COMBLE-MIP's long, windy road

ASR Atmospheric System Research

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plus many more folks

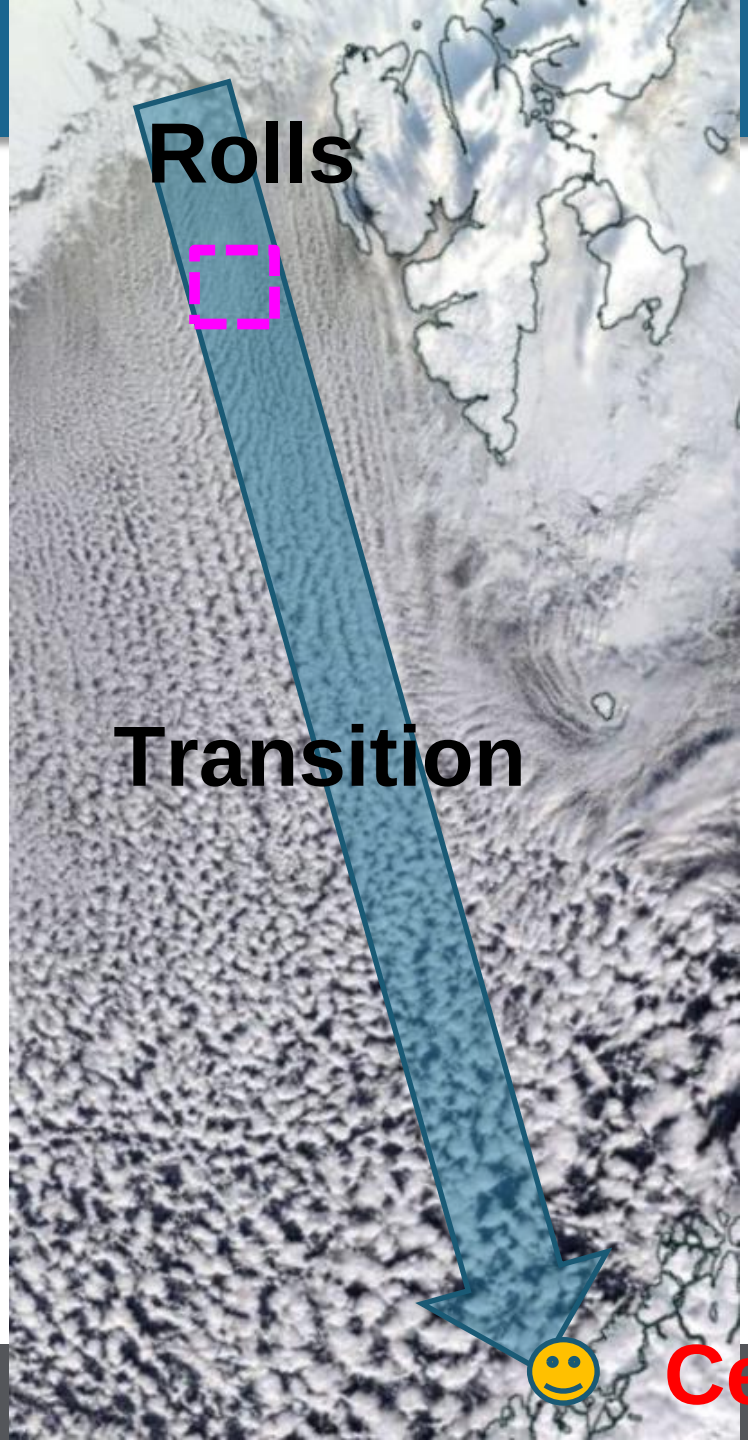
Quick recap of last 1.5+ years (!) of activities

- Initial idea of COMBLE MIP spawned from 2021 ARM/ASR PI Meeting breakout session
  - Decided on LES/SCM
- Considered all CAO cases observed during COMBLE and identified single case for the MIP (late 2021 – early 2022)
  - 13 March 2020, intense CAO conditions
- Drumming up interest in community begin early 2022 (it's still not too late to join!)
  - Over 15 modeling groups planning to participate
- Started developing the case setup in mid 2022
  - Went through **many** iterations and sensitivity tests

