Convective Cell Evolution Analysis Using High-Spatiotemporal Cell Tracking Observations

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Objectives

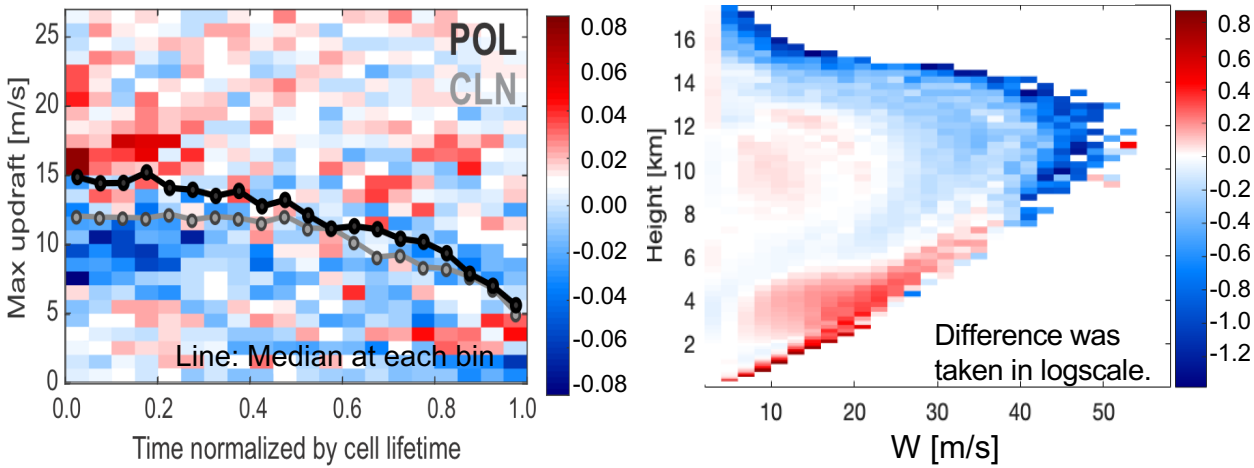
Investigate convective cell evolution using cloud model simulations in the Houston area and cell tracking observations.

Method

- Use of high-spatiotemporal cloud resolving model simulations with different aerosol (CLN and POL) environments (RAMS, Saleeby and van den Heever, 2013) coupled with a radar simulator (CRSIM, Oue et al. 2020) and a cell-tracking algorithm (tobac, Heikenfeld et al., 2019).
- Multi-Doppler radar wind retrieval is applied to the TRACER cell-tracking data at 100-m horizontal and vertical resolutions every ~30-40 sec.

RAMS simulations for Houston with CRSIM and tobac

POL-CLN normalized frequency (Deep cells are presented)



- CLN&POL: Stronger updrafts are generated in the early stage.
- POL: Slightly (~5 m/s) stronger updraft in the early stage. Fewer cells detected (~15% fewer). More frequent short-lived cells (lifetimes < 20 mins)
- CLN: Stronger updraft found at higher altitude.

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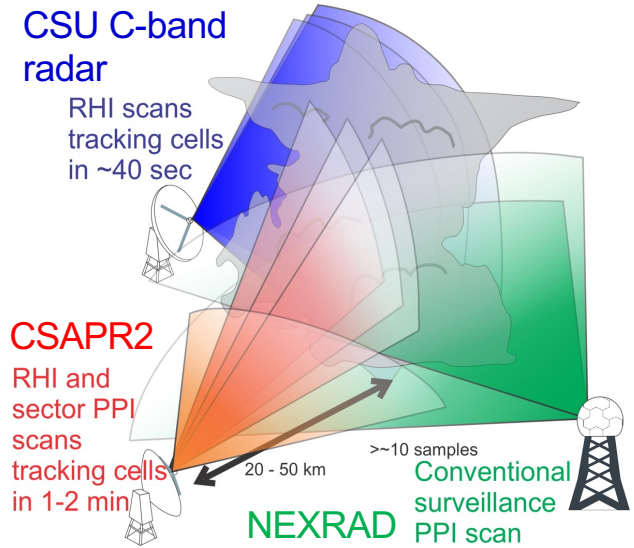
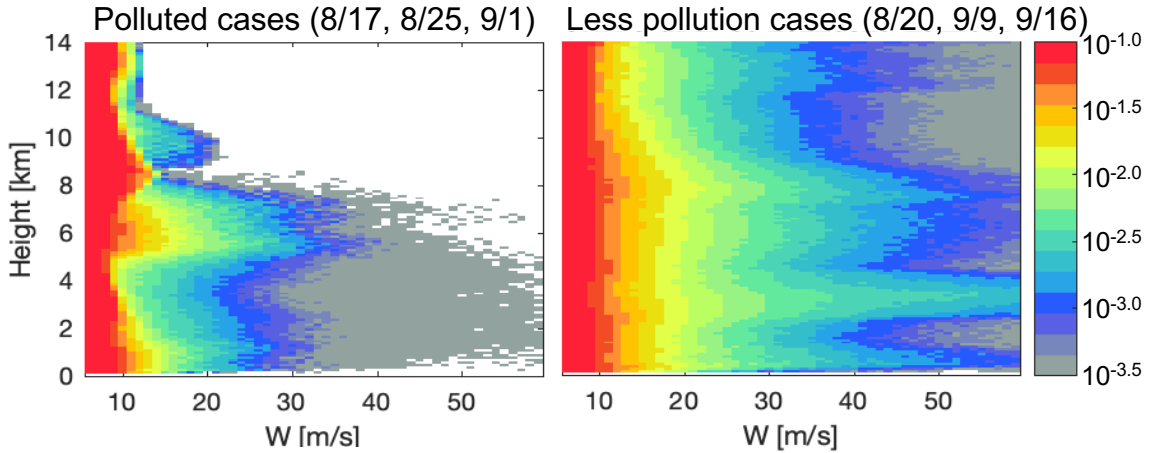
Optimized Scan Strategy Based on OSSEs using the simulations



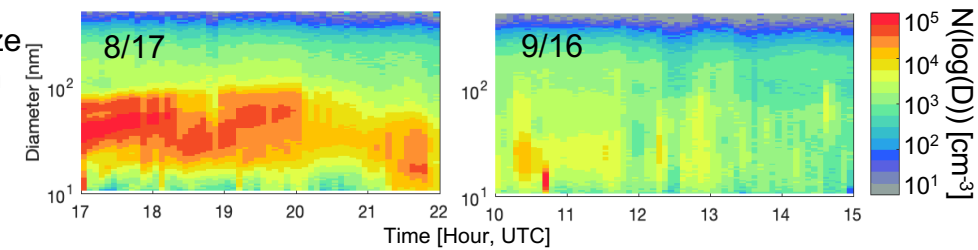
(Oue et al. 2022, adapted)

Multi-Doppler wind retrieval at 100-m horizontal and vertical resolutions every ~30-40 sec.

Preliminary Analysis
CFAD of Updraft from Multi Doppler Analysis



Aerosol size distribution (example cases)



- Multi-Doppler analysis with different aerosol environments were collected.
- We need to analyze updraft lifecycle and the other environmental factors for each case (e.g., moisture profile, wind shear, BL temperature) using more samples (>10 each).

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