Analysis of shallow-to-deep convection transition using Go-Amazon field campaign data

Presenter: Yang Tian

Co-authors: Yunyan Zhang, Stephen A. Klein

Lawrence Livermore National Laboratory

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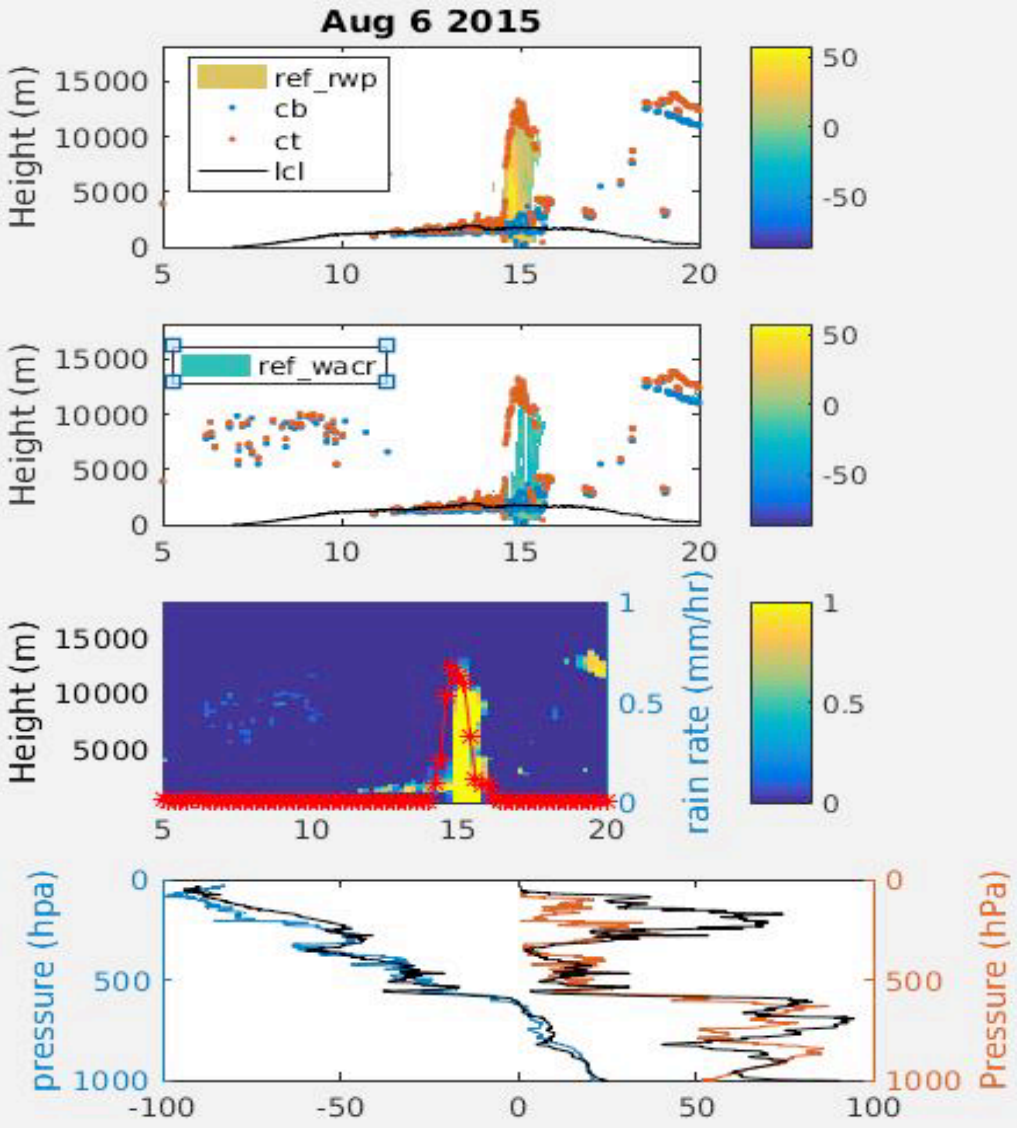
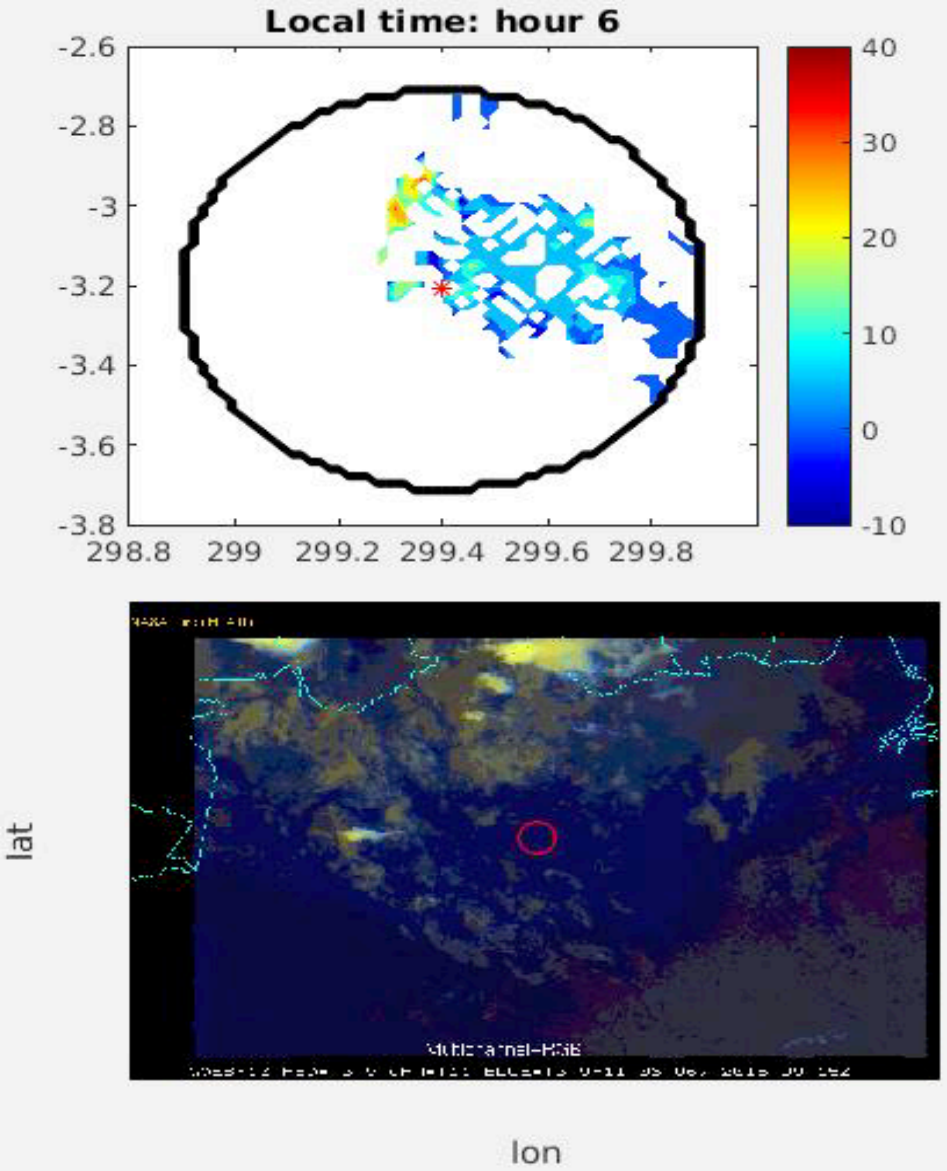
Motivation