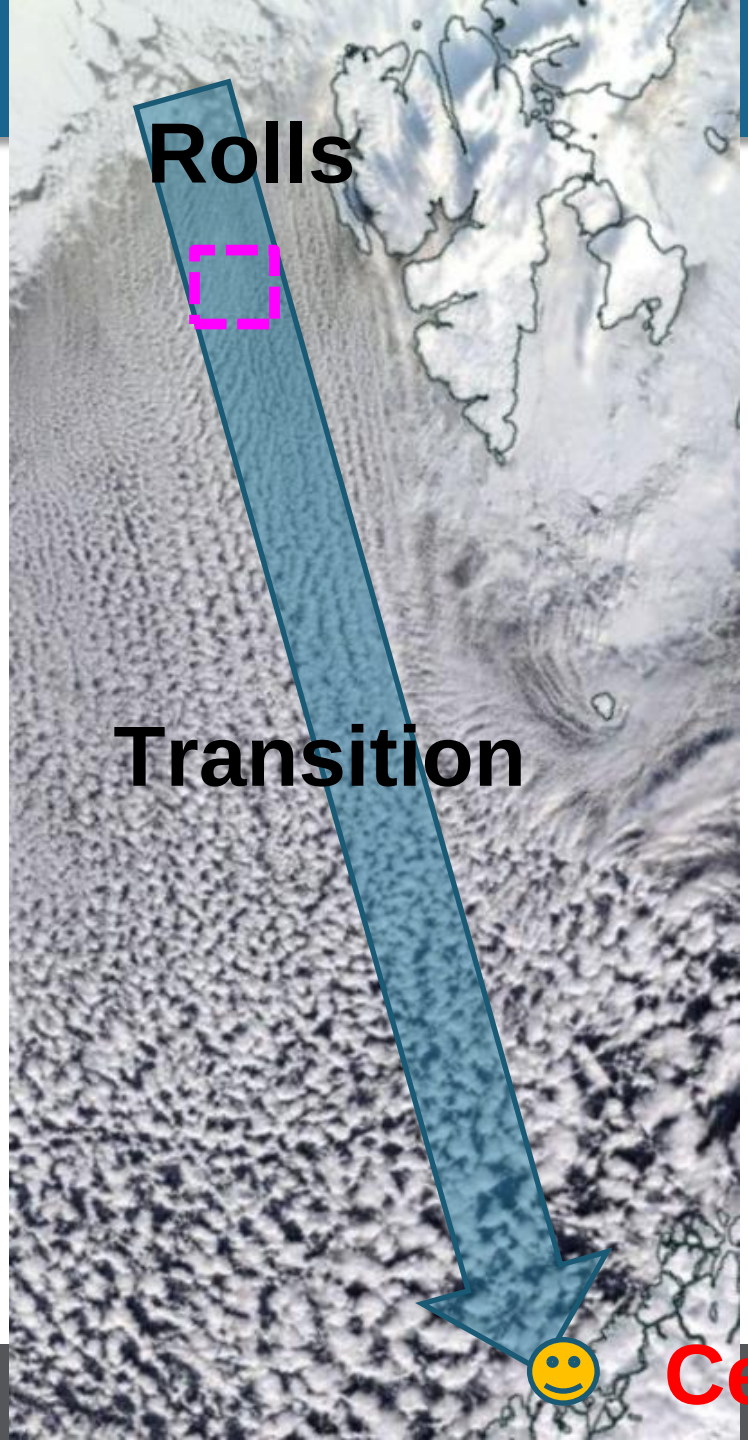
Quick recap of last 1.5+ years (!) of activities

- Presented a white paper to the GASS community in July 2022 in Monterey, CA
  - Breakout session for discussions and valuable feedback
- Held a webinar with interested parties late 2022 to gather additional feedback
- Collaboration with ARM started in mid 2022
  - Project website to host data sets, MIP details, etc.
  - https://arm-development.github.io/comble-mip/
- We have been working diligently this calendar year to improve the model specifications and integrate our work with the ARM Data Workbench

