

Do locally-generated convective cloud regimes have any preference over soil moisture conditions at SGP?

2016 ASR PI meeting LACI breakout

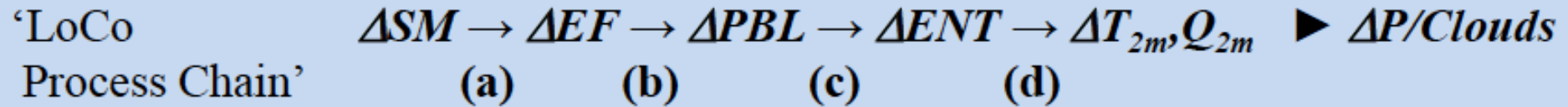
Yunyan Zhang

Thanks to Trent Ford, Chris Fiebrich, Shaocheng Xie and Steve Klein



Motivation

- The effect of soil moisture on “triggering” clouds and precipitation development

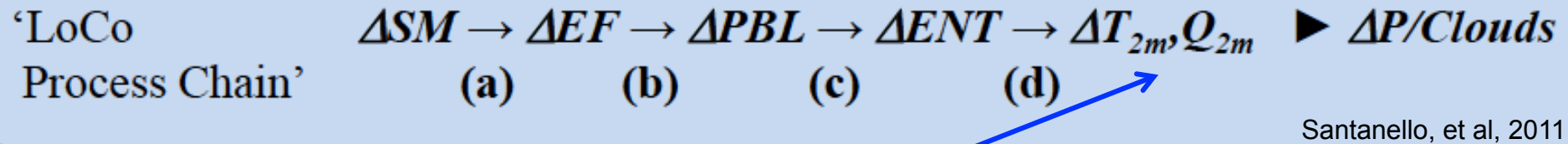


Santanello, et al, 2011



Motivation

- The effect of soil moisture on “triggering” clouds and precipitation development

