The Large-Scale Properties of Regimes of Tropical Convection

Jackson Tan & **Christian Jakob**

Monash University
&
ARC Centre of Excellence for Climate System Science

19th April 2012

Aims: Convection & Large-Scale State

Motivation

There are **significant model biases** in clouds and precipitation, and some are likely linked to the **representation of convection** which relies on the **relationships between small and large scales**.

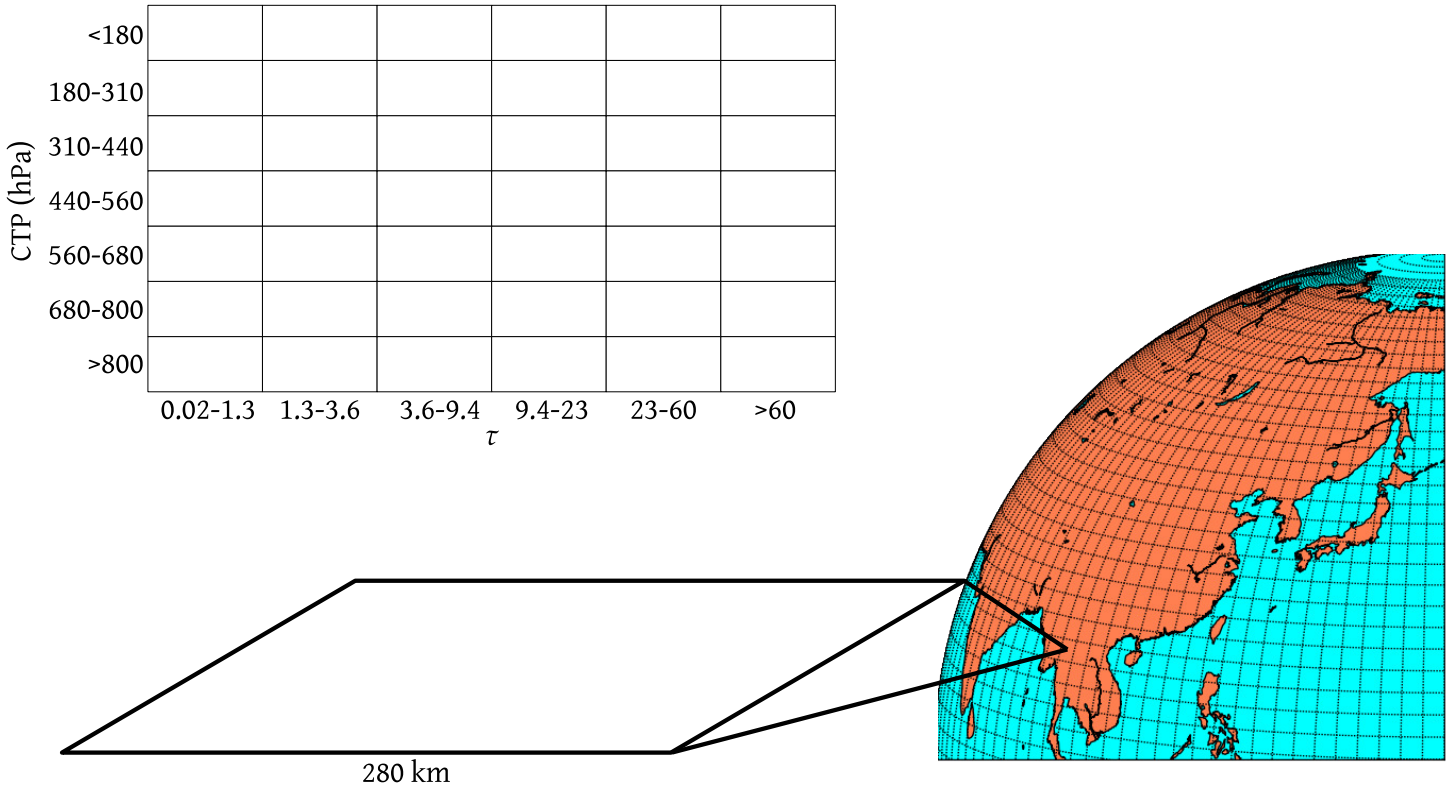
Aims

- Can we identify convective states from the cloud satellite data?
- What is the relation between convection within a grid box and large-scale atmospheric variables?

