Characteristics of Extreme Summer Convection over Equatorial America and Africa

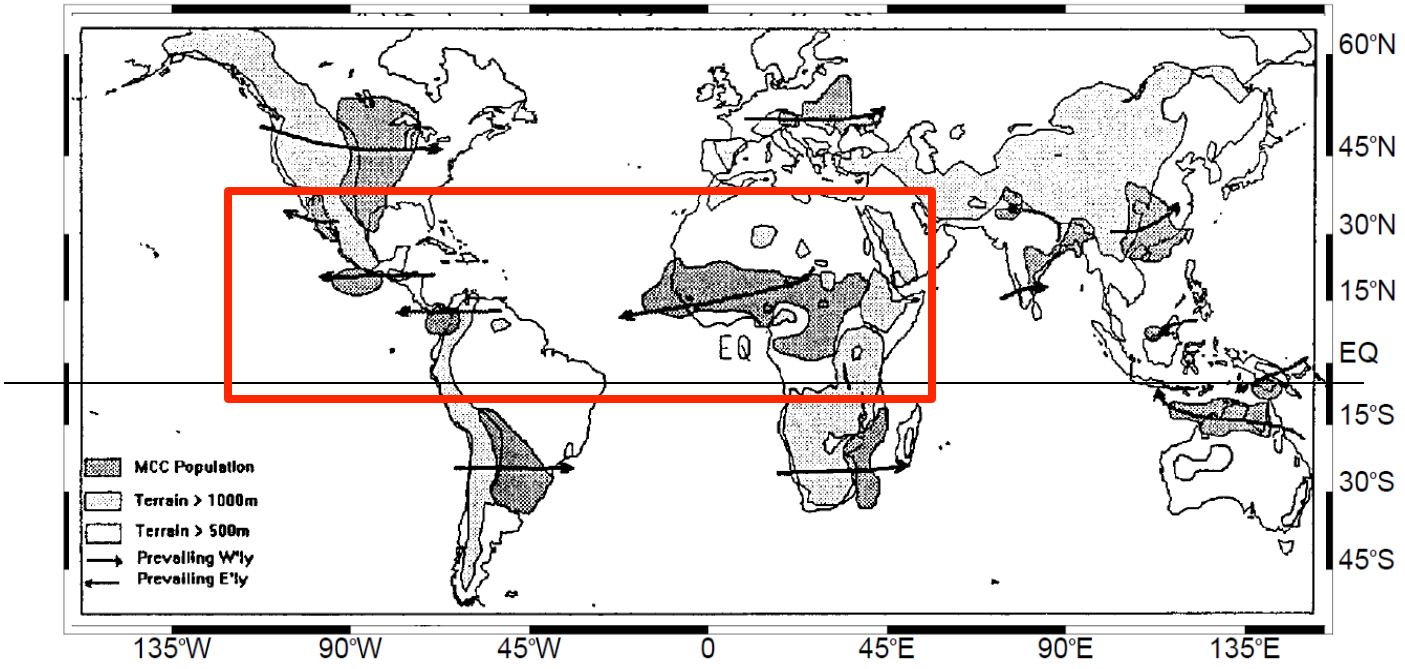
Manuel D. Zuluaga and Robert A. Houze, Jr.
University of Washington

Tropical and Midlatitude Convective Storm Systems and Their Roles in Weather and Climate II
AGU Fall Meeting
San Francisco, December 09, 2013

Objective

- Document the frequency of occurrence and characteristics of various types of extreme cloud phenomena
  - 15 years of summer (JJA) radar reflectivity and rain type from TRMM Precipitation Radar (version 7)
- Describe synoptic conditions leading to these forms of extreme convection
  - ECMWF ERA Interim reanalysis

