

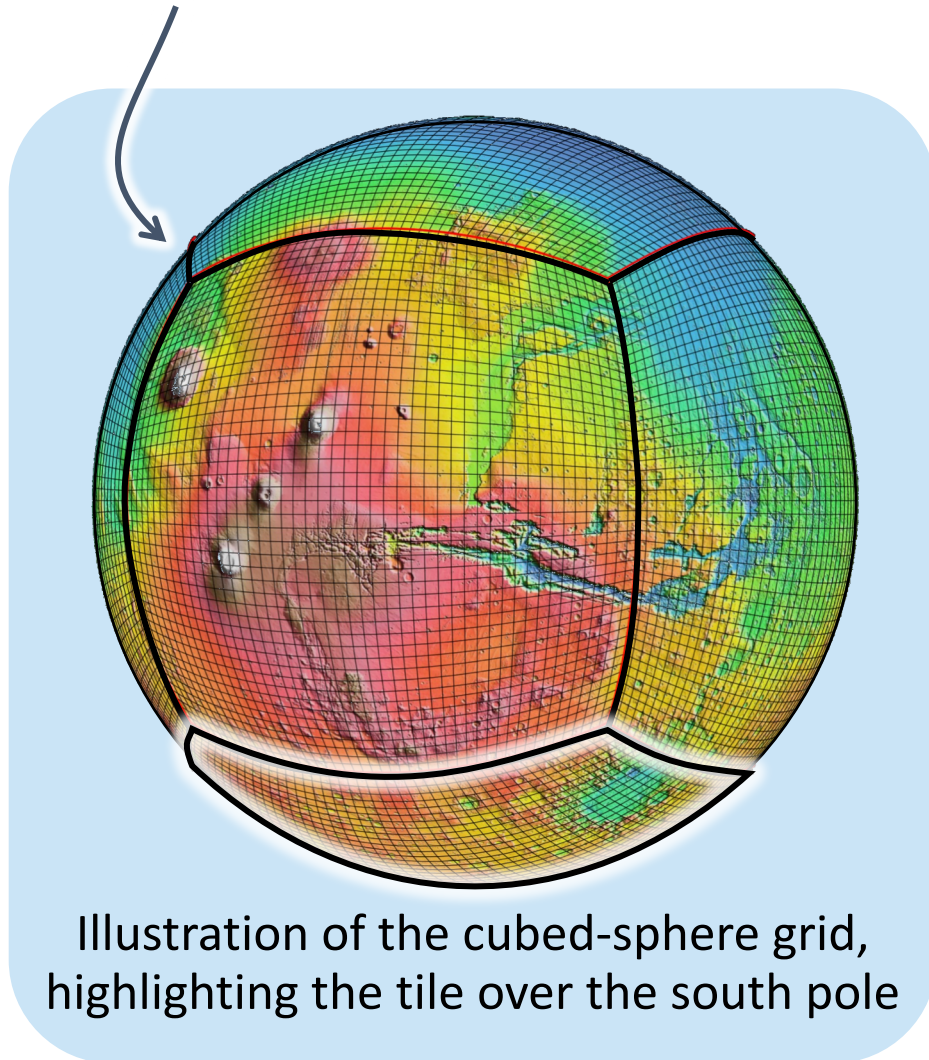
Modeling the B Regional Dust Storm on Mars

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NASA Ames Mars GCM

Cubed-Sphere, Finite-Volume Dynamical Core from NOAA/GFDL

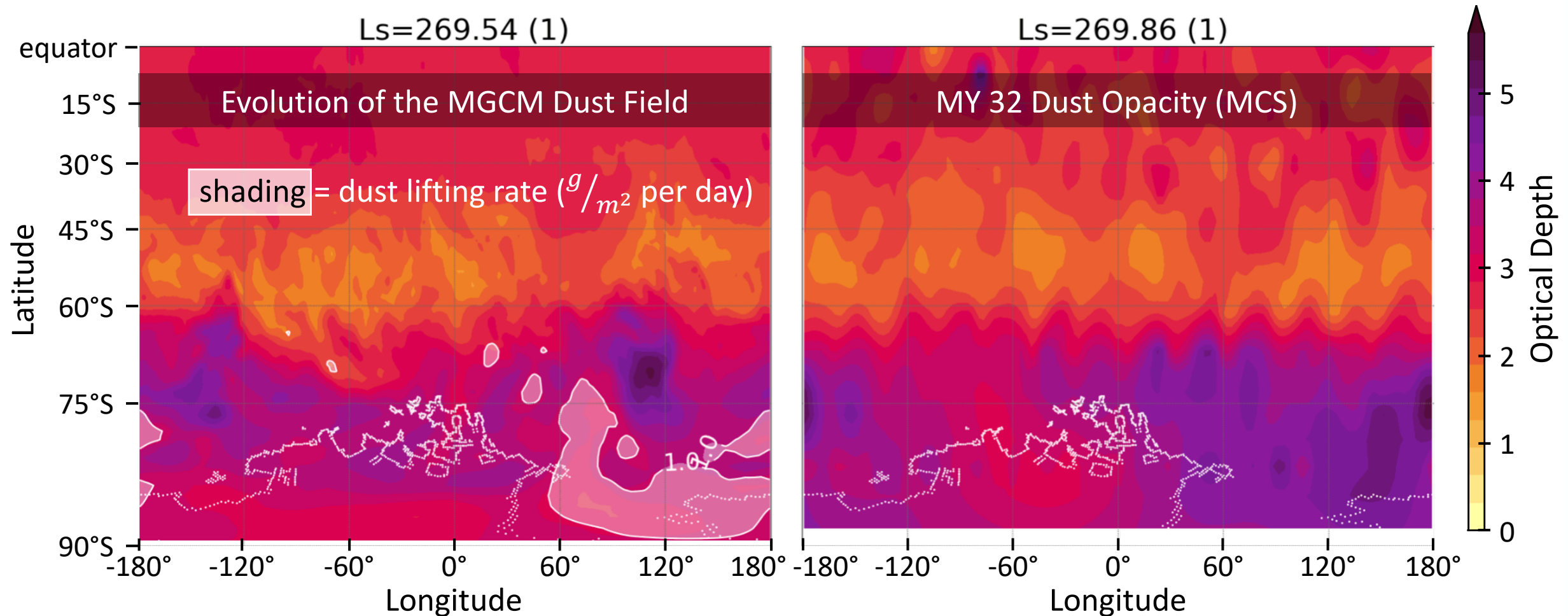


- NASA Ames Legacy MGCM physics²
- $1 \times 1^\circ$ (60 km) horizontal resolution
- 30 vertical layers
- No water ice clouds
- Dust Scheme: assimilated dust lifting³
- Lifted dust particle size distribution defined by $r_{\text{effective}} = 3$ microns

