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WRF Simulated cold pool properties during AMIE/DYNAMO

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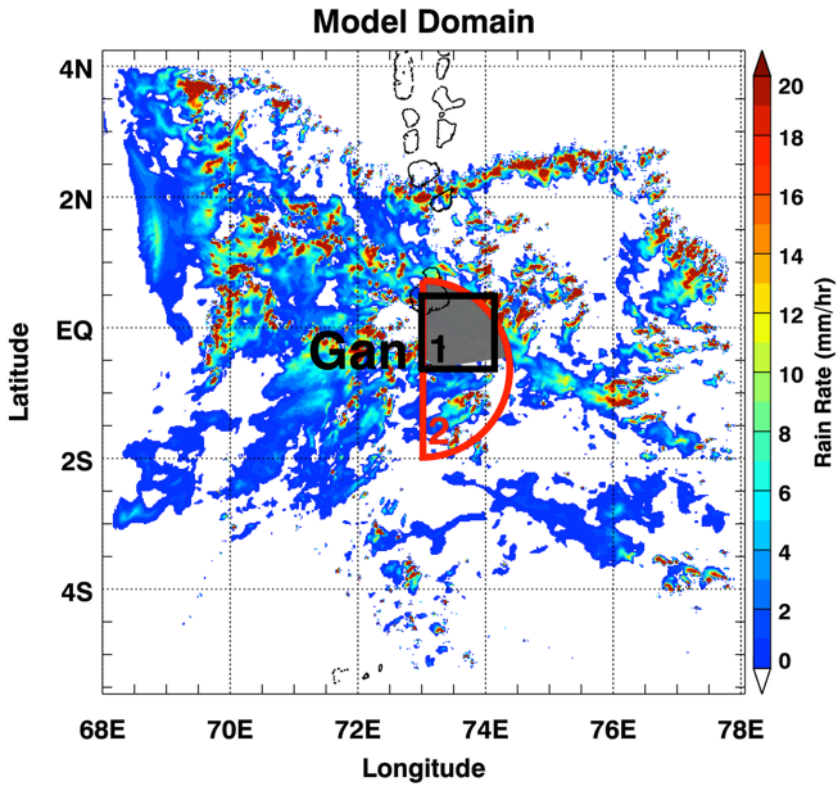
PNNL

2013 ASR Fall Working Group Meeting – Mesoscale Convective Organization Breakout

WRF Simulation Setup

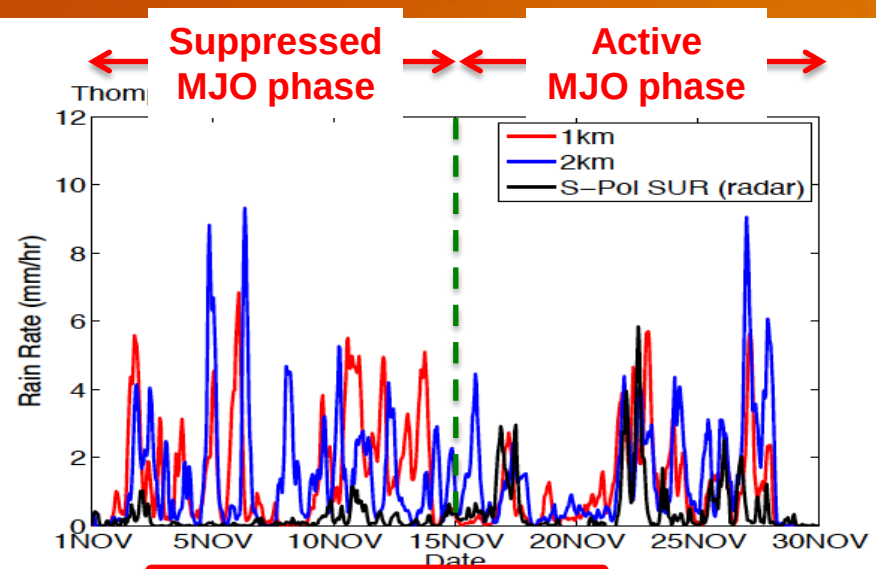
- **WRF at 1-km resolution, no cumulus parameterization**
- **Validate cloud statistics with S-Pol at Gan**

