GoAmazon 2014/5 Observations of the Shallow-to-Deep Convection Transition in Amazonia

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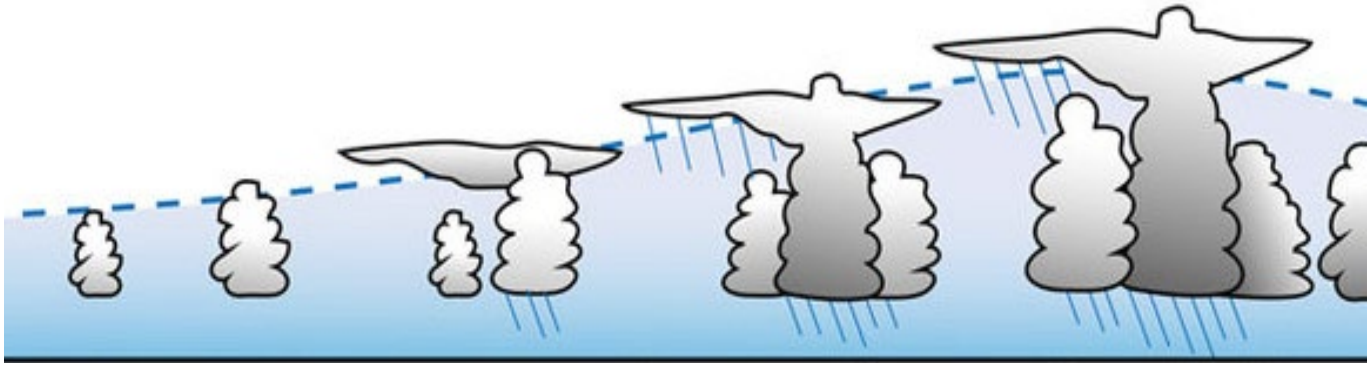
Motivation

- Atmospheric convection covers a range of spatial and temporal scale, hampering our ability to understand what triggers the STD transition, and hence making it difficult to represent it in numerical models.

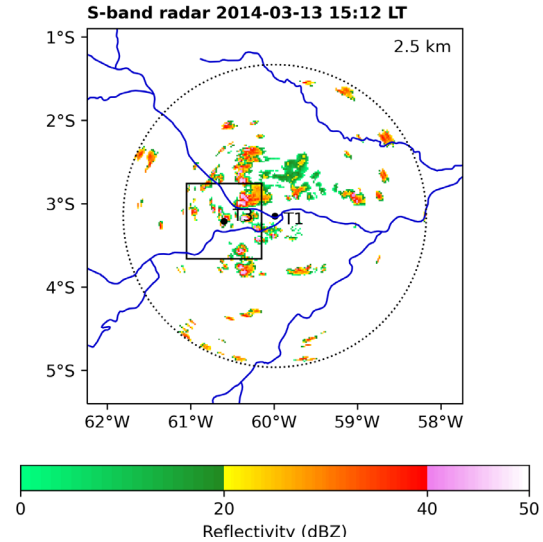


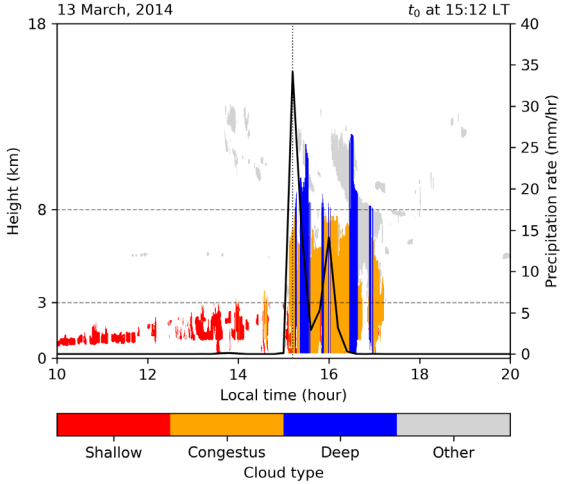
Early morning

Late afternoon

Methods

- Period: ~ 1-year of data (Sep-14 to Nov-15)
- Selection based on:
  1. Cloud mask merged product (CEIL, MPL, WCR, RWP)
  2. S-Band precipitation radar.
- STD events were identified as:
  - A progression of shallow, congestus, and deep clouds
  - At least 1 mm/hr precipitation (4 x 4 km)





