Cloud-Resolving Model Simulations for DYNAMO

Xiaowen Li[1,2] and Wei-Kuo Tao[1]

[1]NASA Goddard Space Flight Center
[2]Morgan State University

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We hope to contribute to…

The understanding of cloud regime transitions during MJO events and clouds' interactions with their environment, quantitatively.

transitions

Shallow convection dominant ->
Congestus dominant ->
Deep convection with
anvil/stratiform clouds

Interactions

Clouds/Precipitation

modify ↓ ↑ constrain

Atmosphere

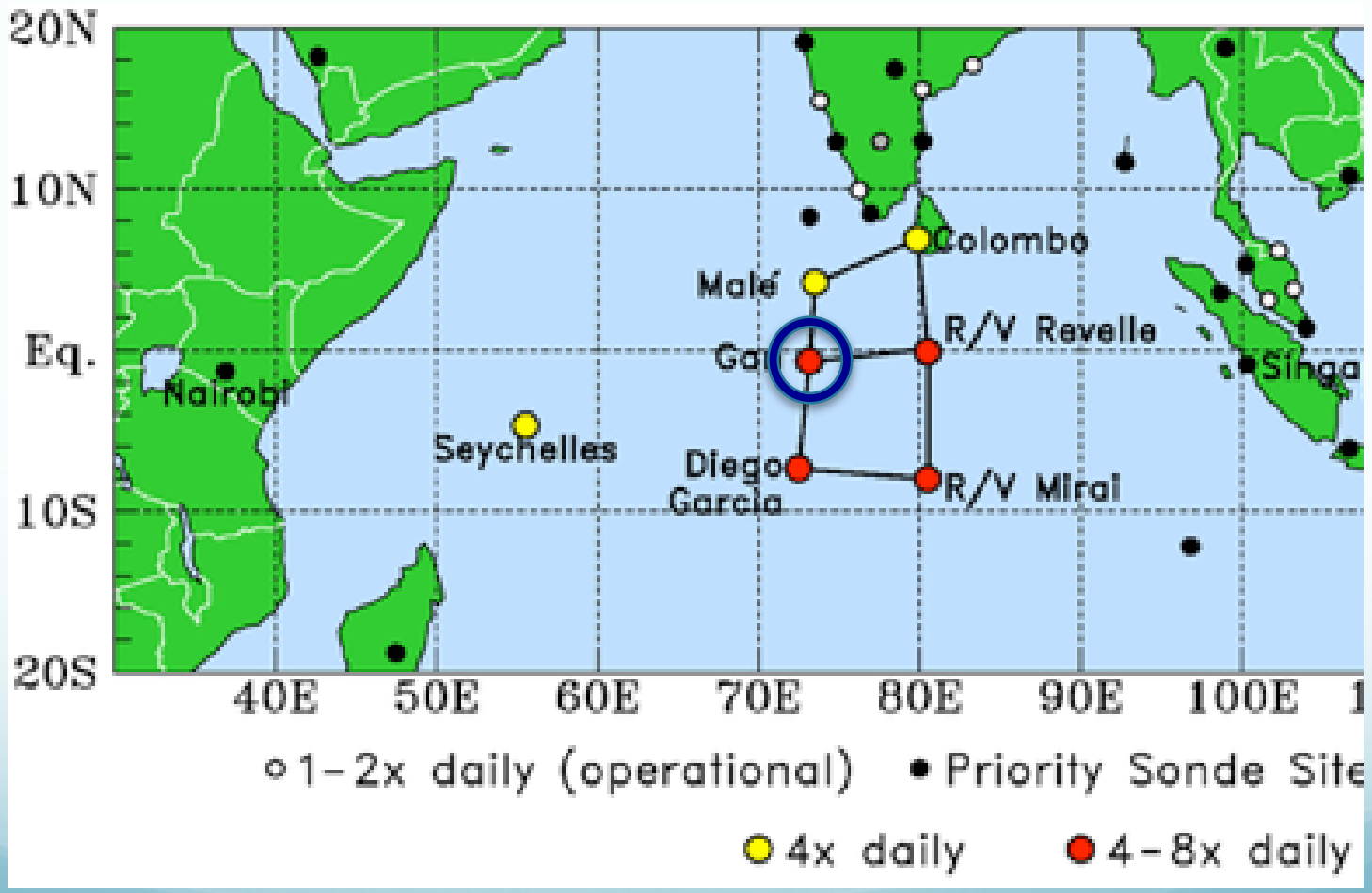
How clouds modify their environment

How does environment constrain clouds?

Goddard Cumulus Ensemble (GCE) model driven by two different sets of large-scale forcing during the same time period of DYNAMO.

