

Understanding the Glaciating States of Mixed-Phase Clouds:

With insight into ice particle habit evolution

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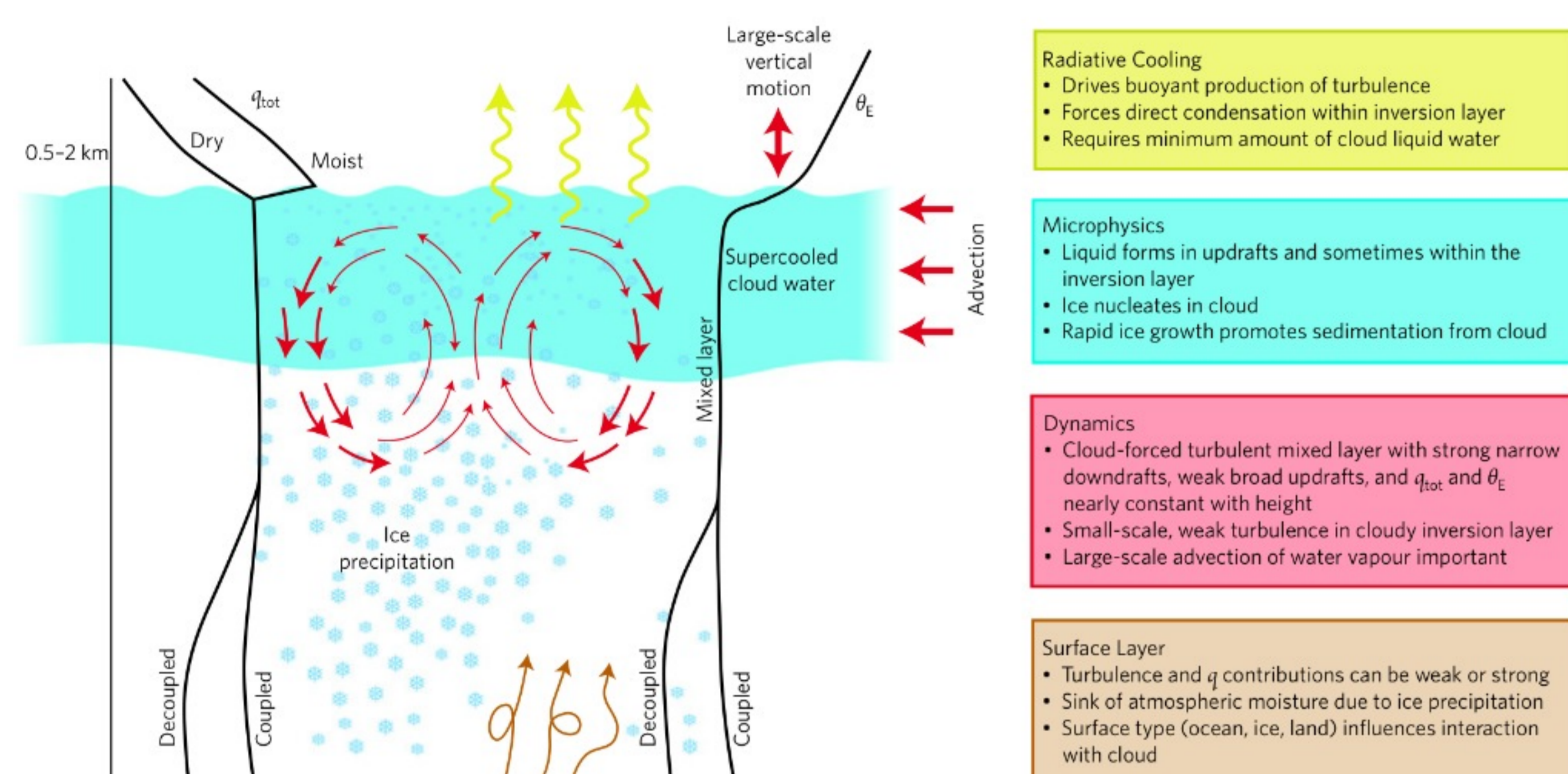
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PENNSTATE