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- STD events were identified as:
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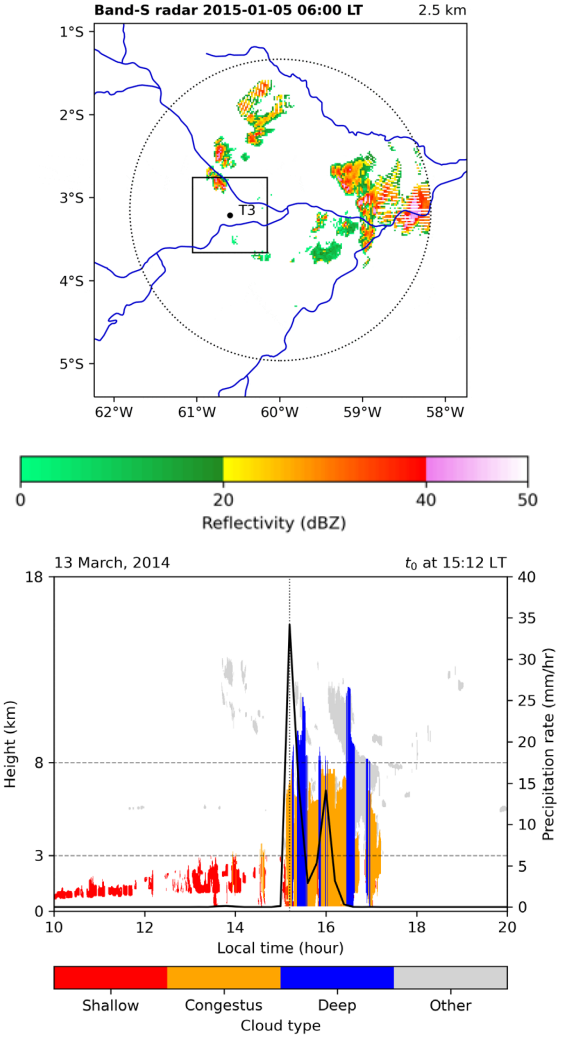
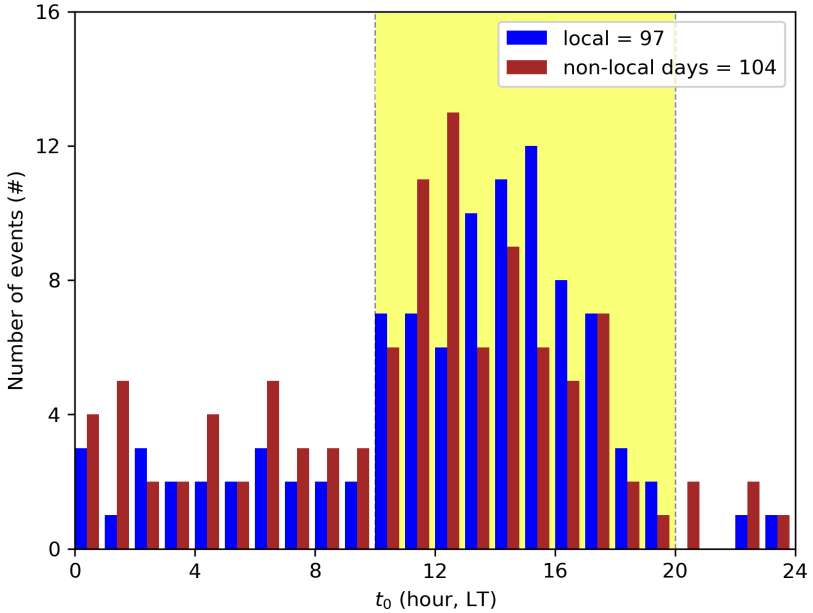
  - **Exclude** days with MCS
    - reflectivity > 20dBz over 10,000 km^2 in the S-band swath