NASA Ames Mars GCM

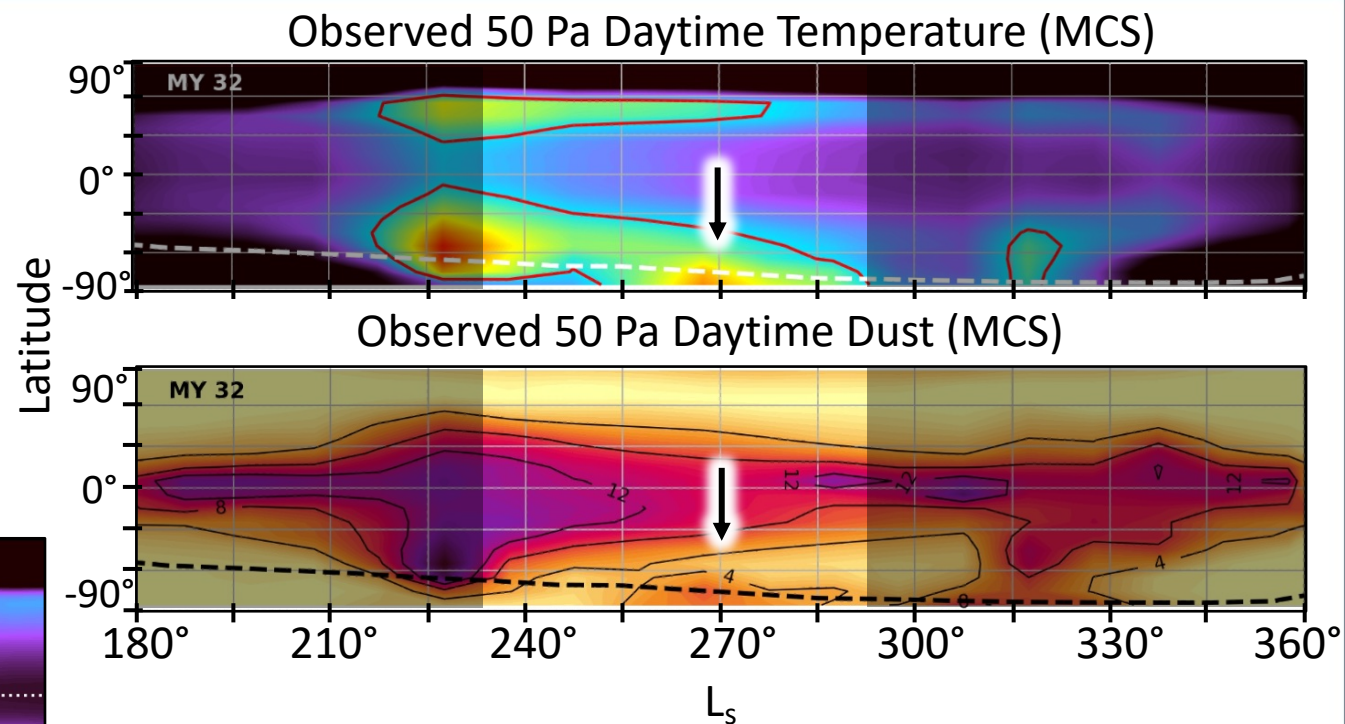
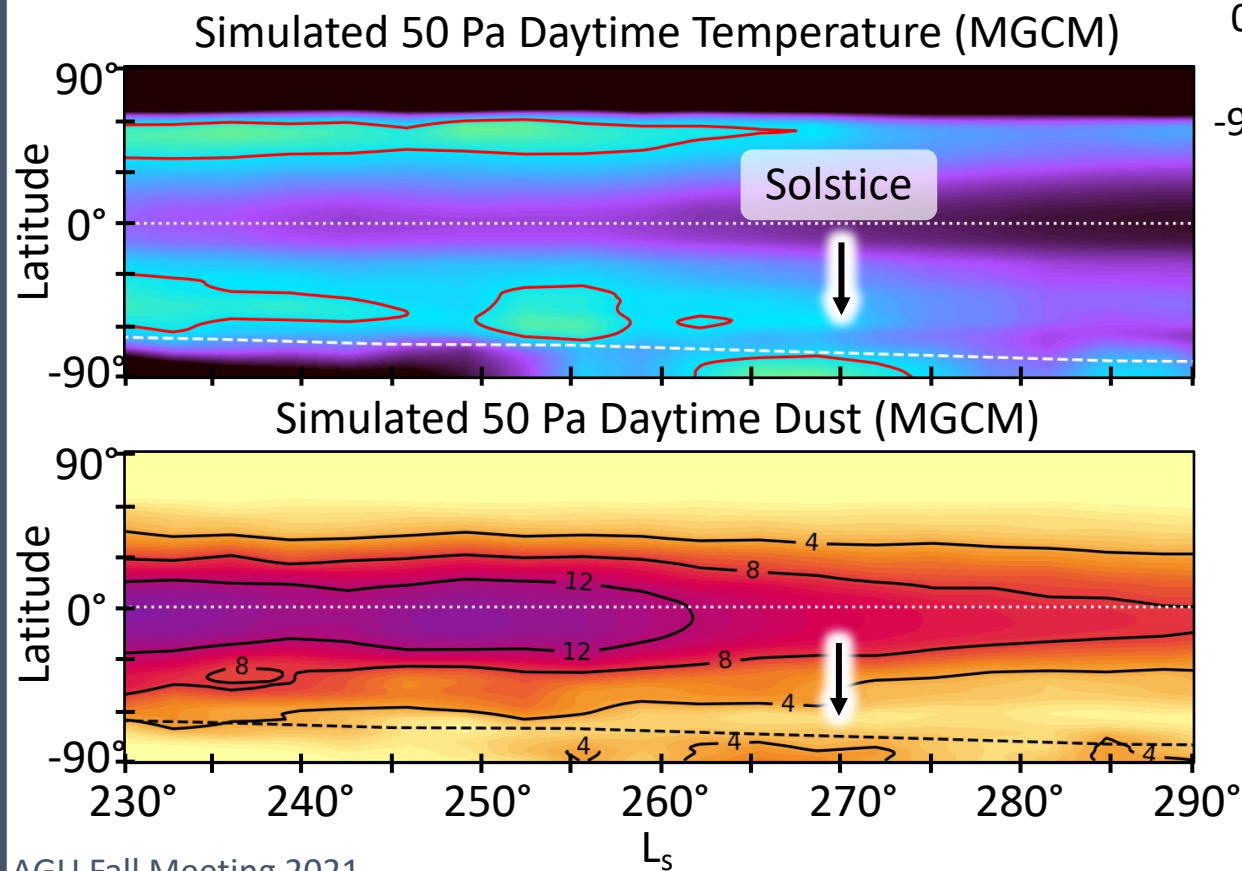
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Illustration: Assimilated Dust Lifting Scheme



