Extreme convection of the tropical belt between America and Africa:

Diurnal Variations and Climatological Rainfall Contribution

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Convection II
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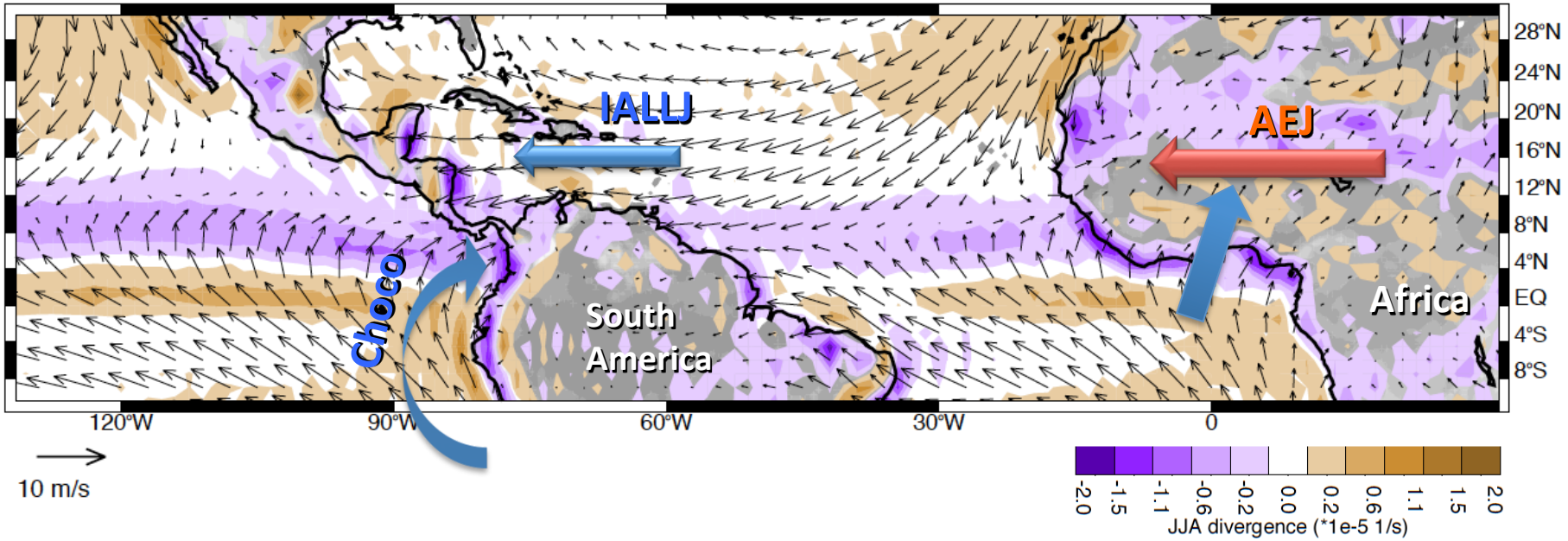
JJA Divergence and Wind climatology