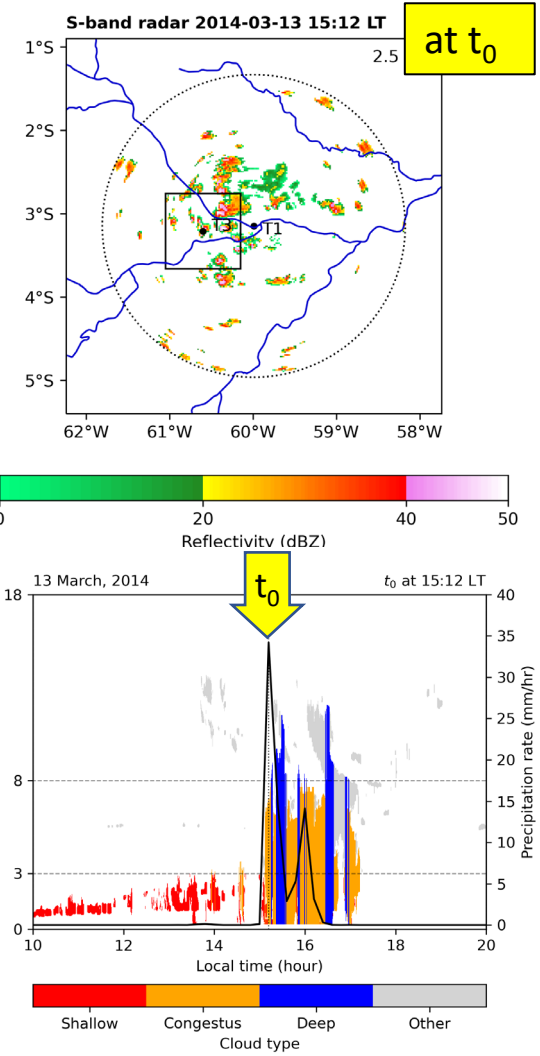
Eulerian Approach

- We built composites centered at t_0
  - **Time of maximum precipitation**



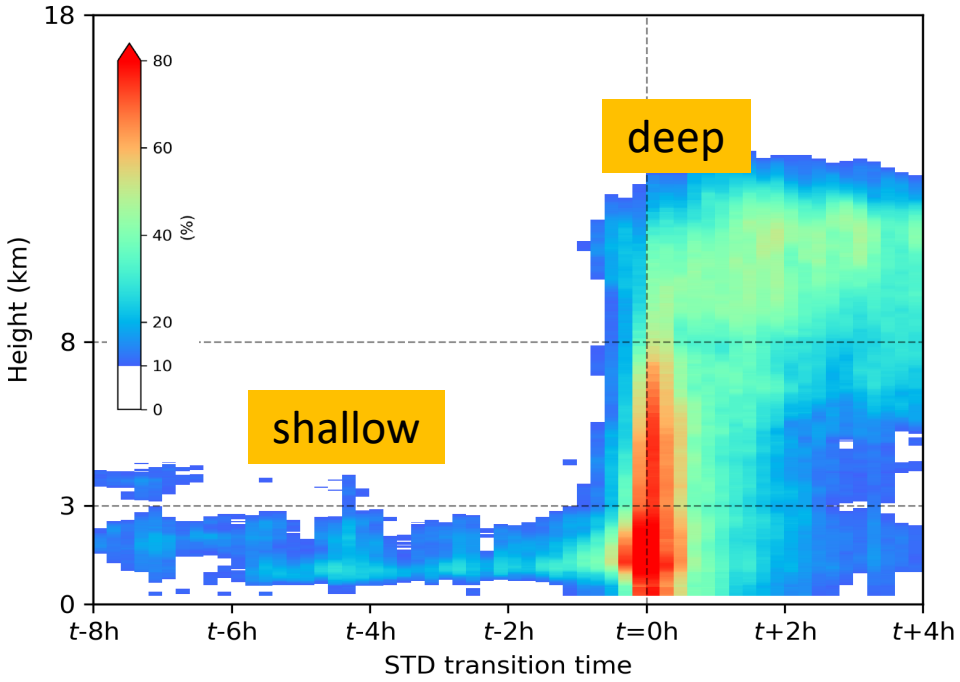
Events by hour. Composites for local afternoon Events (**N = 73).**

Local event example:

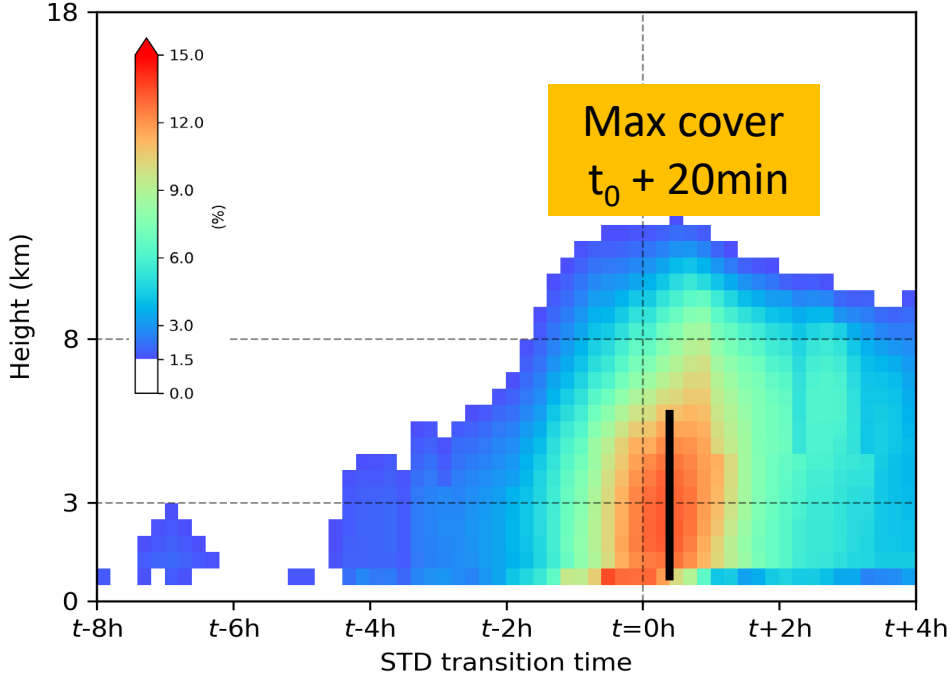


Ground view up

Cloud Frequency (%)
VAP cloud mask

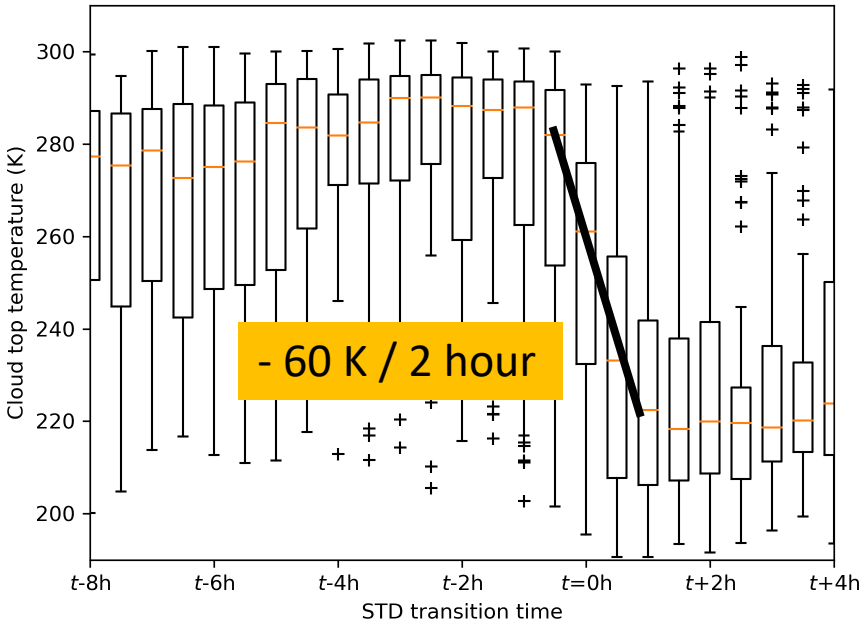


Rain Cover (%)
S-BAND radar (4x4 km)