Key Result #1


The B Storm is reproducible in the MGCM




Simulated B storm is less intense but captures the key features of the observed B storm.

Key Result #2

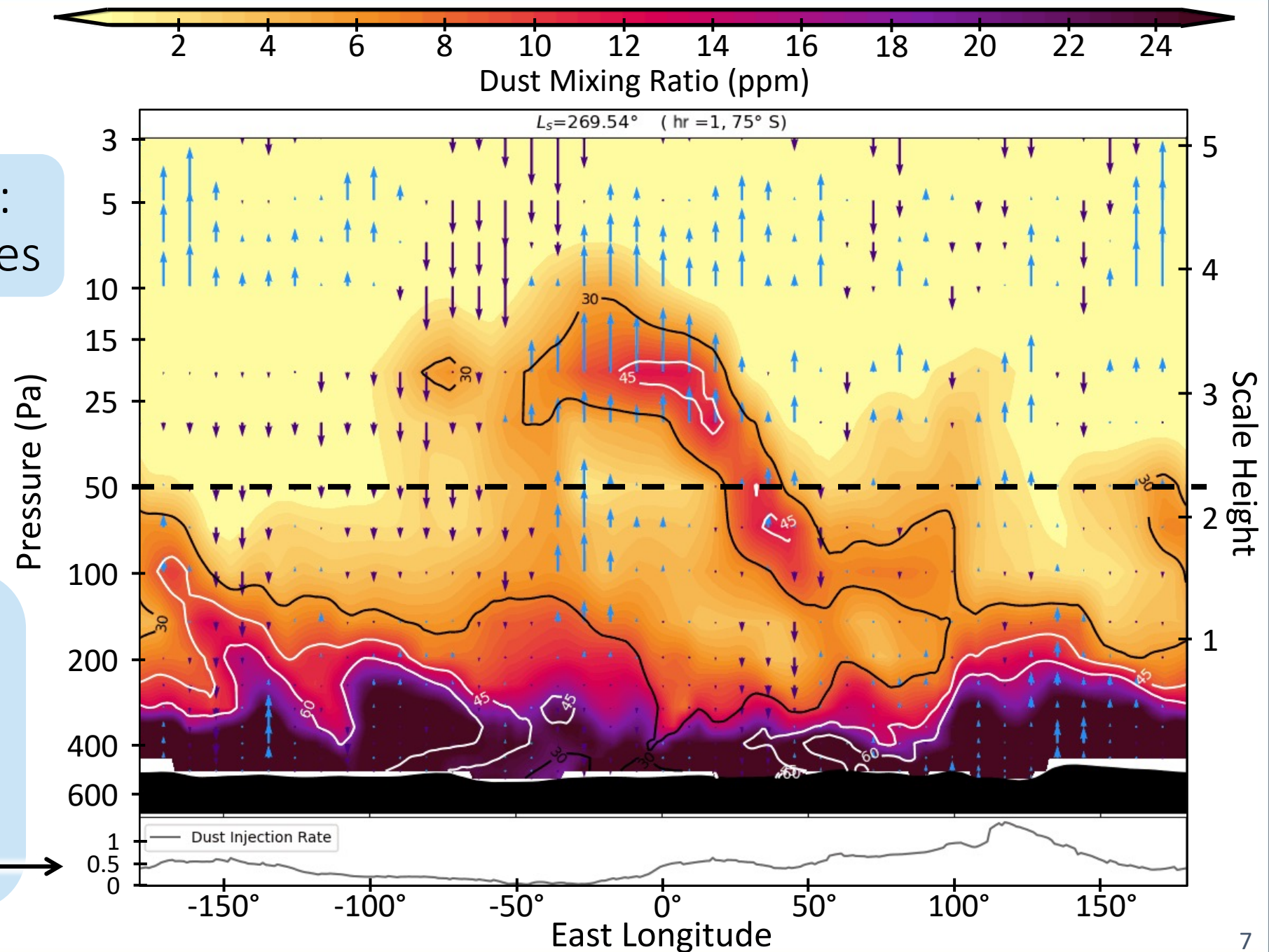
Lofting mechanism:
episodic dust plumes

$1 \text{ m/s} =$ 

Peak Shortwave Heating Rates:
30, 45, and 60 Kelvin/day

Local Noon = 

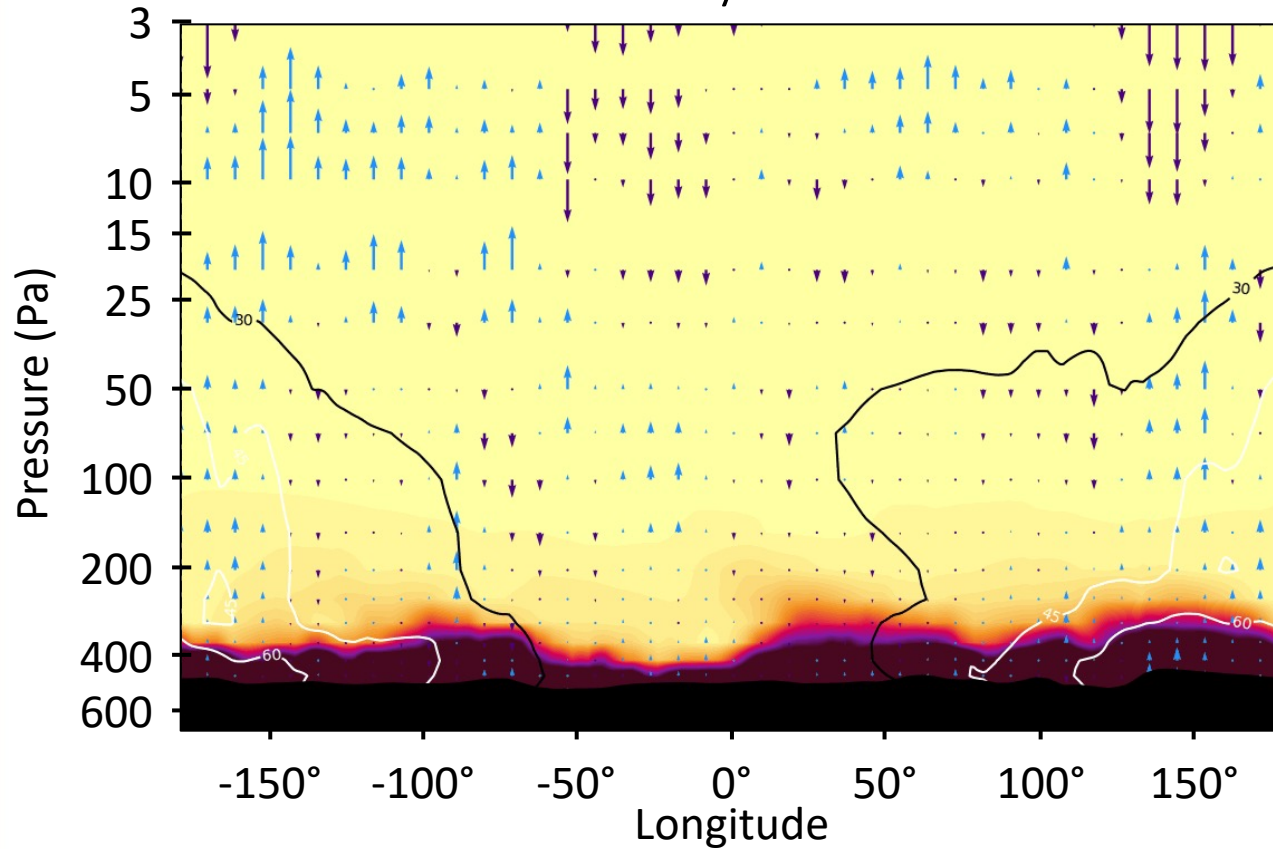
