Toward understanding a climate (time mean) signal in convective precipitation in CAM

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Our "UWens-org" CAM5 version

- Park-Bretherton plume convection only
  - ZM scheme is disabled
- A two-plume ensemble
  - 1st plume is P-B standard "shallow convection"
  - 2nd plume has a lower entrainment rate
- A new prognostic field: "organization" Ω
  - governs 2nd plume's entrainment (via org2rkm)
  - governs 2nd plume's base mass flux (via org2cbmf2)

UWens-org

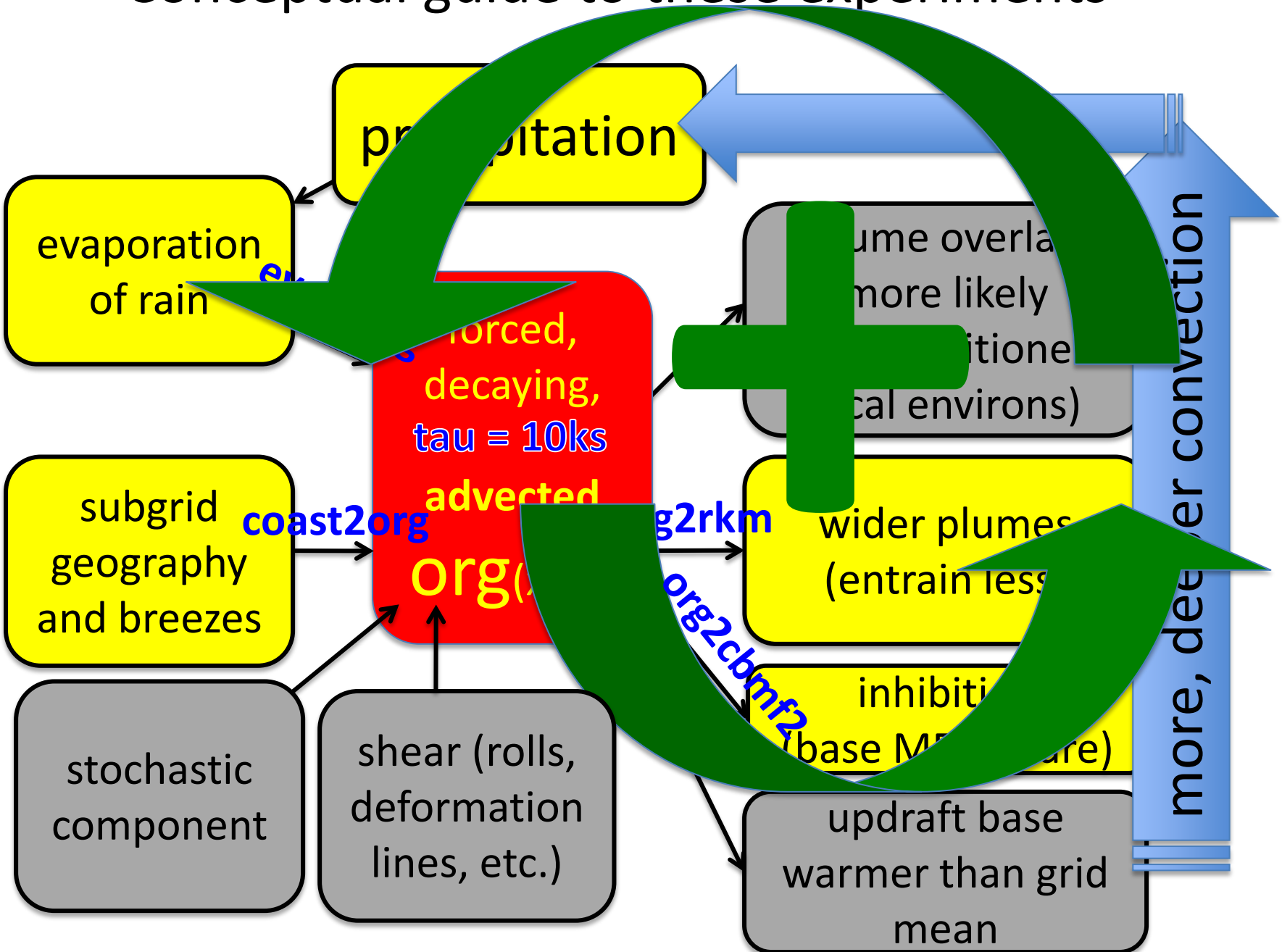
- "organization" Ω *defined* thusly:

$$\frac{\partial \Omega}{\partial t} = -(V_{sfc} \bullet \nabla_h \Omega) - \frac{\Omega}{10ks} + \sum_{sources} S_i$$