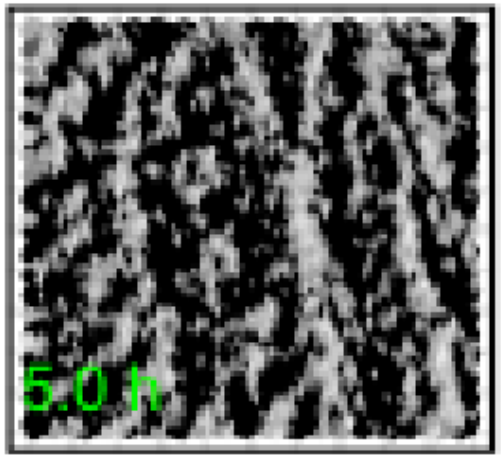
Lagrangian cloud transitions during COMBLE

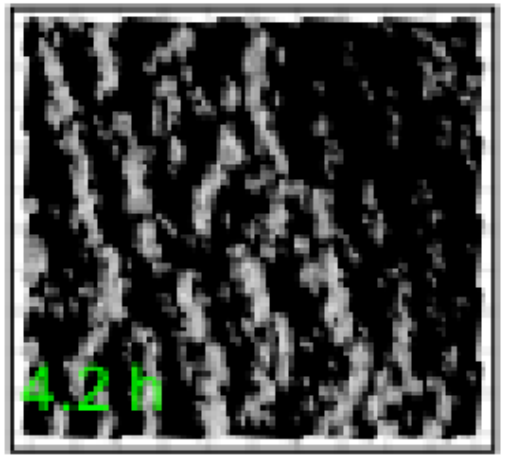


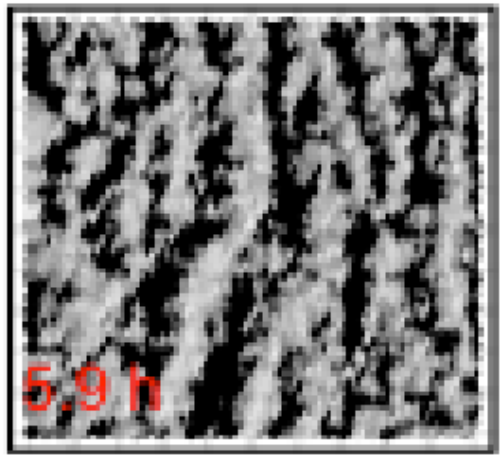
A main snag throughout the process: simulating "good looking" rolls!



Satellite observations show that roll characteristics can vary rapidly over short time periods







Accurately simulating convective rolls is hard for this case

- We find that ERA5 initial profile over pack ice is likely too deep
  - No measurements to constrain
- Numerous attempts to modify the LES setup led to generally unsatisfactory results
  - Nudging relaxation time scale
  - Large-scale pressure gradient discretization scale
  - Shear profile
  - Surface roughness length
  - Spin-up time
  - More realistic MIZ (surface heat flux timing/intensity)
  - Subsidence
  - Radiation
  - Etc.