20° L_s Rolling Average 



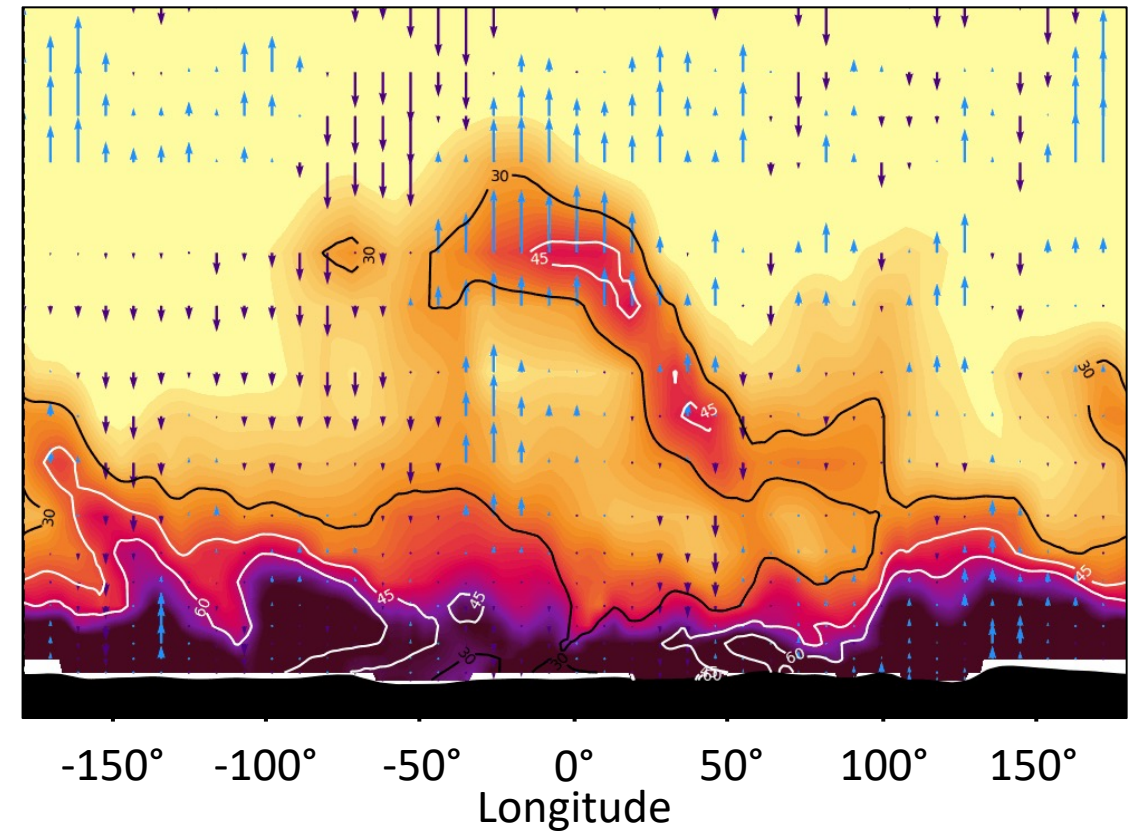
Key Result #3

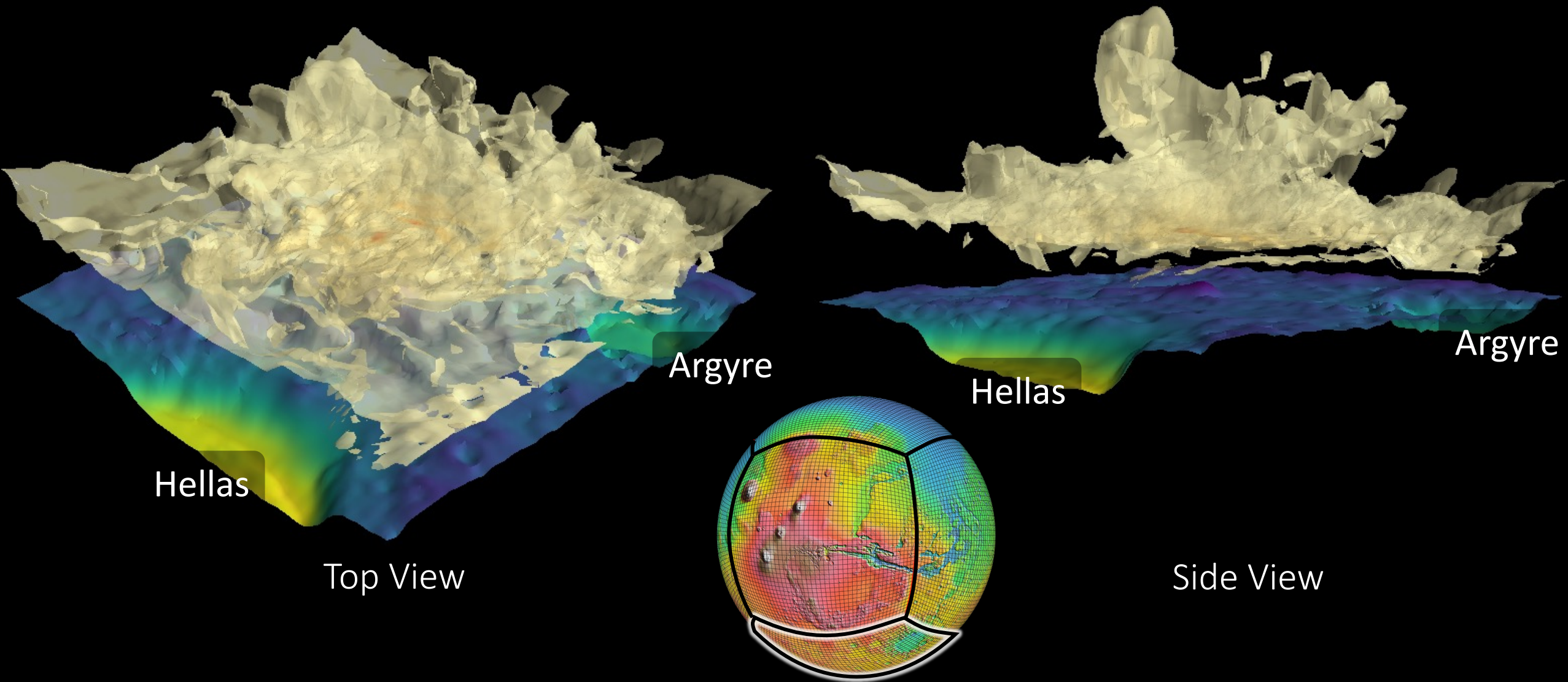
Radiative-dynamic feedbacks are crucial