Mixed-Phase Cloud Maintenance

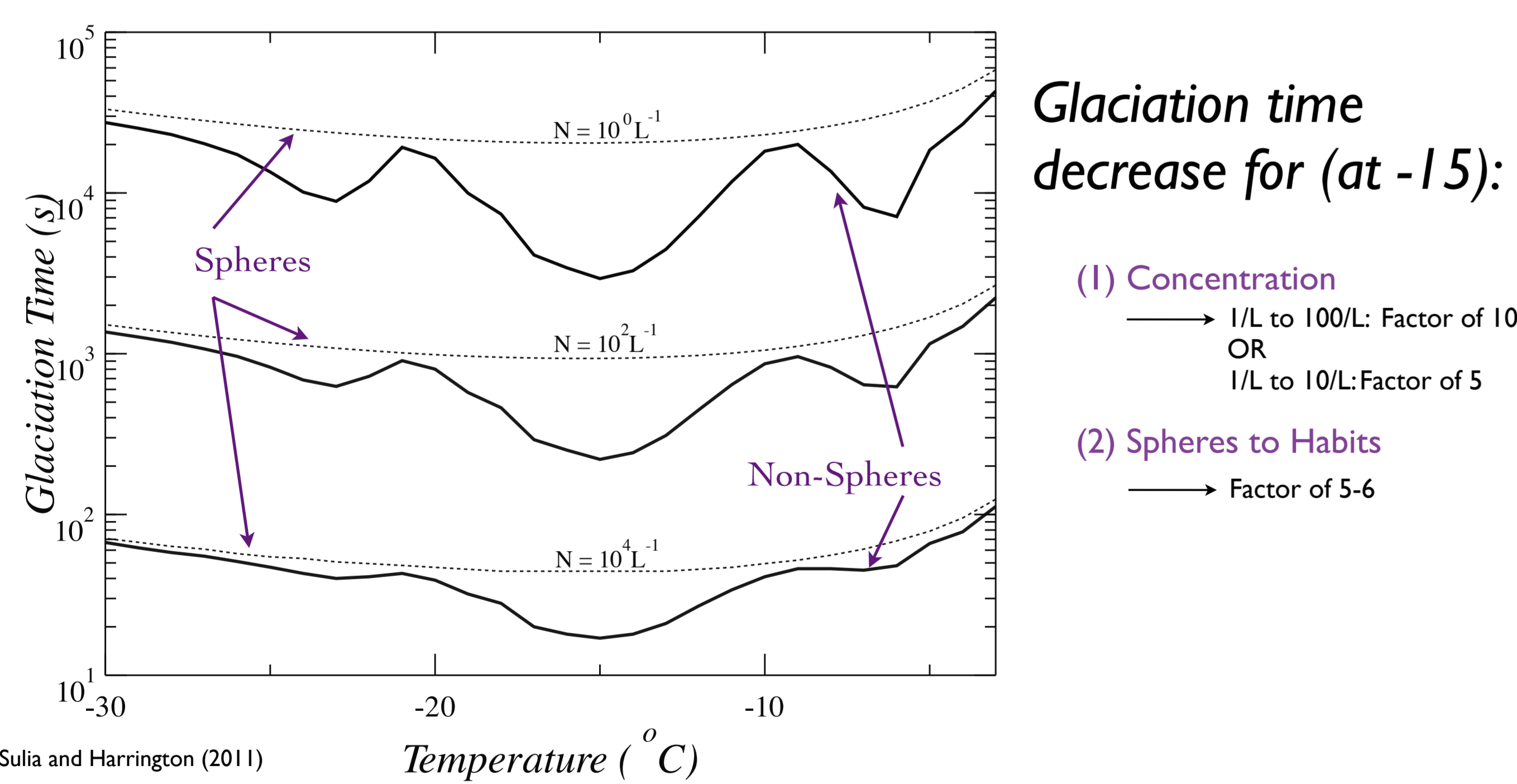
Cloud stability depends on the balance between microphysics and dynamical interactions



Morrison et al. (2011), Nature Geosciences

Ice Growth Matters

Assuming spherical ice growth can misinterpret the potential vapor uptake, and hence the consumption of liquid water.