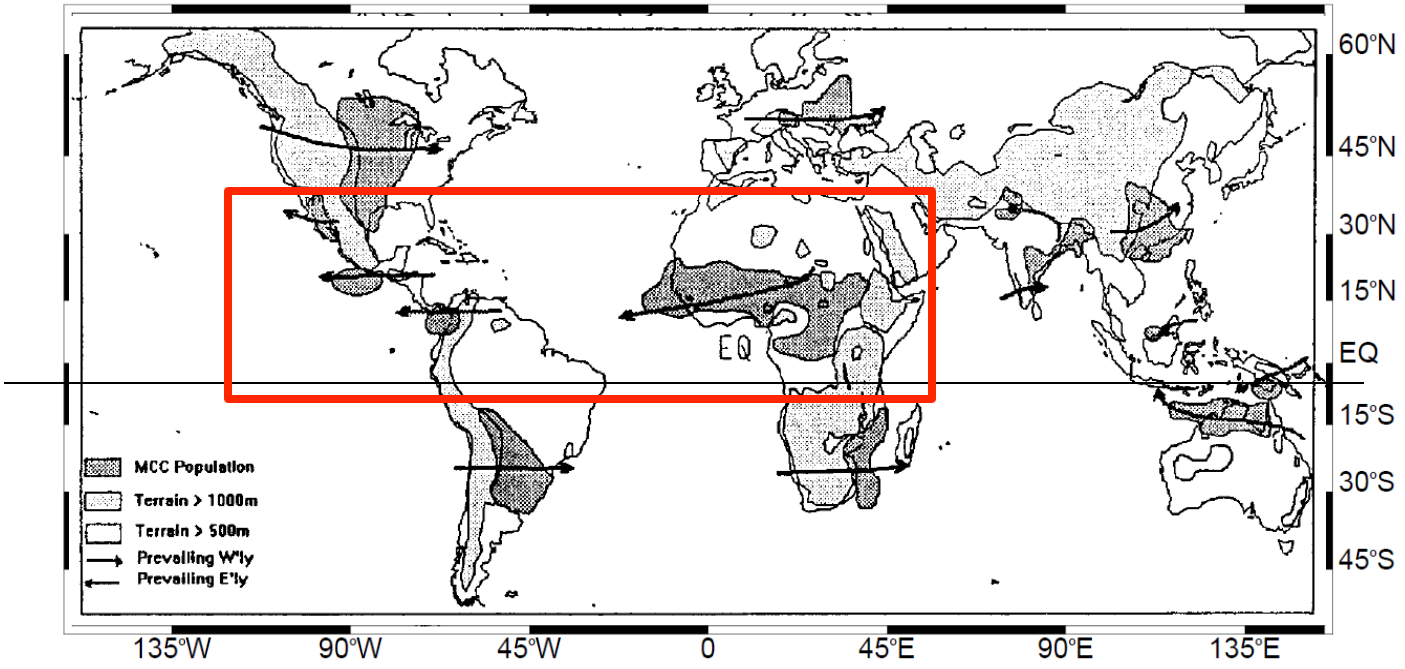
Surface - ERA Interim



- Region where the ITCZ intersects Africa and America landmasses

- Extreme convection is affected by local convergence: African Easterly Jet, Intra-Americas Jet, and the Chocó low-level Jet. Monsoonal flow