Location of extreme events associated with MCC

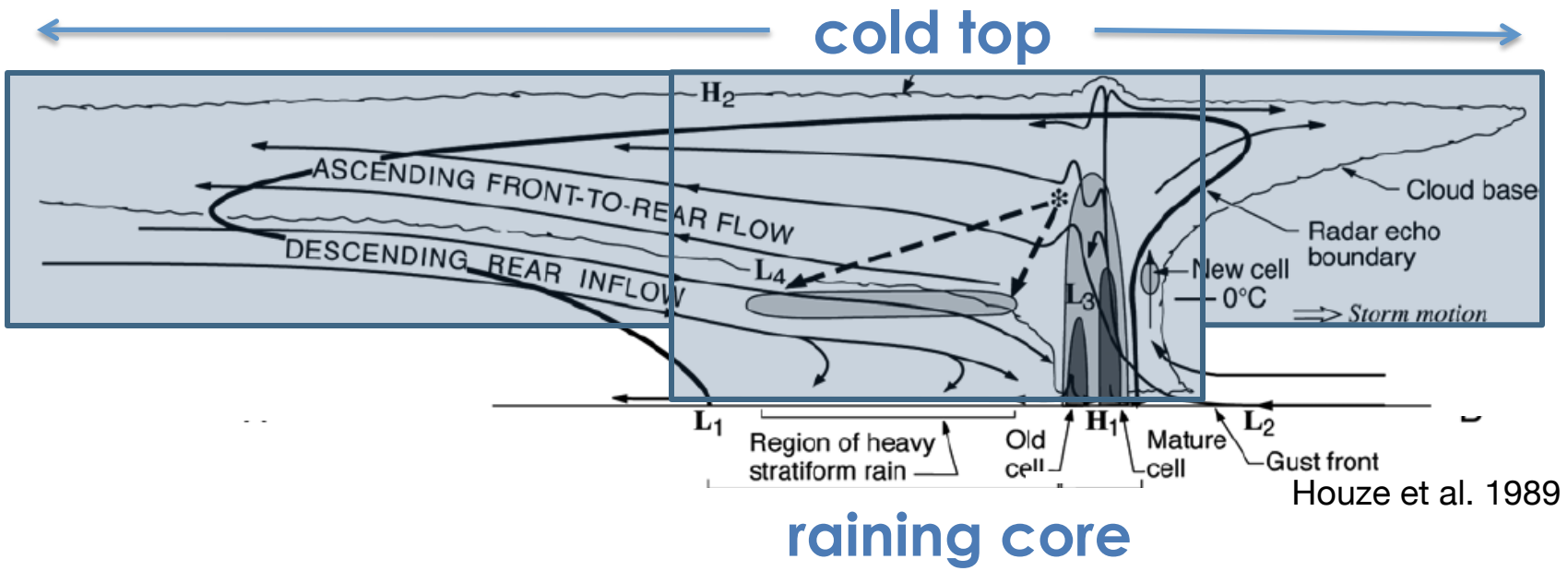


MCC population

Laing and Fritsch 1997

- Mesoscale convective complexes "hot spots" in specific locations around the world
- Studies have concentrated in North and South America, and the Asian Monsoon region.