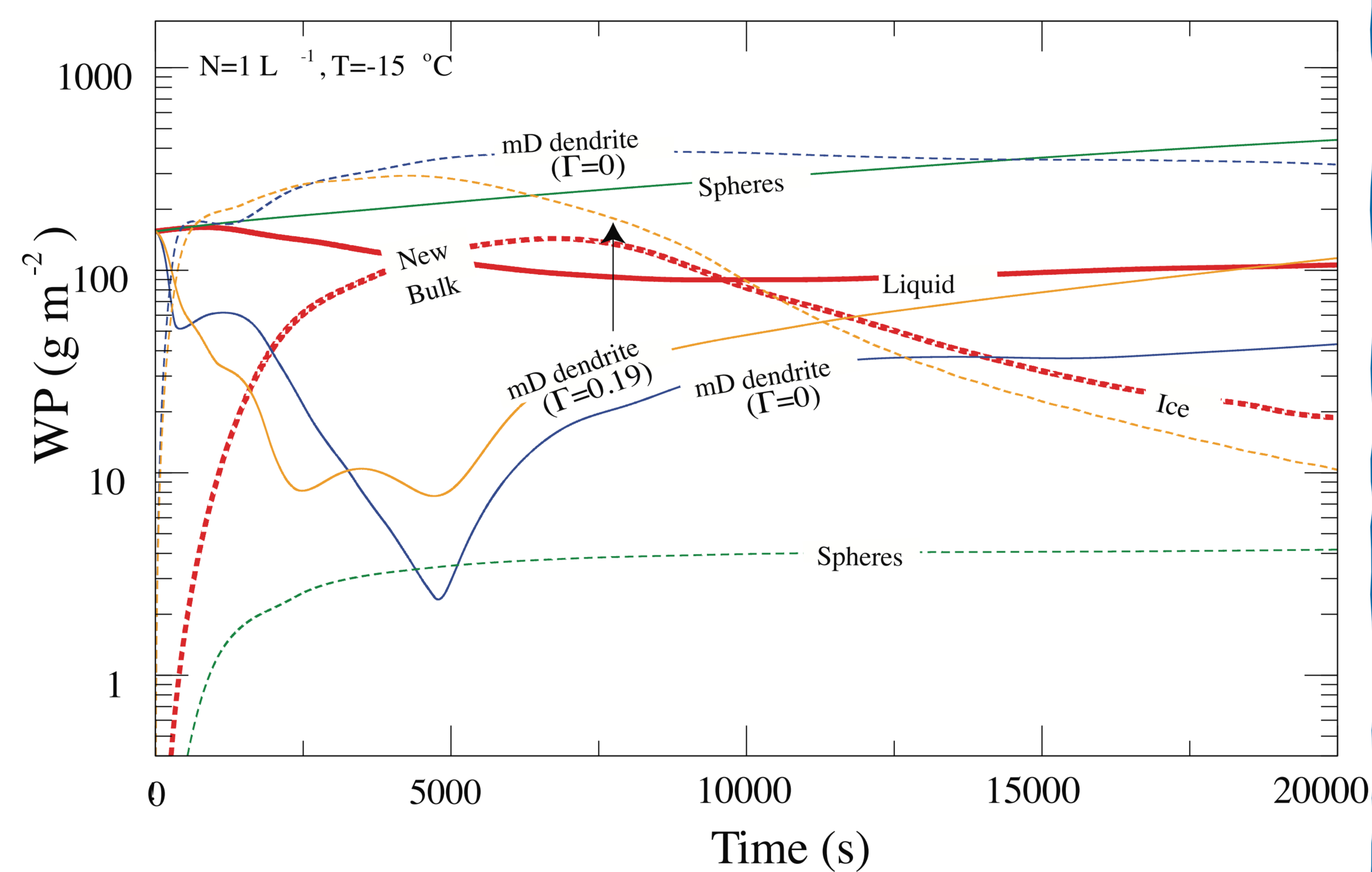


Sulia and Harrington (2011)

The complex growth of ice crystals can glaciating mixed-phase clouds, enhancing ice precipitation, & leading to cloud dissipation.