Radiatively Inert Dust

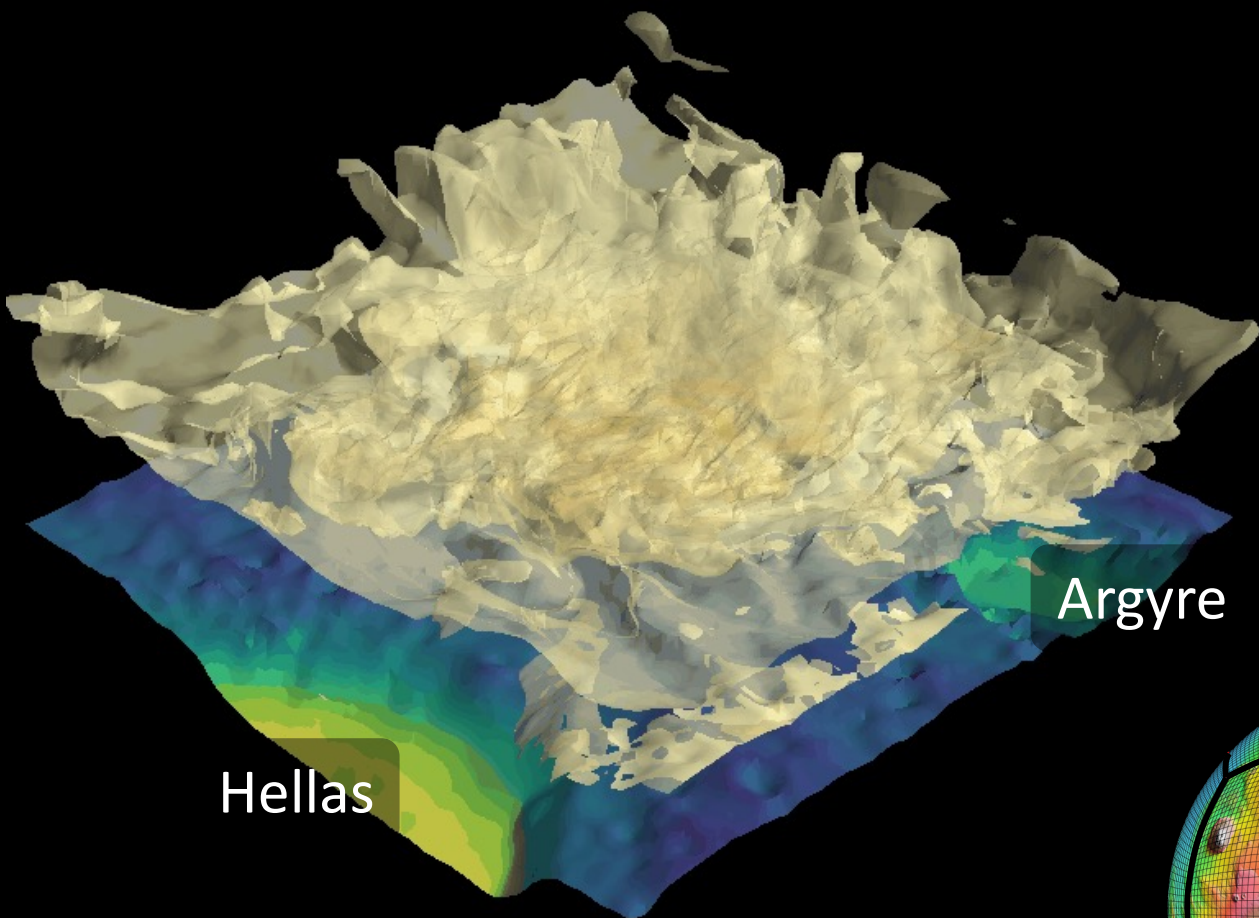


Radiatively Active Dust

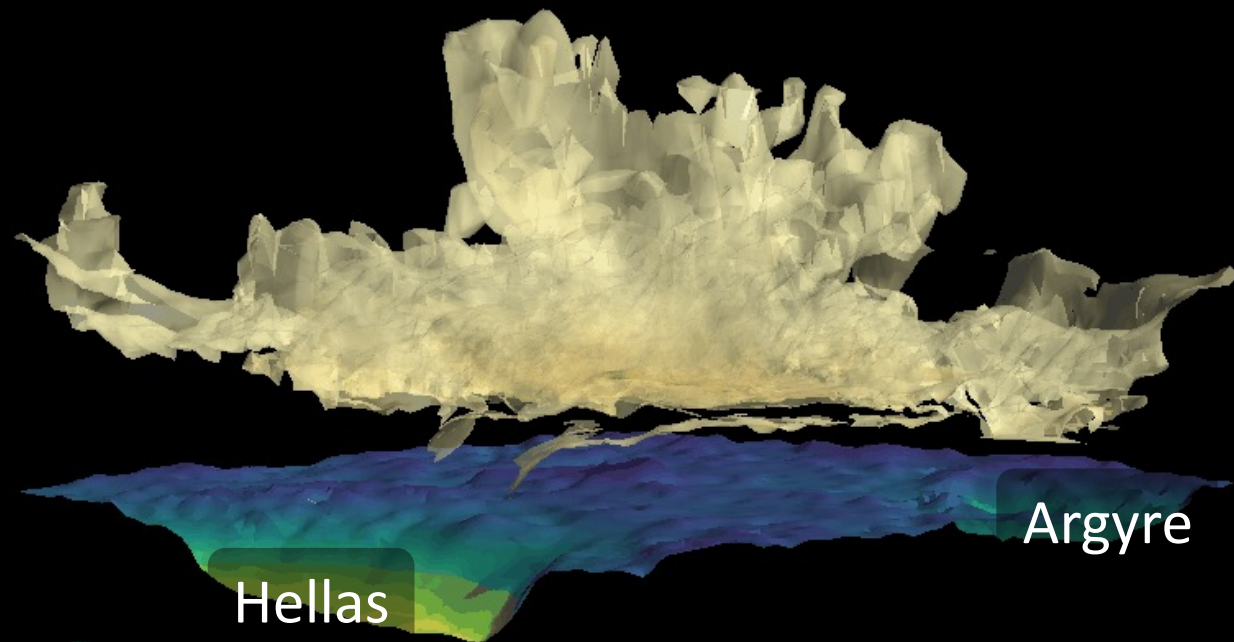




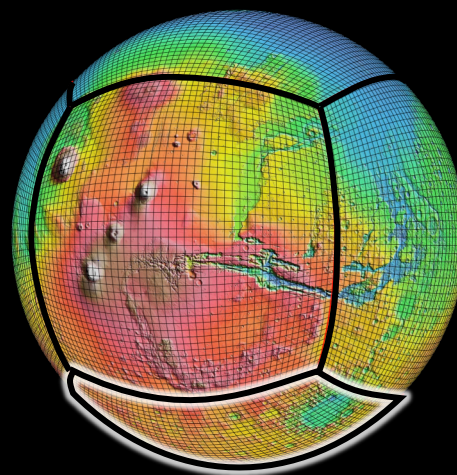