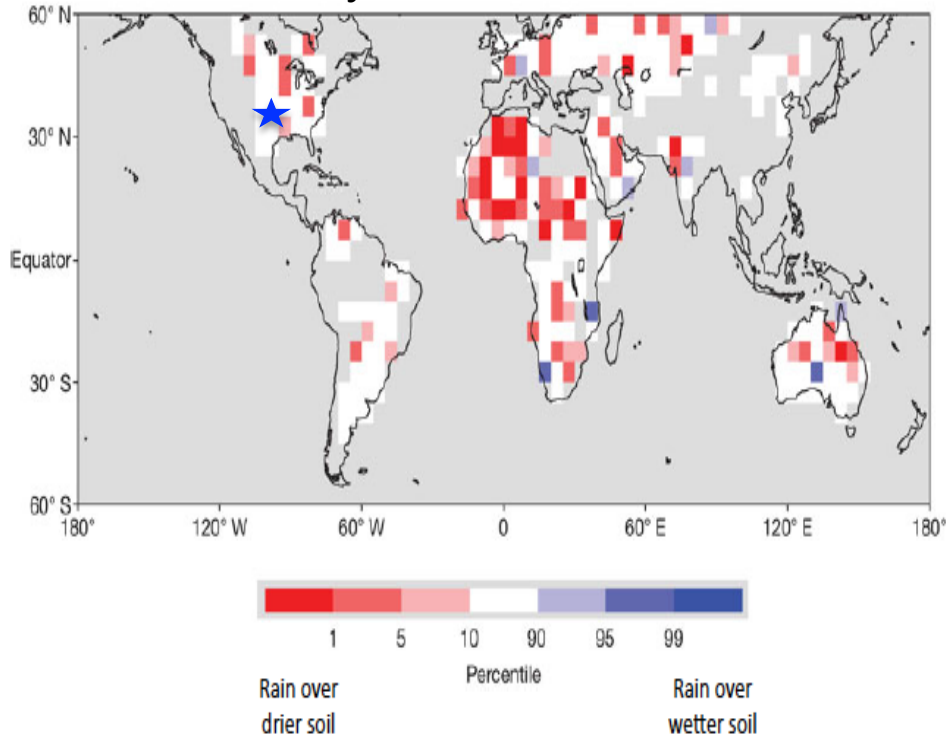


Spatial heterogeneity

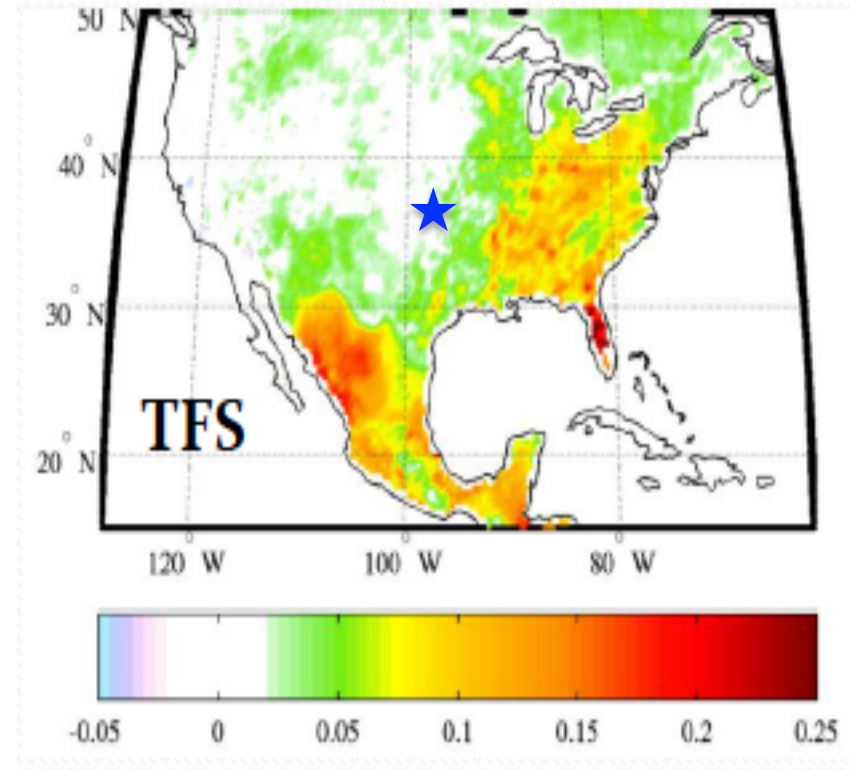
Meso-scale circulation

Negative or Positive soil moisture effect

Taylor et al, 2012



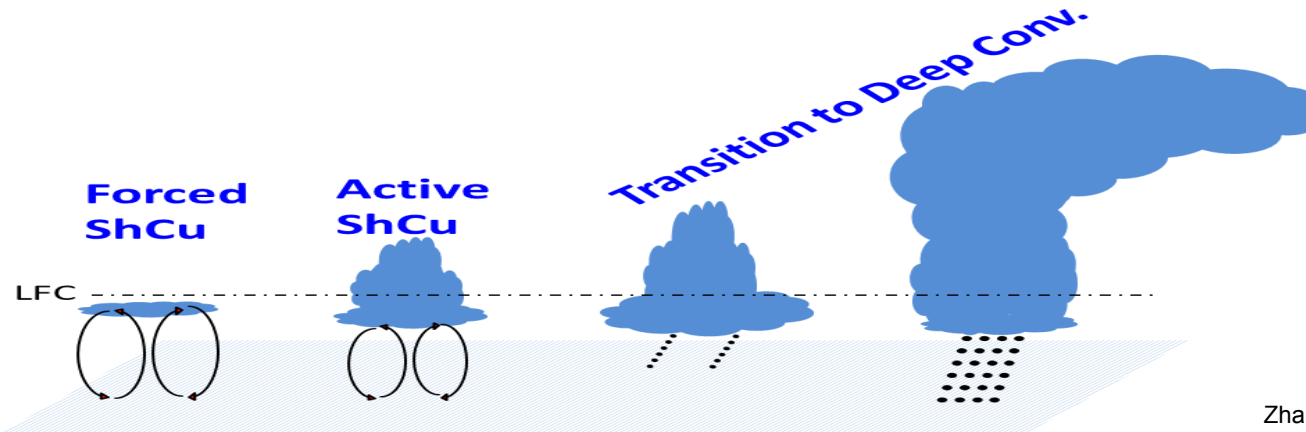
Findell et al, 2011



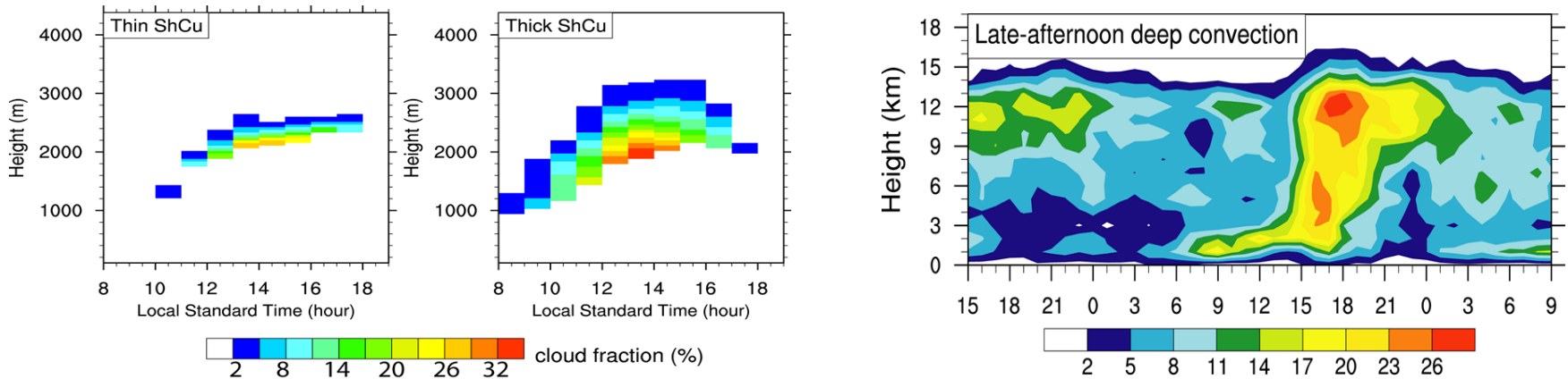
Signal at SGP region is weak.



Locally-generated convection regimes at SGP



Zhang and Klein, 2010, 2013

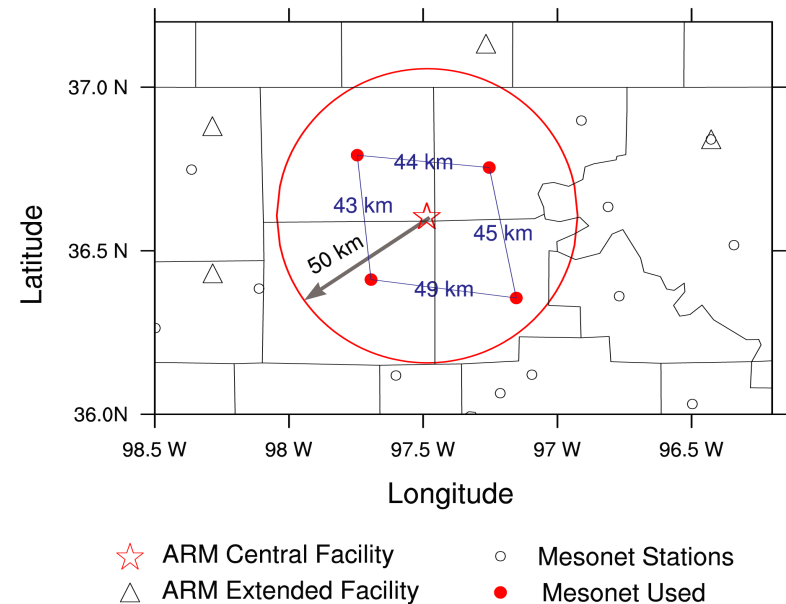