- Observation-based forcing derived from sounding network. Johnson and Ciesielski @ CSU
- Model-based forcing derived from ECWMF reanalysis, with surface rainfall constrained by SMART radar. Xie and Zhang @ LLNL

DYNAMO Sounding Array (October ~ December, 2011)



Model Setup

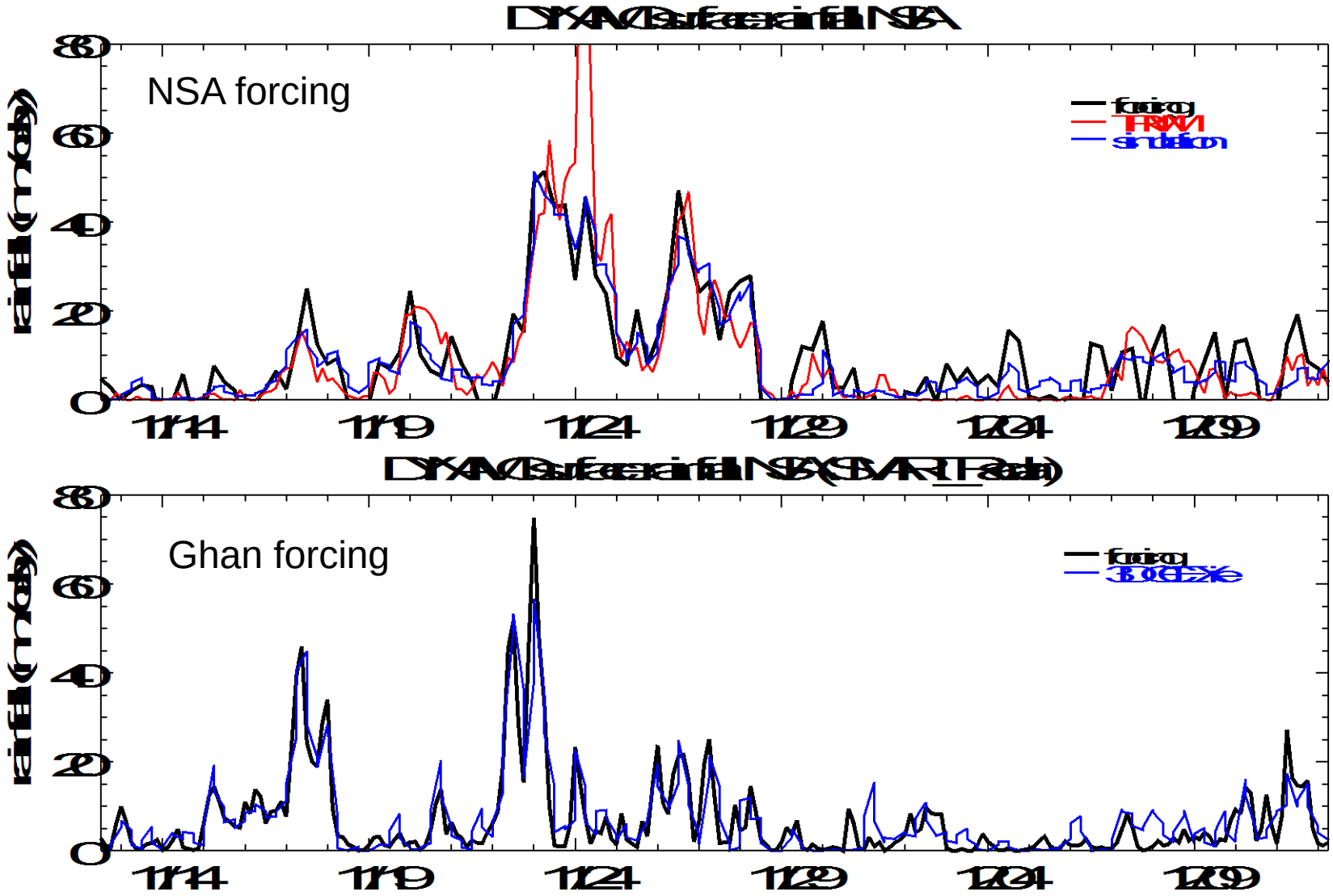
- 256x256x45 levels with horizontal resolution of 1km; Stretched vertical grids.
- 30-day simulation with time step of 6s.
- Single-moment Goddard microphysical scheme.
- Prescribed surface fluxes.

Does the two forcing data tell the same story?