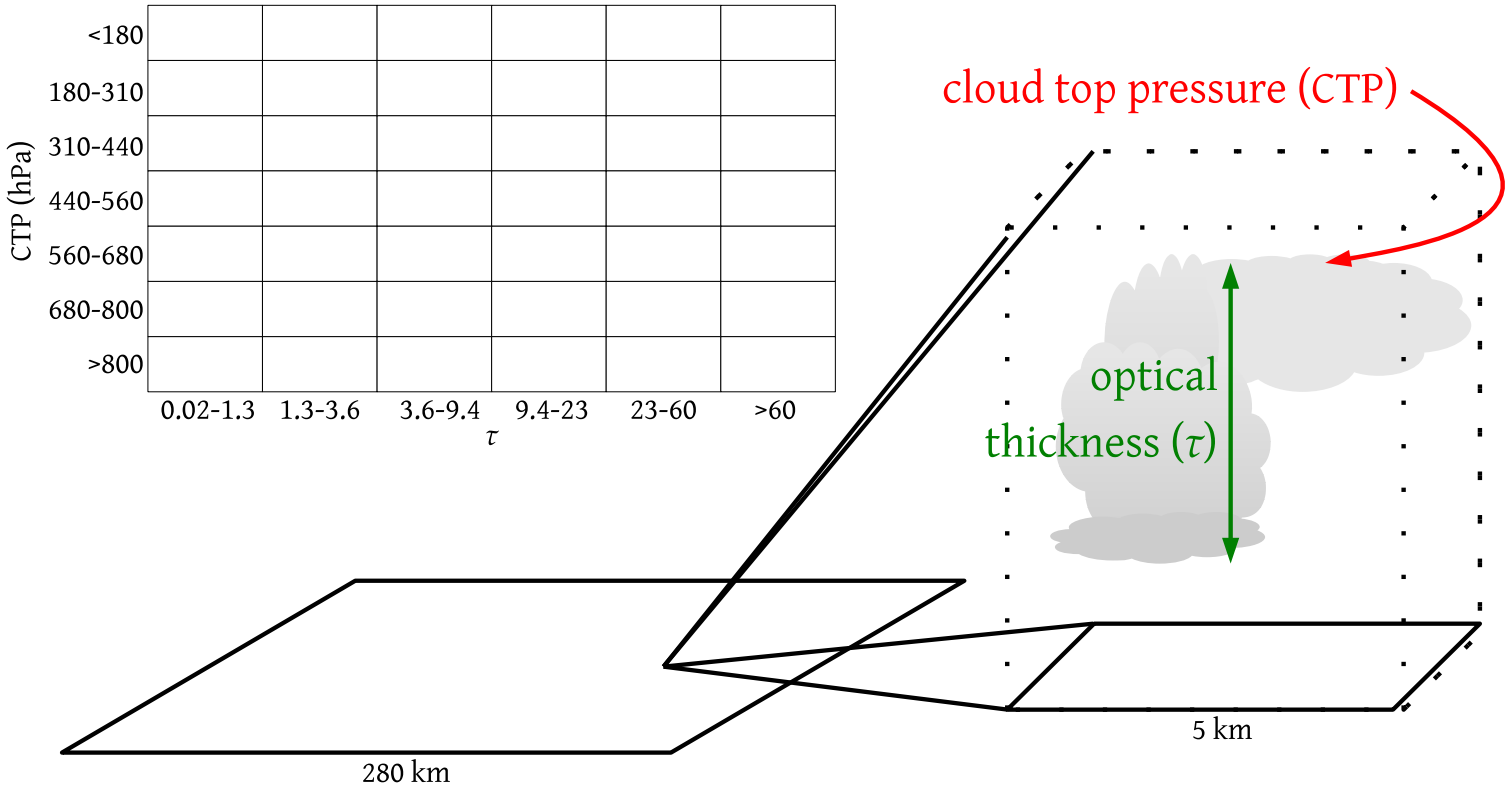
ISCCP

- International Satellite Cloud Climatology Project
- 1983 to 2007
- global tropics and subtropics (35° N/S)
- ISCCP D1 dataset