These regimes are less subject to synoptic forcings,
thus the soil moisture effect should be more noticeable!

Data and methodology

- Based on a cumulative distribution function of 9 LST soil moisture water content at each station, we convert soil moisture water content into percentile.
- Soil moisture heterogeneity was calculated among stations and also converted into percentile.

(Ford et al, 2015)

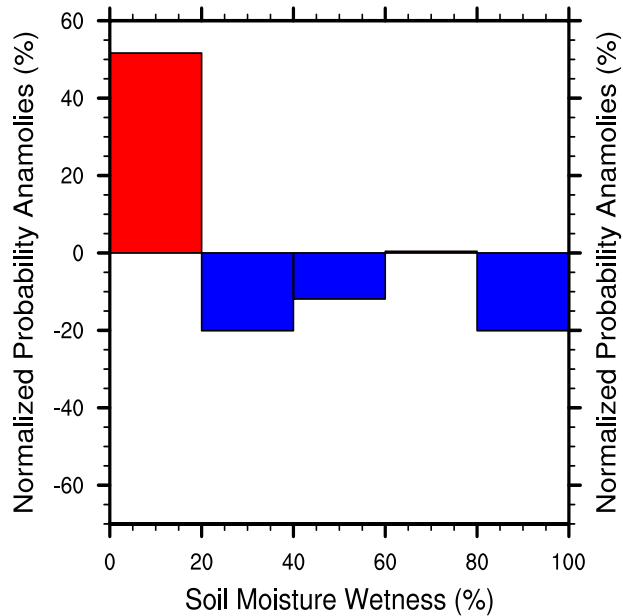


ARM and OK mesonet data are used.

