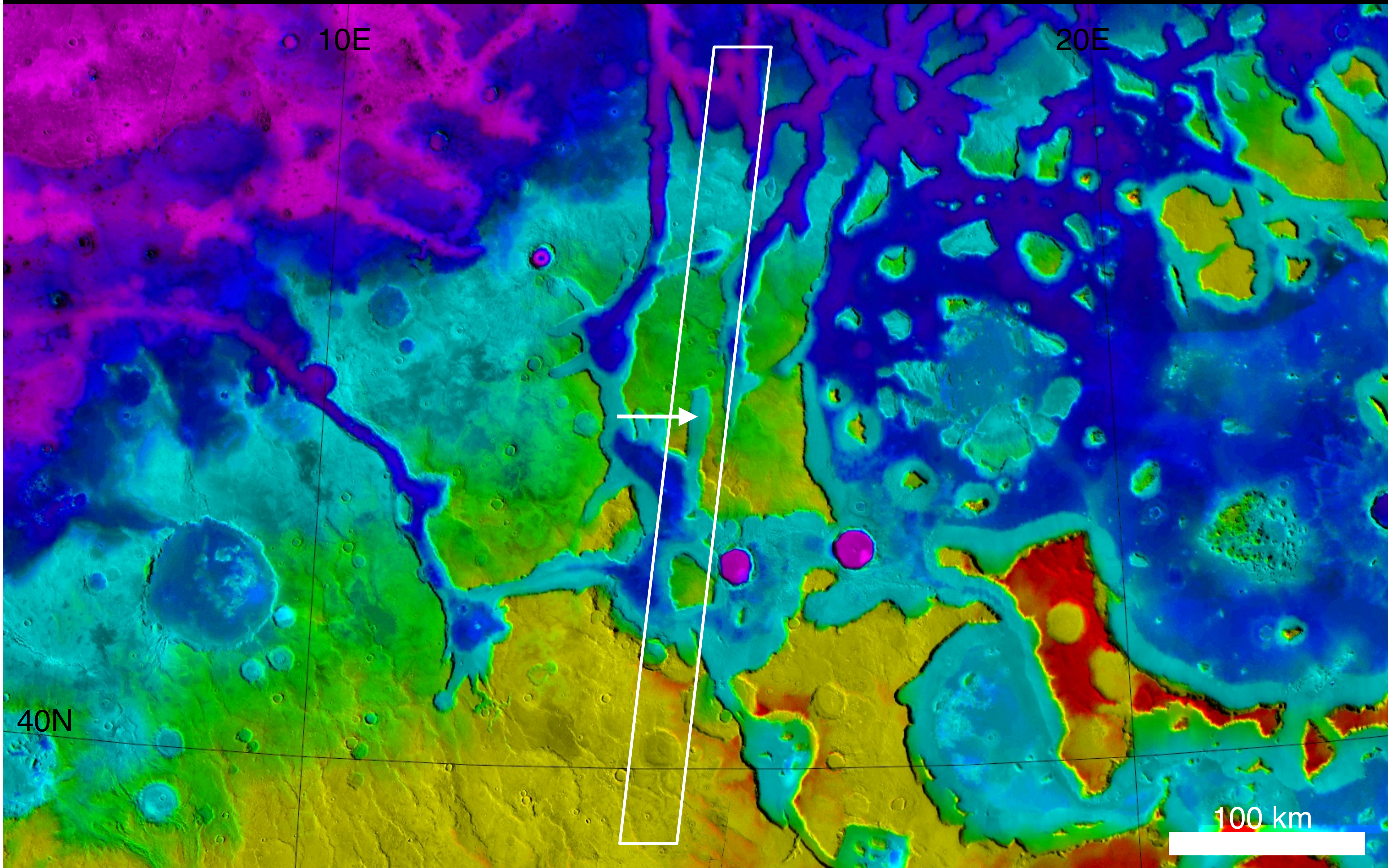


Converting Time to Depth

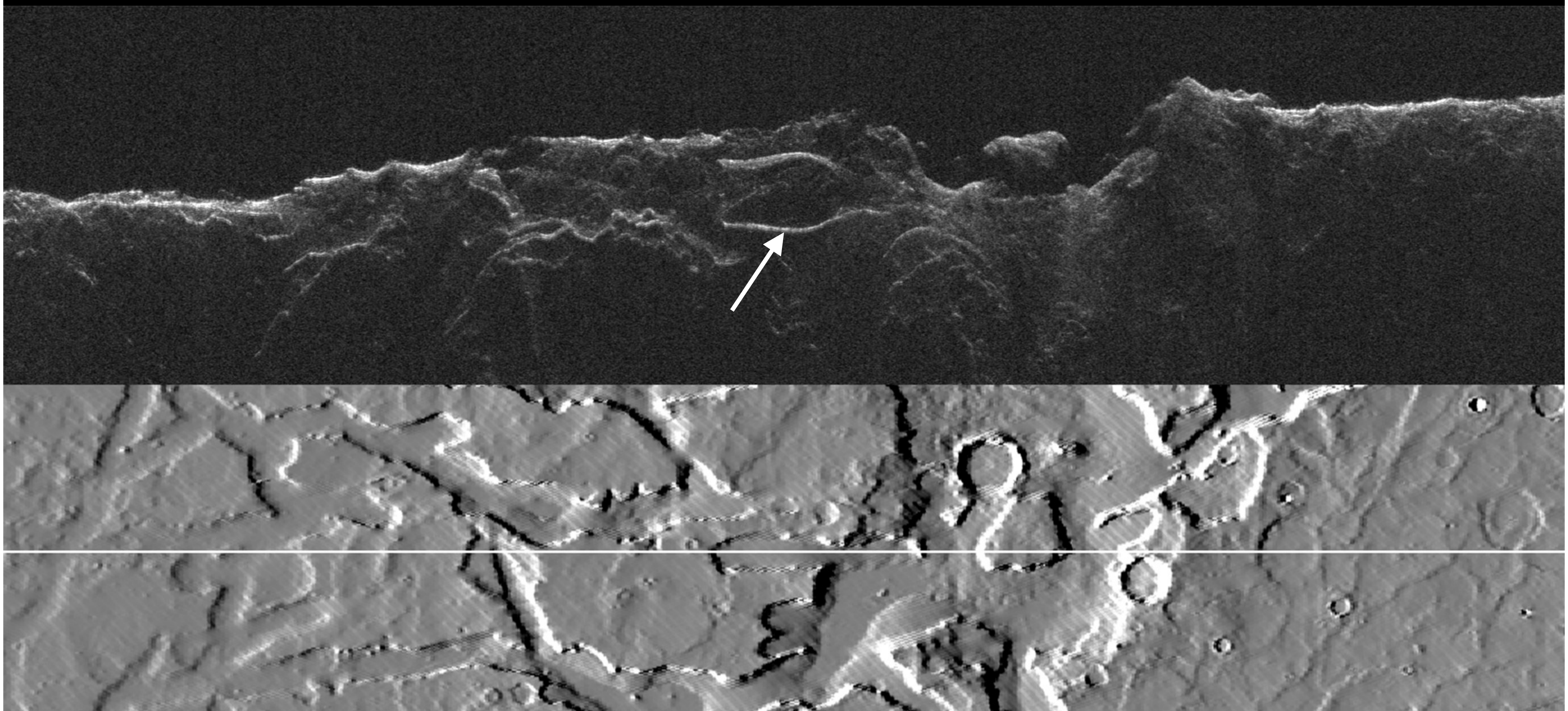