2D Kinematic Studies

- Fixed overturning eddies
- Sedimentation of ice
- Cloud-top radiative cooling
- Surface heat fluxes



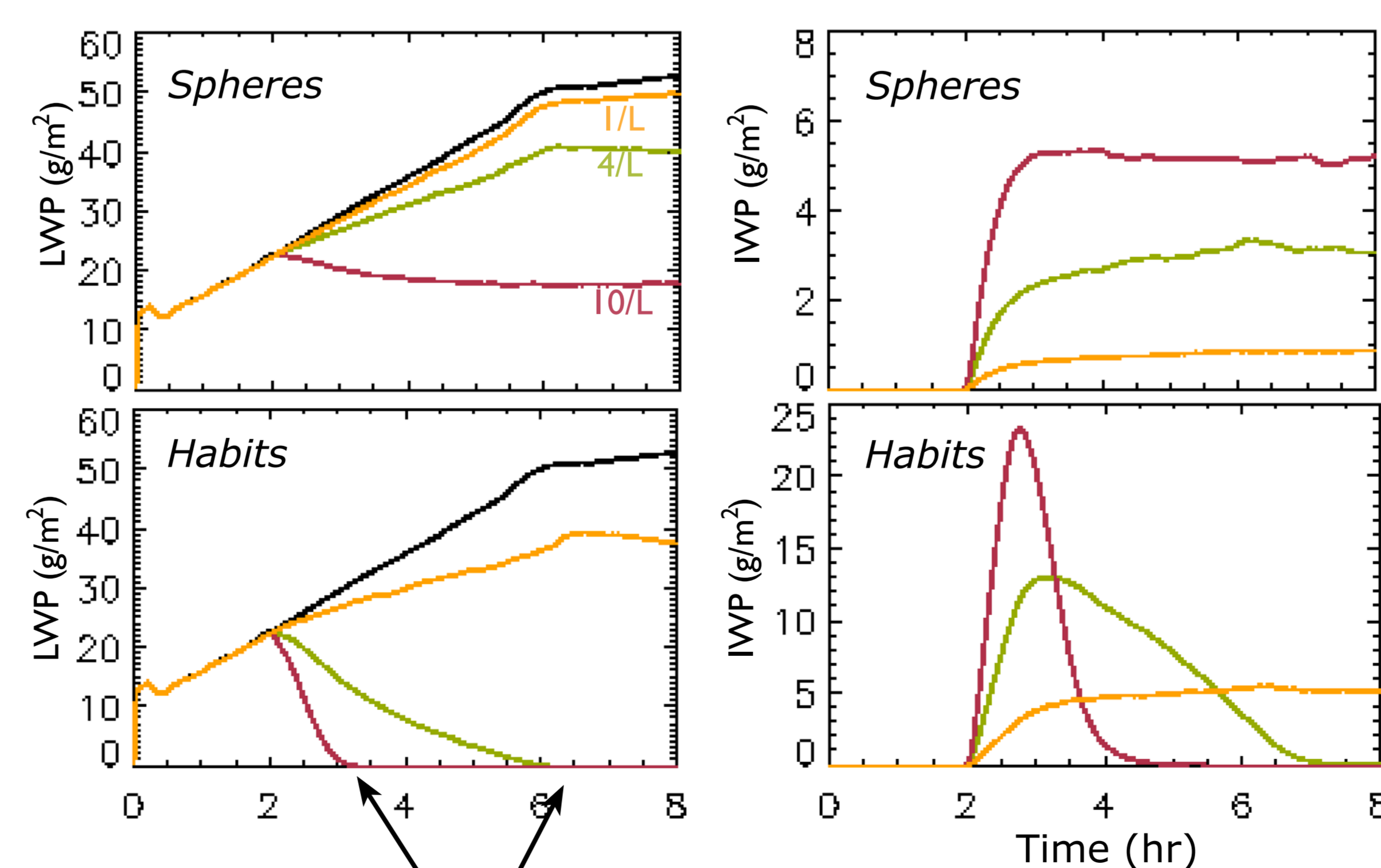
Eulerian tests reveal more stable water paths when habits evolve within the bulk adaptive habit method.