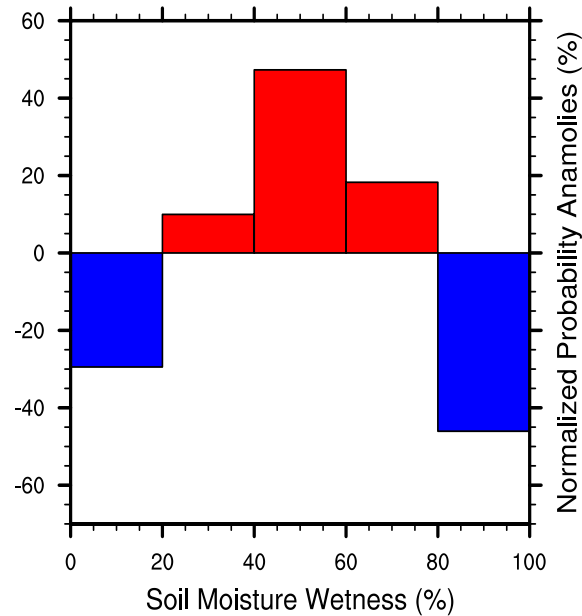


Convection preference over dry/wet soil?

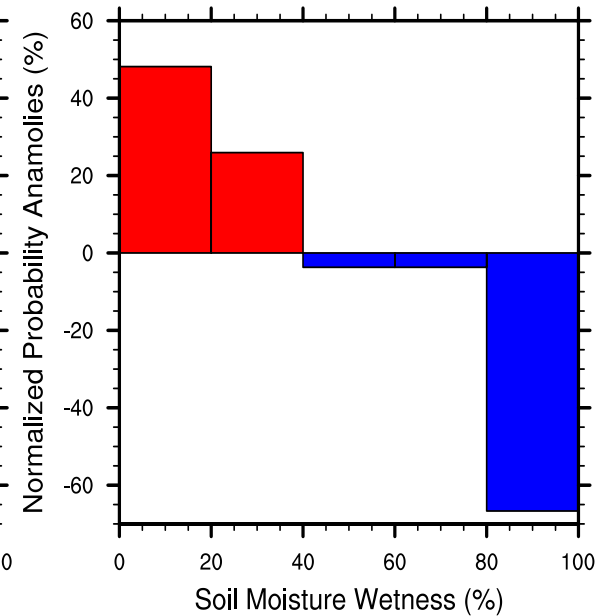
Deep Conv.