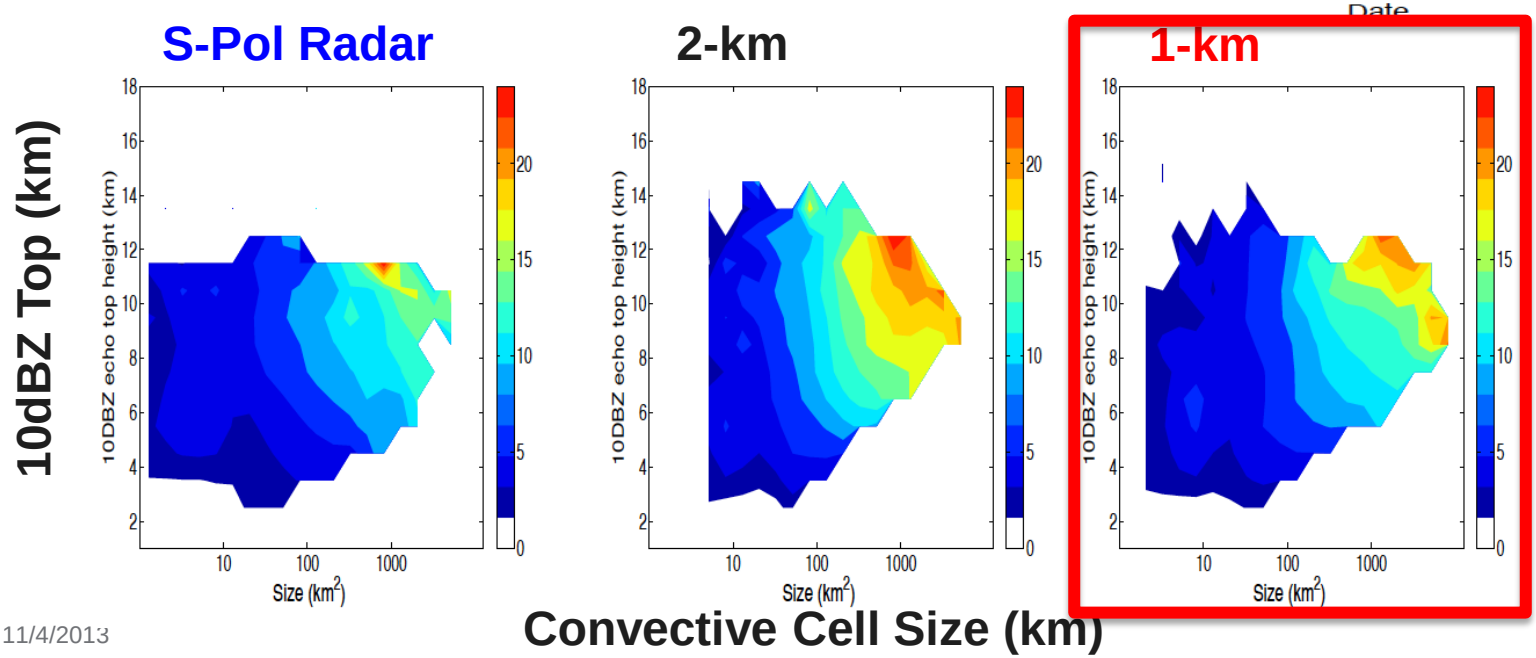


	Model Setup
Period	**Nov 1 – 30, 2011**
Vertical level	27
Lateral/surface forcing	ERA-I 6-hourly analysis
LW Radiation	RRTM
SW Radiation	Dudhia (1989)
PBL	UW scheme
Microphysics	**Modified Thompson (reduces mean rain drop size)**

Evaluation of Cloud Statistics

- Simulated rainfall is overestimated during suppressed MJO phase, slightly better during active phase
- Reasonably reproduced statistics of precipitating convective cells