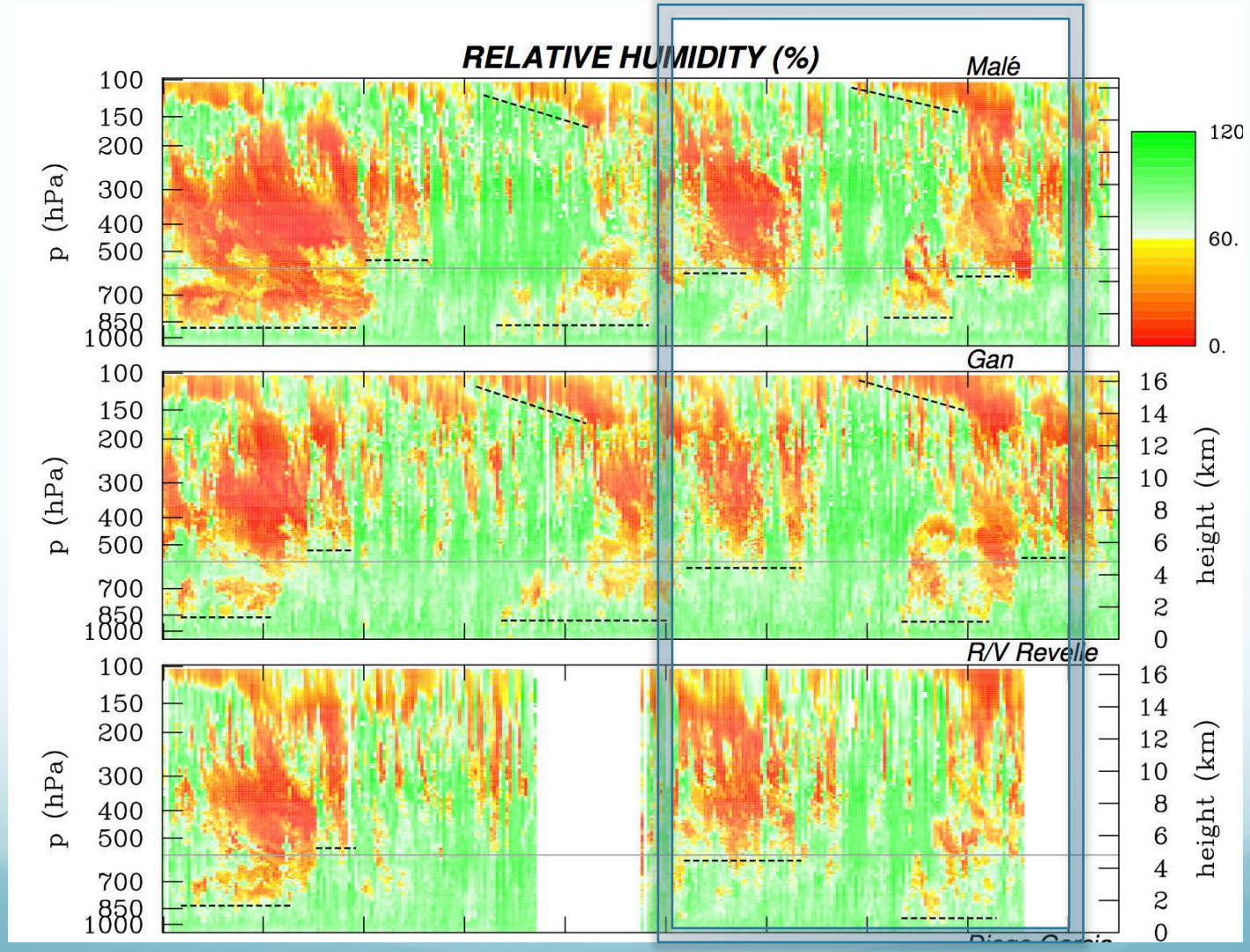
How does the CRM respond to different forcing?

Can we gain some insights in how the environment constrain cloud structures? Cloud feedbacks to the environment?

Simulated Surface Rainfall

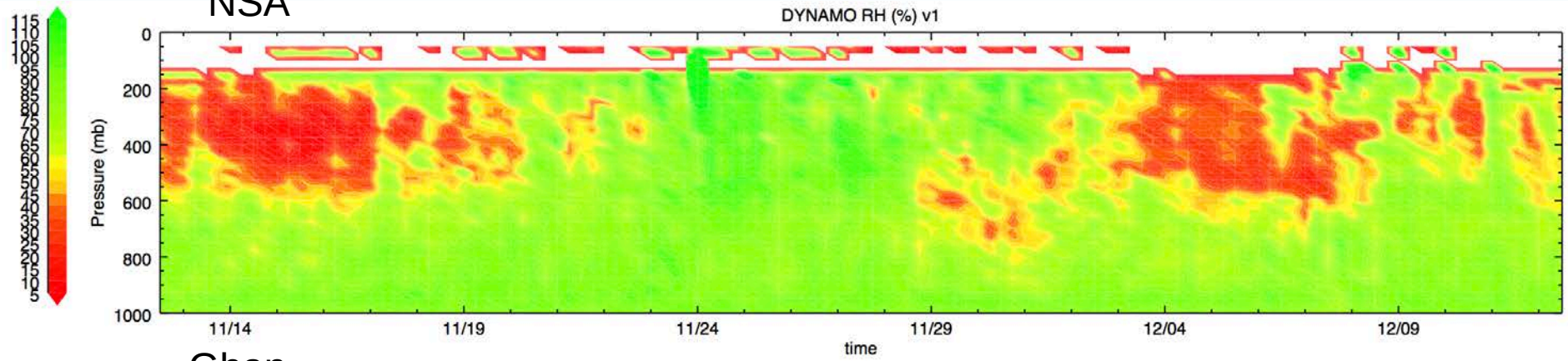


RH observation by sounding (Johnson and Ciesielski, 2013)