Location of extreme events associated with MCC

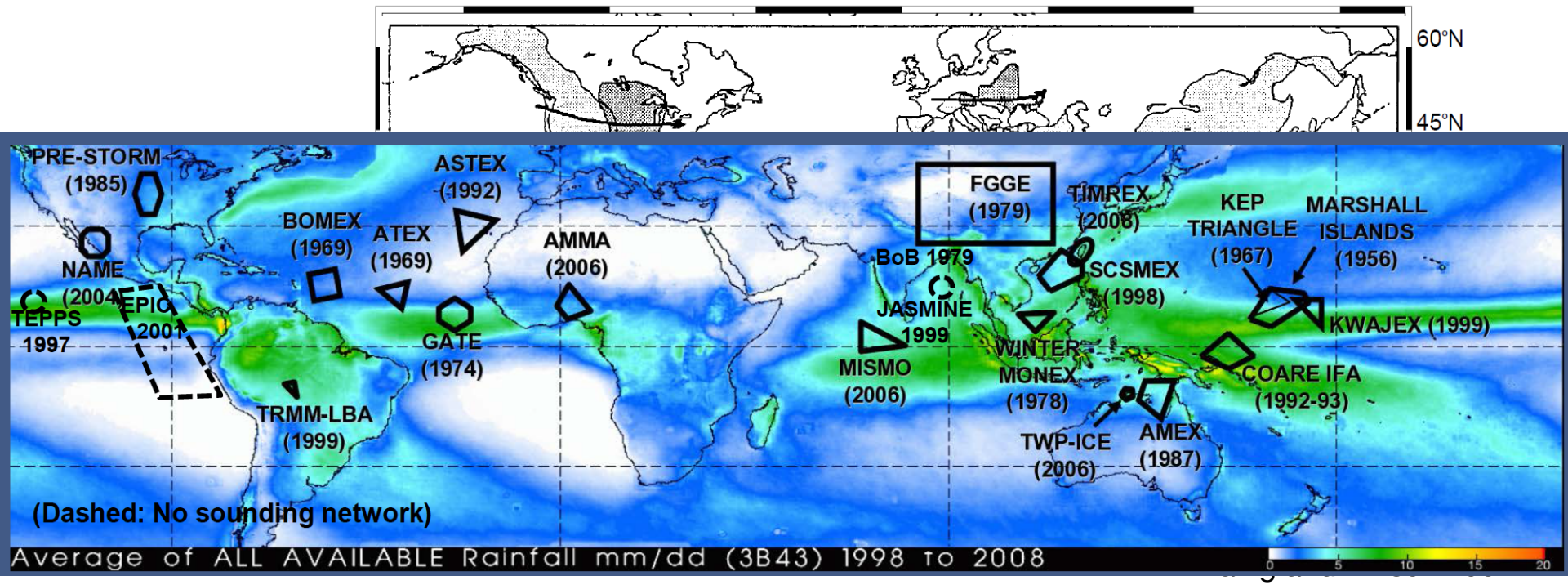


MCC population

Laing and Fritsch 1997

- Tropical America and Africa are favored location for mesoscale convective complexes, which include the largest and most intense convective systems

Location of extreme events associated with MCC