Dust over the south pole



Top View

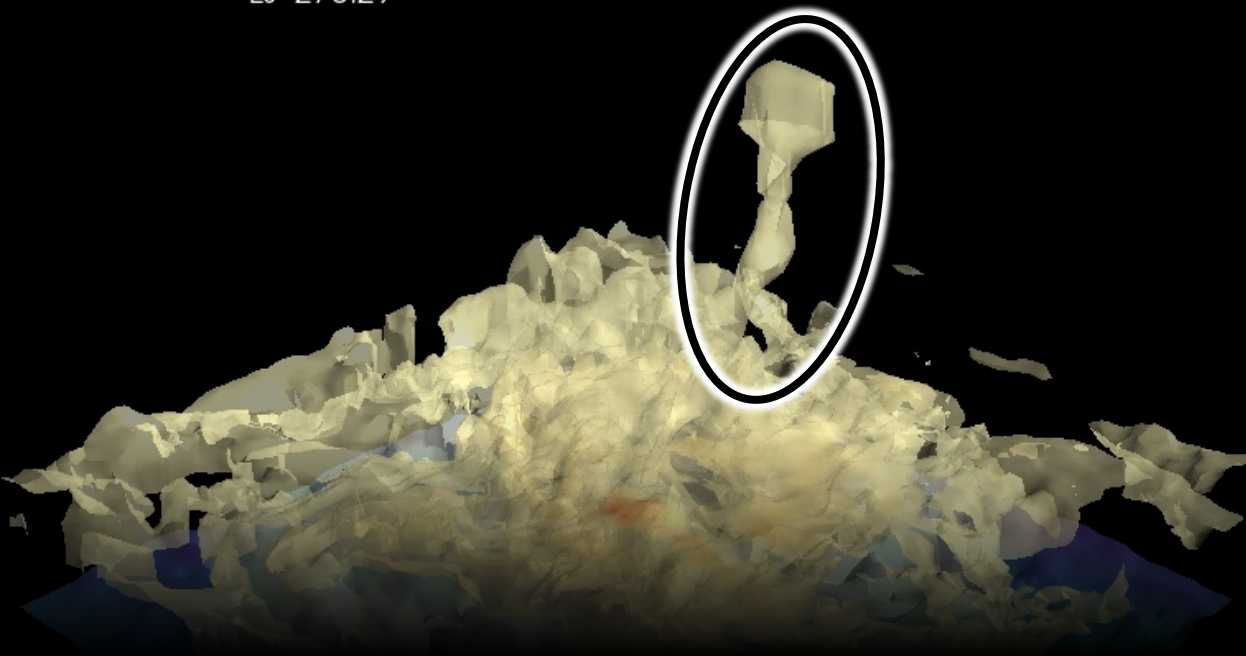


Side View

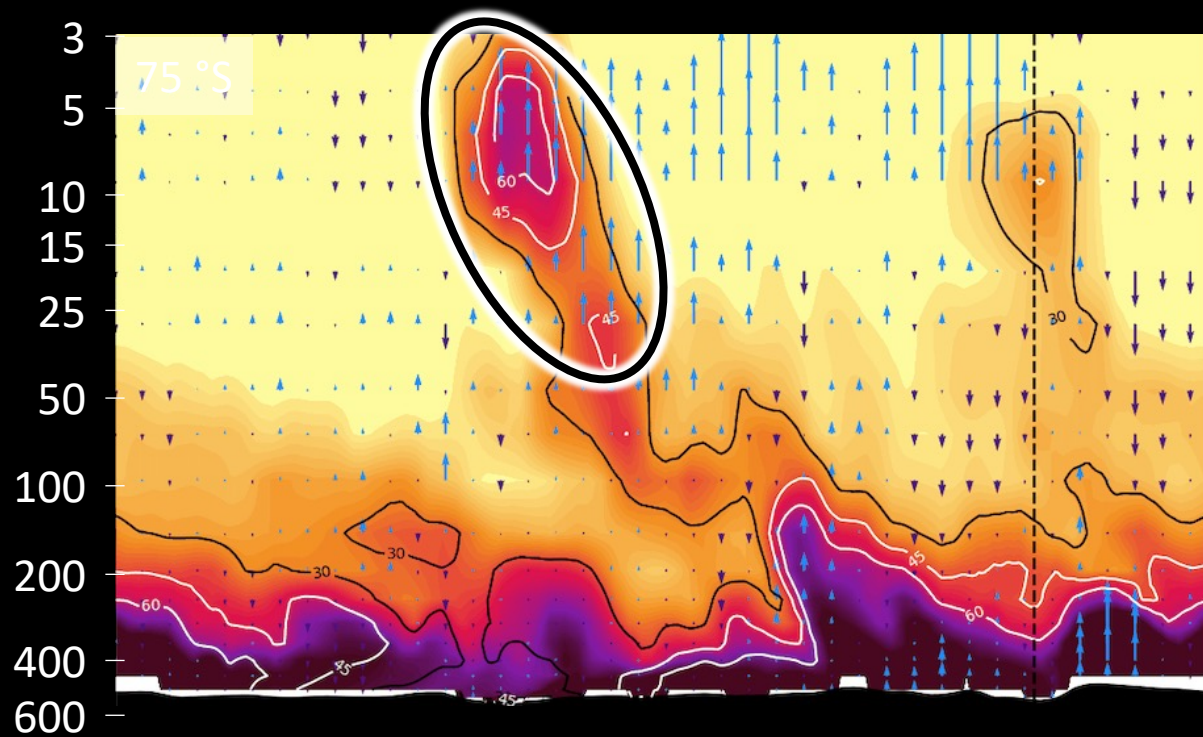
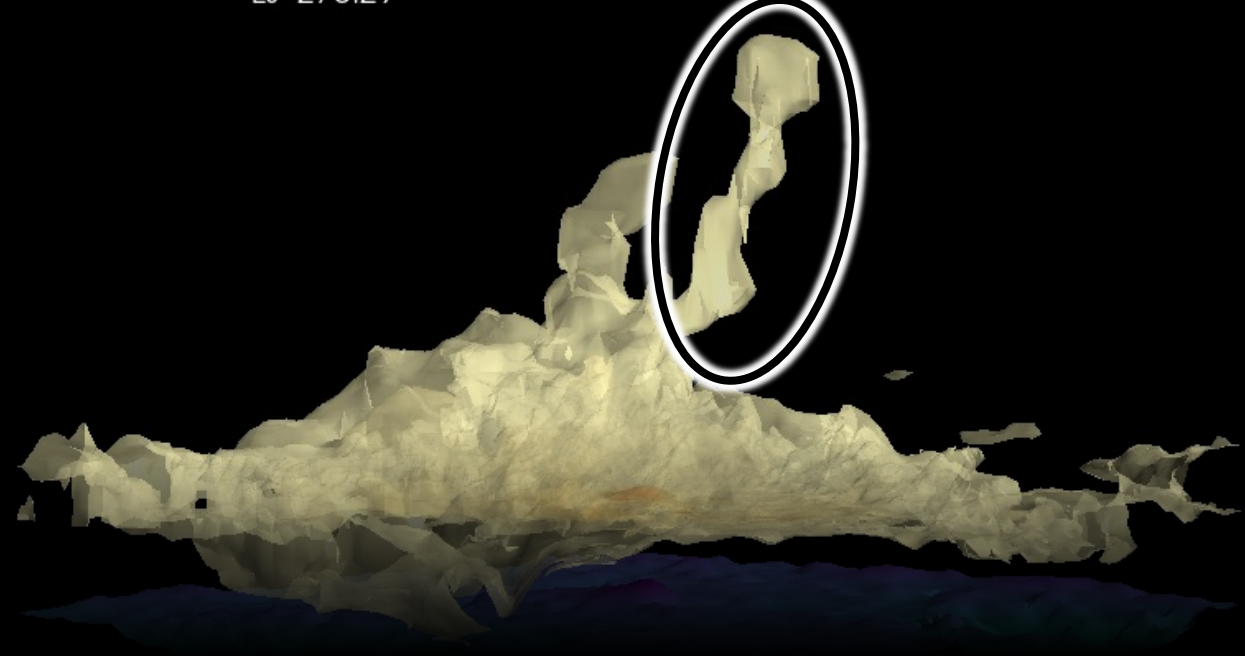