1 2 3

1. Advected by *low-level* flow
2. Decays with *timescale* 10 ks ~ 3h
3. Has *Sources*:
   a) evap2org *(column_integrated_precip_evap) --- basic
   b) coast2org where(0.1 < landfrac < 0.9) --- experiment

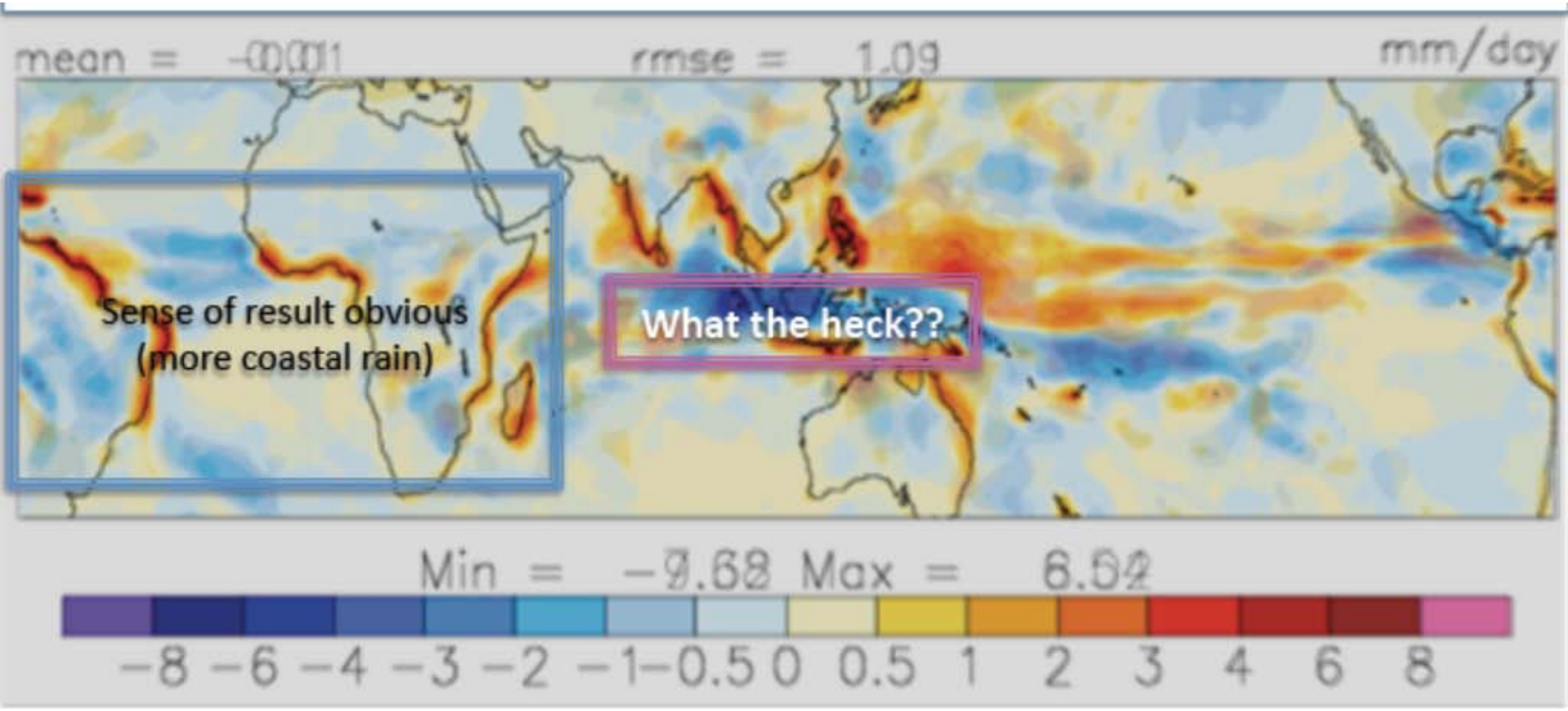
Conceptual guide to these experiments



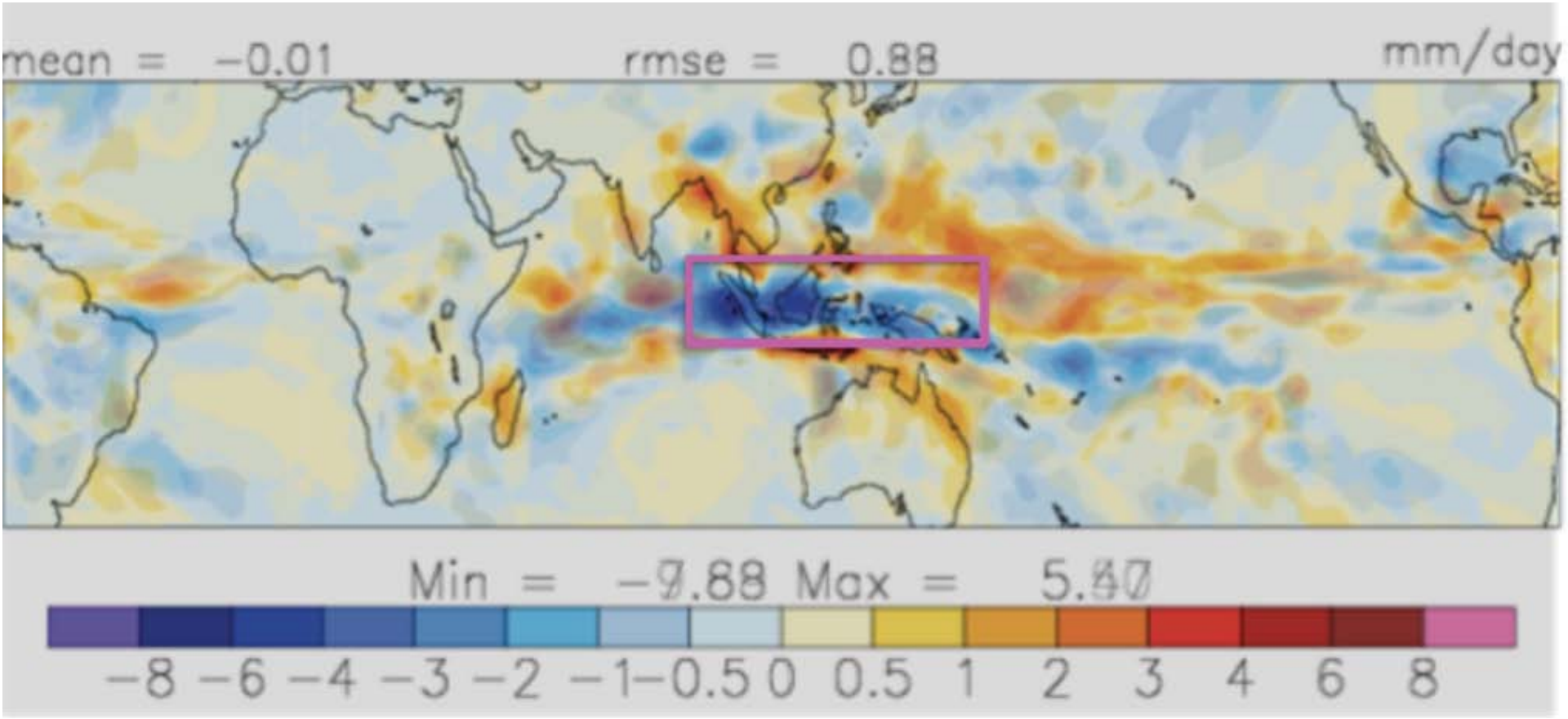
A time-mean PRECC signal

- What is the impact of coast2org source?
- Expectation: coast2org → more Ω in coastal regions → more cloud base mass flux is sent up, into less-entraining 2nd plume → more PRECC
- But feedbacks can change that initial effect
  - positive (org → evap of precip → org)
  - or maybe negative (e.g. heating → dyn → drying)
  - or maybe eddy (via time correlations in disturbances)
  - few *a priori* constraints: why modeling is interesting!