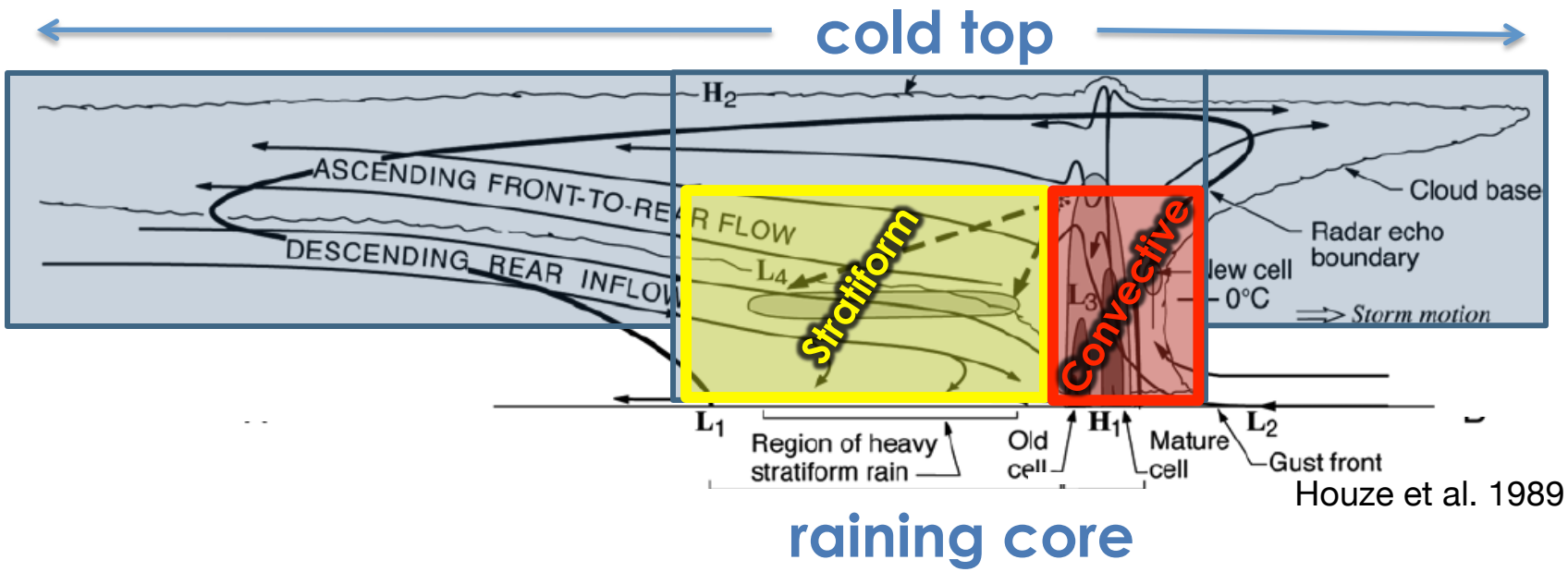
Identification of extreme convection



Houze et al. 1989

- Previous studies used IR or passive MW measurements to determine the climatology of extreme convection