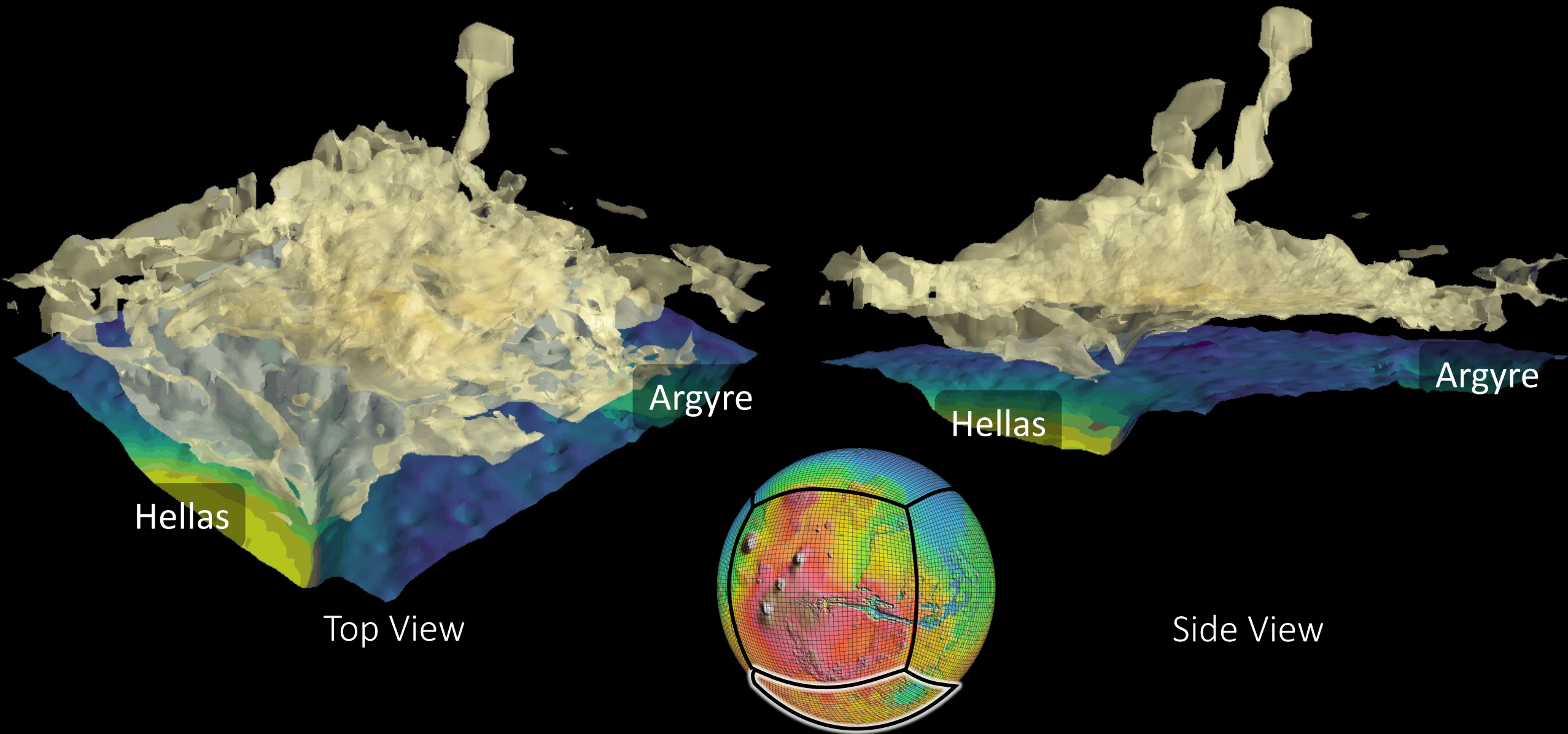
Dust over the south pole

Ls=270.29



Ls=270.29





Dust over the south pole

Summary

Key Results

1. MGCM reproduces the B storm well
2. Dust is lofted in dust plumes
3. Radiative-dynamic feedbacks drive the dust plumes

- How is dust lofted?
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Notable Patterns

Plumes produce detached dust layers with behavior resembling the “solar escalator” effect⁴.



Self-lifting of dust layers
due to the radiative
heating of the dust

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- How is dust lofted?

- How is dust lifted?

Future Work

Identifying the cause(s) of dust lifting:

- Topographical variation
- Cap-edge processes
- The CO₂ sublimation flow.

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Live Session

Processes in the Present-Day Atmosphere of Mars II

Wednesday December 15, 2021

07:45 – 09:00 Pacific Standard Time

Room 395-396 or virtually