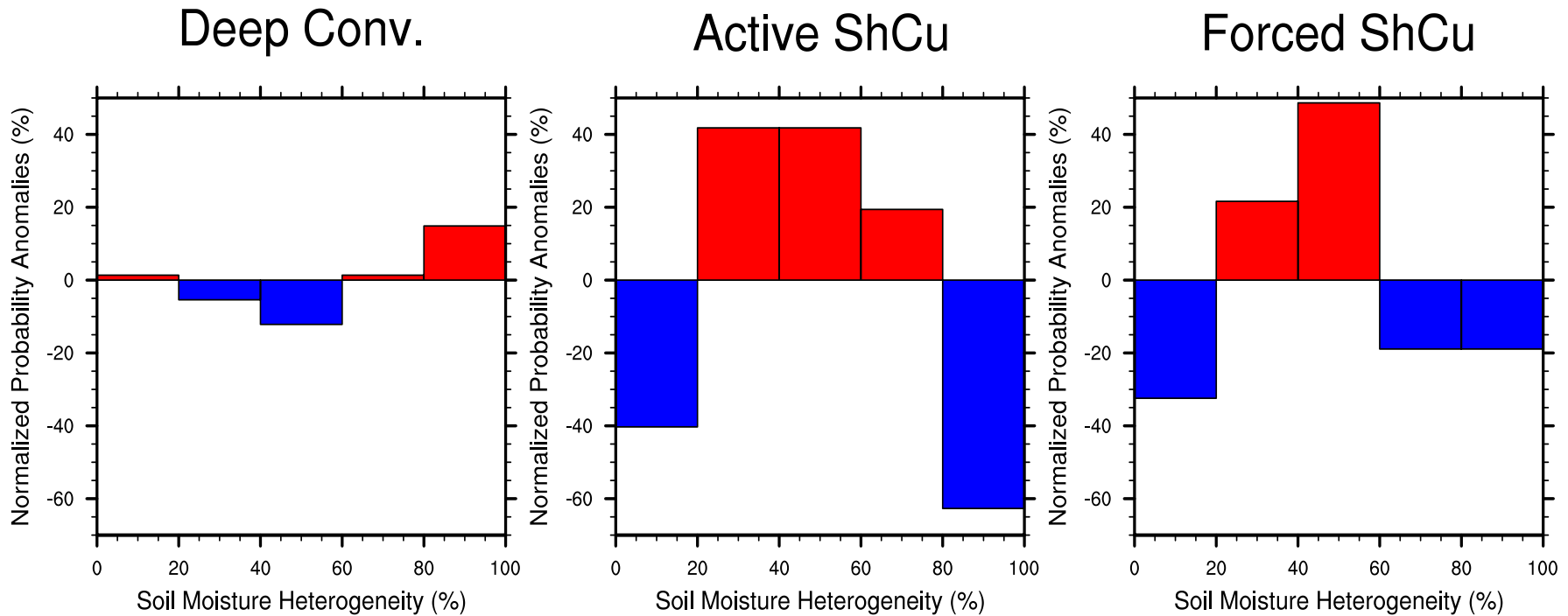
Active ShCu



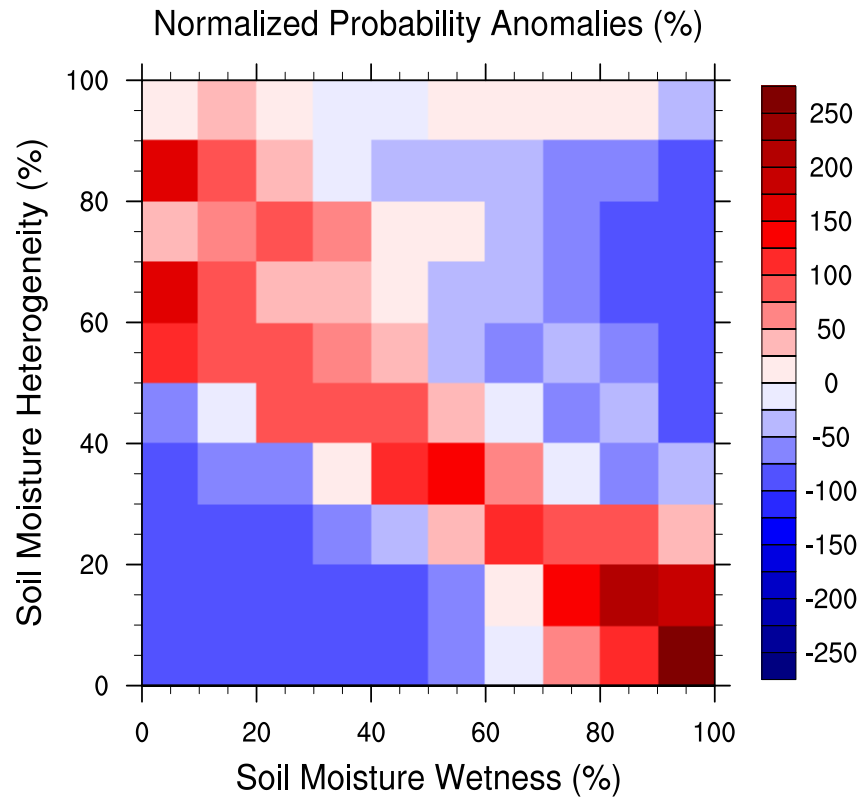
Forced ShCu