Valley in West Deuteronilus

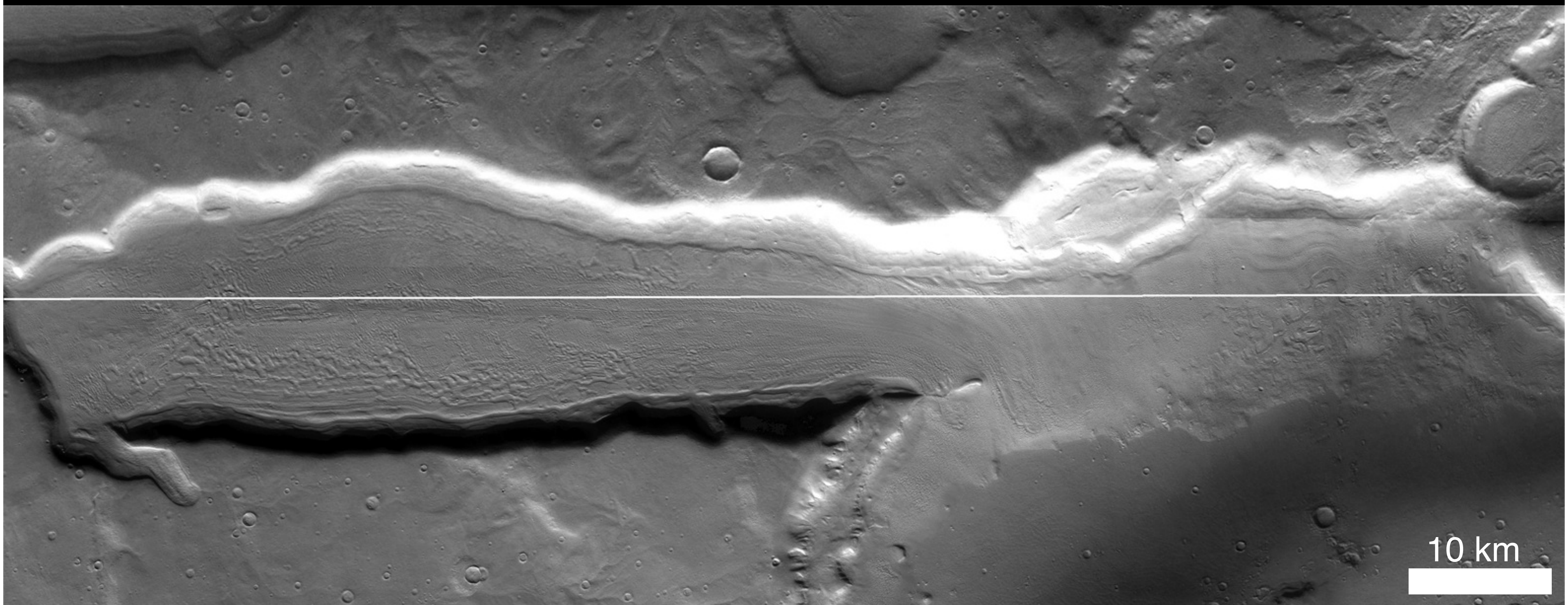
MOLA Elevation on THEMIS Day IR