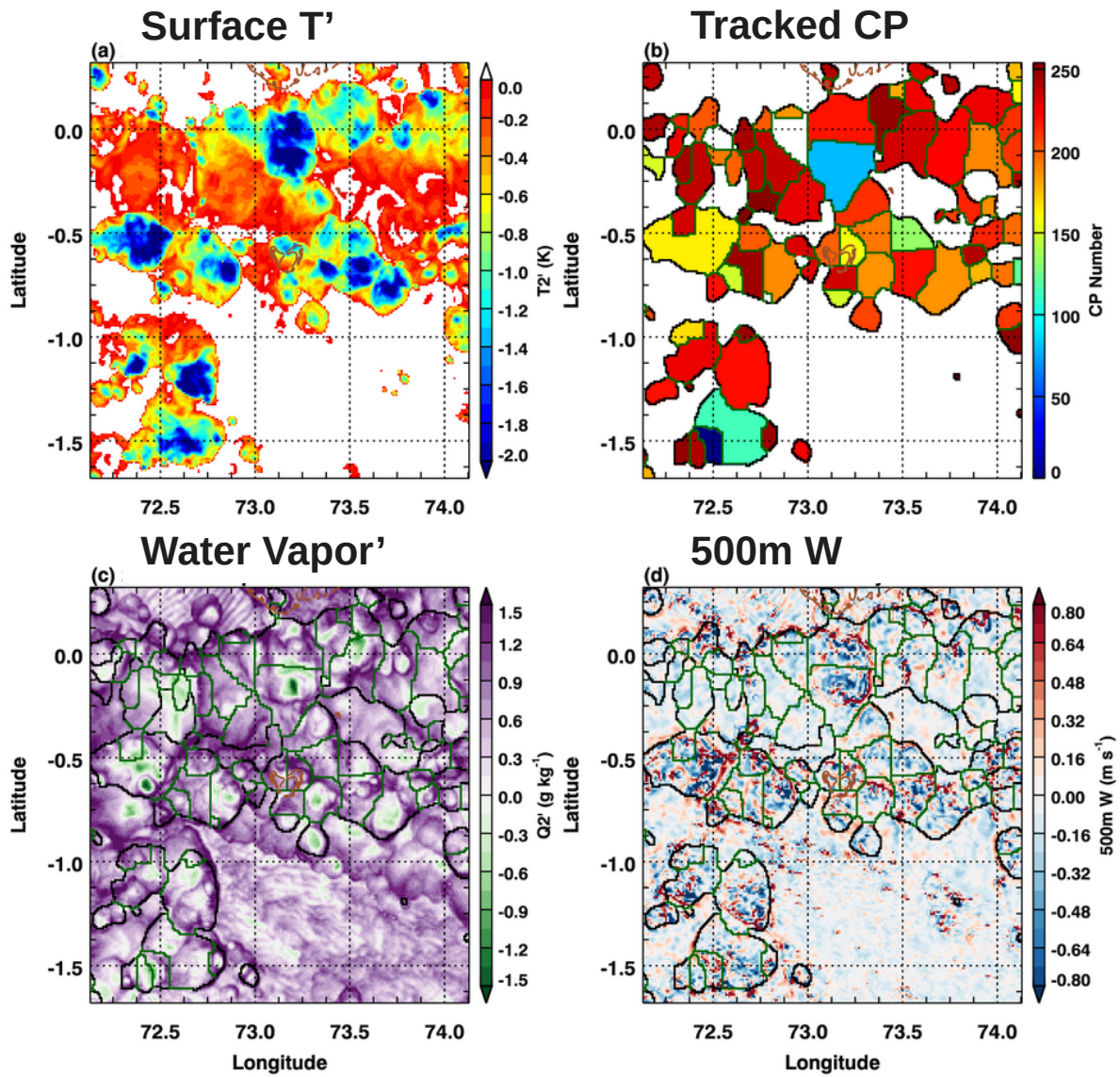




Better resolves coldpool

Coldpool Identification

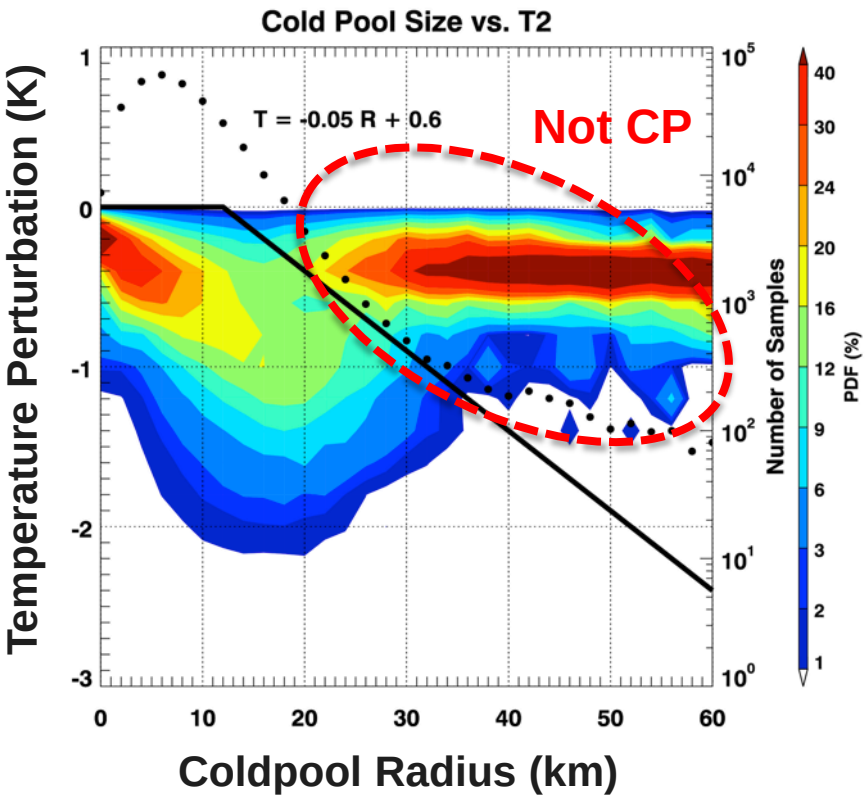
- Use surface T' (domain mean) to define individual coldpool
- Define 2 edge types:
  - Gust front (contact with moist environment)
  - Colliding edge (contact between cold pools)