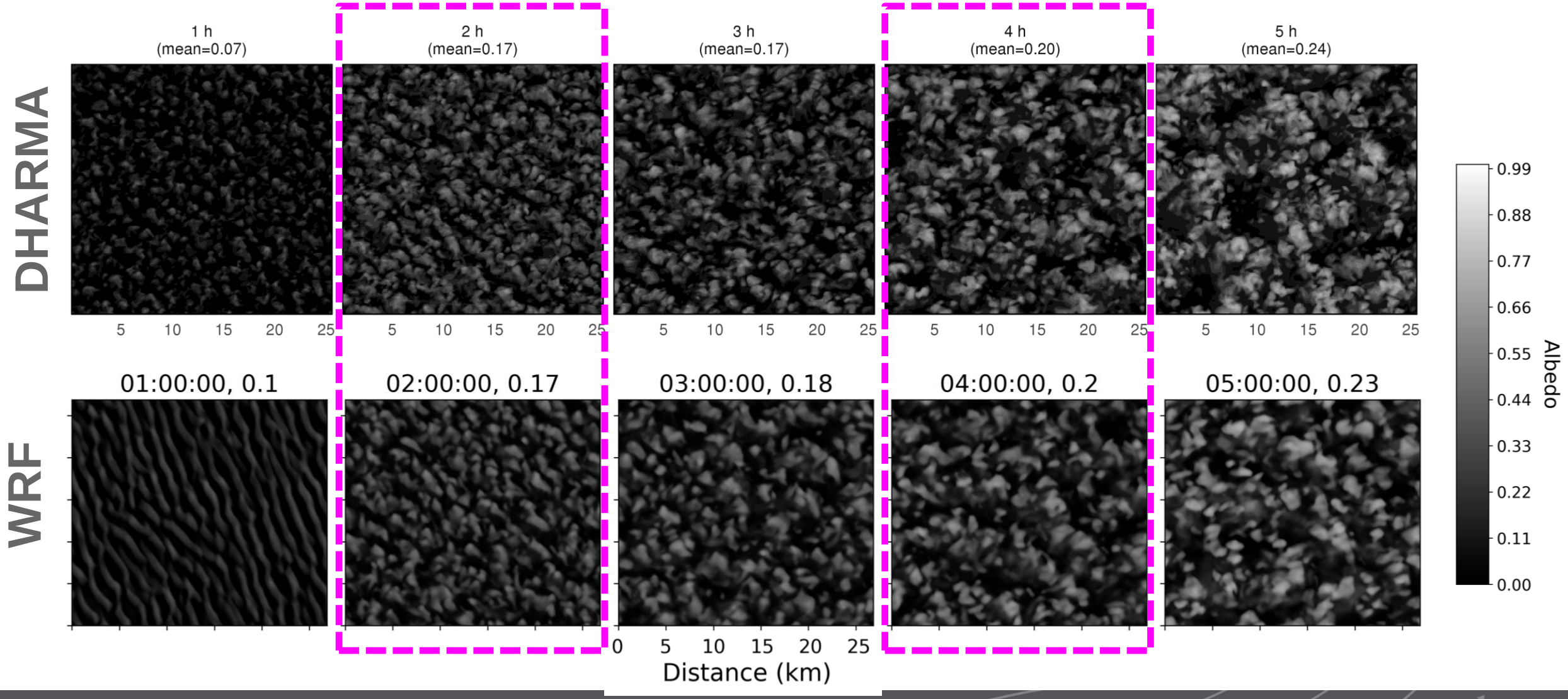
Main Model Configuration

Attention

The most up-to-date DEPHY forcing file (V2.2) may be found here.

Model component	Setting
Horizontal grid cell spacing	Dx=Dy=100 m
Horizontal domain dimensions/size	Preliminary: Nx=Ny=256; Lx=Ly=25.6 km (required) Production: Nx=Ny=1280; Lx=Ly=128 km (desired but not required) - Note: if you are unable to perform the "Production"-sized domain, then we will accept smaller domain configurations
Vertical grid	According to input forcing file specifications - Variable name to use: *zw_grid*
Domain top	7 km
Start/end times	22 UTC on 12 March 2020 18 UTC on 13 March 2020
Initial profiles	Thermodynamic and kinematic soundings provided