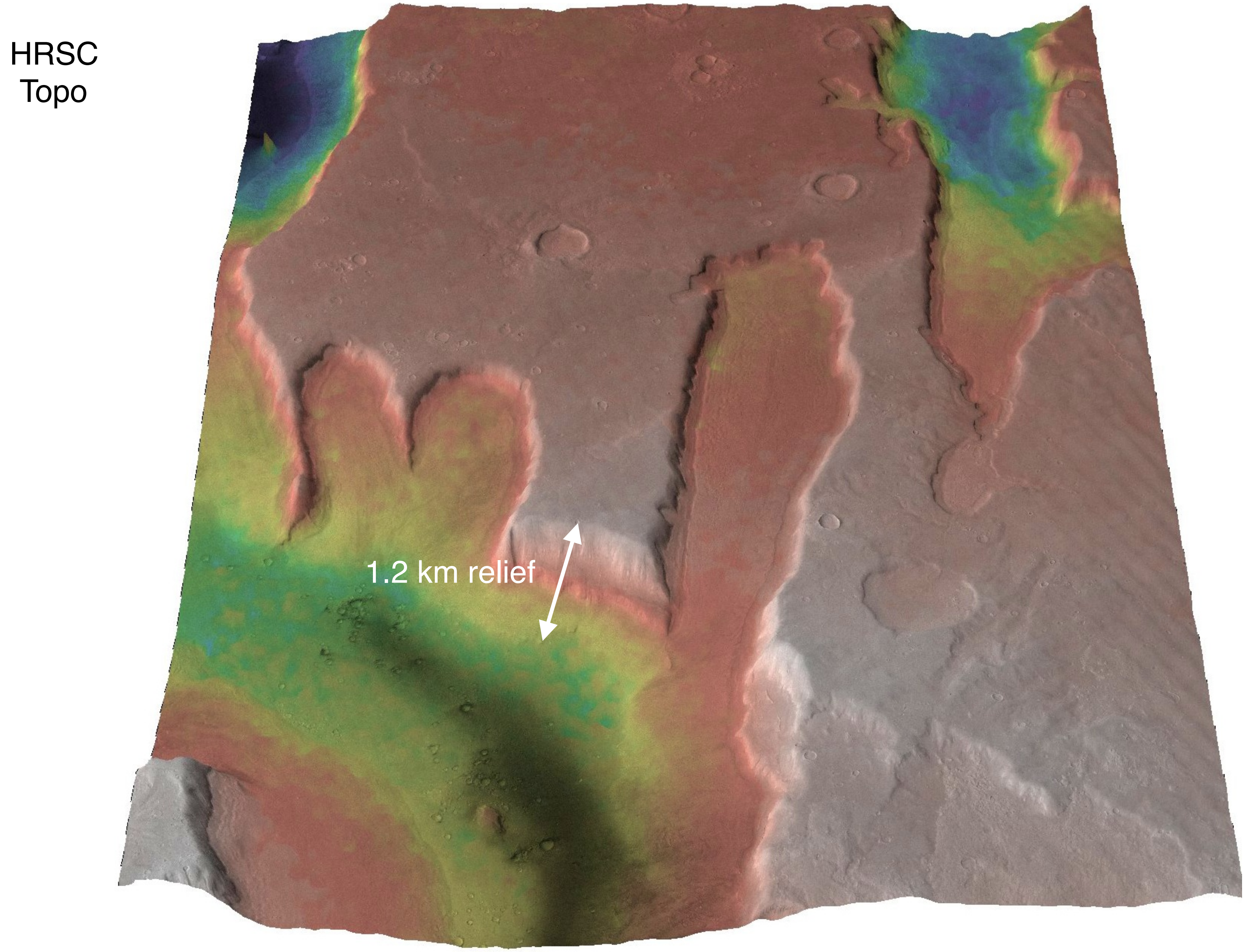


Time

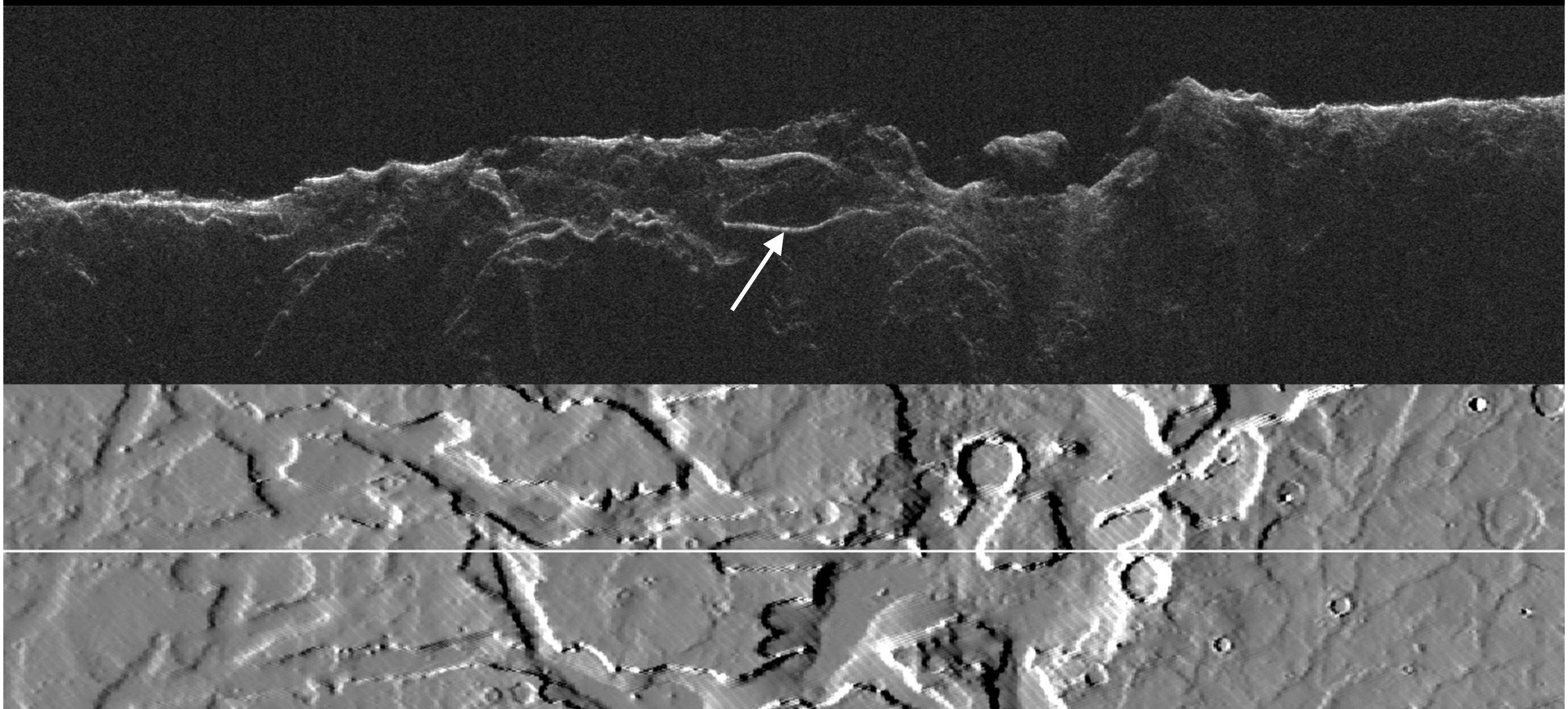


THEMIS VIS