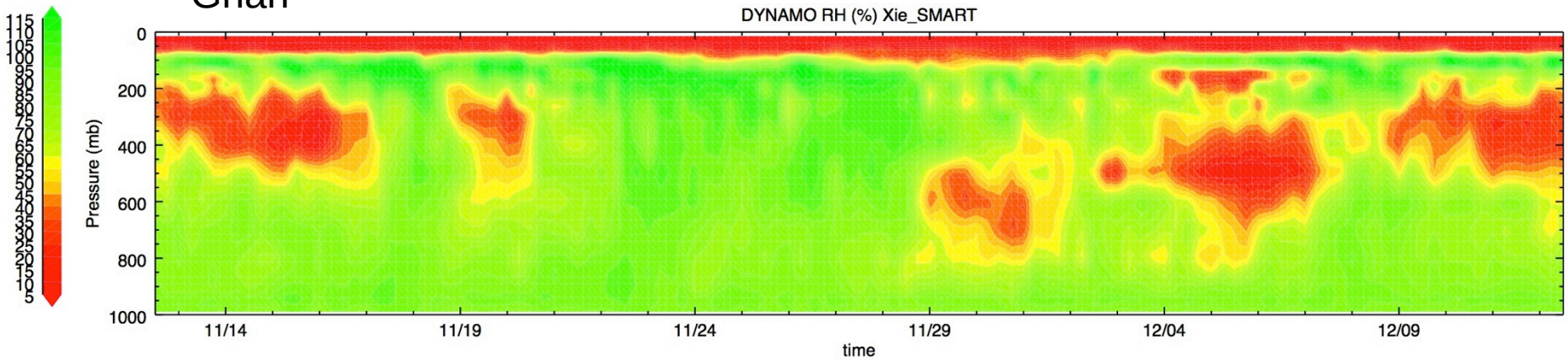


RH series in large-scale forcing

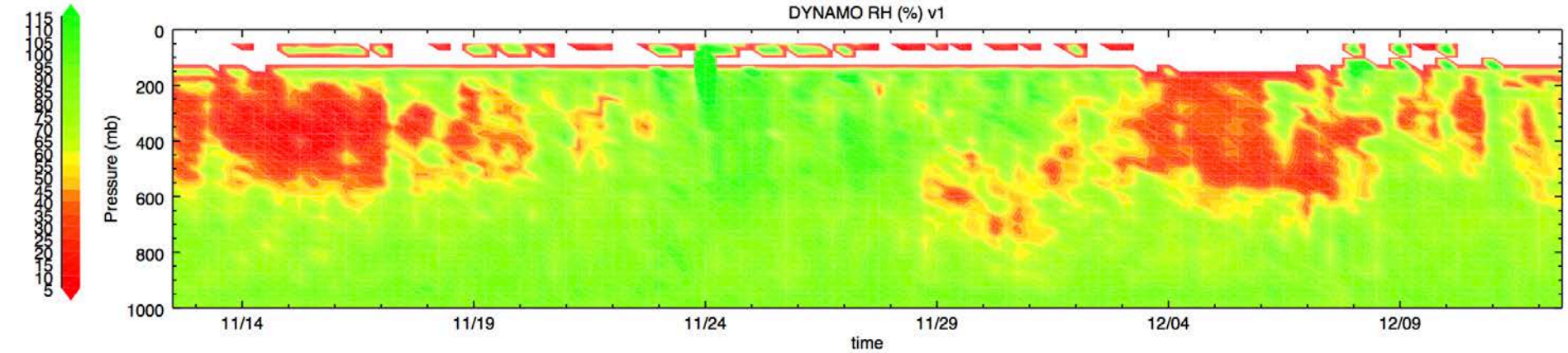
NSA