Identification of extreme convection

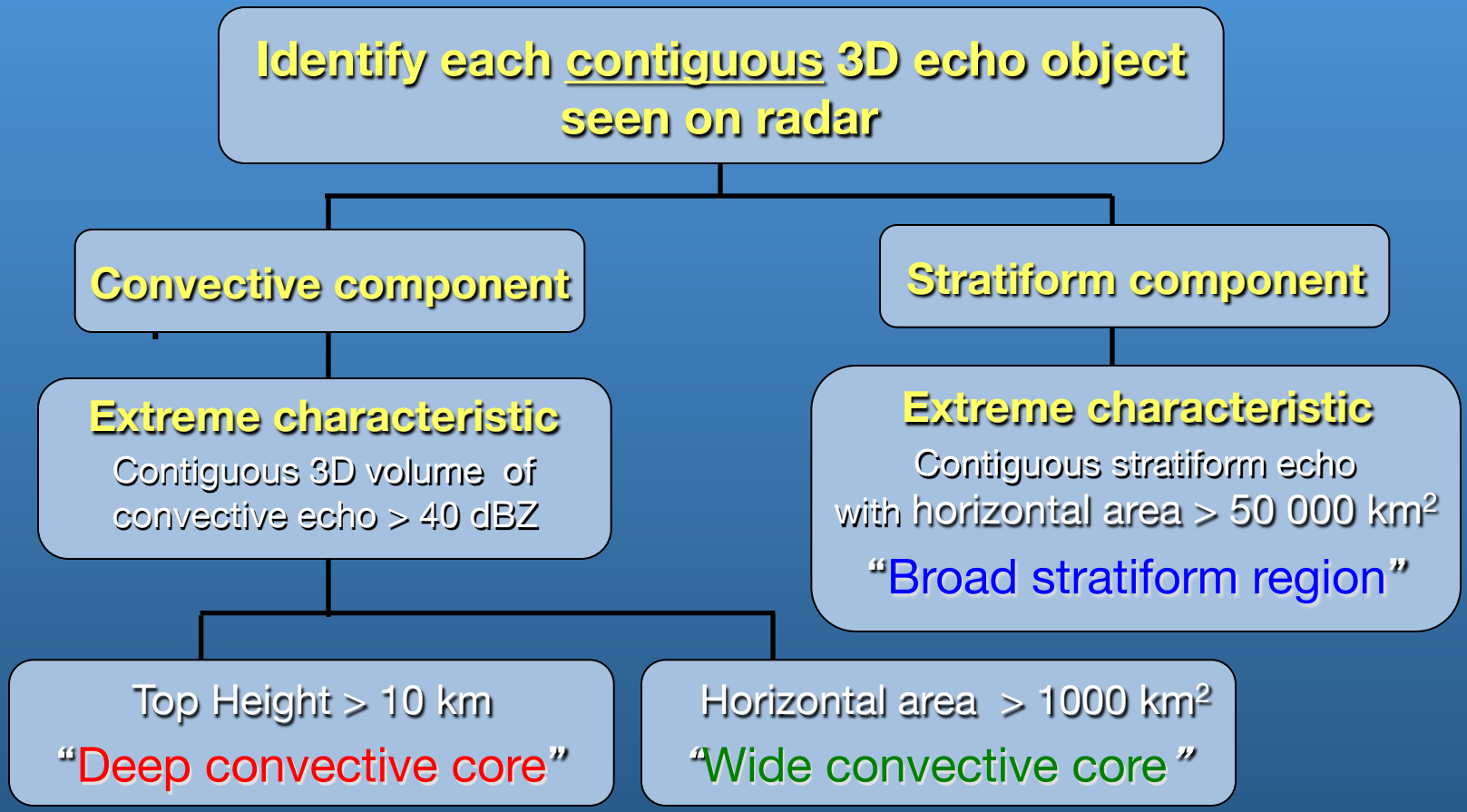


Houze et al. 1989

- Previous studies used IR or passive MW measurements to determine the climatology of extreme convection

- TRMM-PR used to analyze the three dimensional structure and rain type separation

TRMM PR objective identification



Houze et al. 2007; Romatschke et al. 2010, Romatschke and Houze 2011; Barnes and Houze 2013; Zuluaga and Houze 2013

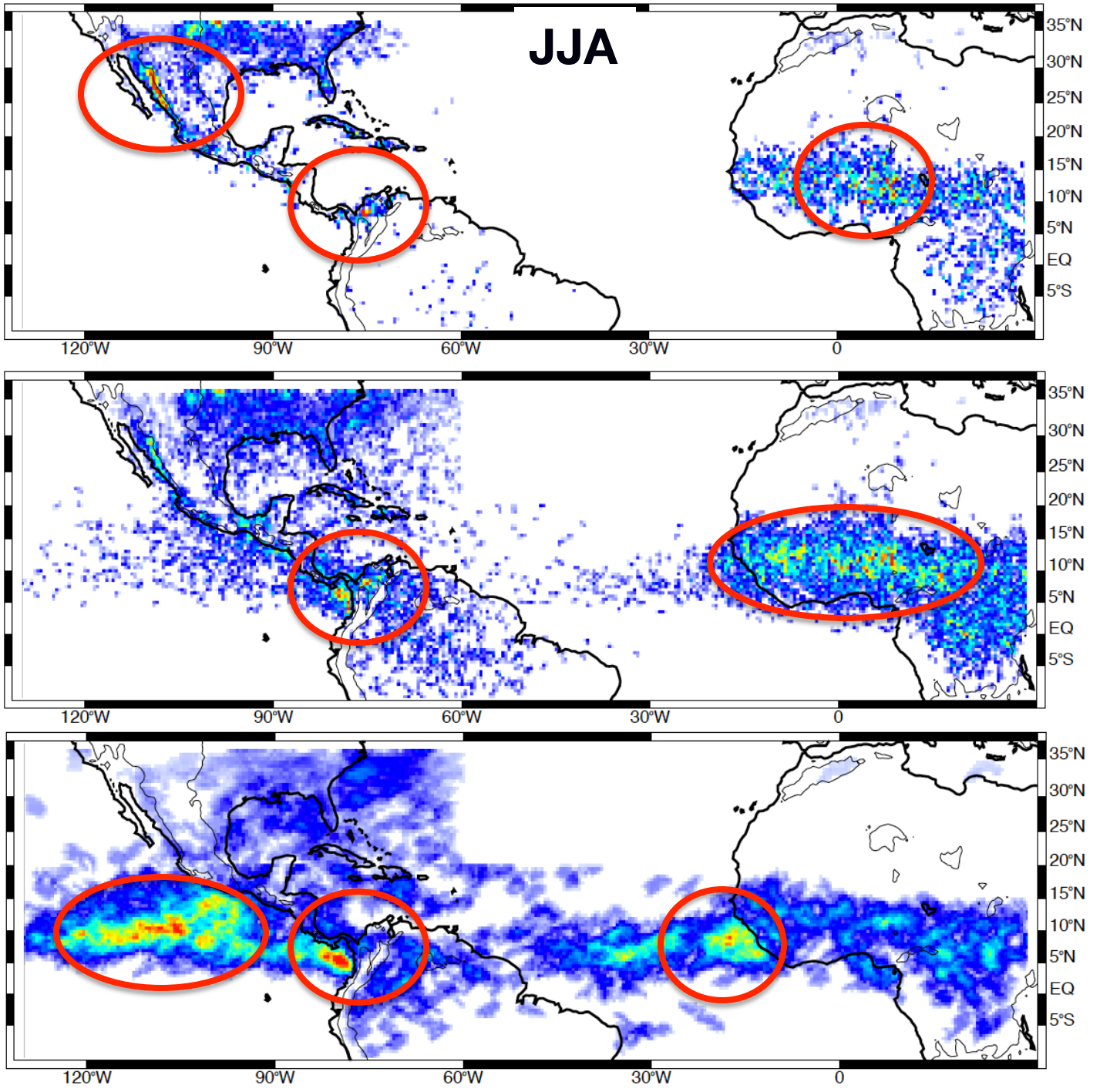
Spatial distribution of
extreme convective elements