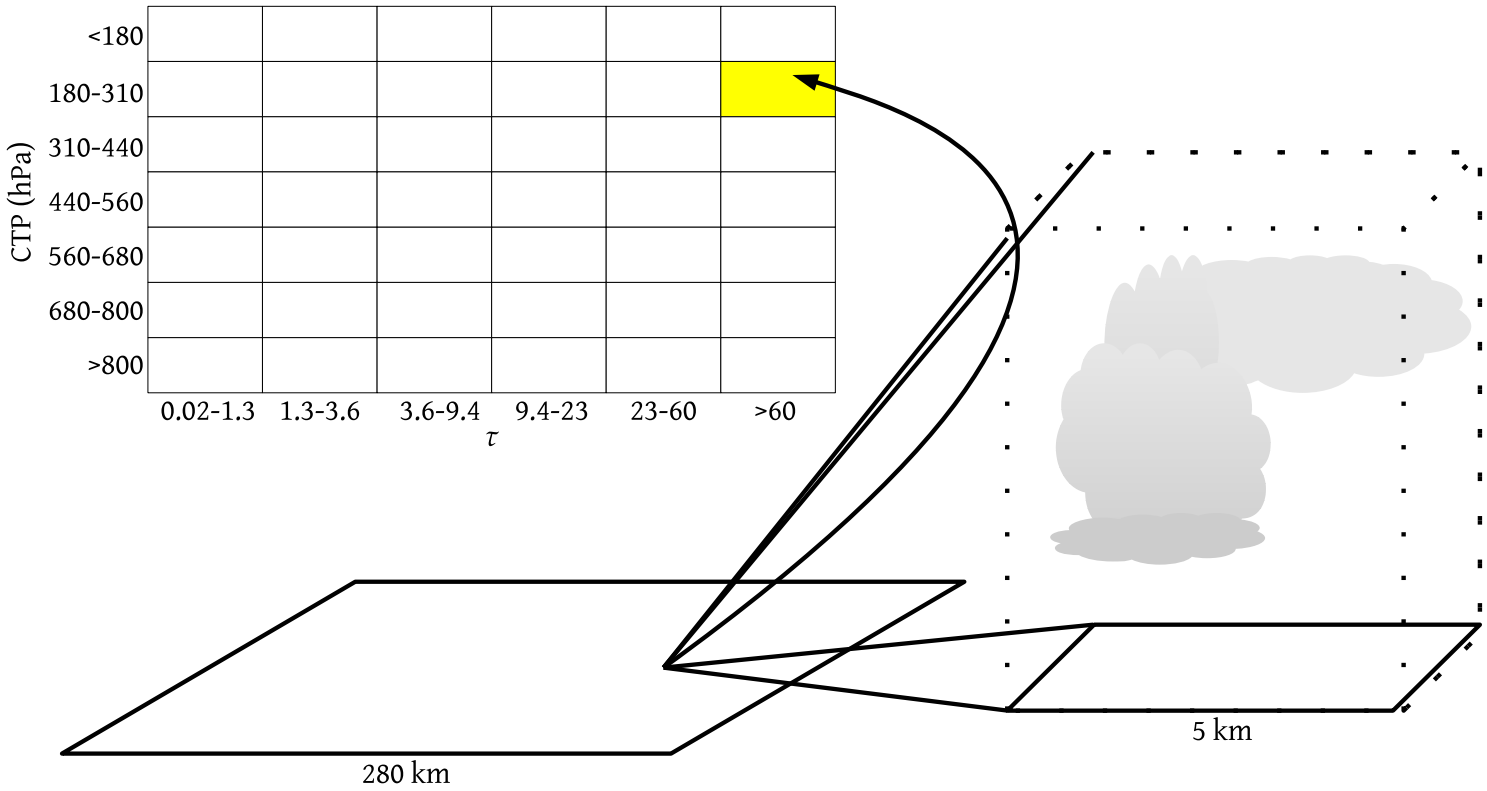
ISCCP D1 Retrieval



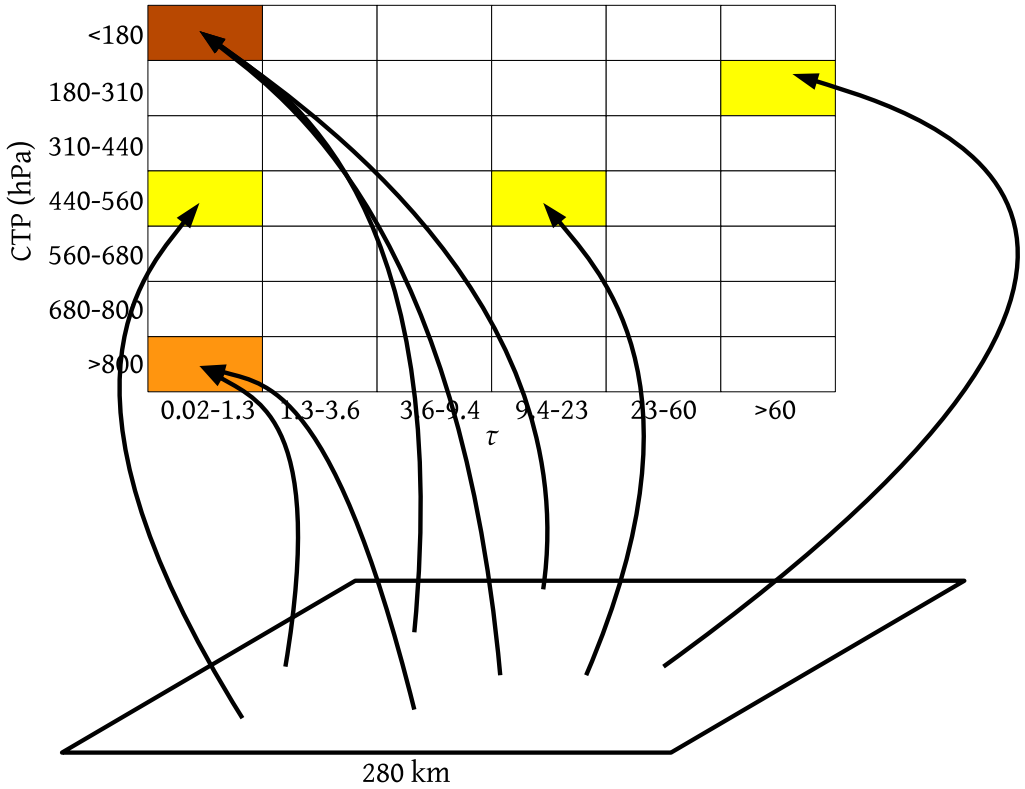
ISCCP D1 Retrieval