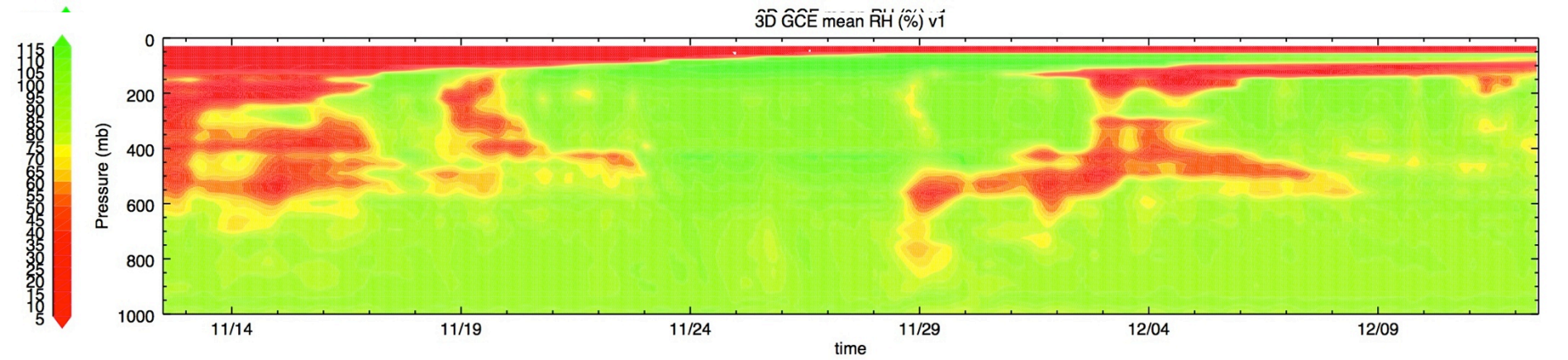


Ghan

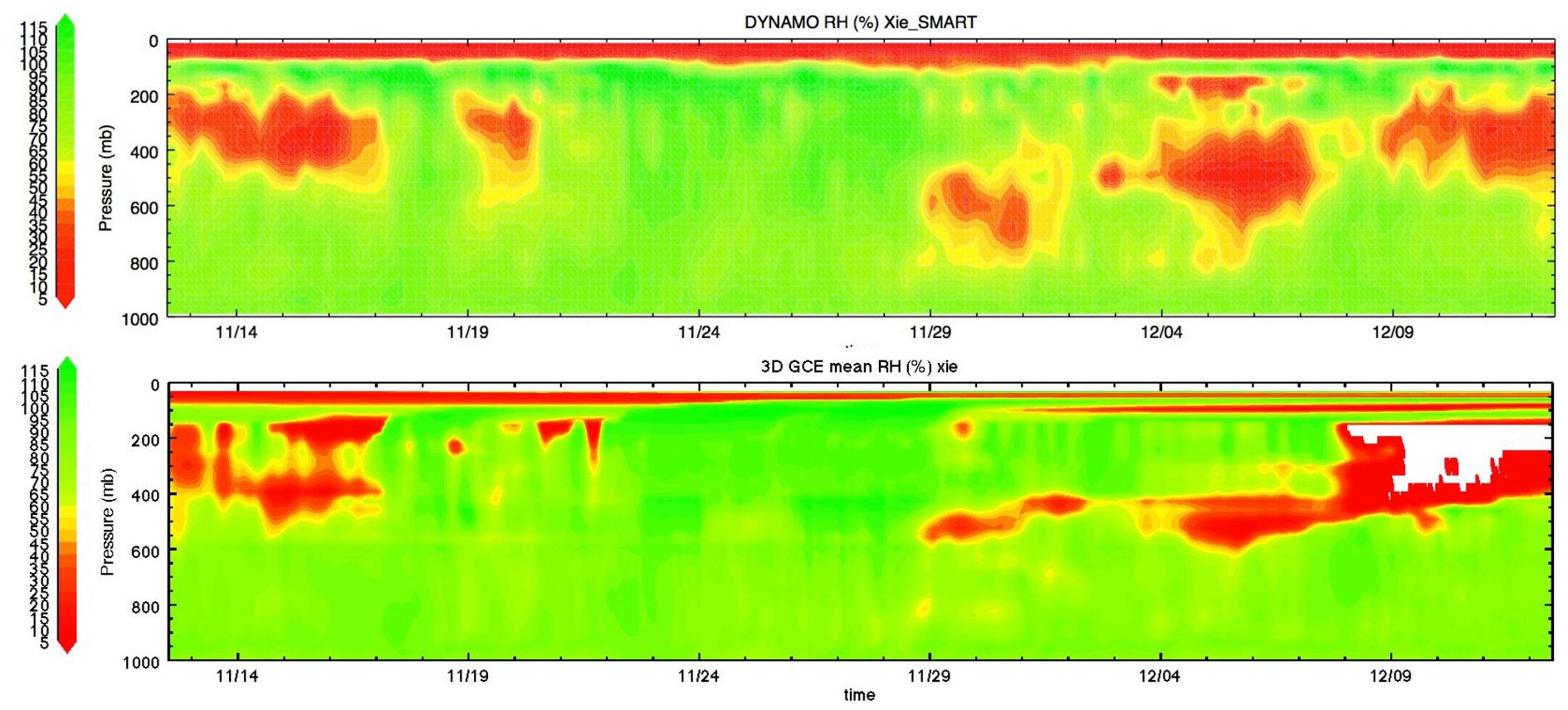


RH series in model simulations (NSA)