America and Africa

Deep Convective Cores

Wide Convective Cores

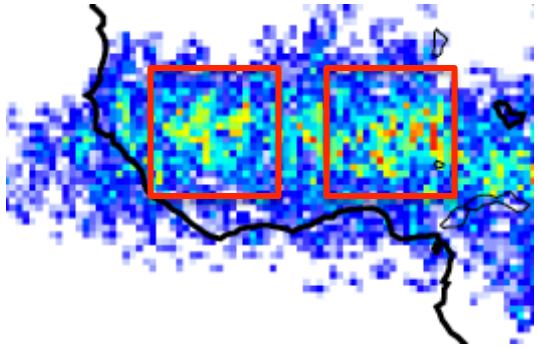
Broad Stratiform Regions



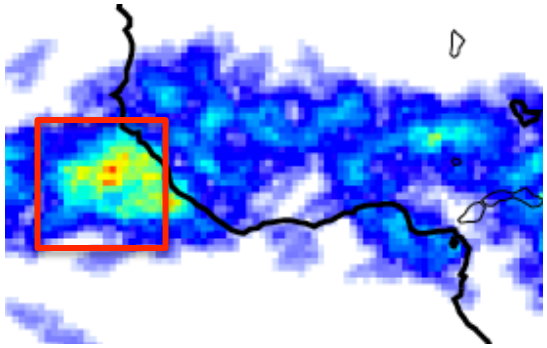
Environmental conditions during the occurrence of extreme convective elements