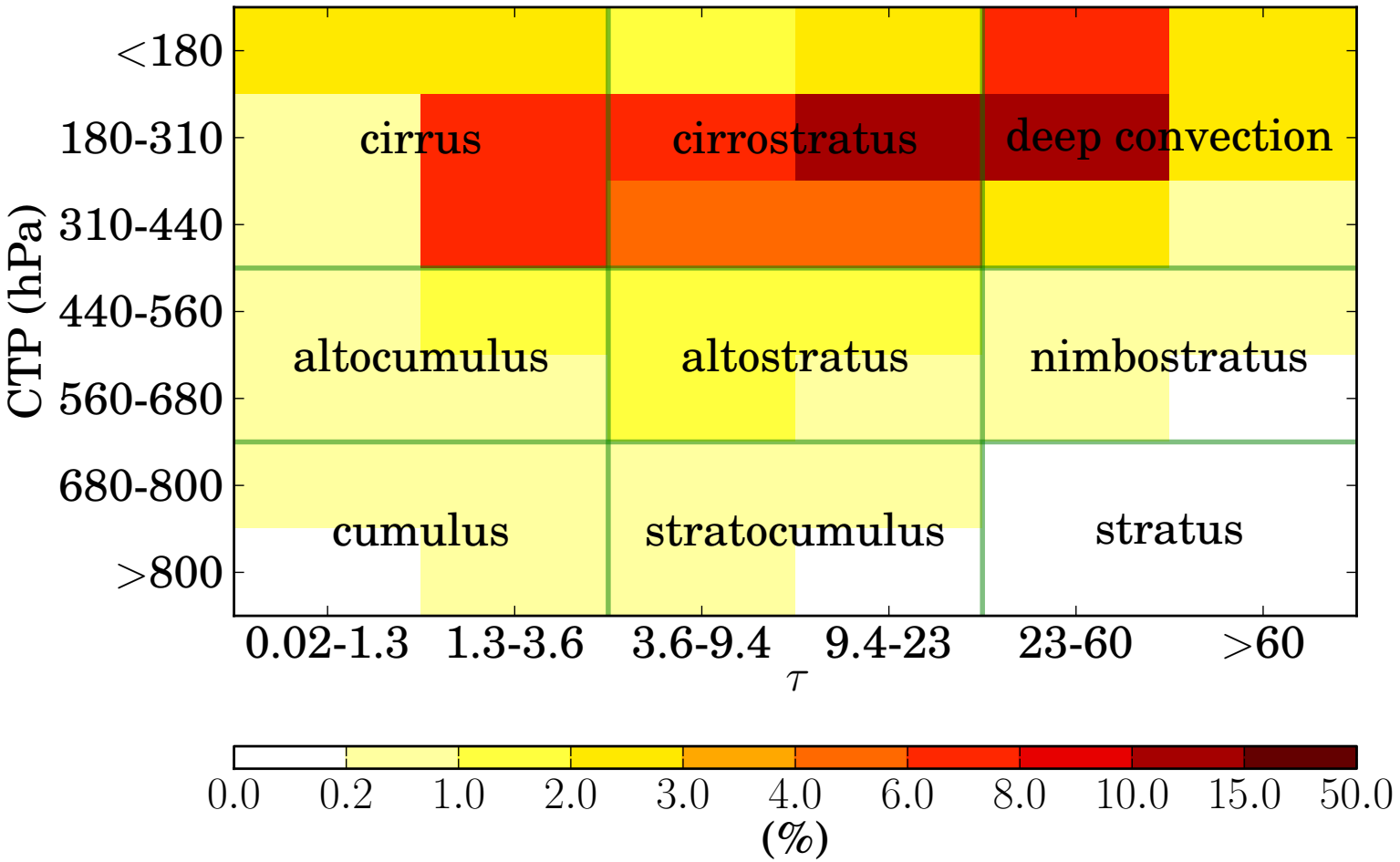
ISCCP D1 Retrieval



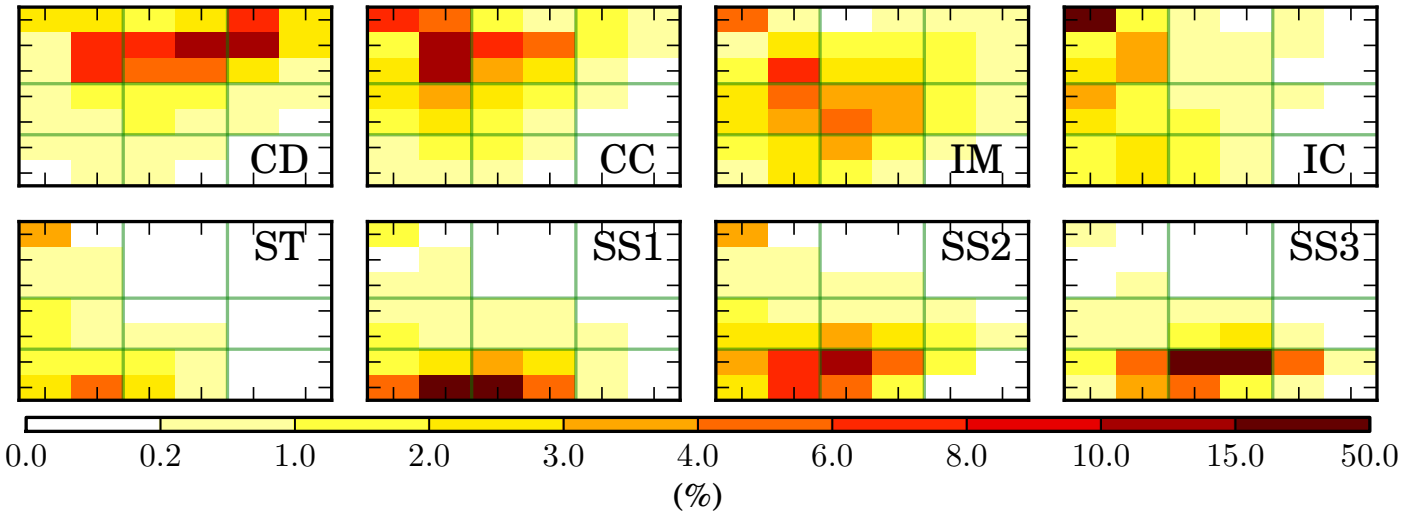
ISCCP D1 Retrieval



Example of a Joint-Histogram