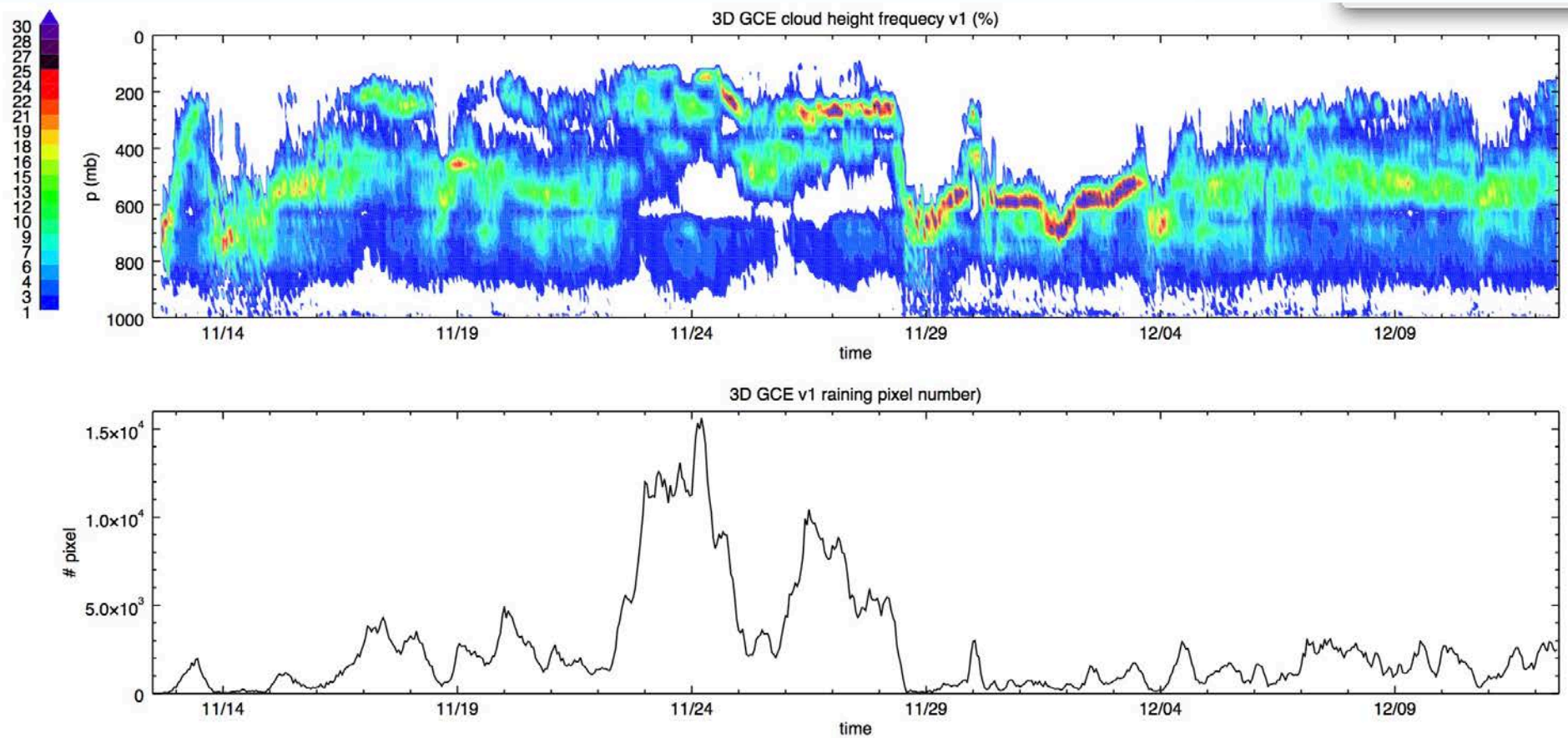




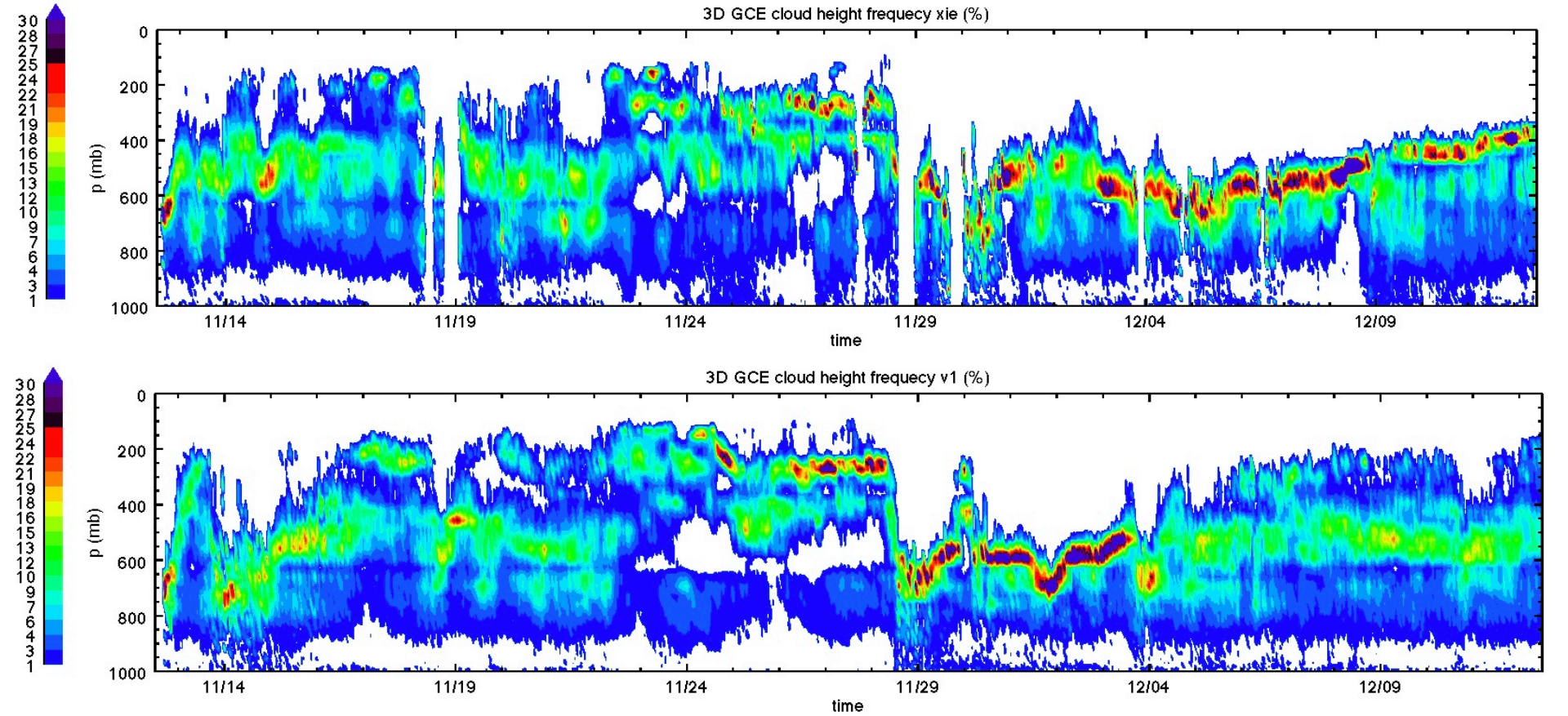
RH series in model simulation (Ghan)