Africa and East Atlantic

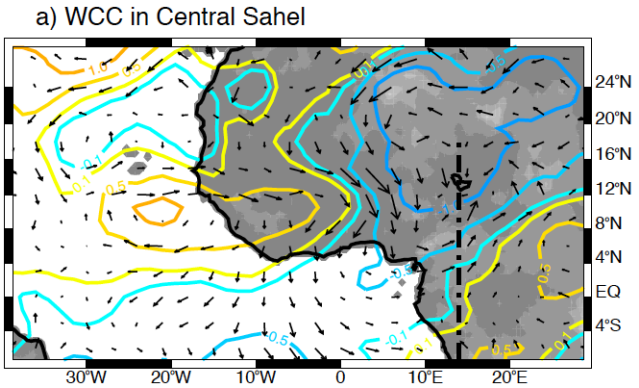
Wide Convective Cores

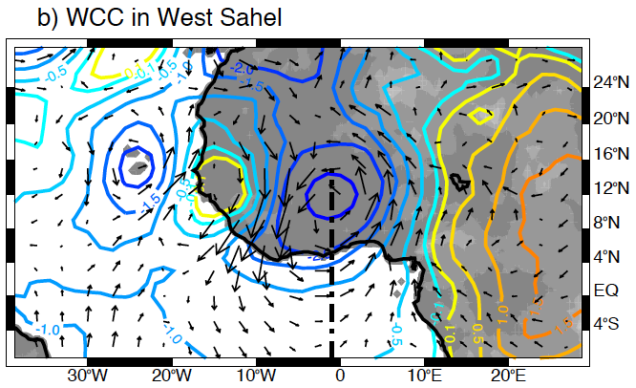


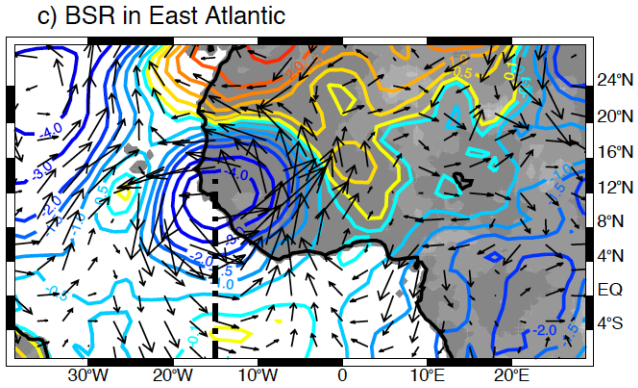
Broad Stratiform Regions

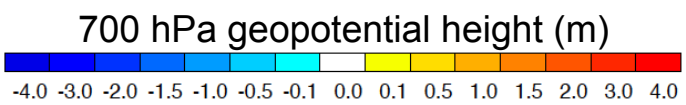


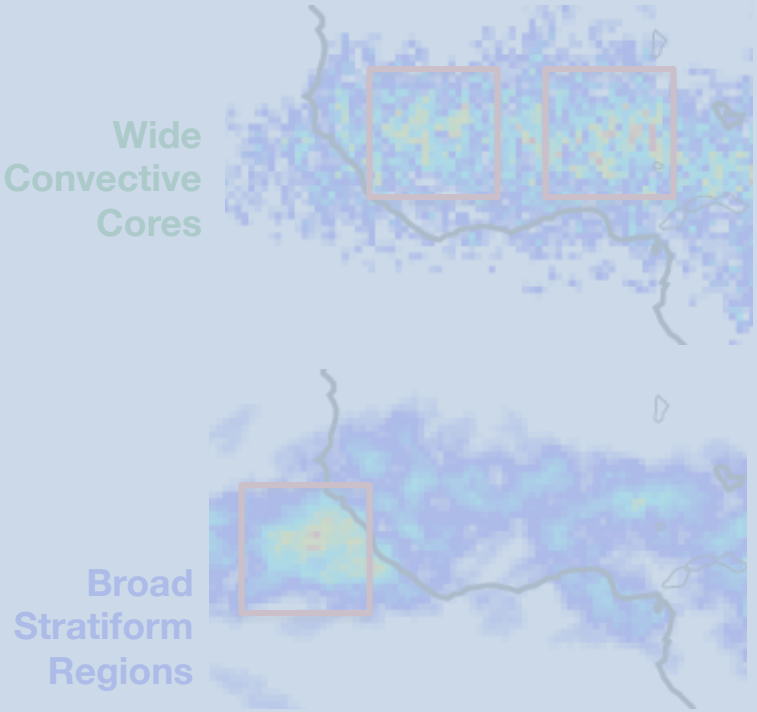
Composite 700 hPa geopotential height and wind vector anomalies