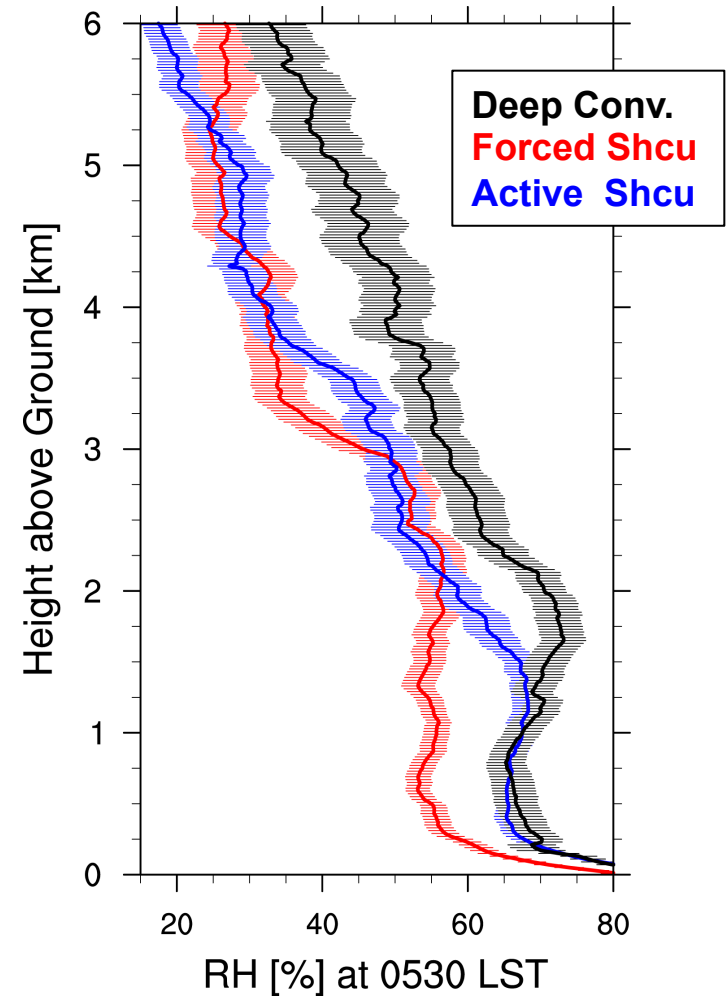
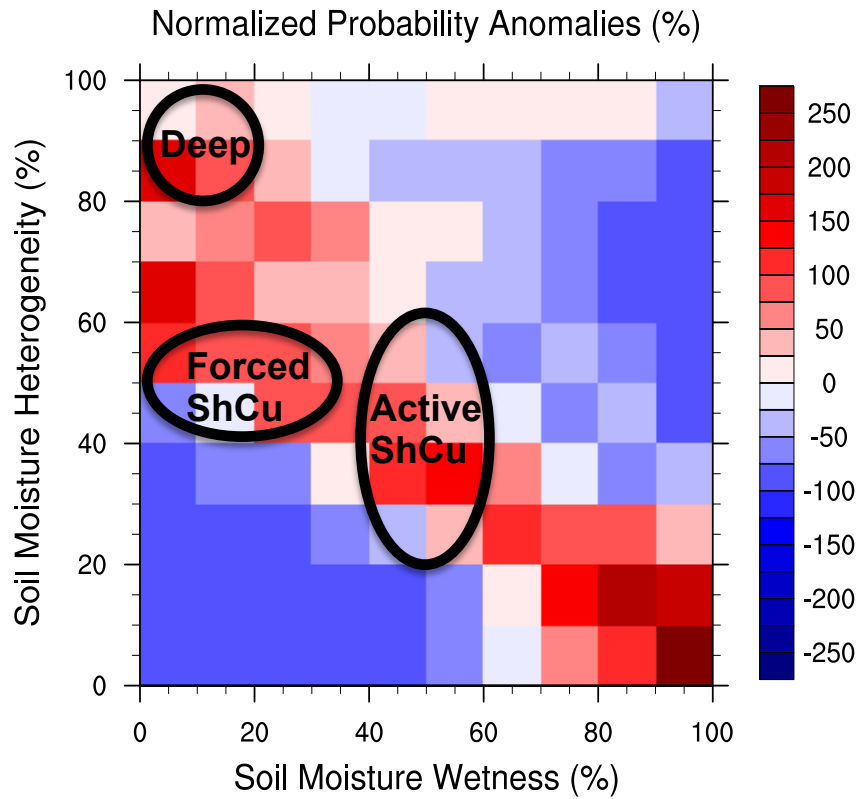
Convection preference over strong/weak soil heterogeneity?