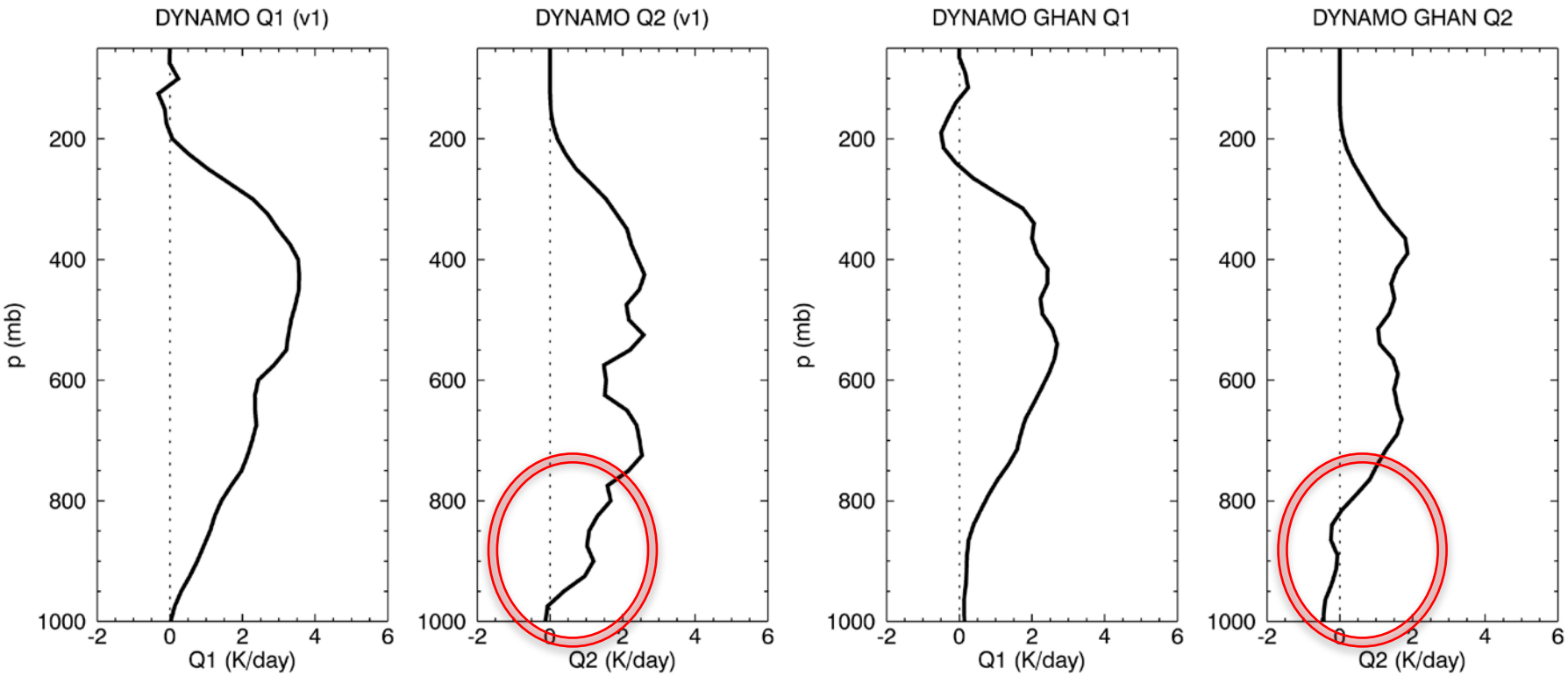
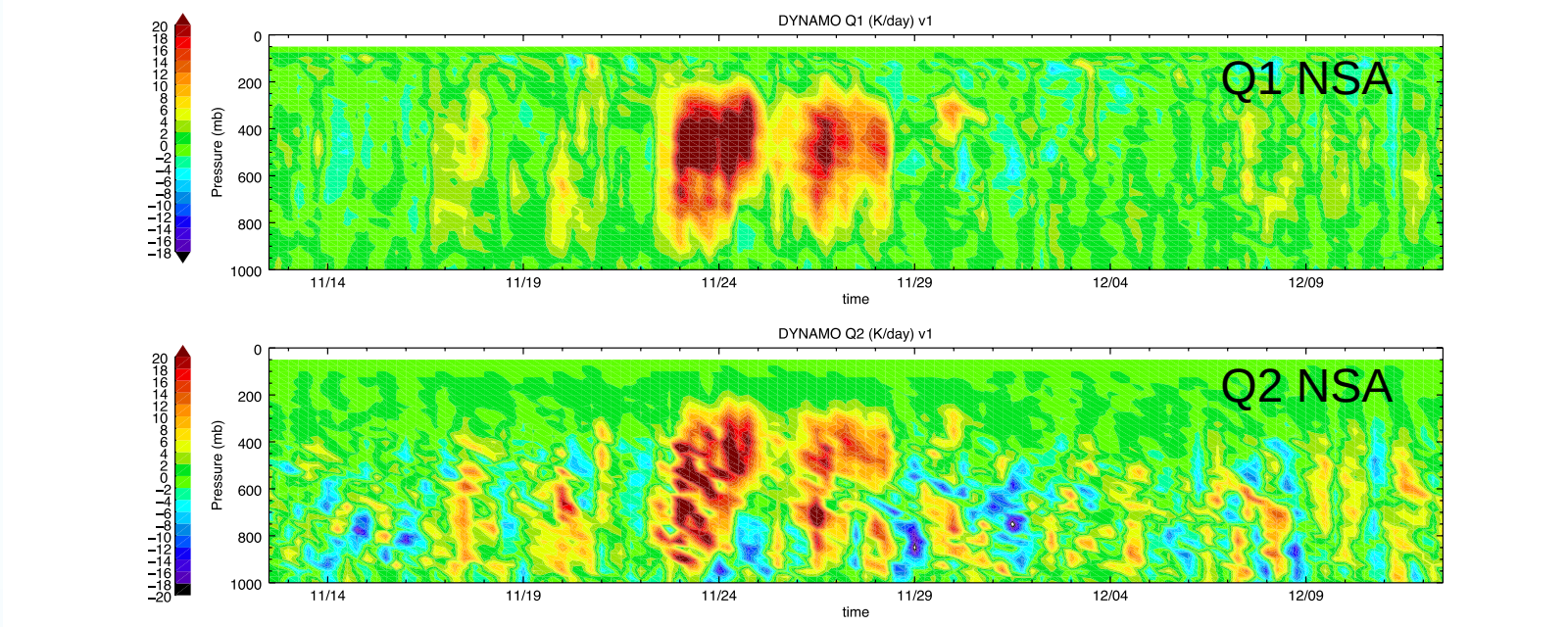
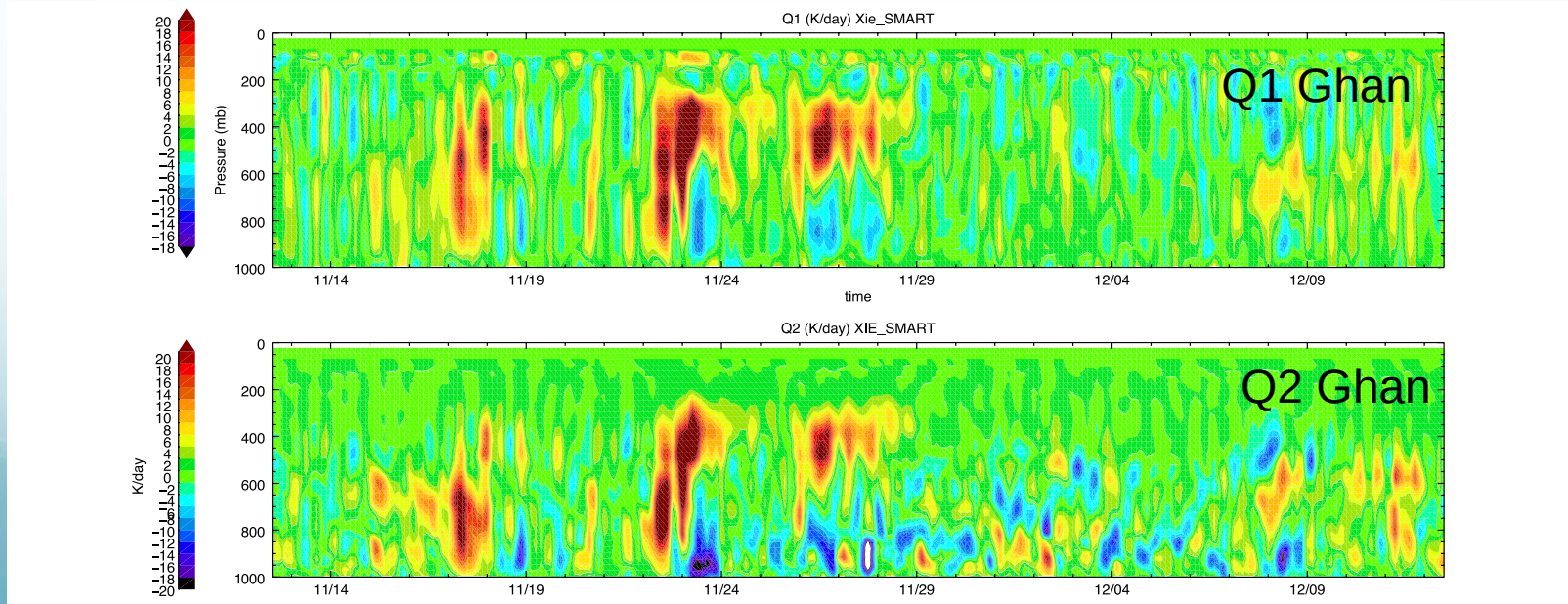
Cloud population transitions in simulations (NSA)



Cloud population transitions in simulations (Ghan)



Domain Mean Q1 and Q2 profiles



Domain Mean Time Series of Q1 and Q2