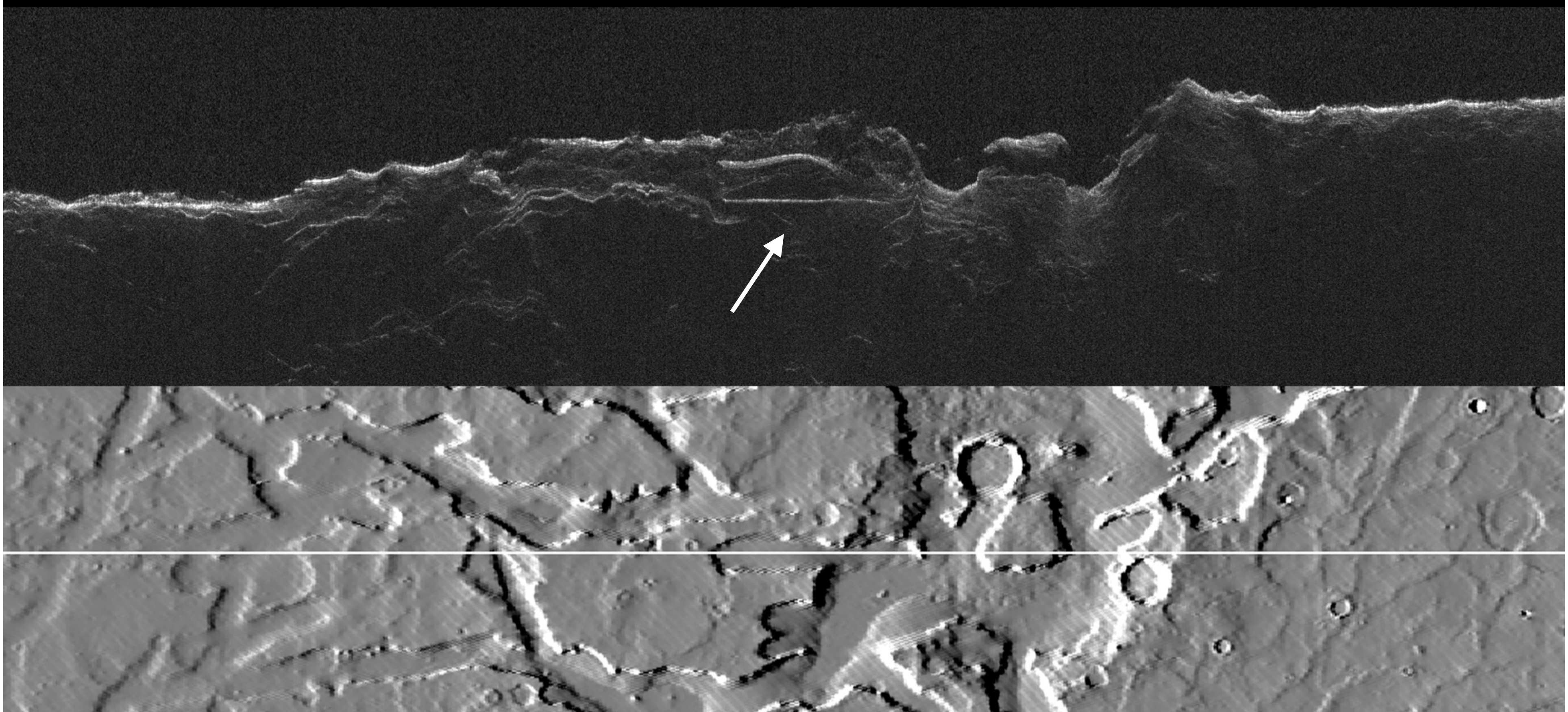


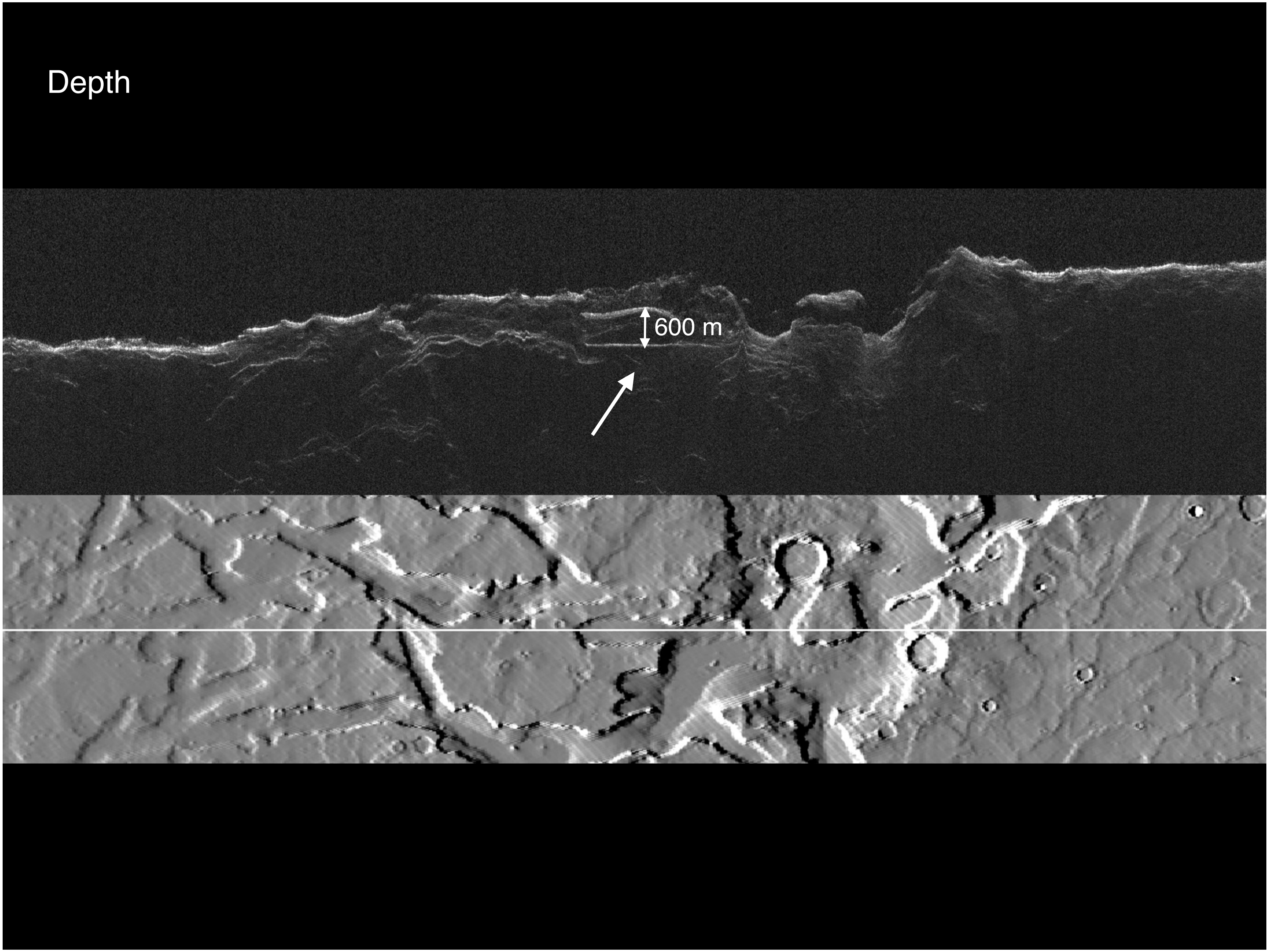

HRSC
Topo
1.2 km relief

Time