- Tropical America and Africa are favored location for mesoscale convective complexes, which include the largest and most intense convective systems

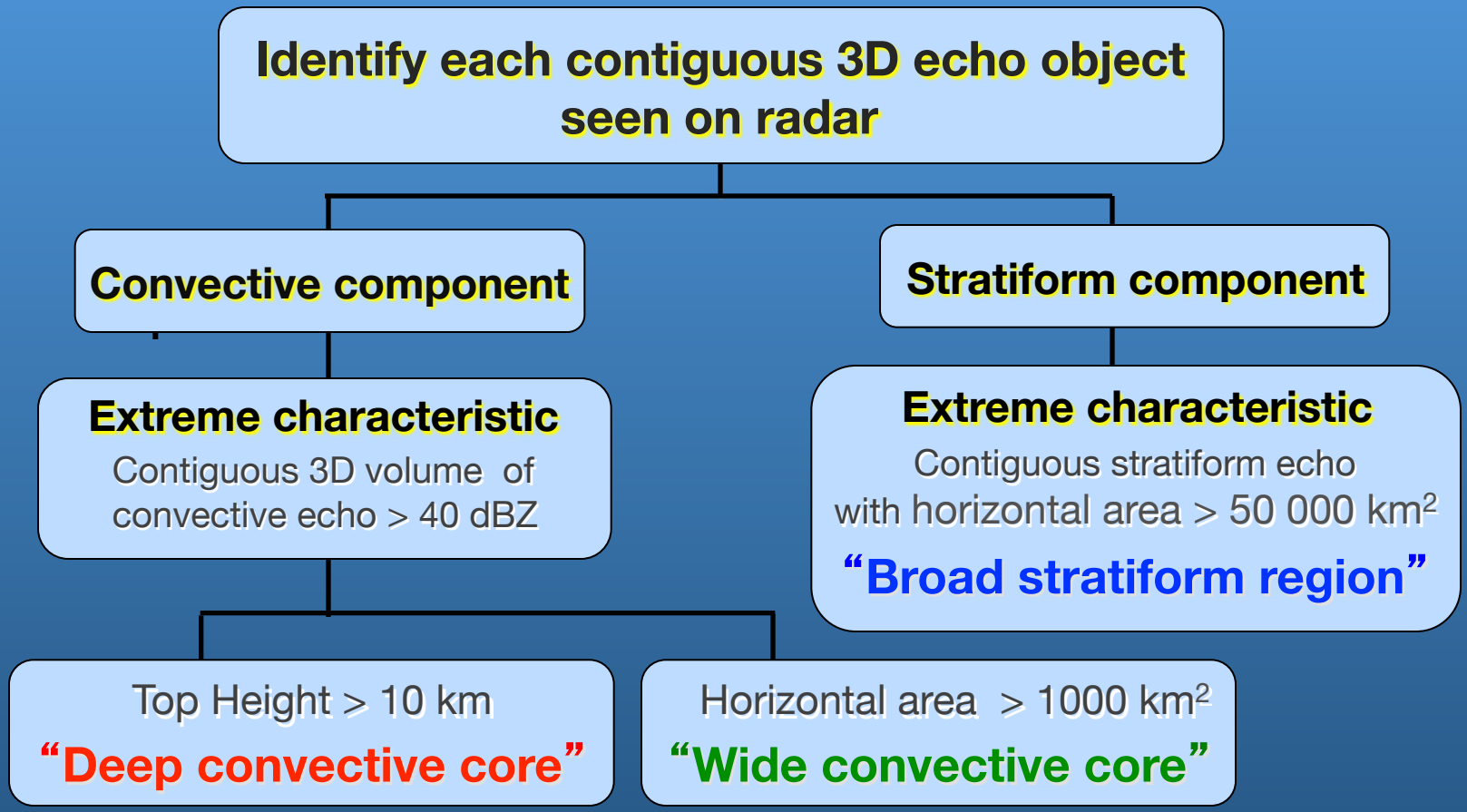
- Studies have concentrated in different regions around the world, but not much for Meso-America