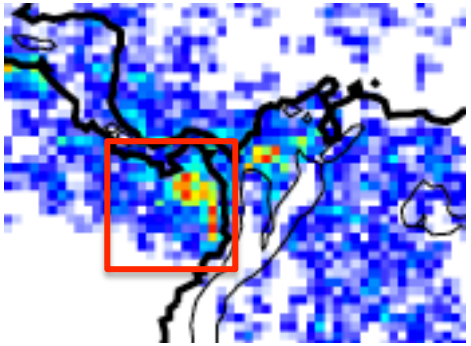




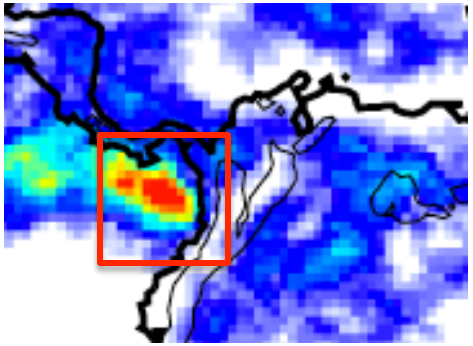


Colombia and Panama Bight

Wide Convective Cores

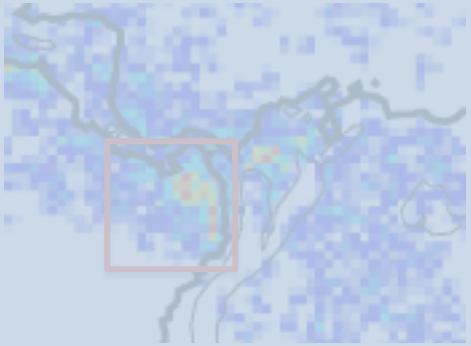


Broad Stratiform Regions

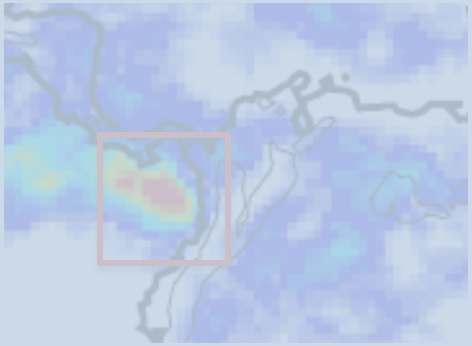


Colombia and Panama Bight

Wide Convective Cores

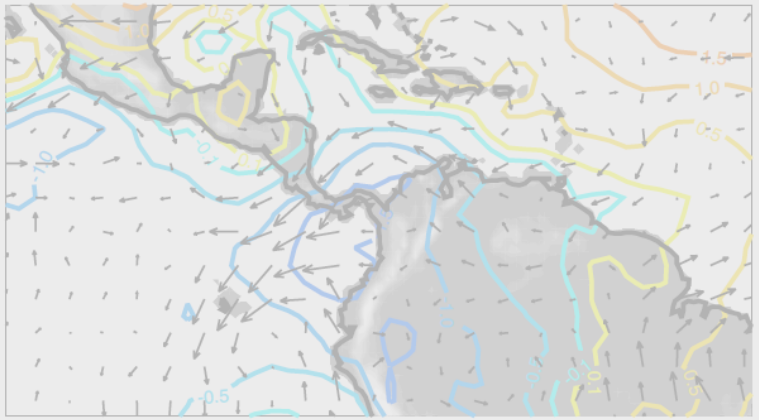


Broad Stratiform Regions

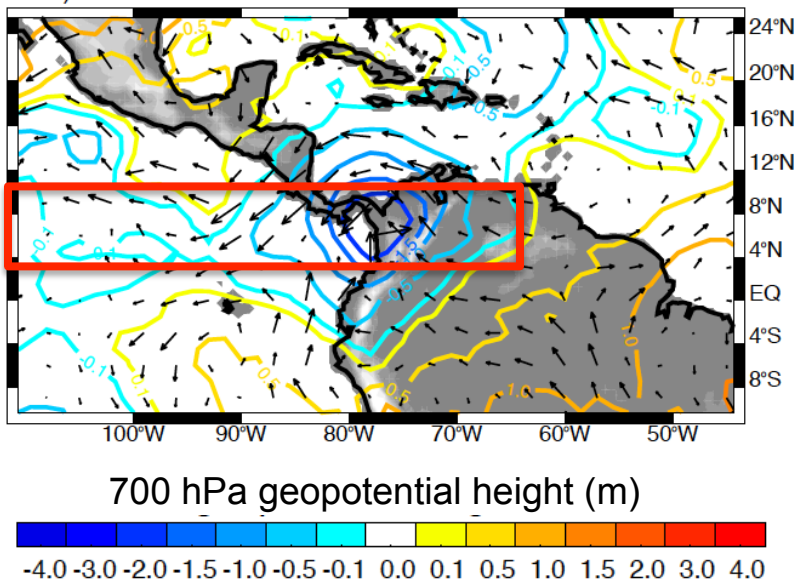


Composite 700 hPa geopotential height and wind vector anomalies

a) Hour -12

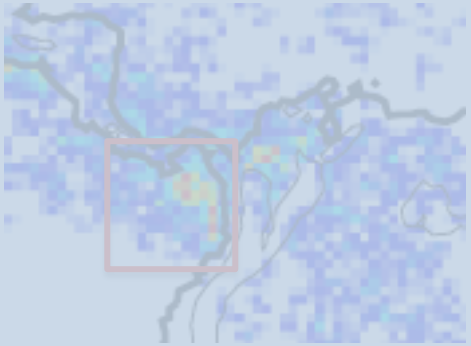


b) Hour 0

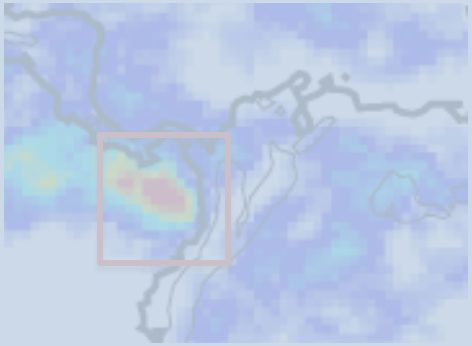


Colombia and Panama Bight

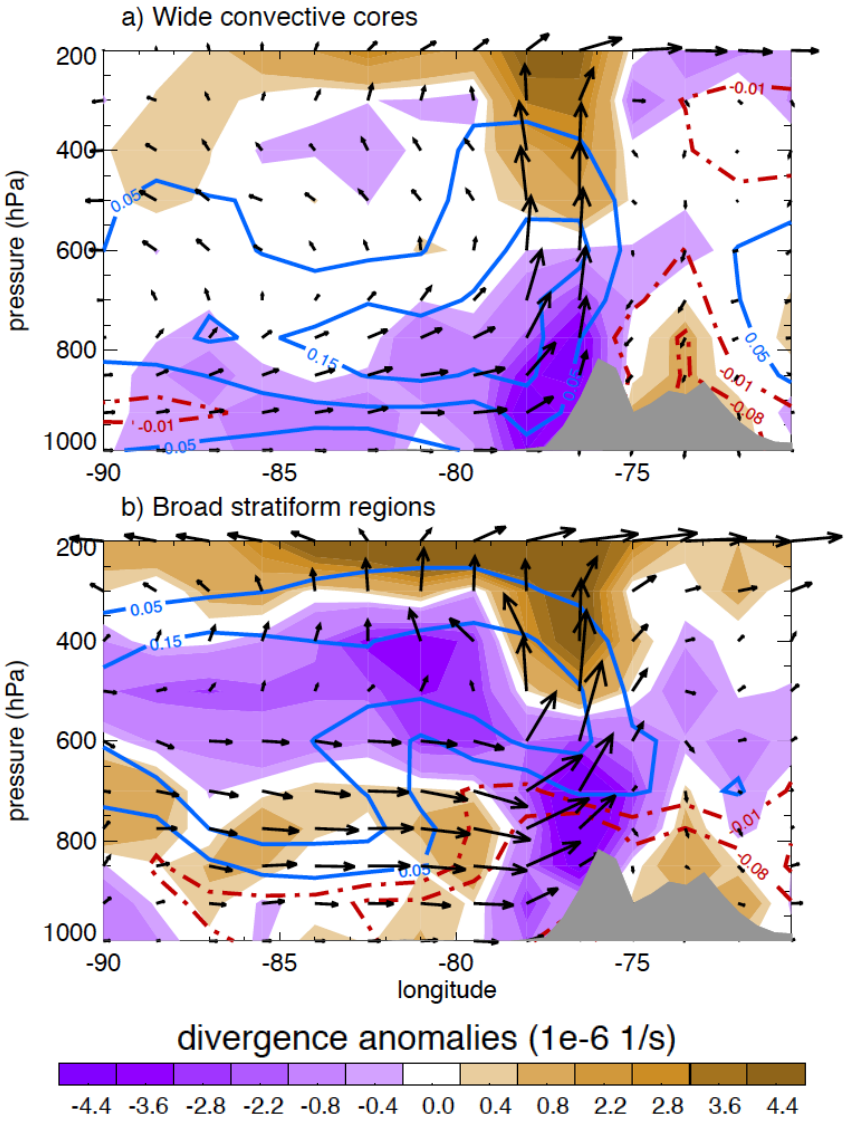
Wide Convective Cores



Broad Stratiform Regions



Latitudinal-averaged composites of divergence, humidity and zonal-vertical wind vector anomalies



Conclusions

- Identified forms of extreme convection over the tropical belt including the East Pacific Ocean, Central and South America, Atlantic Ocean, and North Africa

- Over equatorial Africa and East Atlantic ocean:
  - Extreme events were widely zonally distributed
  - African Easterly Waves strongly affect the distribution of extreme events

- Over equatorial America:
  - Extreme events tend to be concentrated in confined regions
  - Controlled by significant topographic features

This research was supported by:
NASA grants NNX13AG71G, NNX10AH70G,
DOE grant DE-SC0008452, and NSF grant
AGS1144105

Wednesday, December 11 in the afternoon session

H33E-1426. TRMM precipitation analysis of extreme storms in South America: Bias and climatological contribution

Kristen L. Rasmussen and coauthors

This research was supported by:
NASA grants NNX13AG71G, NNX10AH70G,
DOE grant DE-SC0008452, and NSF grant
AGS1144105