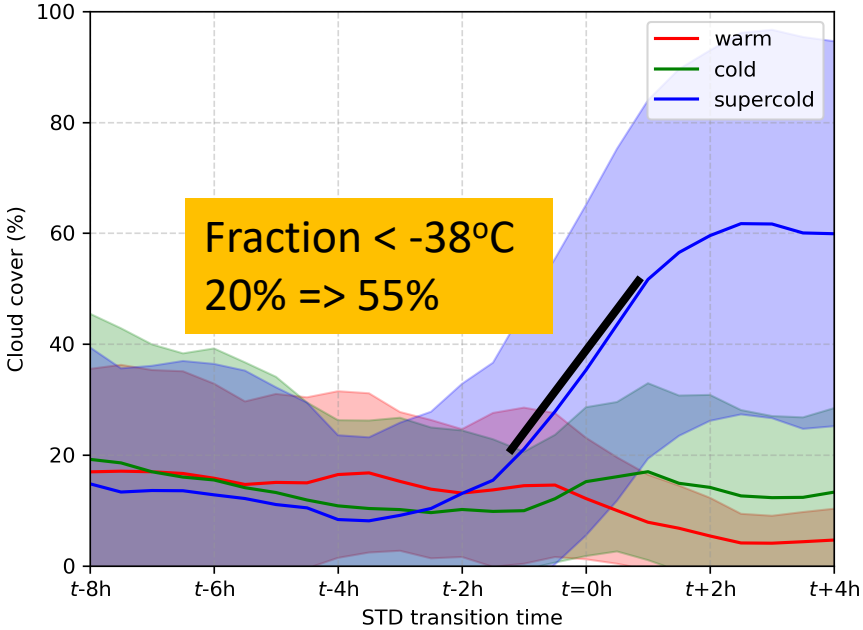


GOES view down

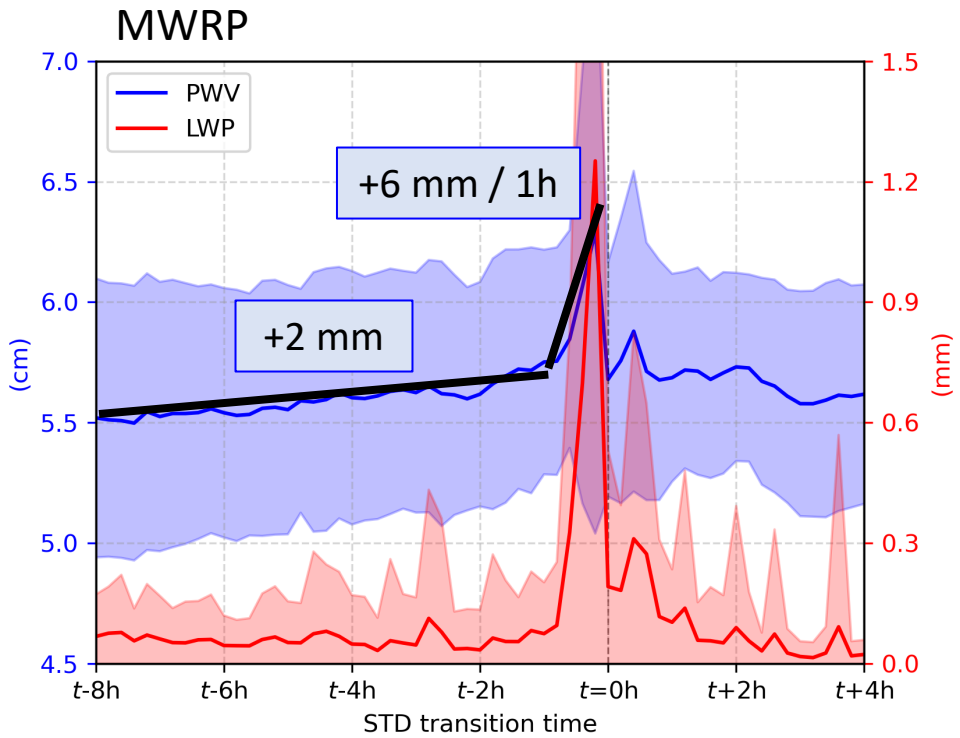
Cloud Top Temperature (K)
GOES-13, 16x16km