Objective

- Document the frequency of occurrence of various types of extreme cloud phenomena, describing the diurnal cycle
  - 15 Years of June-July-August radar reflectivity, and rain type from the TRMM Precipitation Radar (version 7)

- Describe their climatological rainfall contribution
  - Traditional *Z*-*R* relationship to estimate precipitation (Rasmussen et al. 2013)

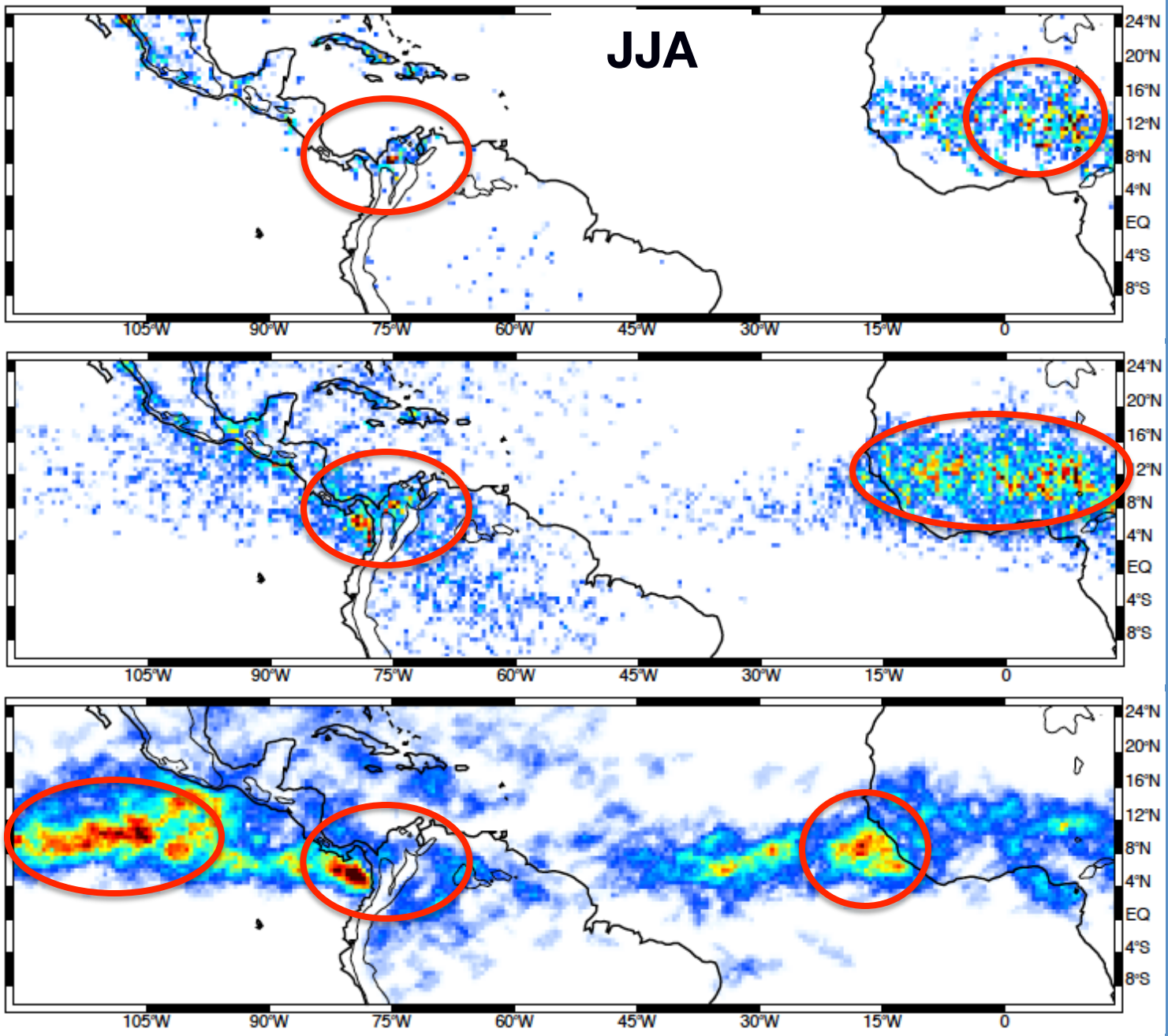
TRMM PR objective identification



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

TRMM-PR probabilities



Zuluaga and Houze, 2014.

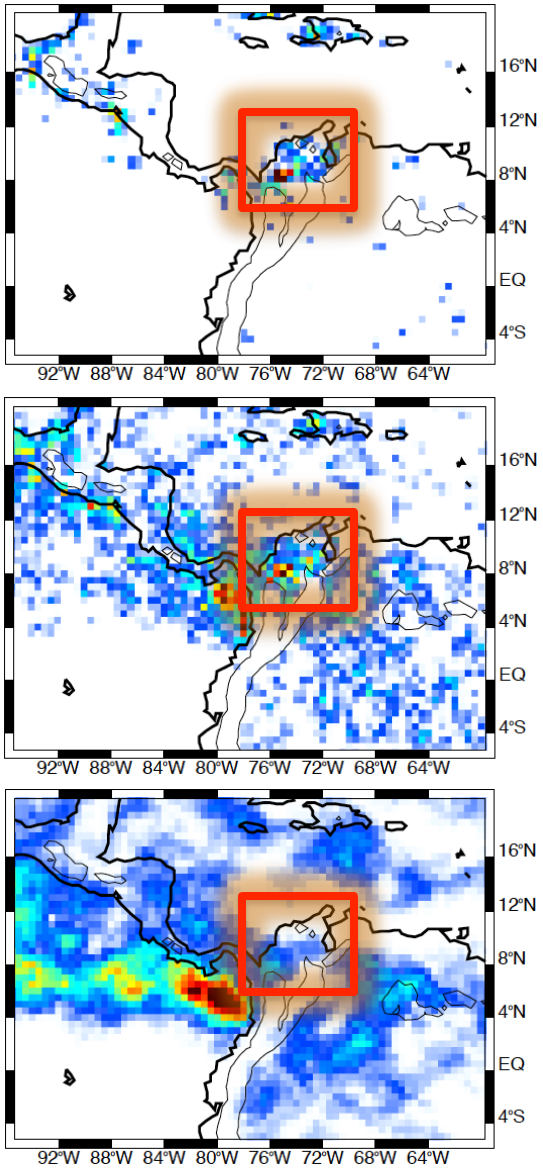
Diurnal cycle of extreme convective elements over the American and Africa sectors

