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Tropical continental downdraft characteristics: mesoscale systems versus unorganized convection

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Supplemental Material

In Fig. 2 of the main text, the 5-min average composites of surface meteorological variables surrounding deep convective events (+/- 3 h) met stringent criteria: minimum precipitation rates of 10 mm h^{-1}, coincident $\Delta\theta_e$ of -5 K or less, and complete data coverage from the radar wind profiler in the hour surrounding the precipitation maximum. Additionally, the data were averaged by convection type (isolated cell or MCS). Here, we composite without requiring both criteria or complete data coverage from the radar wind profiler. We also test the robustness to averaging more coarsely at 30-min intervals.

All events with a minimum $\Delta\theta_e$ less than or equal to -5 K within a 12 h window are averaged and shown in Fig. S1 (183 events), and events with precipitation rates greater than or equal to 10 mm h^{-1} within a 12-h window are averaged and shown in Fig. S2 (166 events). Error bars are +/- 1 standard deviation with respect to time 0. A total of 65 events meet both criteria coincidentally, and from this sample of 65, 29 are sampled in the main body of the text (11 isolated cases, 18 MCSs). The cases composited in Figs. 2 and 3 are listed in Table I.

Sensible and latent heat fluxes are unavailable at 5-min resolution for use in the main text; they are, however, available at 30-min resolution and are included in the composites presented here. Fluxes are derived from the eddy covariance technique, which involving correlation of the vertical wind component with the horizontal winds, temperature, water vapor density, and carbon dioxide concentration (ARM Climate Research Facility 2014). A fast-response, three-dimensional sonic anemometer provides the wind components and speed of sound, while water vapor density is from an open-path infrared gas analyzer. Surface flux data from 03 Apr 2014–20 Oct 2015 are used here, with periods of missing and unreliable data excluded, as flagged by ARM.

The composites based on $\Delta\theta_e$ (Fig. S1) show marginal differences in the thermodynamic variables compared to the composite based on precipitation (Fig. S2): lower relative humidity, higher temperature, and higher CWV. It is likely that this results from a daytime bias for the composites in Fig. S1. They do, however, differ in their respective mean rain rates and $\Delta\theta_e$ at time 0, confirming that not all precipitation produces $\Delta\theta_e$ of -5 K or less and vice versa. Although we are limited in our ability to draw conclusions from the flux data, as eddy covariance is unreliable during rainy periods, the sensible and latent heat fluxes are generally larger before the event and lower afterwards.

Date	Time (UTC)	Date	Time (UTC)
03/27/14	13:30	03/11/14	15:30
03/31/14	07:00	05/20/14	17:00
04/01/14	16:00	07/17/14	21:30
05/16/14	18:00	08/15/14	19:30
06/19/14	16:00	09/09/14	19:30
06/21/14	02:30	09/13/14	17:30
07/03/14	10:30	09/22/14	15:30
07/22/14	20:00	10/06/14	16:30
08/16/14	15:00	01/04/15	16:30
10/04/14	15:00	02/03/15	21:30
10/12/14	05:00	03/02/15	21:00
10/18/14	15:00		
01/10/15	14:00		
01/14/15	18:00		
01/19/15	20:00		
03/29/15	16:30		
04/25/15	16:00		
07/22/15	14:00		

Table SI: Dates and times (UTC) of MCS (left column) and isolated cell (right column) passage. Data is obtained from the timeseries of $\Delta\theta_e$ (30-min averages) and signifies the timestep before the drop in equivalent potential temperature observed at the surface.