Effect of coastal Ω source
(overlay of two 5-year means for sig.)

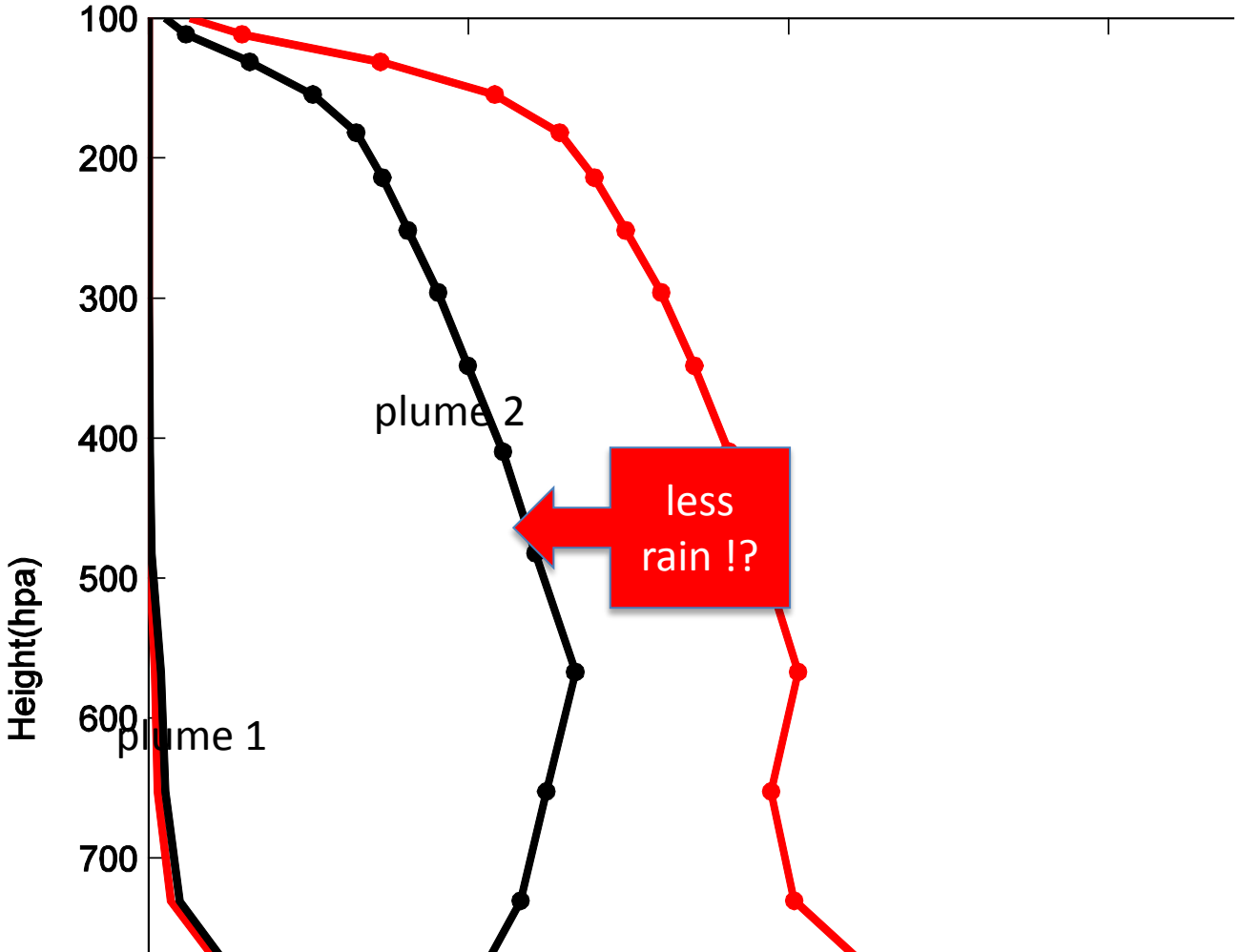


Counterintuitive sign is *local* to MC
Effect of coastal Ω source only in MC:



Why *less* MC rain with coastal Ω source?

- yet with *more* deep mass flux in plume #2...



Explaining a time-mean surprise

- Some precip efficiency effect?
  - Saturated M in tropical qsat(T,p) profile produces a pretty constant condensation rate per unit mass flux.
  - So cond → PRECC must vary by many 10s of %
    - condensate → precip conversion?
    - re-evap of precip above surface?