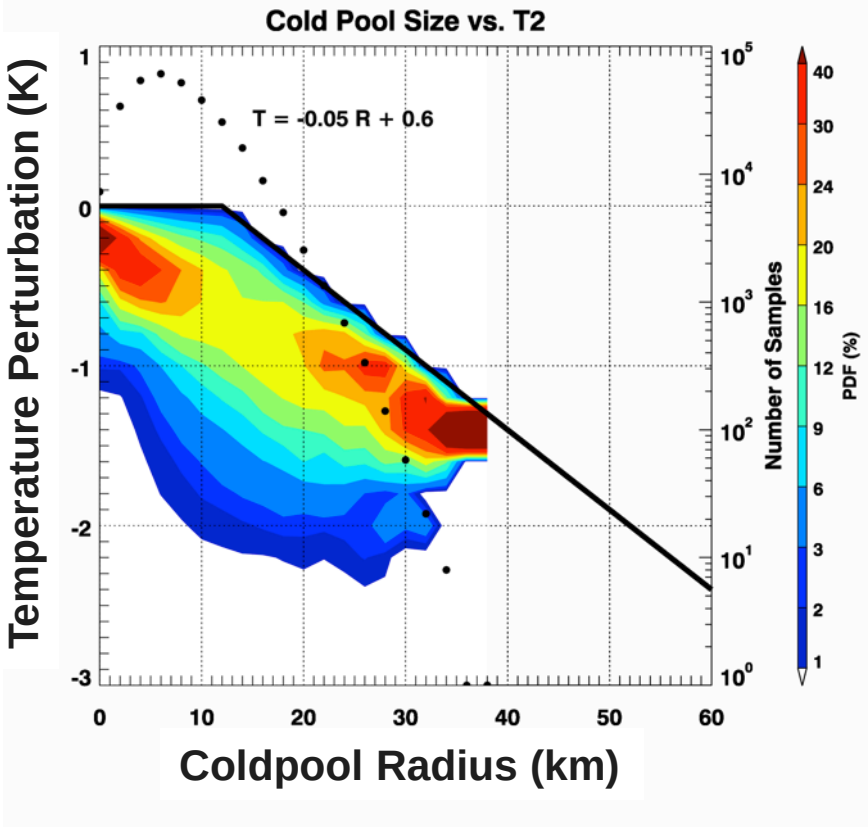
Further Defining Coldpool

- Size vs. average T' shows two modes
- Fit a function to further define "true" coldpool