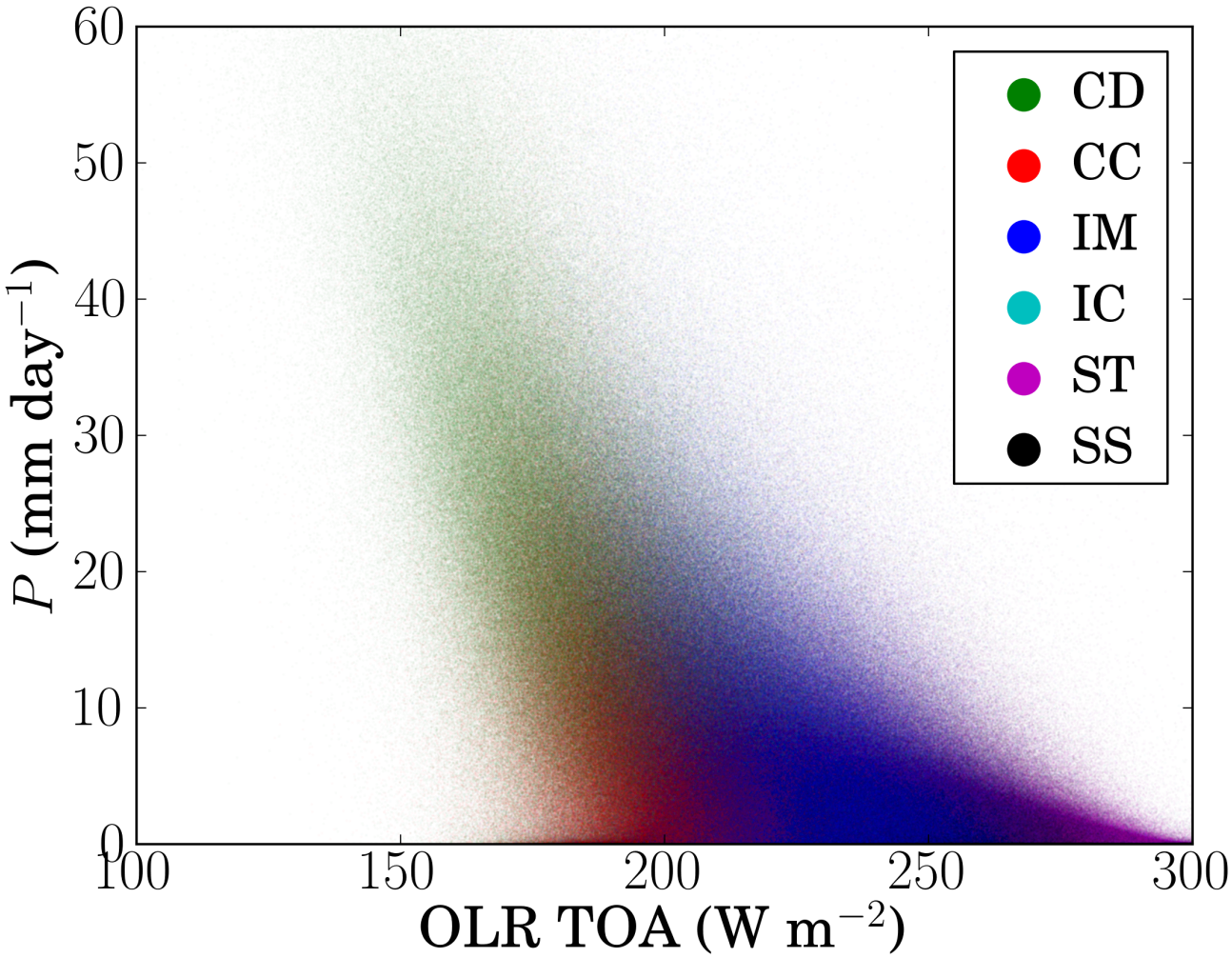
Eight Tropical Cloud Regimes



	dominant cloud type	
Convective:	**D**eep stratiform (**CD**)	**C**irrus (**CC**)
Intermediate:	**M**ixture (**IM**)	thin **C**irrus (**IC**)
Suppressed:	**T**rade cumulus (**ST**)	**S**tratocumulus (**SS1-3**)