WRF-LES:

Domain: 65 x 65 horizontal grid points
200 vertical grid points
 $\Delta x, \Delta y=20\text{m}, z=2 \text{ km}$

Dynamically-Coupled

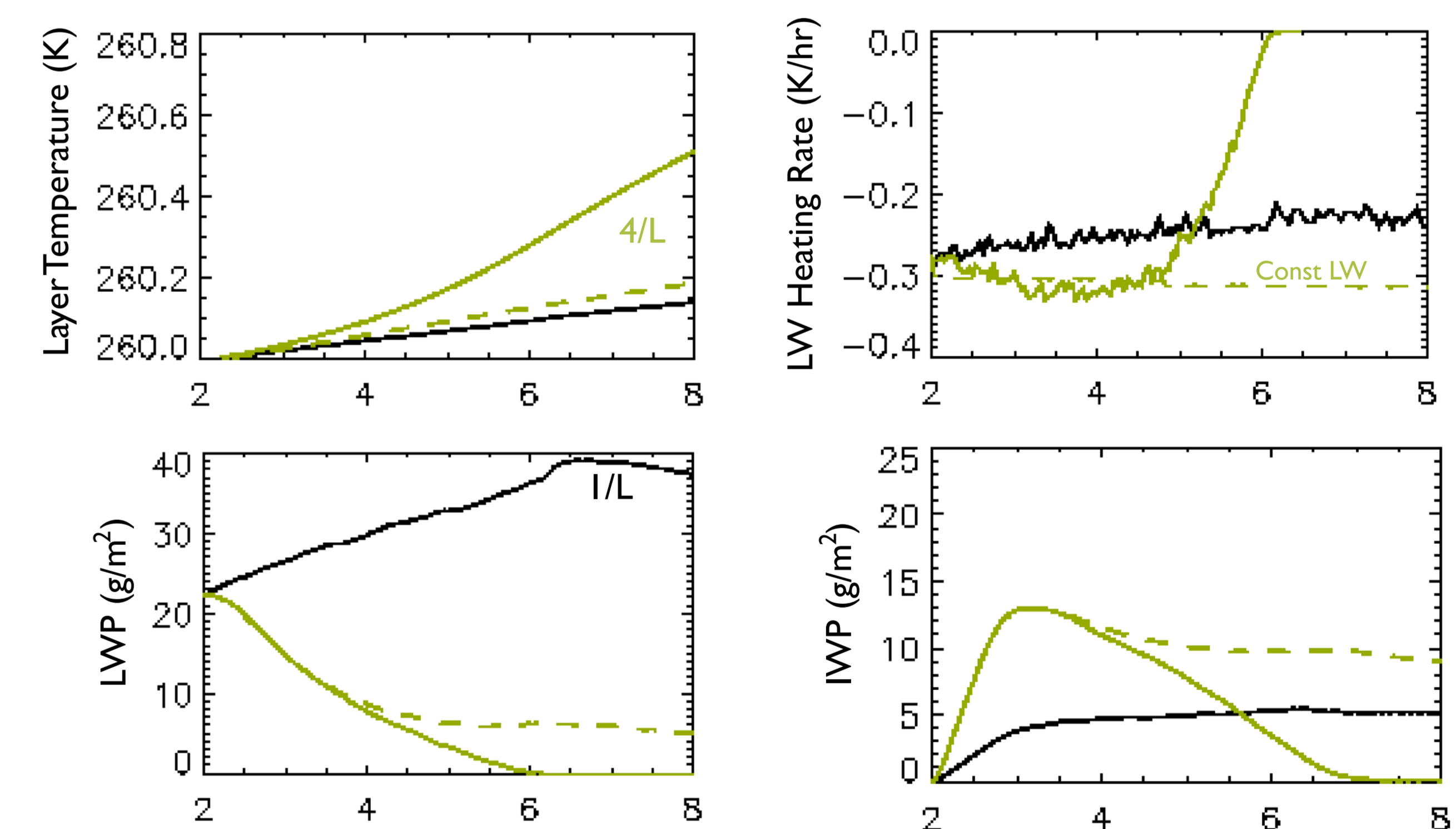
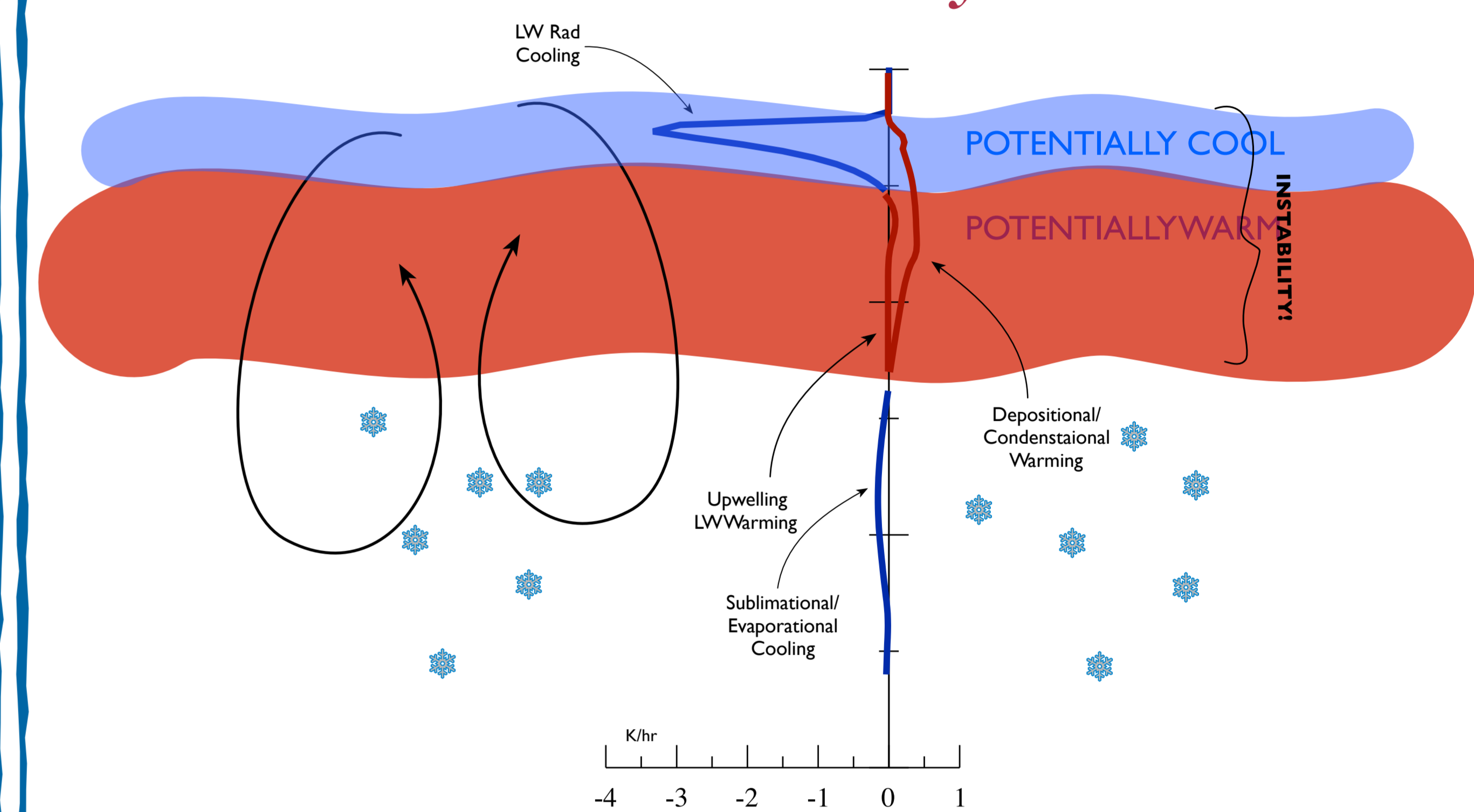
Studies of ISDAC Flight 31, following Ovchinnikov et al. (2011)