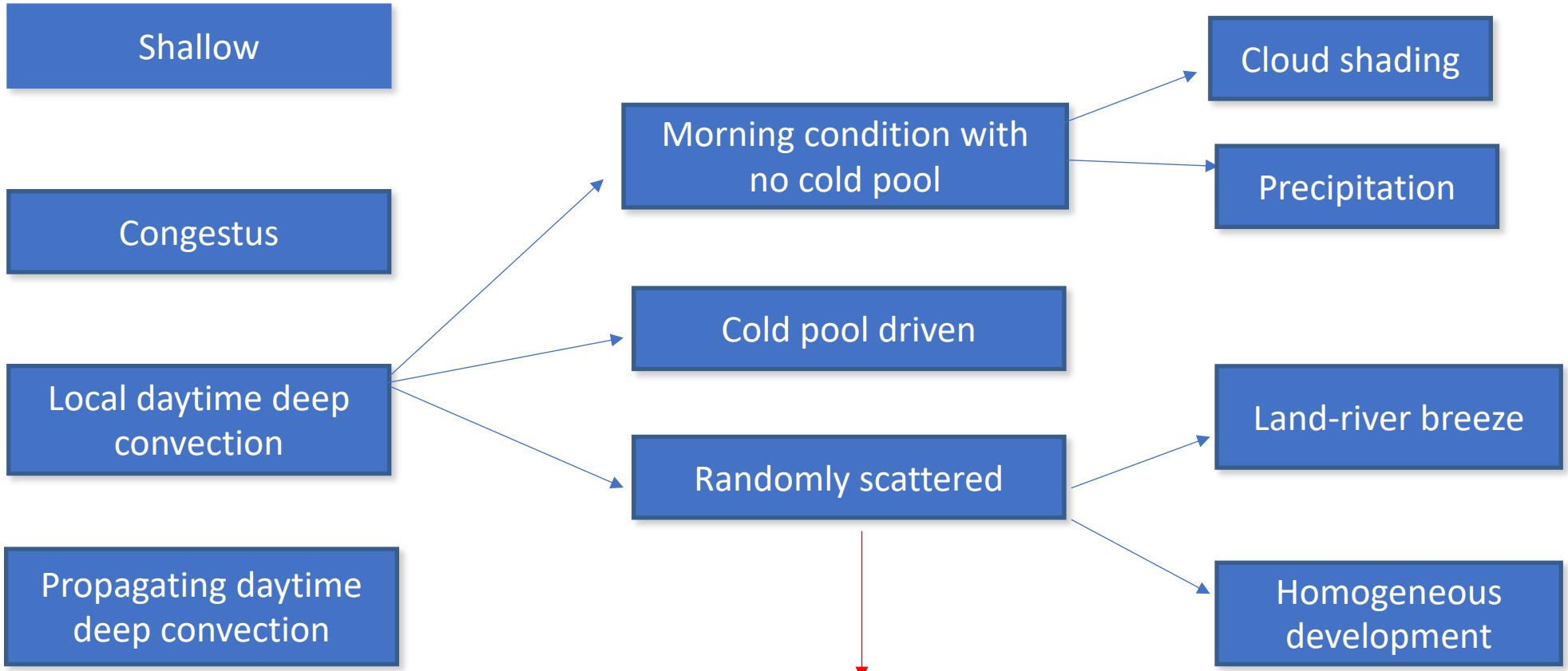
- Amazon is a key region for global hydrological cycle (energy and moisture)
- Poor representation of convection in climate models
- Understand the shallow to deep transition, especially the factors (surface/atmospheric) that control the transition timing, strength and duration of deep convection, and the diurnal cycle of precipitation
- Implication of convective upscaling mechanism and improve convection representation in the model