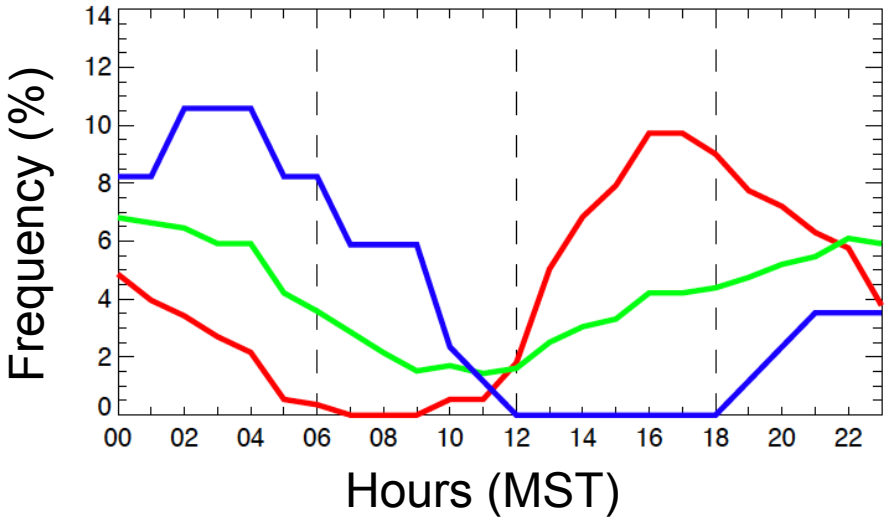
Diurnal cycle in the Northern Colombia

Deep Convective Cores

Wide Convective Cores

Broad Stratiform Regions

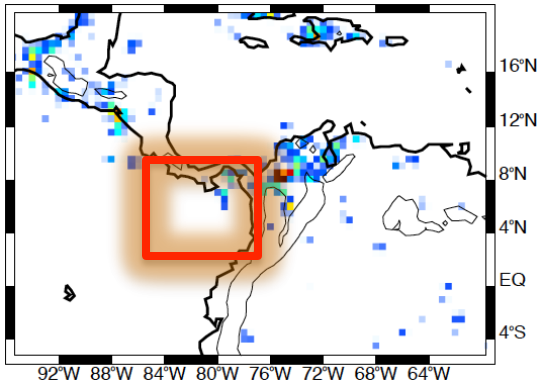




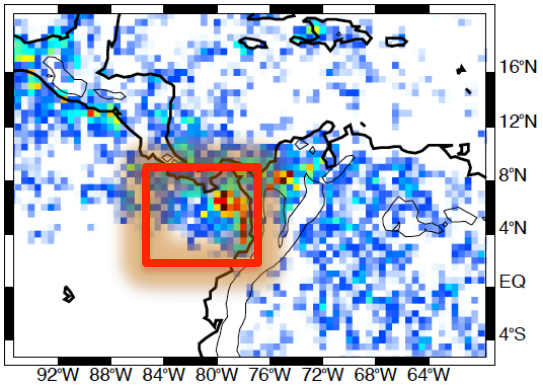
- Sequence of convective elements peaking:
  - DCC late afternoon
  - WCC mid-night
  - BSR early morning
- Similar cycle for Sahel region in Africa