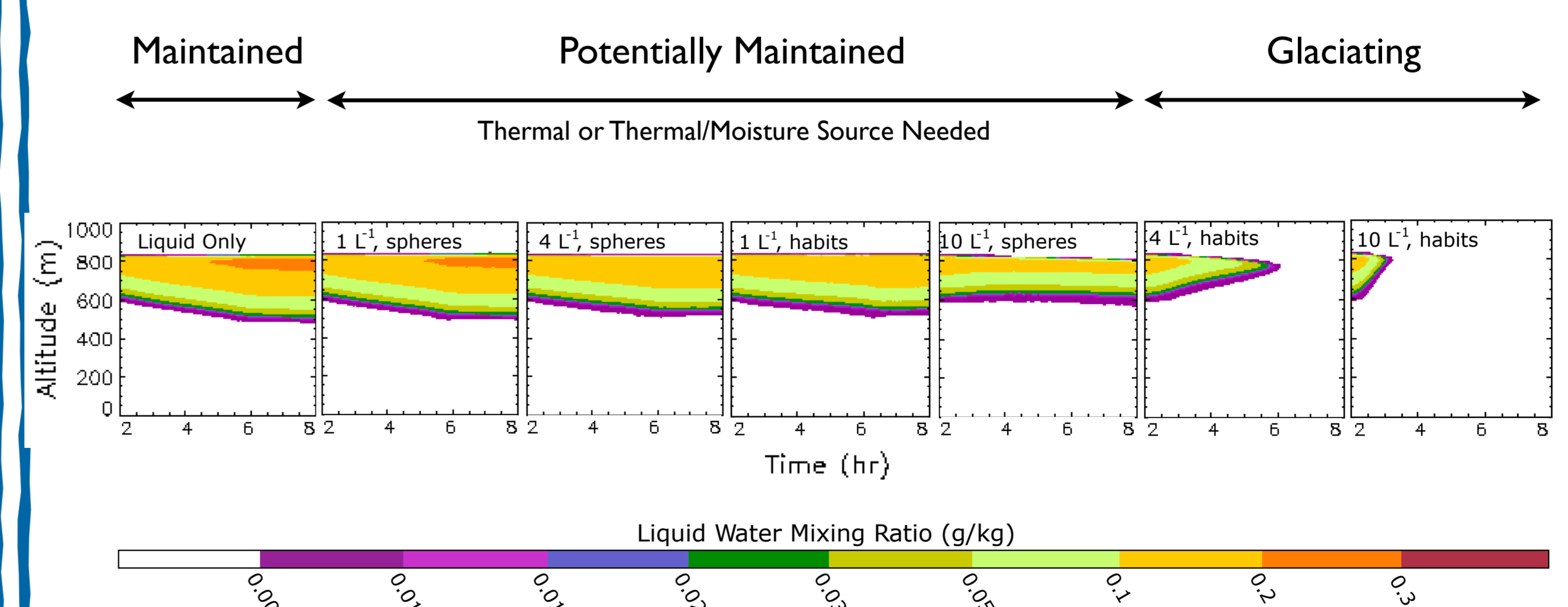
GLACIATION -- Reason, partly: Thermal Effects.

Glaciating States: Thermal Effects

Driver of Turbulence



Mixed-Phase Cloud Maintenance: A Hypothesis



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