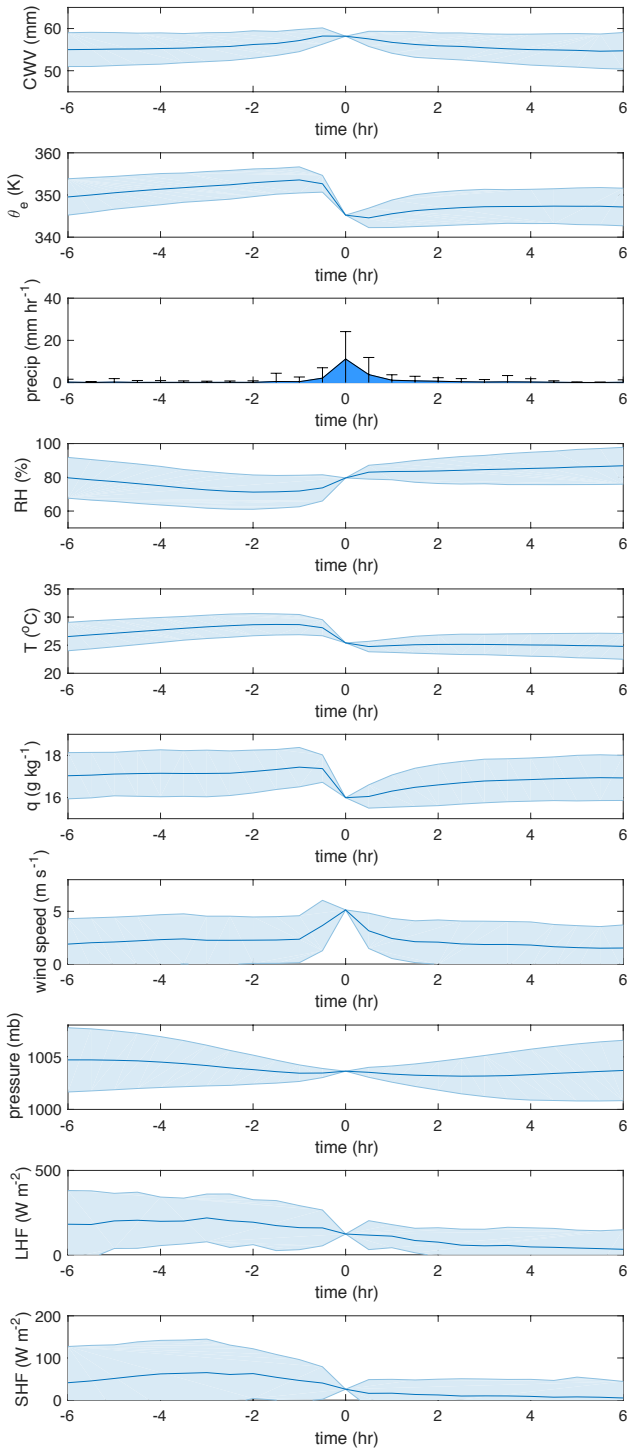

Figure S1: Composites of meteorological variables from the AOSMET station at site T3 (GOAmazon) 6 h leading and 6 h lagging drops in equivalent potential temperature less than or equal to -5^{o} K. 183 events total, sampled from 10 Jan 2014–20 Oct 2015, contribute to the composite. Error bars are +/- 1 standard deviation.

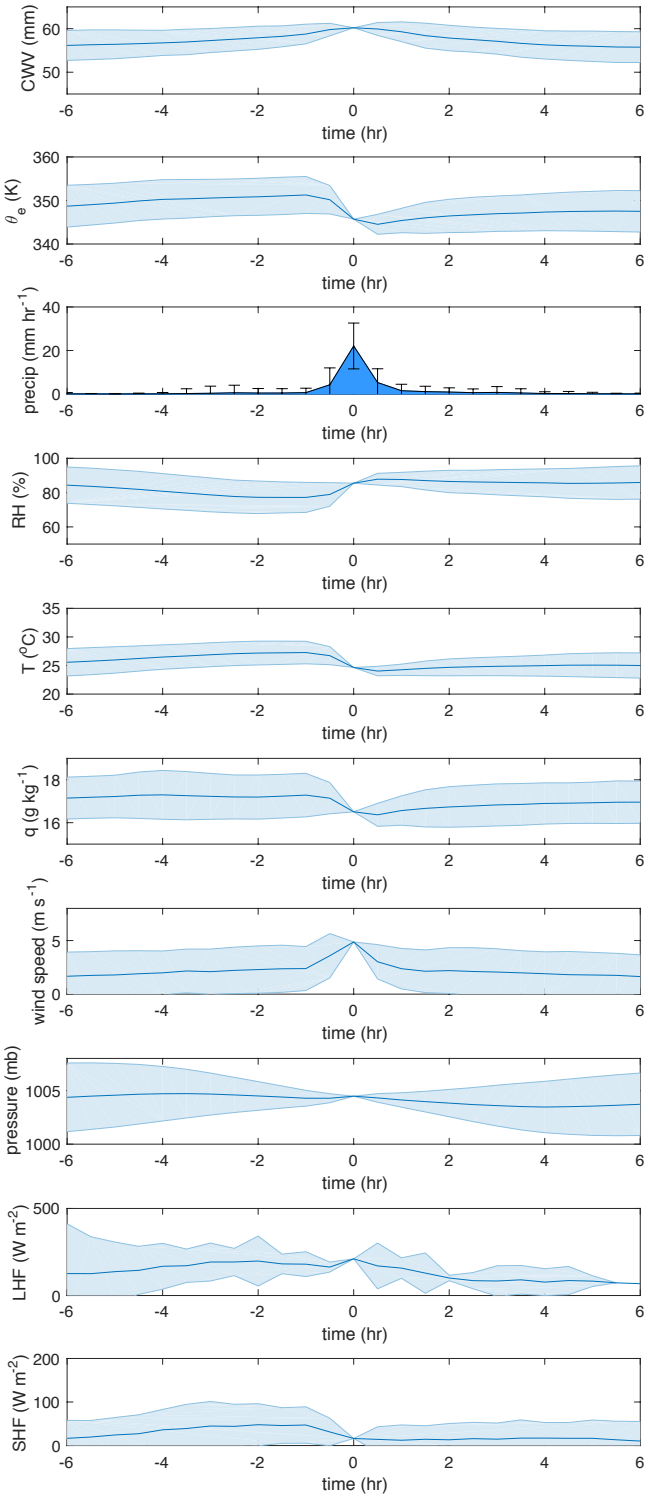

Figure S2: Same as Fig. S1, except composites are based on precipitation rates greater than 10 mm h^{-1} instead of a $\Delta\theta_e$ criterion.