Diurnal cycle in the Colombian coast

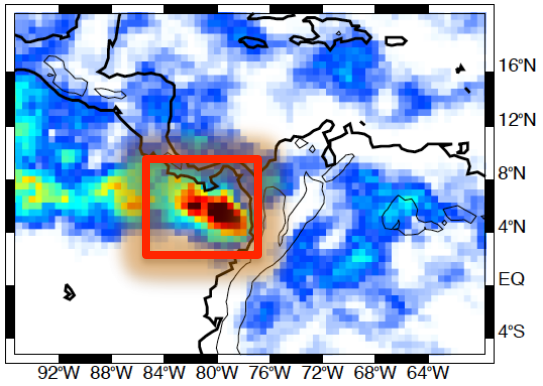
Deep Convective Cores

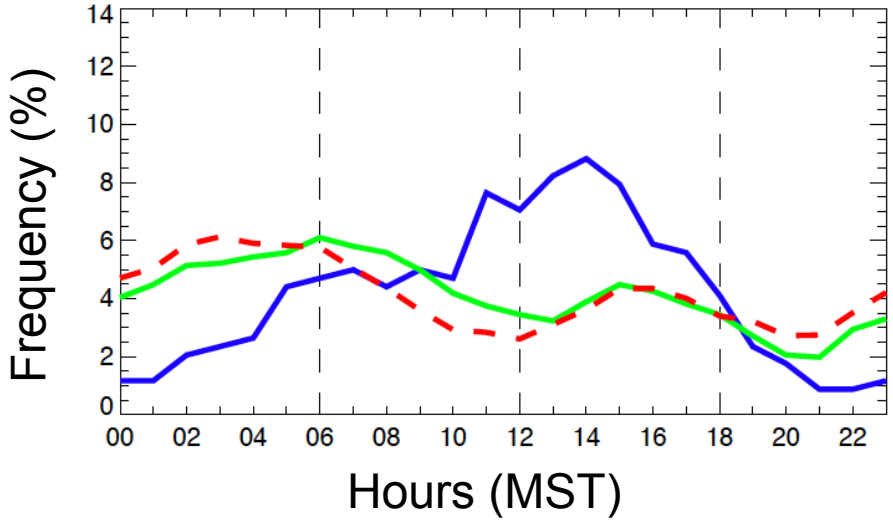


Wide Convective Cores



Broad Stratiform Regions

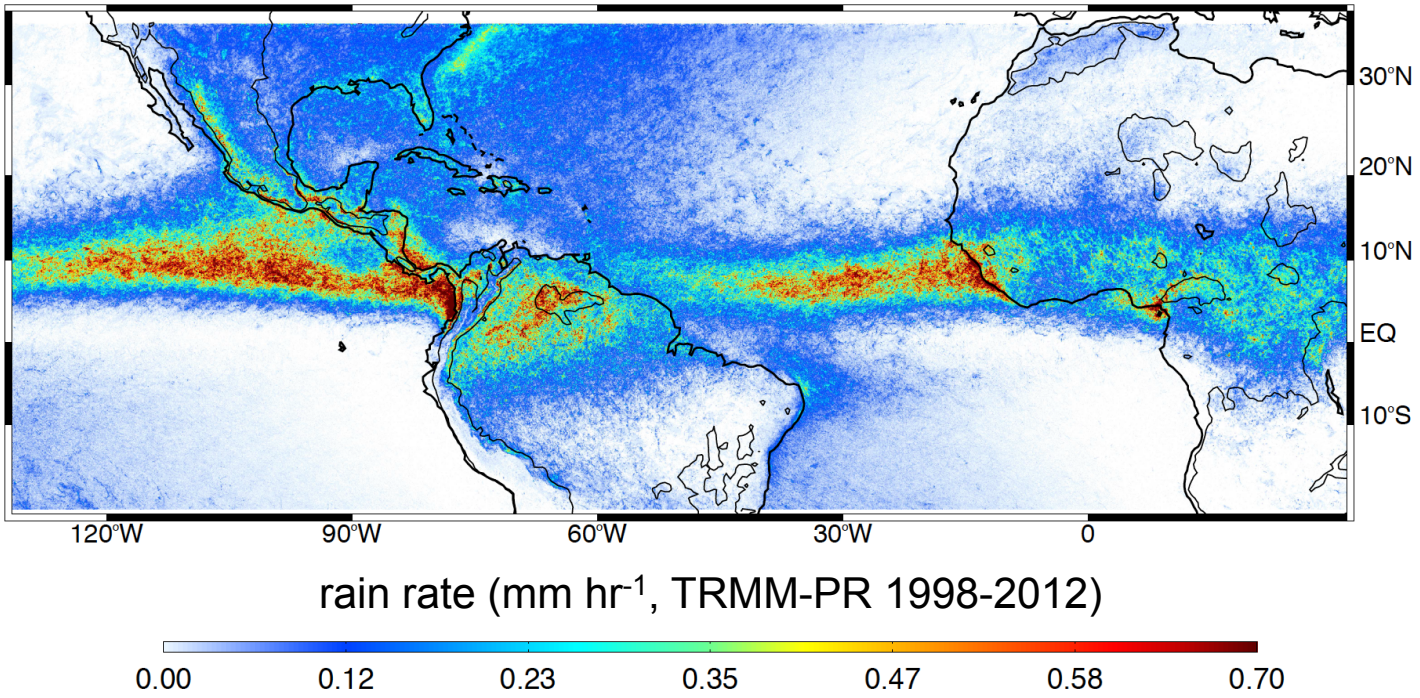




- Sequence of convective elements peaking:
  - **DCC after mid-night**
  - **WCC early morning**
  - **BSR mid-day**
- Consistent with the synoptic conditions during their occurrence
- Similar for the East Atlantic region