Integrate all available datasets for classification





Amazon convective system classification

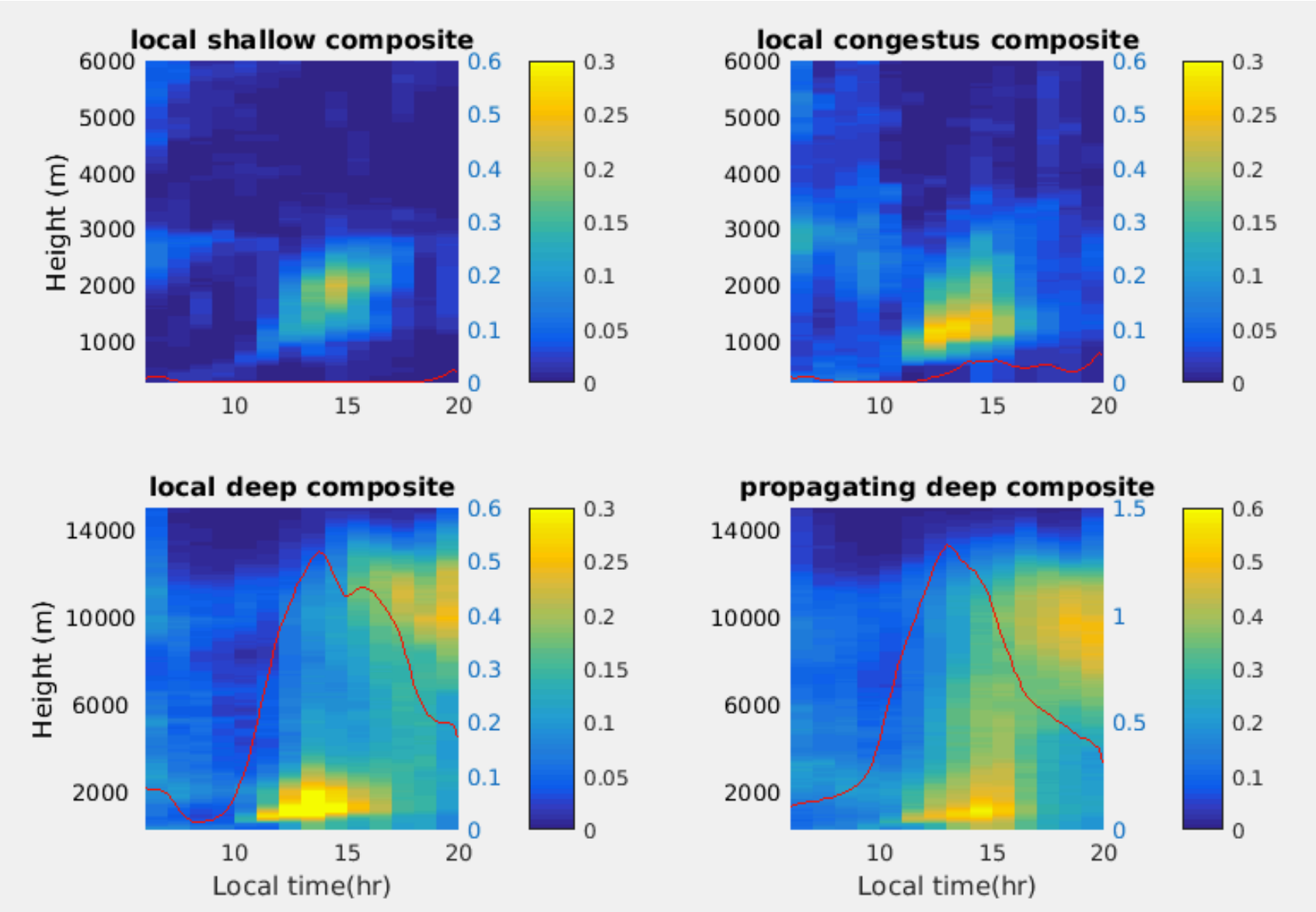


Scientific questions:

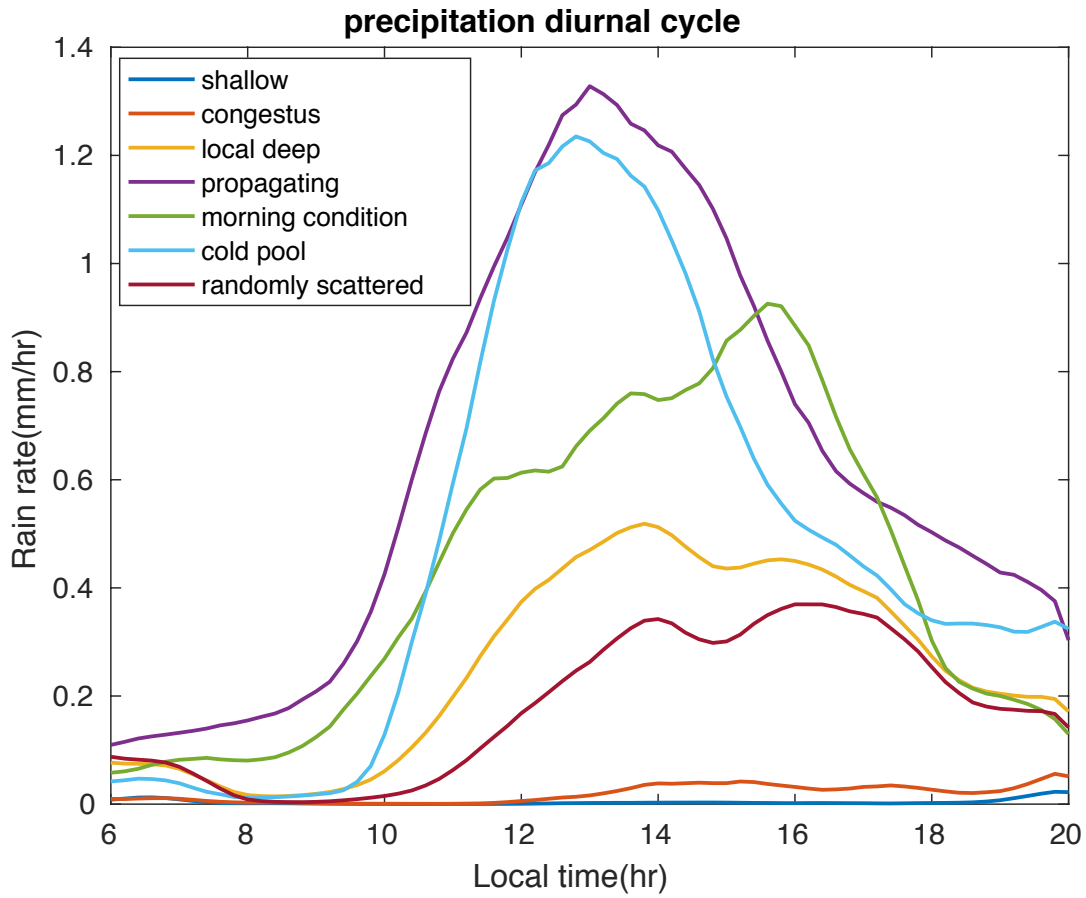
1. What determines the diurnal timing of local precipitation?
2. How important is the land-river breeze?
3. Self-aggregation or not? If aggregated, why and how?