Before

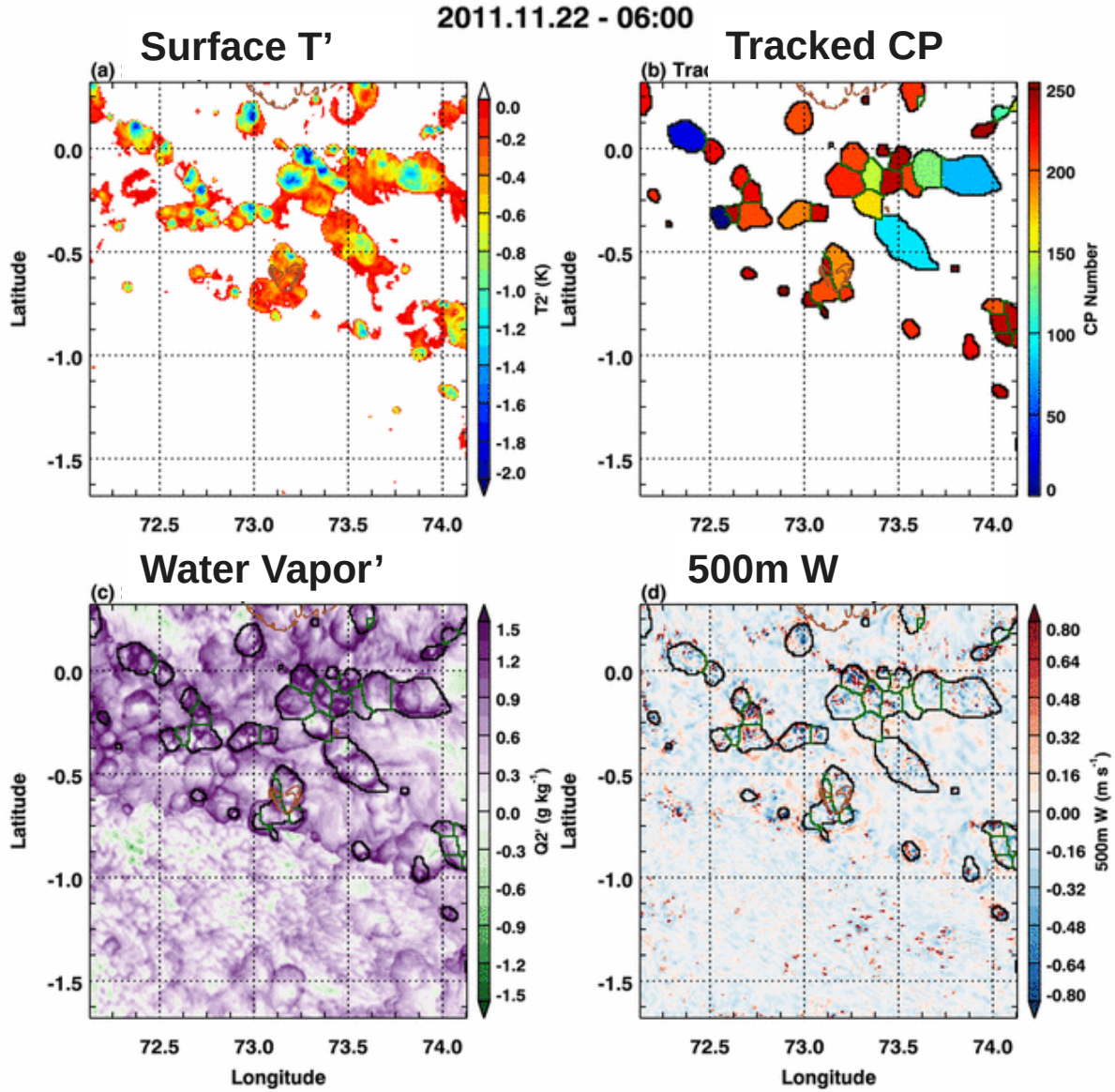


After

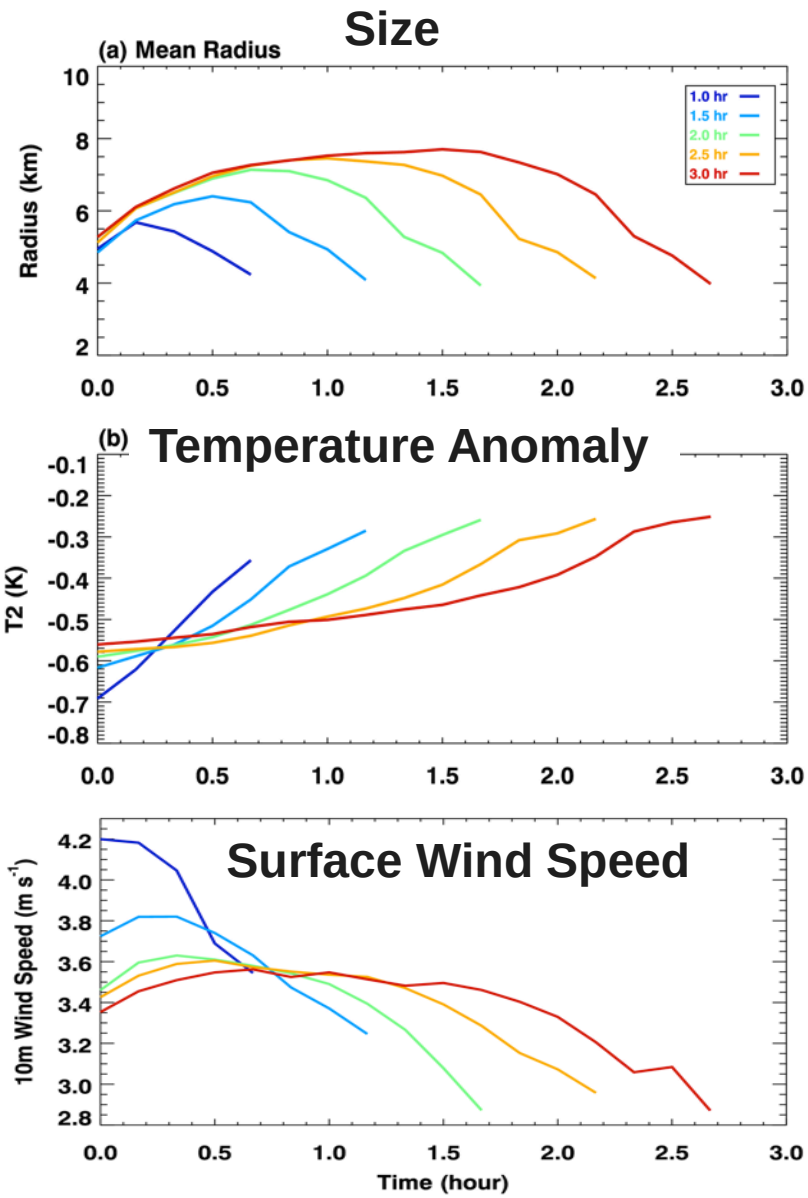


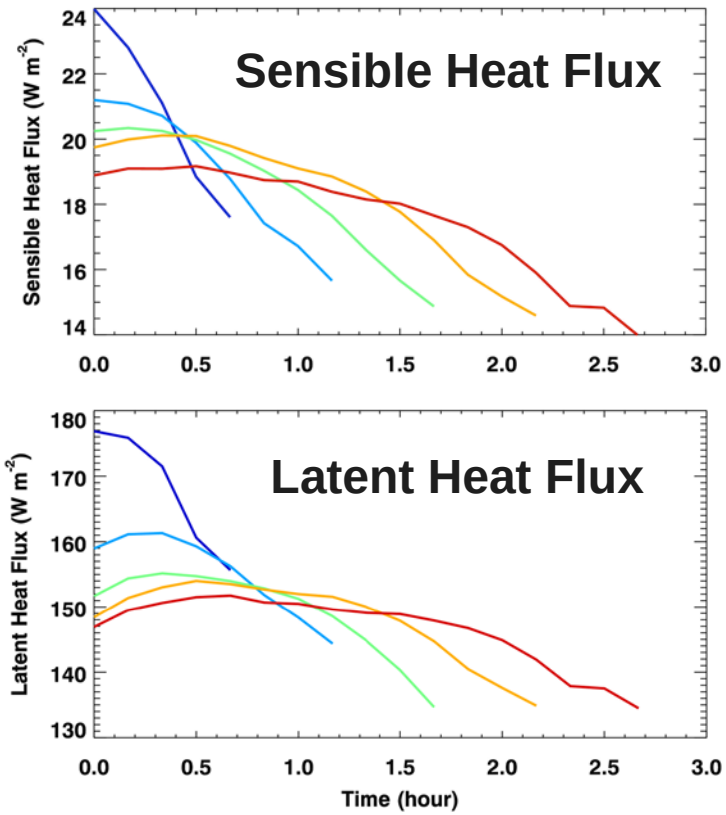
Tracking Coldpools

- Use simple overlapping method to track coldpools (similar to cloud tracking)
- Current segmentation of coldpool maybe too small, need further refinement
- Statistics of cp evolution