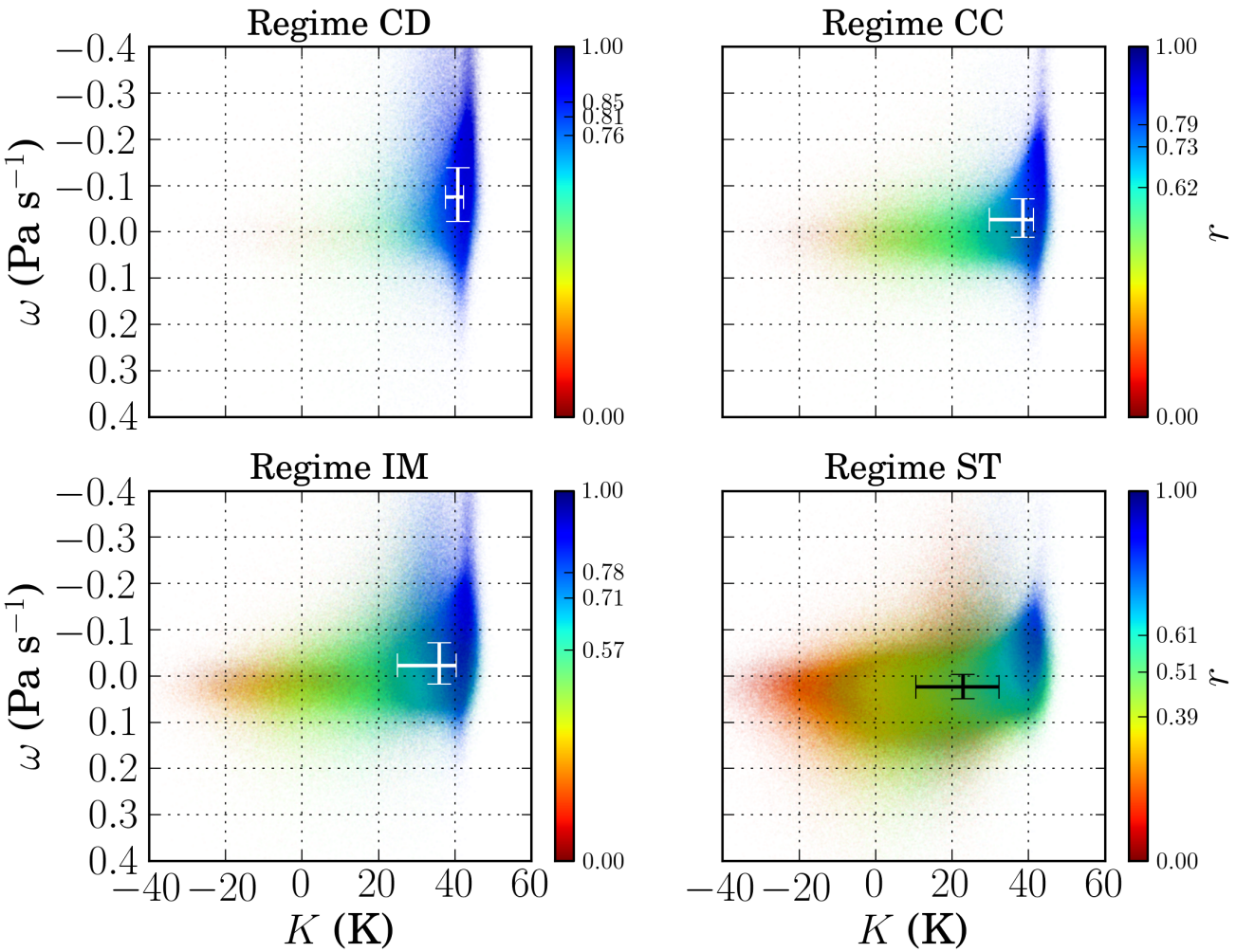
Similar to: Oreopoulos and Rossow (2011), Mekonnen and Rossow (2011)

Relation to Convection



P: daily precipitation [GPCP]; OLR: outgoing LW radiation [ISCCP FD]

Relation to Large-Scale Variables



K: modified K-index; ω: vertical velocity (600 hPa); r: saturation ratio [ERA-Interim]

Summary

Aims

- Can we identify convective states from the cloud satellite data?
- What is the relation between convection within a grid box and large-scale atmospheric variables?

- regimes derived from cloud data can identify different convective states
- they demonstrate different large-scale properties depending on their convective strengths
- our results open up new avenues to evaluate climate models and construct statistical models of convection