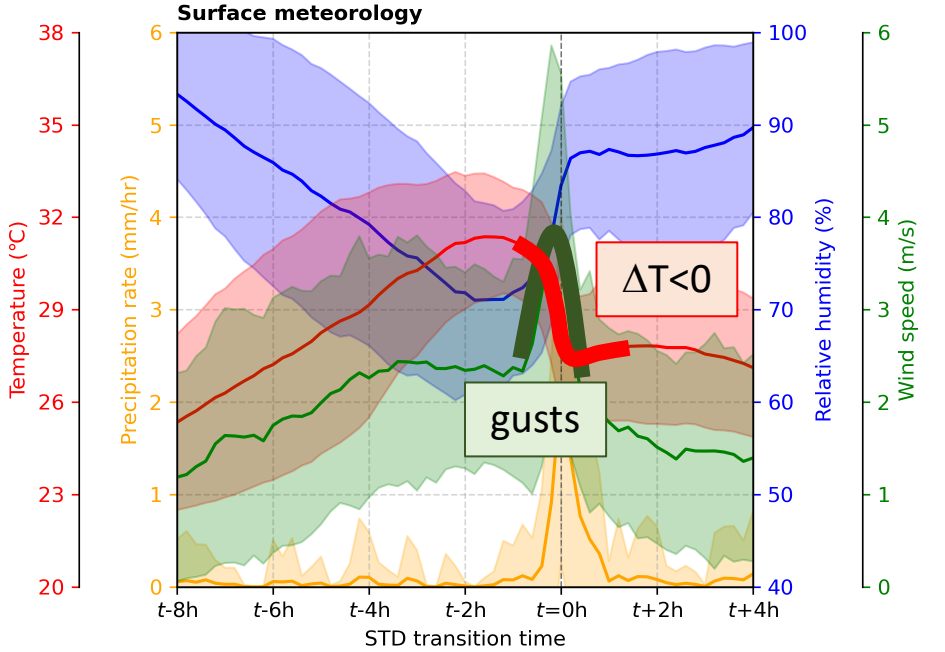


Cloud Cover (%)
GOES-13, 100x100km

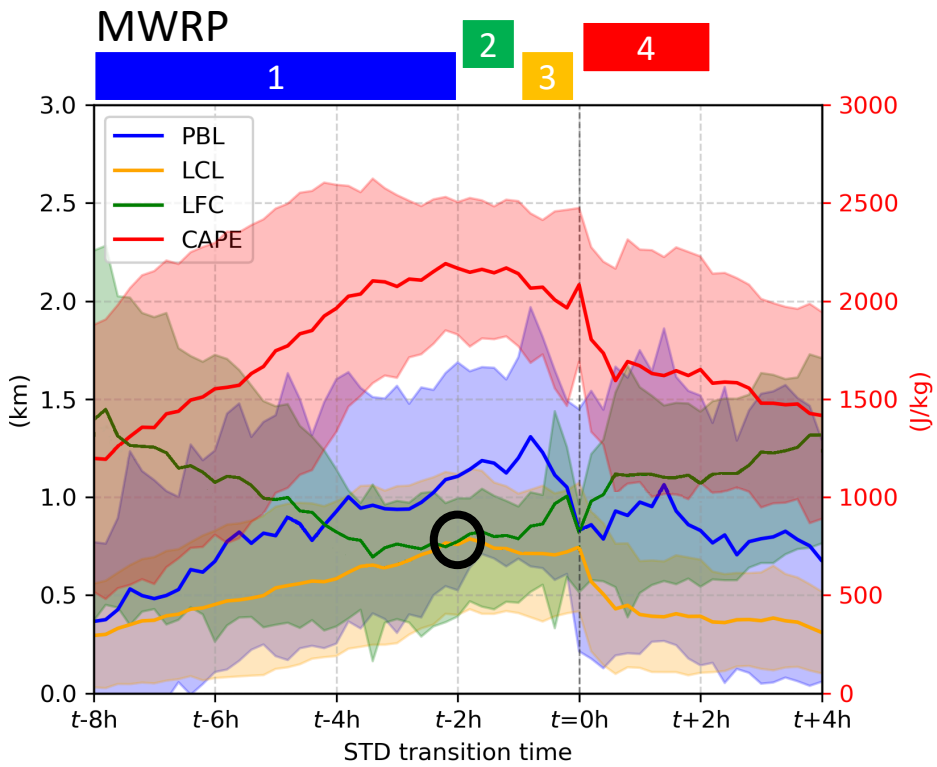


Clouds + Surface view





STD transition



~ 7am ~ 3pm

1. **After sunrise**
   PBL and LCL rise, CAPE increases, LFC drops
   Cold clouds are < 20%

2. **After the trigger** (LFC = LCL)
   Shallow clouds grow rapidly into congestus
   PWV continues to increase