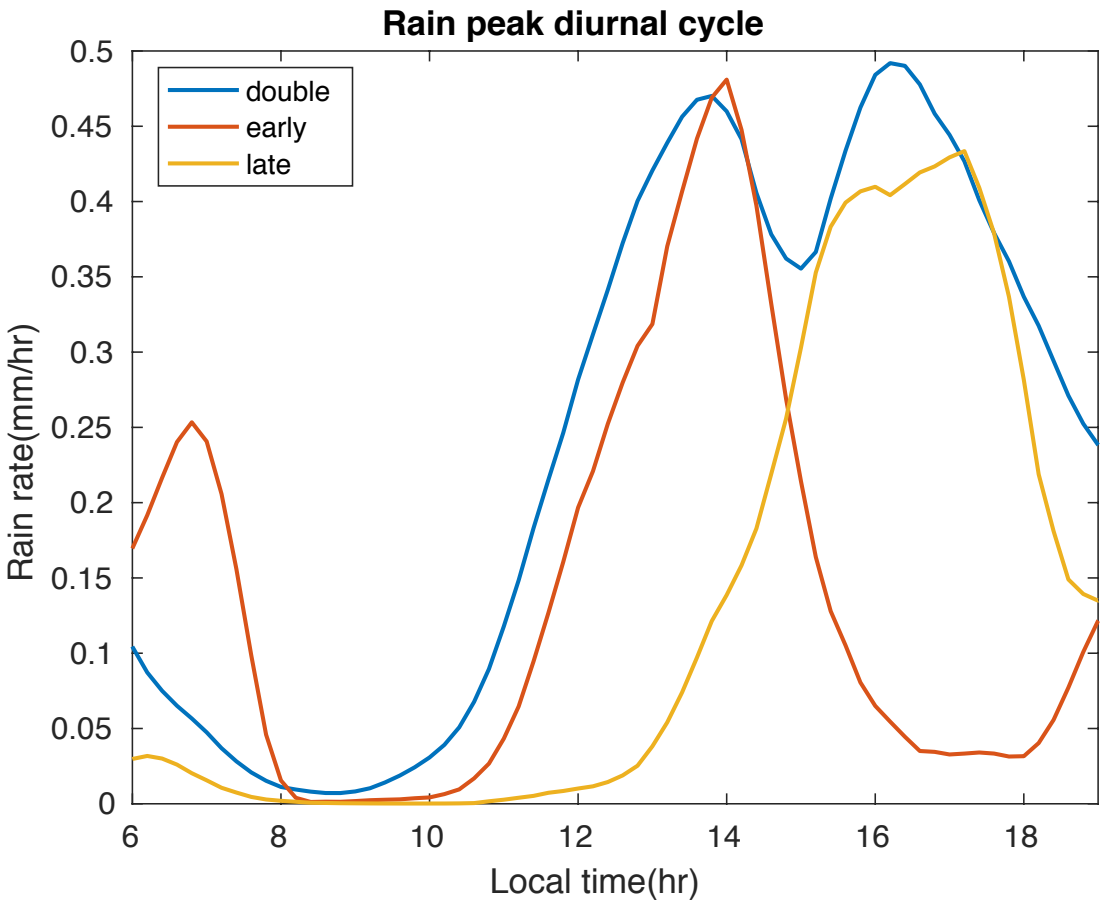
Cases	Number of cases	Description	Selection criteria
Shallow cumulus	65	Shallow clouds with slight drizzle	Peak rain rate smaller than 0.05mm/hr
Shallow to congestus	50	Medium intensity precipitation with relatively deep cloud layers	Peak rain greater than 0.05mm/hr & smaller than 0.25mm/hr. Cloud top does not exceed 7km
Shallow to deep (No external disturbance such as morning precipitation or cold pool, randomly generated)	139	Locally generated convective systems with little external disturbance in the pre-conditions	Peak rain occurs between 12-6pm, peak rain rate exceeds 0.25mm/hr, no cold pool and morning condition due to mesoscale system between 8-10am.
Shallow to deep (cold-pool driven)	32	Noticeable clod pool disturbance from satellite observations followed by shallow cu development in-situ and transition to deep cu	Visible cold pool gust front detected through satellite and radar imagery, and convection develops along the front.
Shallow to deep (other disturbance such as cloud shading or morning precipitation)	20	Strong morning system followed by shallow cu development in-situ and transition to deep cu, no visible cold-pool detected	Existing system from the night before that produces low-cloud shading or early-morning precipitation
Propagating	The rest of the days	Coastal and basin propagating system	Propagating systems that pass

Diurnal cycle of different convective systems



Diurnal cycle of different convective systems





Out of all randomly scattered deep cases, 58 cases have double peaks, 31 peaks in the early afternoon (11-14LT) and 44 peaks in the later afternoon (14-18LT)

Results and future work

- Double peaks in the randomly scattered transition cases: ~1pm and ~4pm.
- The later peak might be contributed by convective self-aggregation of previously generated smaller convective cells.
- Pre-condition of the environment (cold pool, cloud shading, morning precipitation, fog etc) and river breeze effect can play critical roles here.
- Physical mechanisms controlling different peaks will be addressed.

Poster session: B1, Wednesday 3:30-5:00, 29