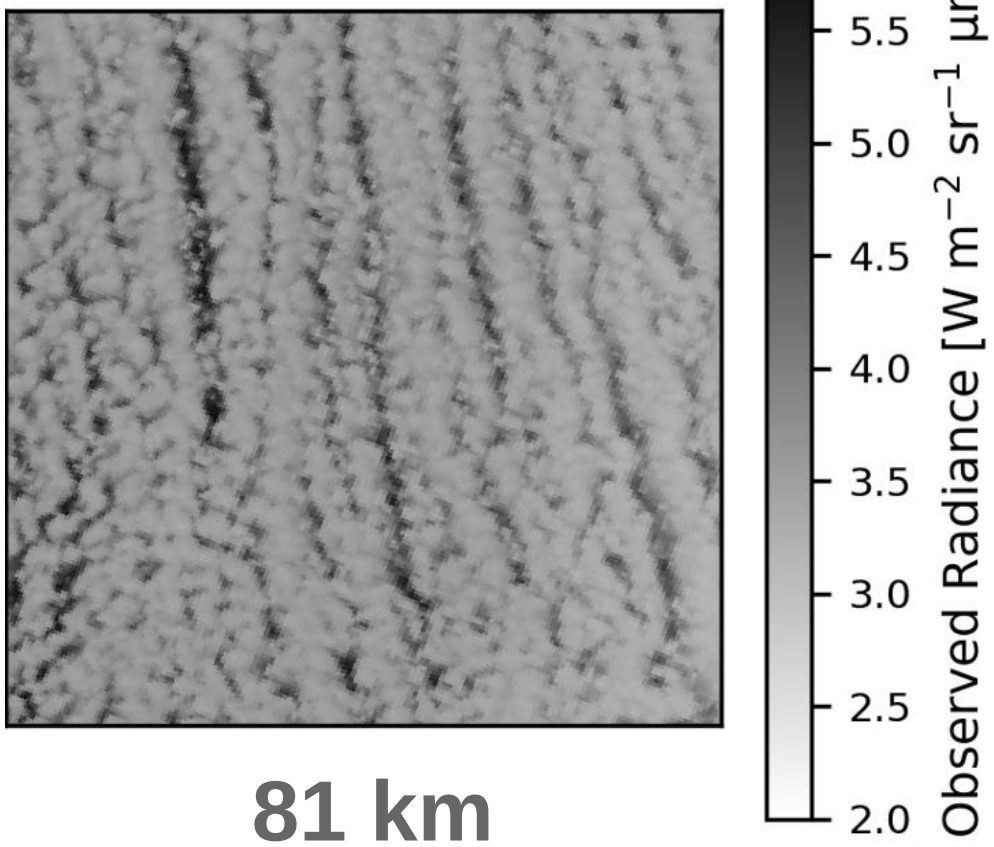
Pseudo-albedo near the ice edge ("rolls")