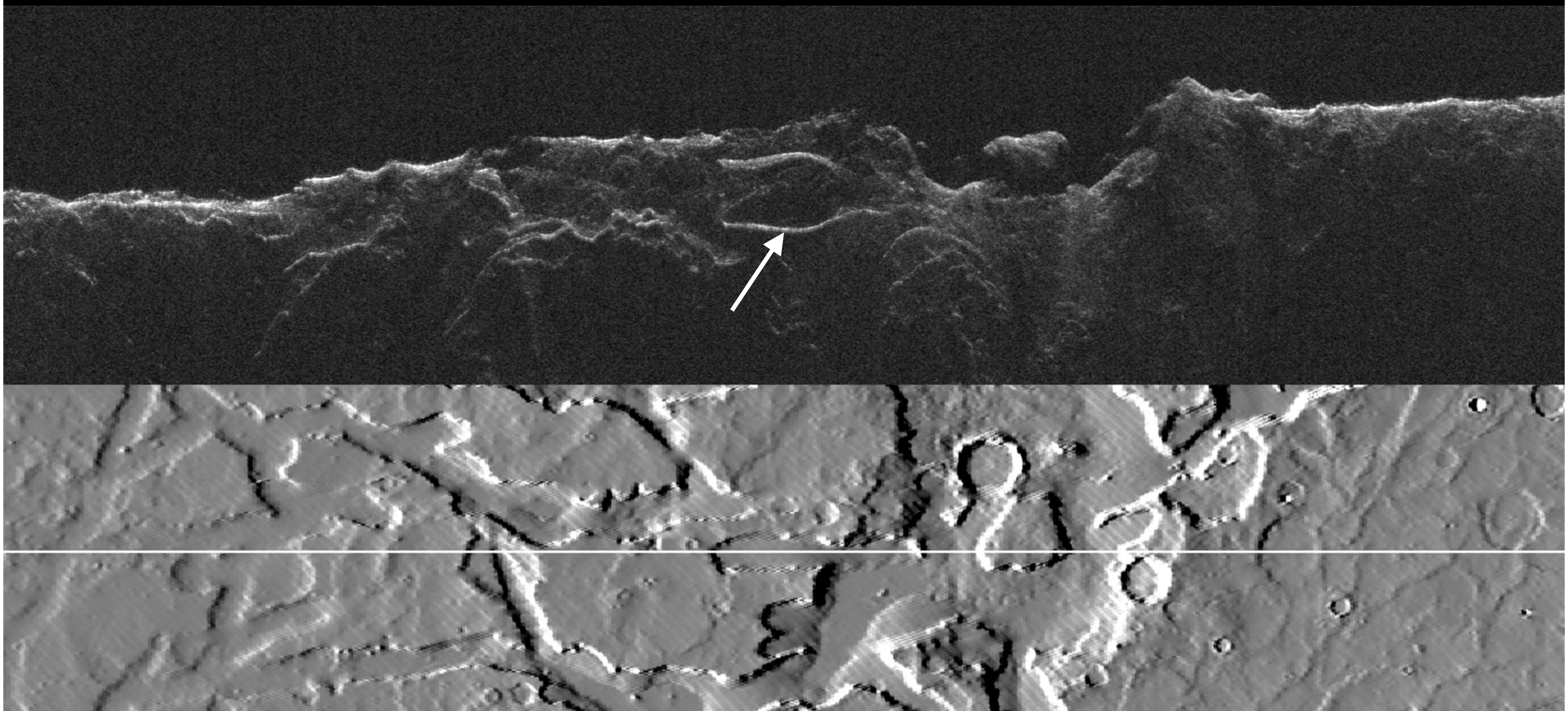


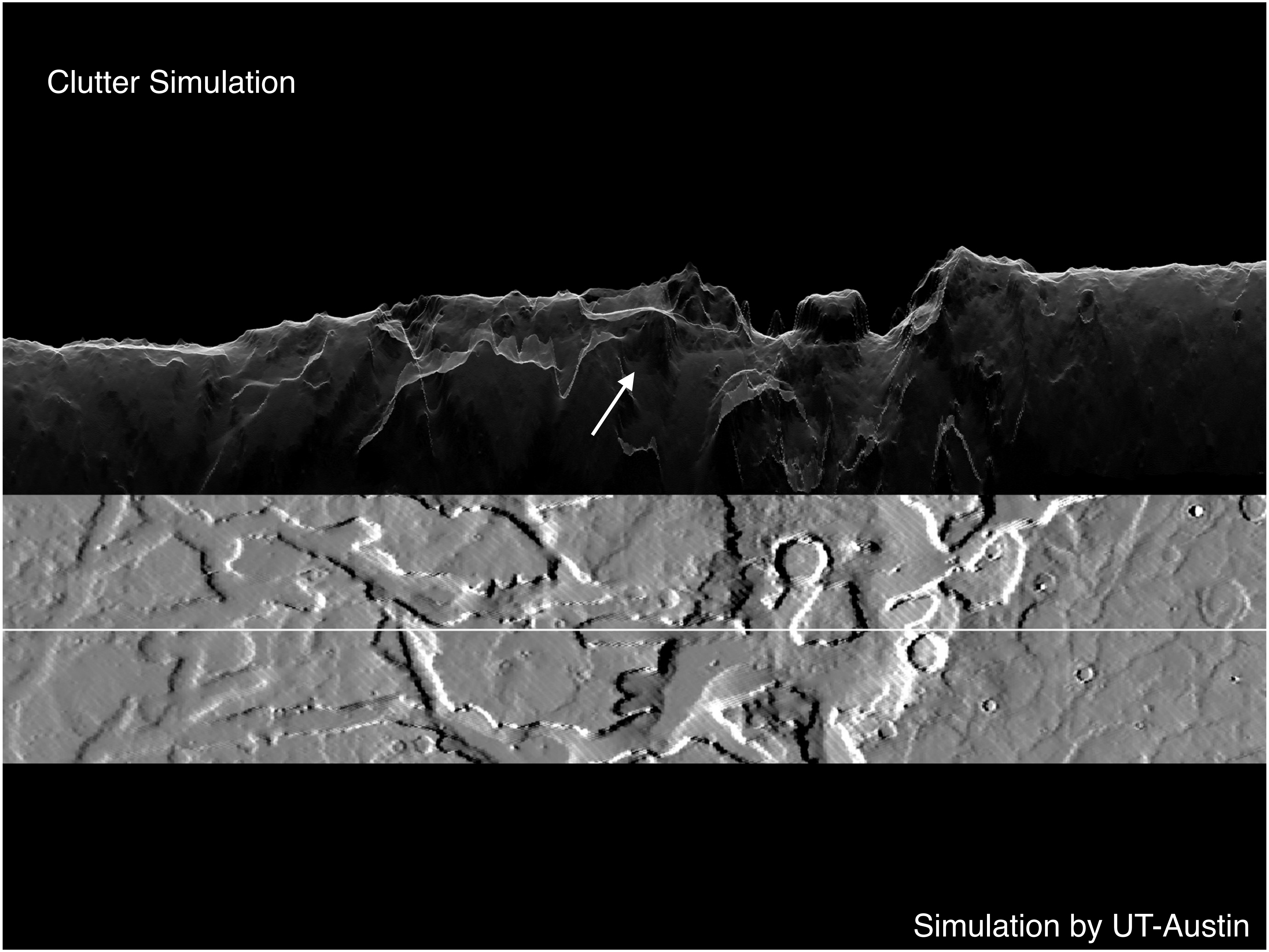
Depth




Depth
600 m

Time




Clutter Simulation
