Shallow-to-Deep Convection Transition in Amazonia from GOES and GoAmazon 2014/5 Observations

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INTRODUCTION

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.

Here we characterize the shallow-to-deep convection transition using the GoAmazon2014/5 field campaign in the Central Amazon, near Manaus-AM, Brazil (Martin et al., ACP 2016).

GoAmazon2014/5 T3 site location, (-3.2133 S,-60.5987 W).

RESULTS

I. PBL and LCL rise from 400m (t_0-8h) to 700m and 1200m (t_0-2h), at the same time as LFC drops from 1500m to 700m, and CAPE increased from 1200 J/kg to 2200 J/kg. During this period, the warm and cold clouds comprises < 20% of cloud fraction.
II. After the atmospheric trigger (LFC = LCL, t_0-2h), shallow clouds grow rapidly into congestus (t_0-1h). PWV increases linearly until (t_0-2h), from 5.5 to 5.7 cm.
III. The next phase is the congestus organizing into deep convection, which happens from t_0-1h to t_0, at the expense of CAPE consumption. PWV increase more rapidly, to 6.3cm. CTT drops from 280K to 220K. Evaporation of rain moistens the PBL, increasing RH and lowering the LCL, which decouples from the LFC that begins to rise.
IV. Precipitation persists until t_0+1h. Cold-fraction is maximum (60%) around t_0+2h.

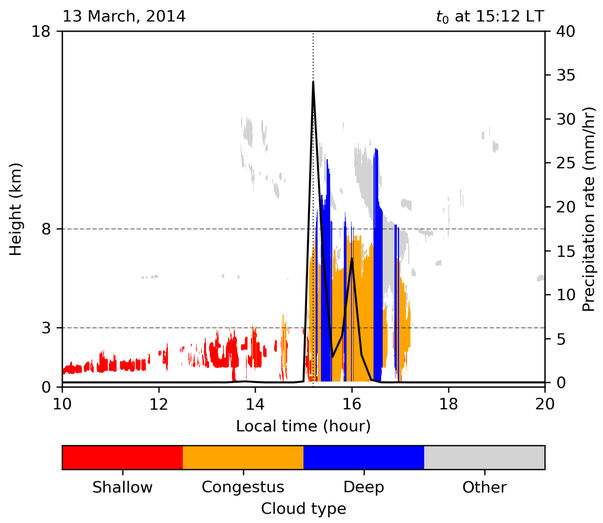
DATASETS & METHODS

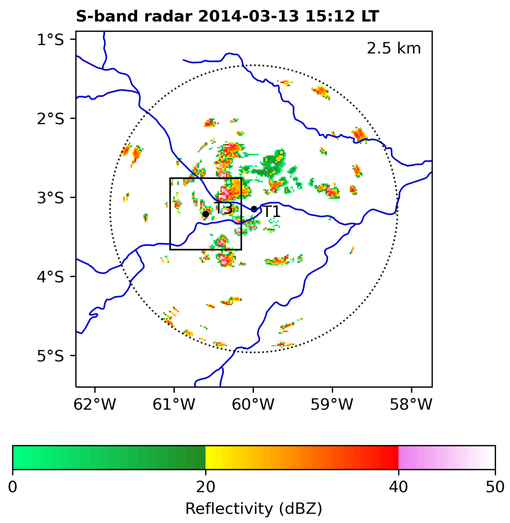
Period: 1-years of data (Sep-14 to Nov-15)

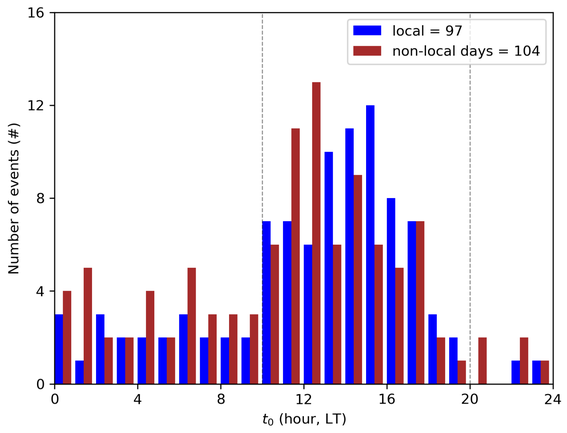
The selection of events is based:
(1) cloud mask merged product (CEIL, MPL, WCR, RWP)
(2) S-Band precipitation radar.

STD events were identified as:
- A progression of shallow, congestus, and deep clouds (vertical, cloud mask)
- At least 1 mm/hr of convective precipitation (4 x 4km, s-band radar)
- Not an MCS day (reflectivity > 20dBz over 10000 km^2 in the S-band swath)

In an Eulerian approach, we built composites centered at t0, the time of maximum precipitation to investigate the STD timescale and evaluate thermodynamic and environmental conditions.







Identification of an STD event based on the cloud mask VAP product and surface precipitation from the S-BAND radar (left).

The 2.5 km radar reflectivity at the time of maximum precipitation rate (instant t0) highlights the local character of the event (right).

Distribution of events by hour. We built composites for the local afternoon events.