Joint PDF: soil moisture and heterogeneity

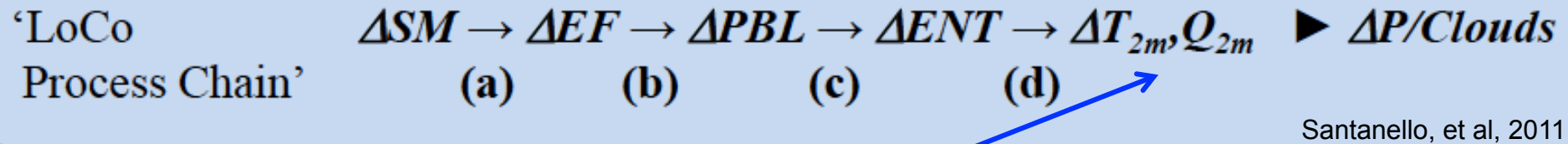


Local convection: Atmospheric vs. Surface Control



Motivation

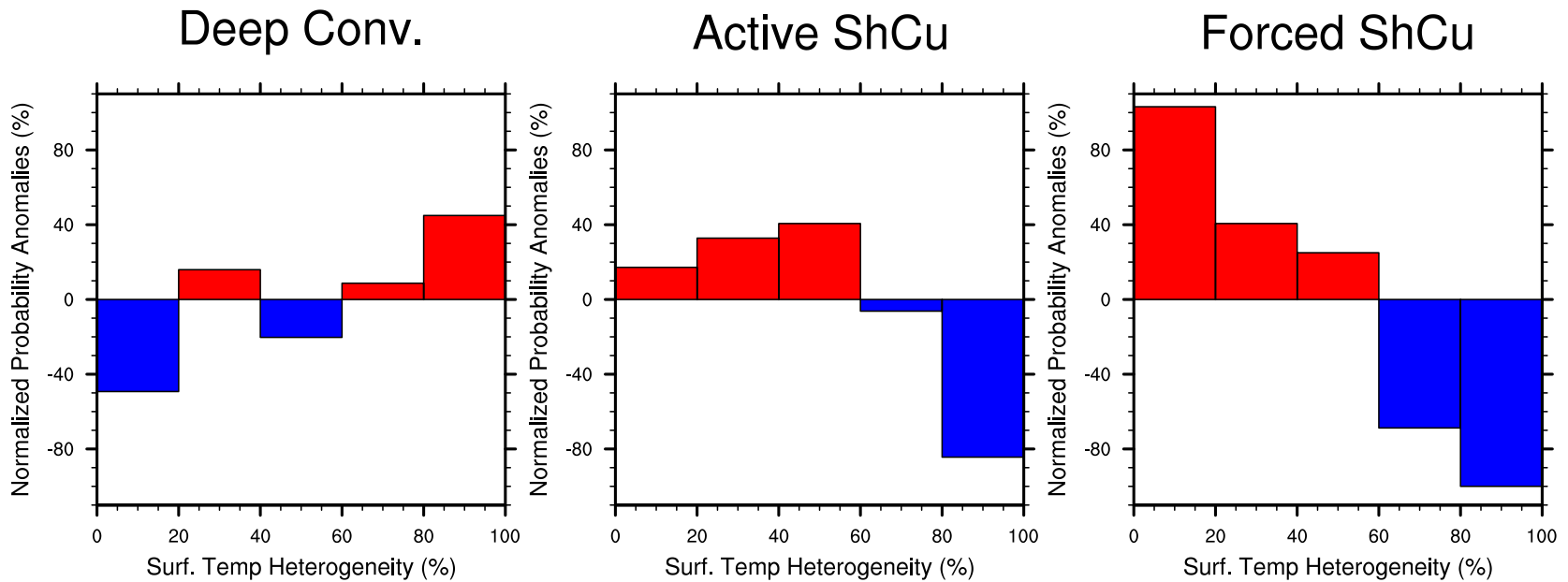
- The effect of soil moisture on “triggering” clouds and precipitation development