Simulation by UT-Austin

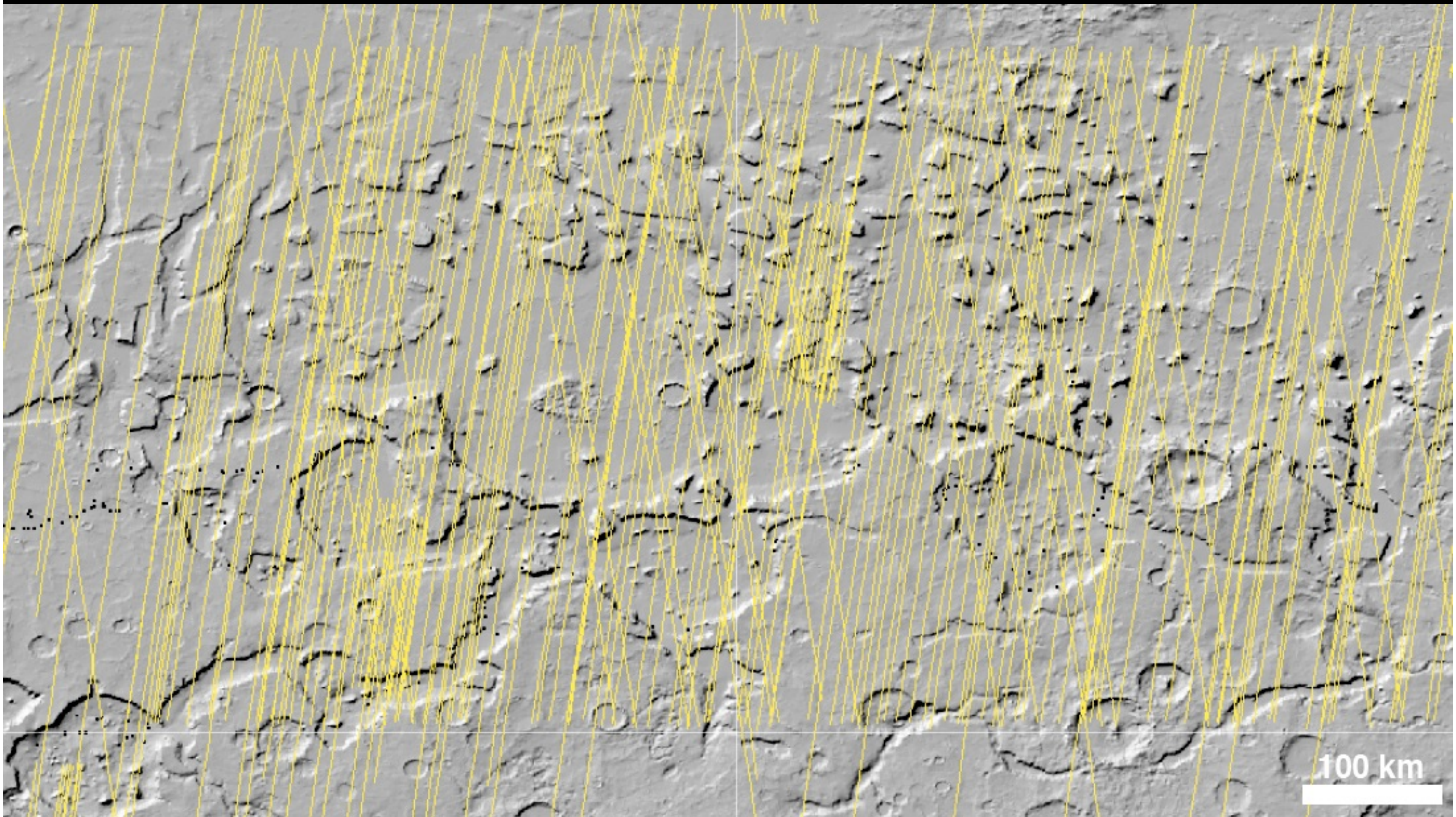
Mapping Criteria

- Compared all potential subsurface detections with clutter simulations. Reflector must be unambiguously distinct from clutter echoes.