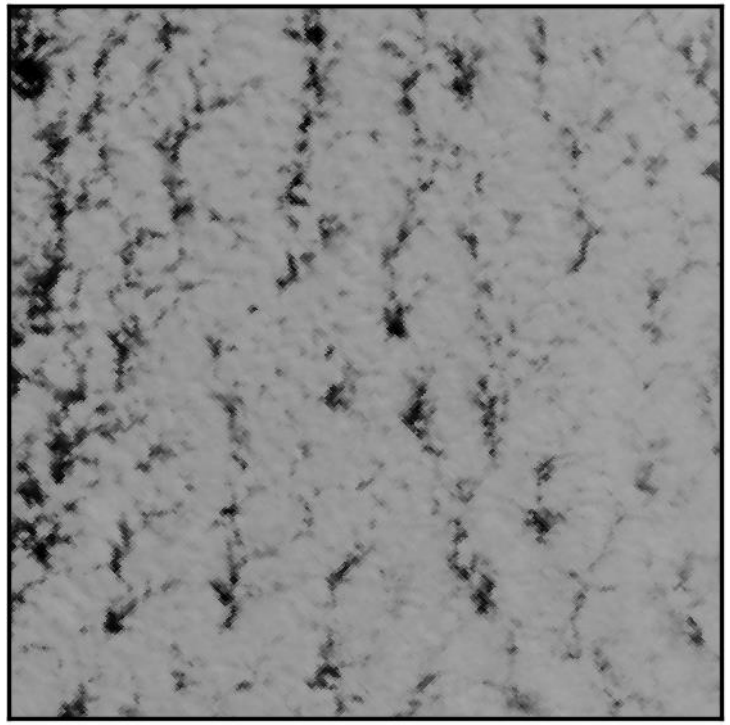


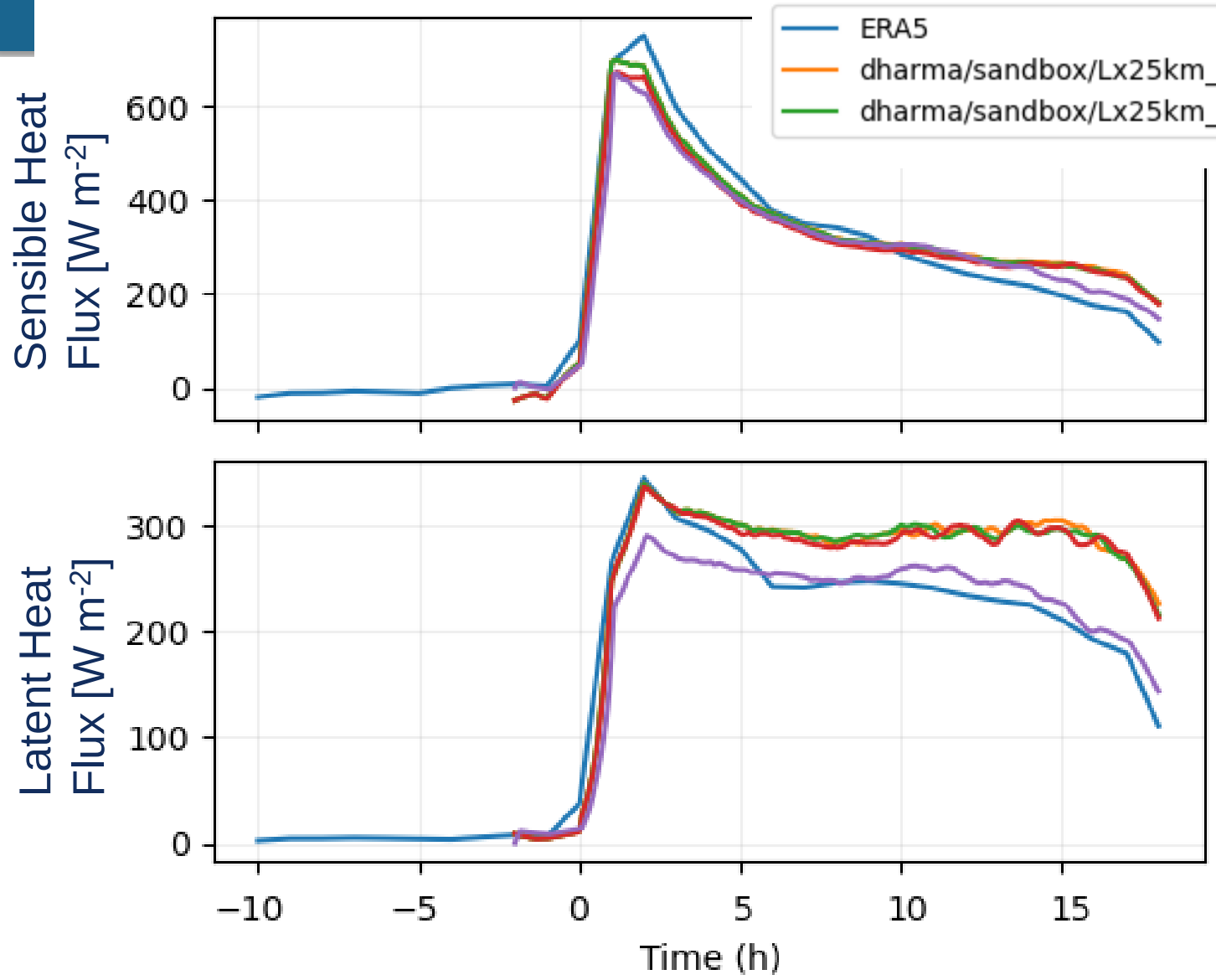
What the satellite sees at:

t ~ 2h

t ~ 4h





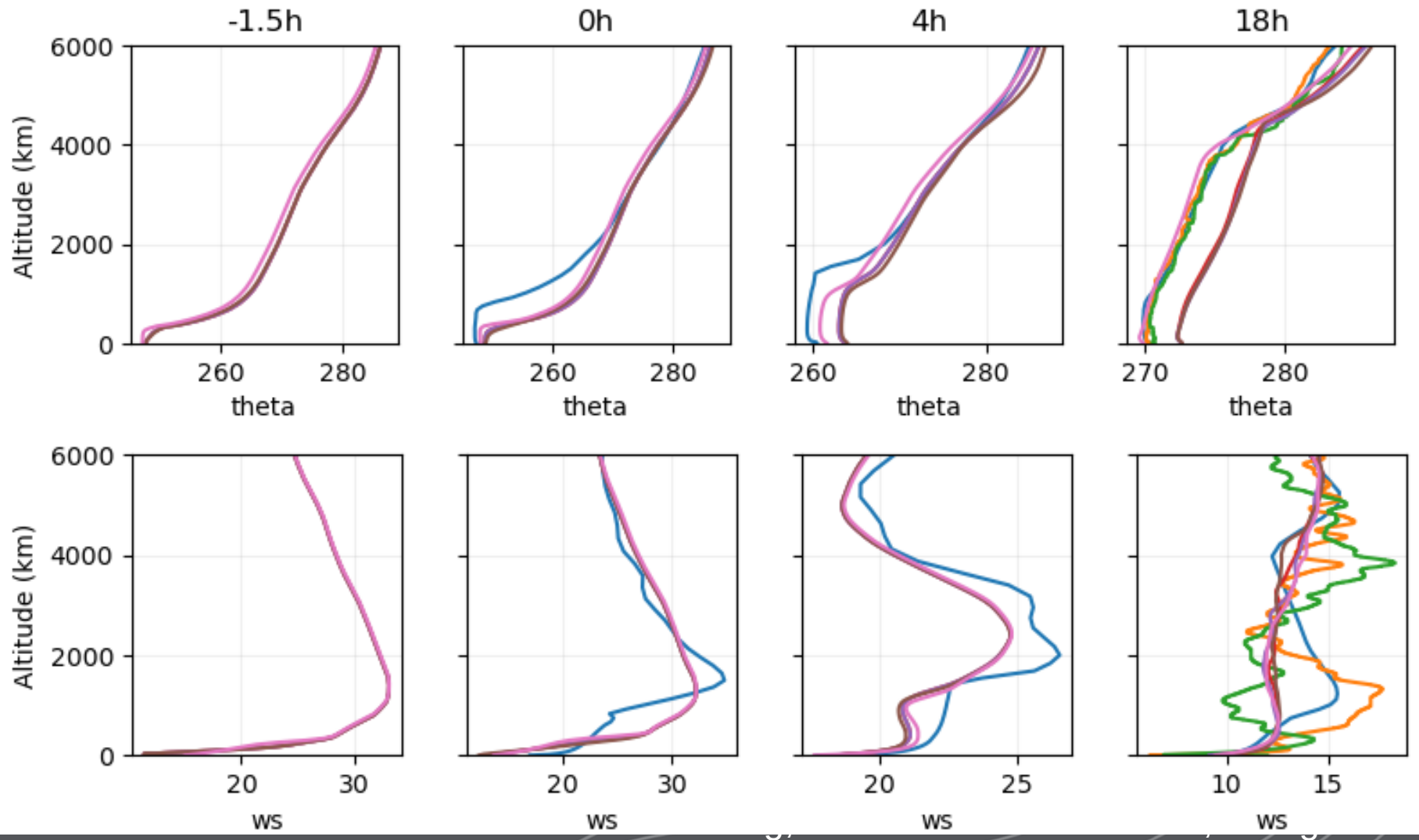


Domain-mean quantities

- Imposing surface forcing via skin temperature leads to reasonable surface fluxes when computed interactively & compared to ERA5

Domain-mean quantities

- Thermal and kinematic vertical structure agree well with ERA5 along trajectory and COMBLE measurements downstream



Timeline

Attention

Ready to make your model outputs accessible to other MIP participants? Please refer to this page to learn how to upload your model outputs to the repository.

Stage	Product	Due Date
Phase I	- SCM/small-domain LES, liquid-only	Nov. 15, 2023
	- SCM/small-domain LES with ice	Nov. 15, 2023
	- Large domain LES with ice	Feb. 1, 2024
Phase II	- SCM/small-domain LES, liquid-only	Nov. 15, 2023
	- SCM/small-domain LES with ice	Nov. 15, 2023
	- Large domain LES with ice	Feb. 1, 2024