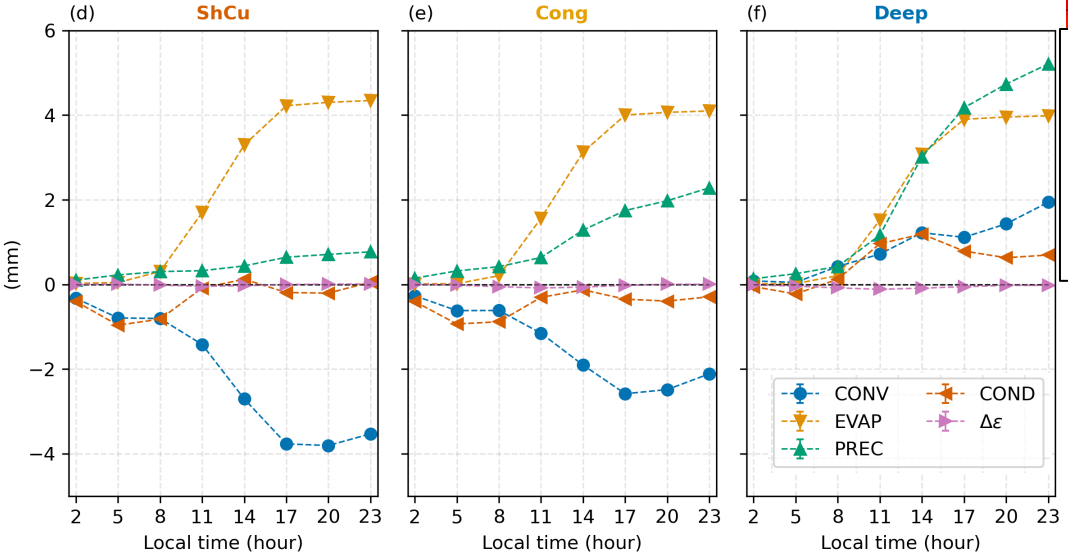
3. **Congestus => Deep**
   CAPE is consumed. Fast PWV / LWP increases.
   CTT drops 60K. T decreases lowers LCL
   LFC rises (decouples)

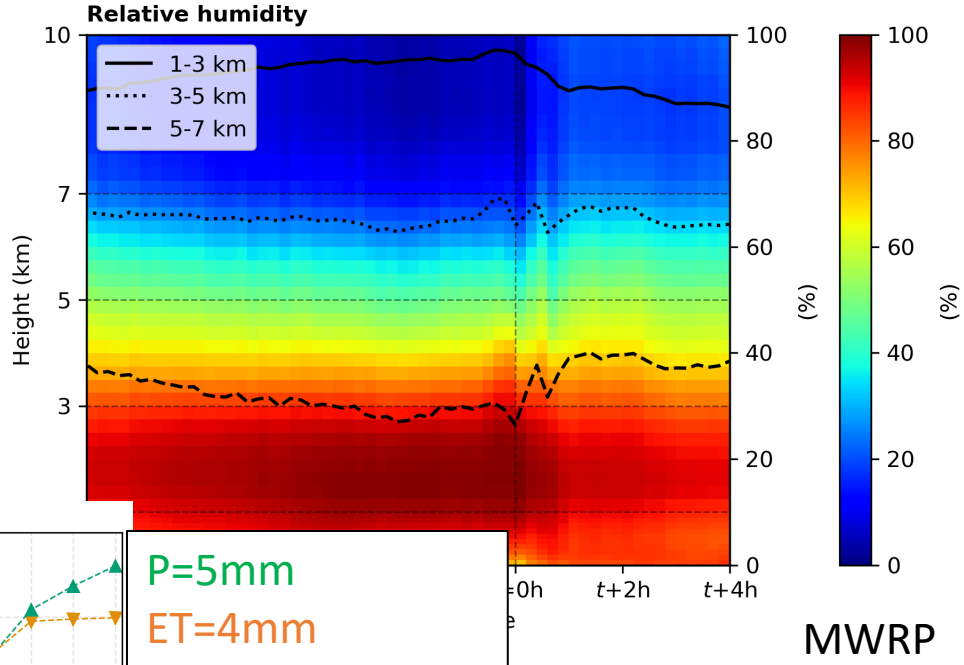
4. **Dissipation**
   Precipitation persists until t_0+1h.
   Cold-fraction is maximum (60%) around t_0+2h.

Convergence

VARANAL, Water budget

Accumulated in time





P=5mm

ET=4mm

Conv=2mm

PWV+IWP=1mm

MWRP

Conclusions

- Composites of N=73 STD events:
  - LCL = LFC triggers the STD transition (t_0-2h)
  - Strong convergence starts at t_0-1h
  - Cold pools decouples LCL / LFC

- Constrasting shallow/deep days:
  - Moisture convergence in deep days
  - Moisture divergence in shallow days

- Still have to analyse:
  - Large-scale circulation
  - LES modelling