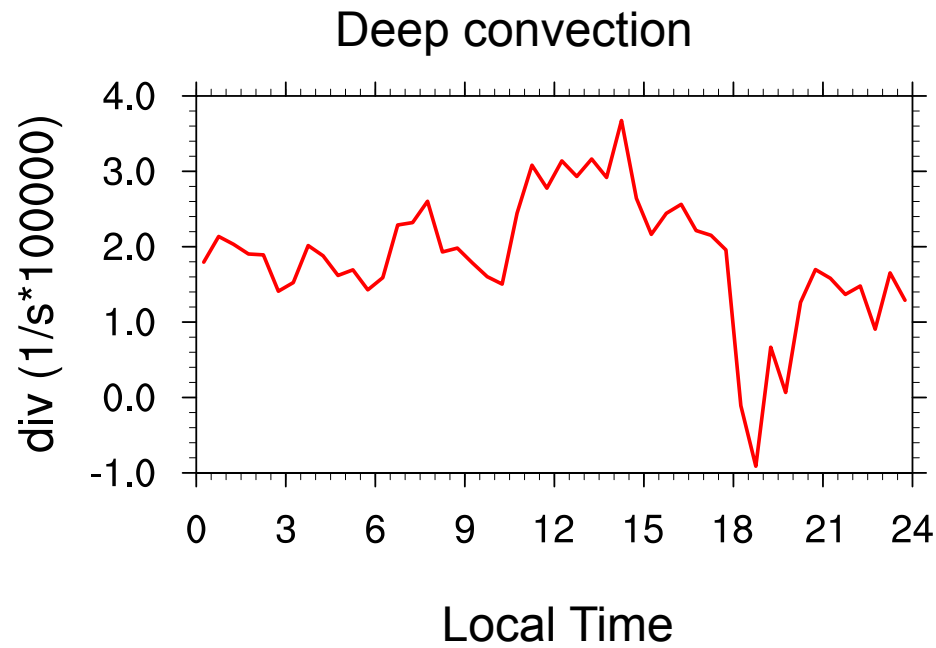
Spatial heterogeneity

Meso-scale circulation

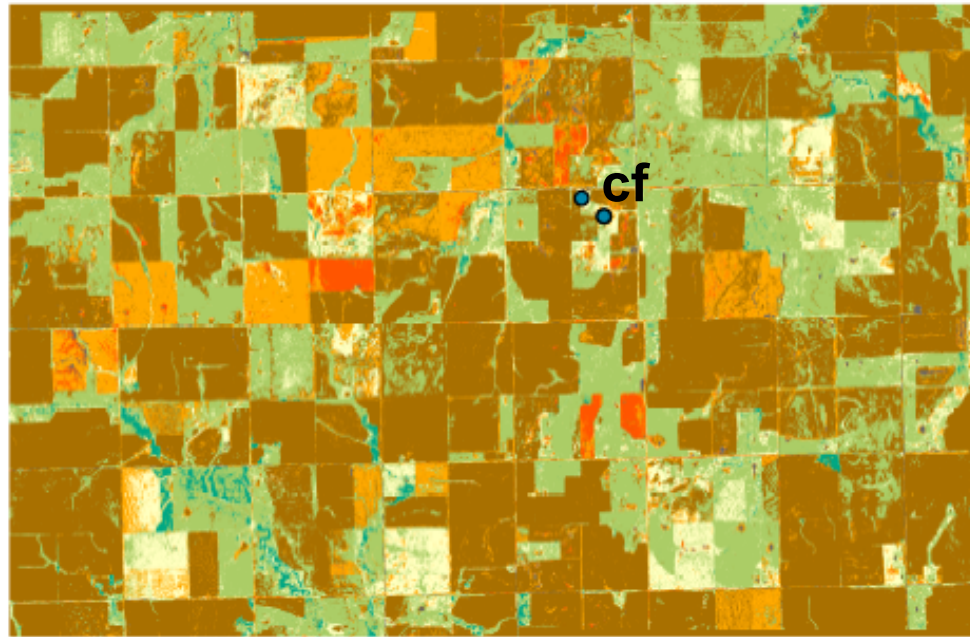
Convection preference over strong/weak temperature heterogeneity



Meso-scale wind at surface



Heterogeneity length scale



Courtesy of Michael Mulqueen and Alice Cialella

Heterogeneity length scale is comparable to mixed-layer depth and shallow cumulus size.
Our future work is to use LES coupled with land scheme to study this effect.



Summary

- Locally generated convective clouds show preference over soil moisture conditions and its heterogeneity
- deep convection at SGP has more preference to occur
 - over drier soils
 - with the larger temperature heterogeneity
 - However no evidence of the associated mesoscale circulation