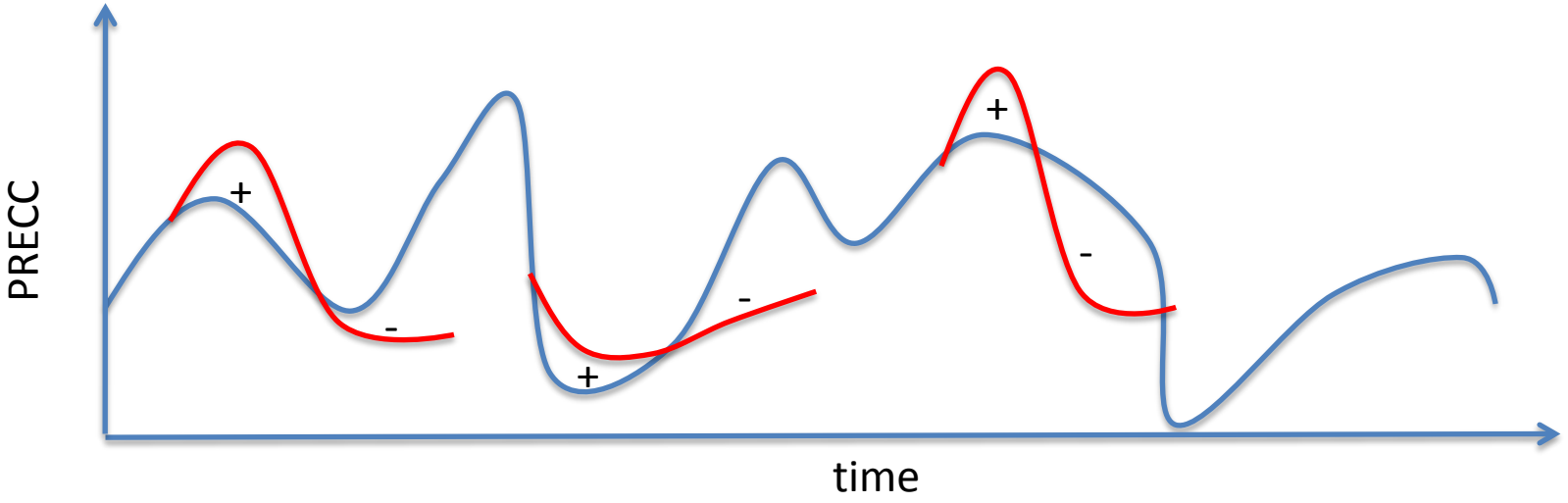
Explaining a time-mean surprise

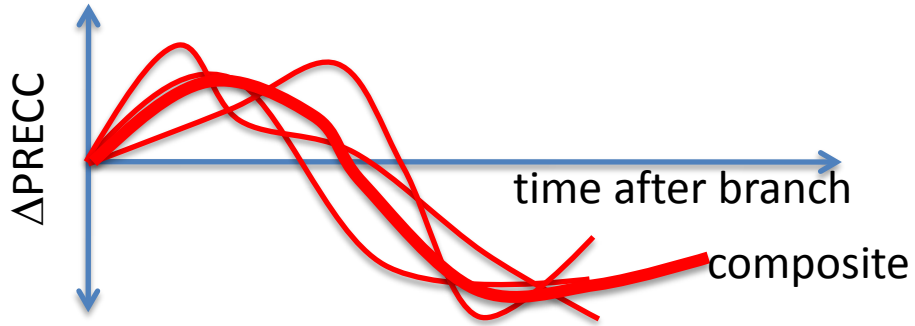
- Are time mean fields a sufficient basis for explanation, or must we consider temporal correlations of fluctuations (of M and RH for example)?

- And always, forever, we worry: ? bugs ?

Branch run strategy

- See how counterintuitive sign (opposite to immediate, local effect) emerges





<u>Idea</u>: Explaining the turnaround in a case, and/or in the composite, plus showing that it is characteristic of a statistically meaningful number of branch cases, would constitute an explanation for the surprise/mystery sign

Less than that, today

- IDV demo:
  - 20 fields in CAM5-UWens-org JJA weather
  - with x-sections and soundings