Basic Coldpool Properties

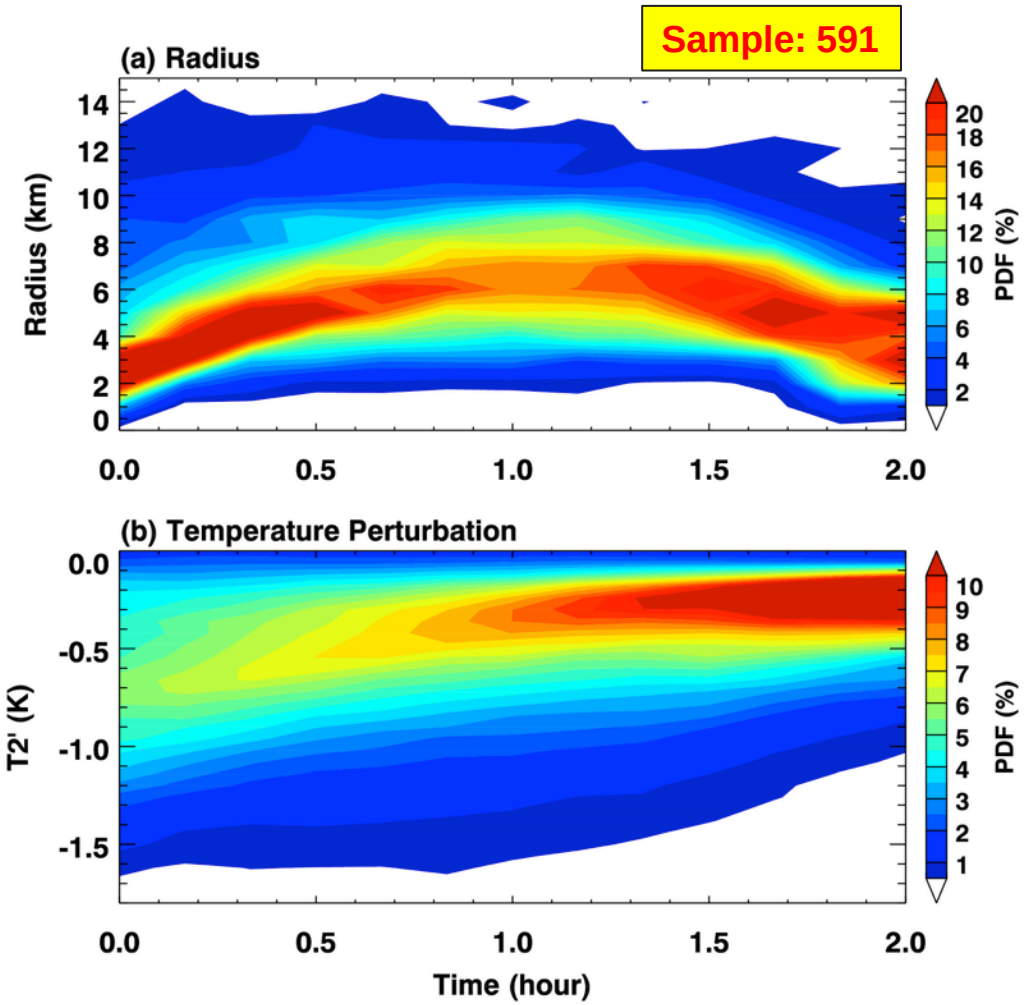




- Non-colliding cp (R_{max}>3km, T_{min}<-0.5K)
- Faster recovery of T for shorter cps
- Weaker surface wind speed and heat flux for longer lasting cp

Evolution of Size/Temperature

- For non-colliding coldpools lasting **2 hours long**
- A wide range of sizes and strength (T')
- Most coldpool max radius 4-10km, T' < 1K