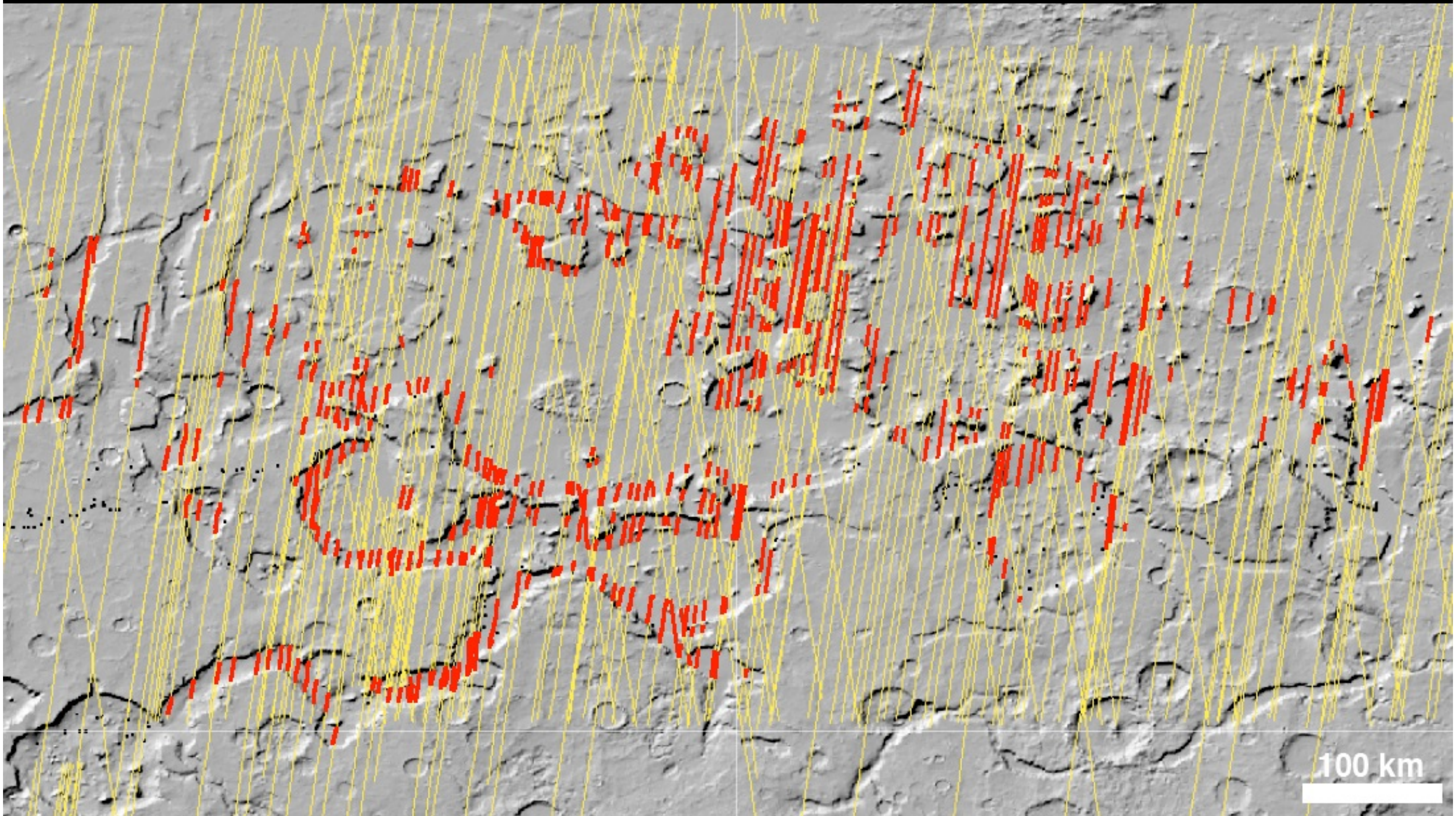
- Transformed radargram to time dimension. Reflector must be in a “sensible” position relative to extrapolated valley floor.

- Verified extent/continuity/repeatability of reflector detection by comparing adjacent and overlapping tracks, where available.

SHARAD Coverage



Detected Interfaces



Summary

- SHARAD signals penetrate lobate aprons to ~1 km depth.

- Ice is widespread in Deuteronilus Mensae; most “classic” aprons show an ice signature.

- Lobate aprons, lineated valley fill, concentric crater fill all show the same signature.

- Aprons to the east are less amenable to basal reflector detection.

- Surface area of observed ice masses = 21,100 km^2
- Volume (assuming average thickness of 300 m) = 6325 km^3
- ~ 5 cm global equivalent layer (compare to PLD: ~ 20 m)

- Current ice deposits ~100s of MY old are intriguing targets for further exploration.