Evolution of Vertical Velocity

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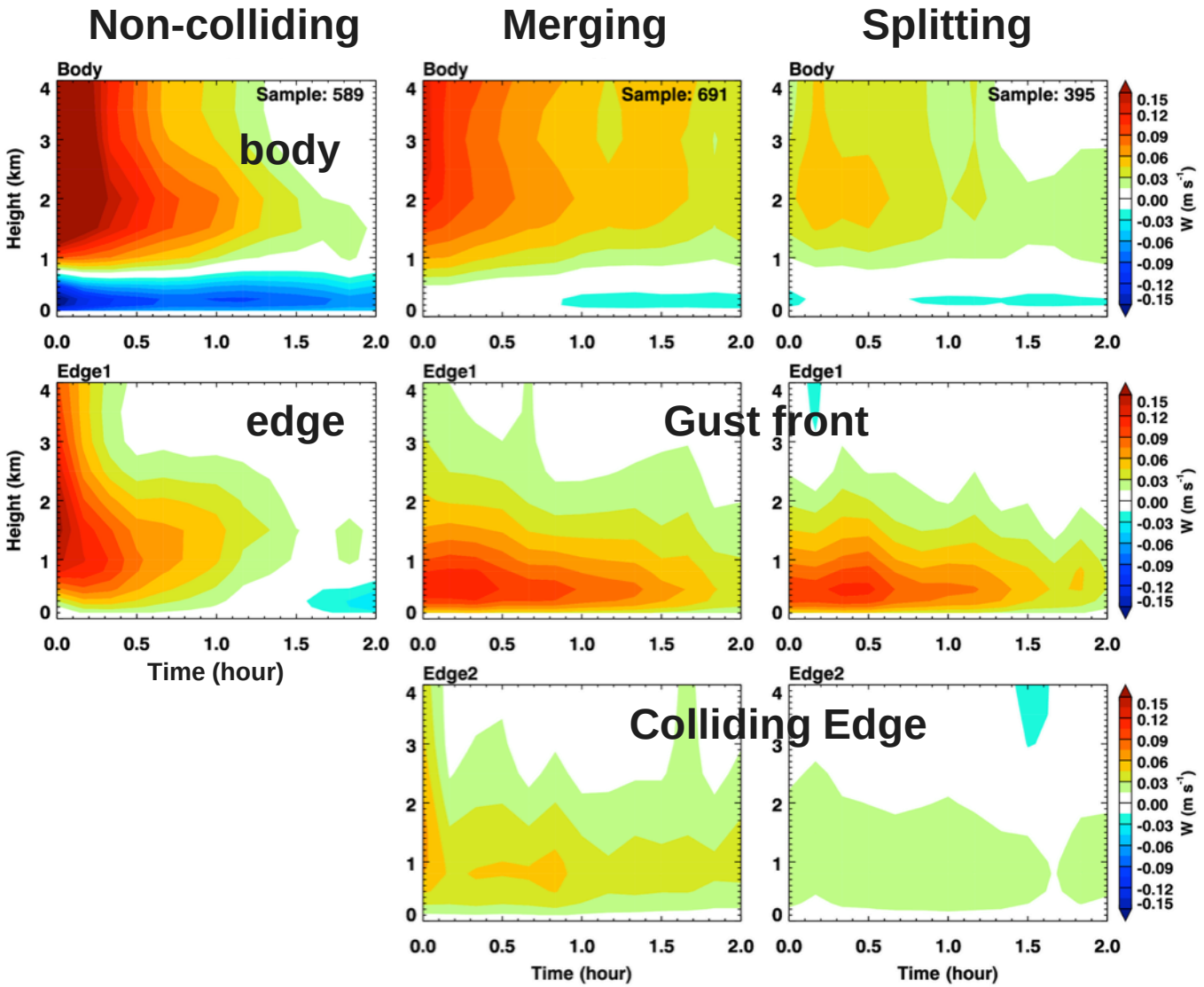
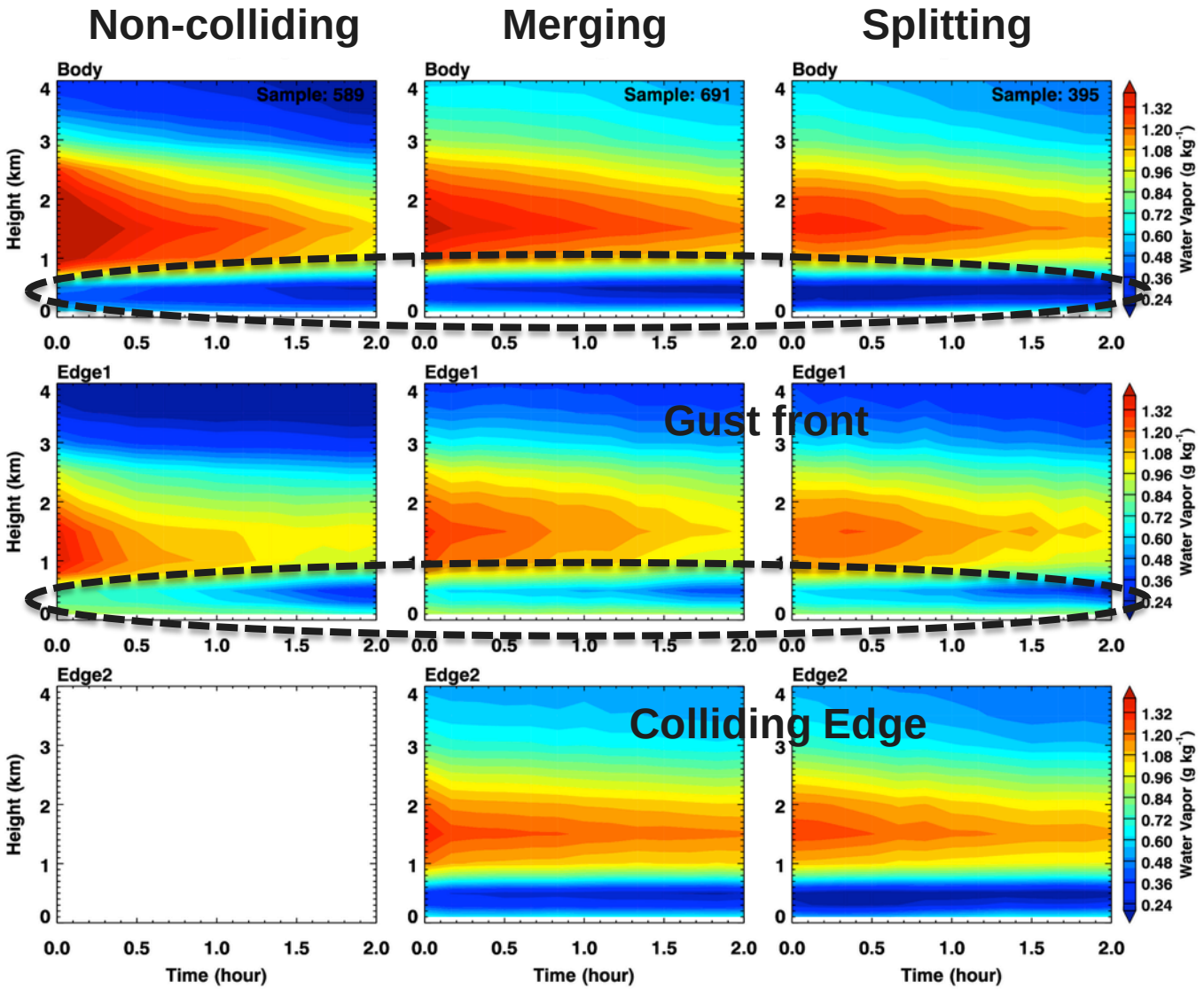
- Downdraft inside coldpool below 800m, updraft above (cloud)
- Enhanced W at edge up to 2km, lasting half-way through lifetime
- Stronger W at gust front than colliding coldpool edges



Evolution of Moisture

- Coldpool depth ~800m
- Enhance moisture at edge compared to body – mixing with moist environment
- Colliding edge is similar to coldpool body



Future Work

- Run simulation at increased resolution (500m, 40 levels)
- Improve coldpool definition (local anomaly)
- Investigate relationship of intensity of cold pool and vertical velocity, subsequently developed vs. non-developed deep convection under different environments
- Compare with AMIE/DYNAMO observations
  - Identify observed coldpool events that pass Gan site
  - Validate simulation against MET/sounding observations