Climatological rainfall contribution of extreme convective elements

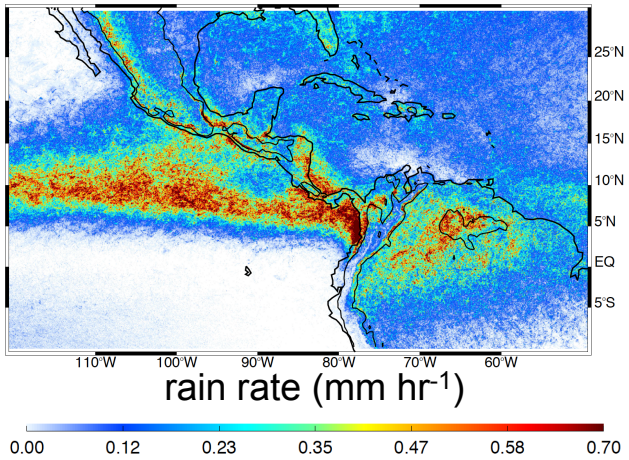
TRMM PR - JJA rainfall climatology



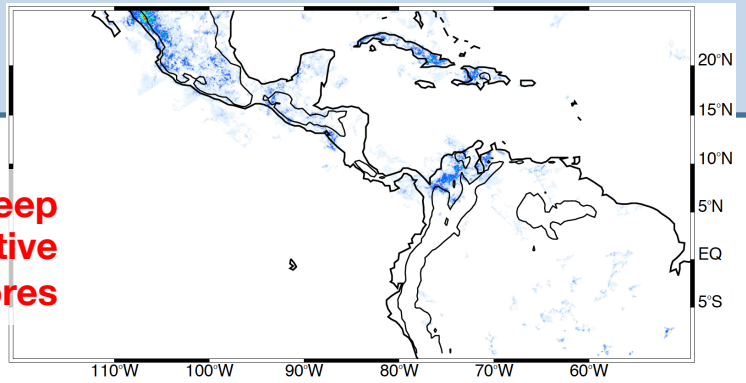
What percentage of the climatological rain rate is produced by extreme events?

TRMM rainfall contribution by storm type

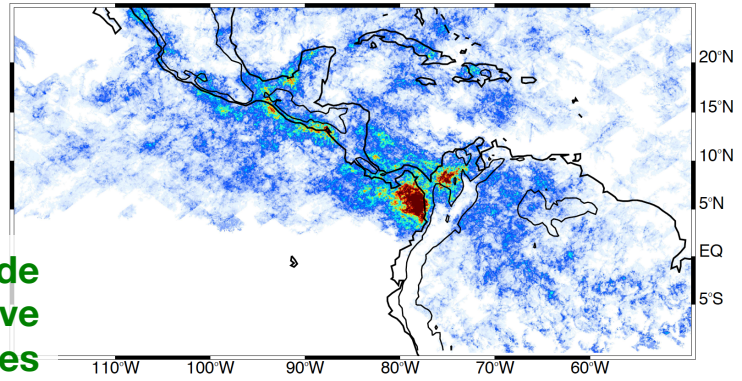
JJA TRMM rain rate climatology



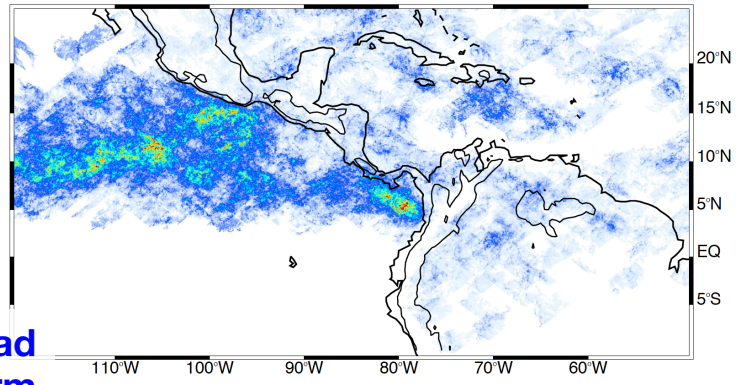
Deep Convective Cores

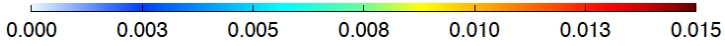


Wide Convective Cores



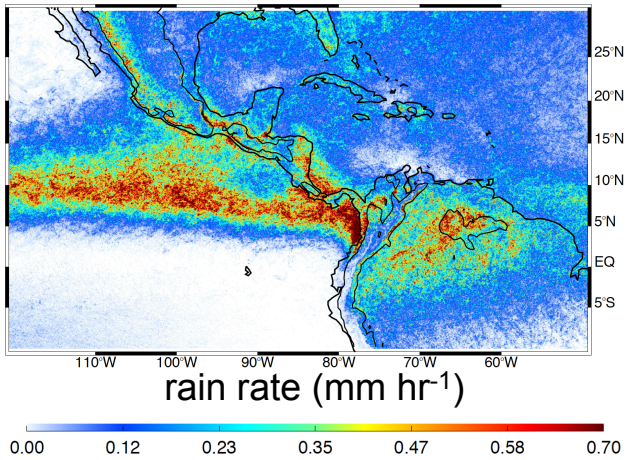
Broad Stratiform Regions



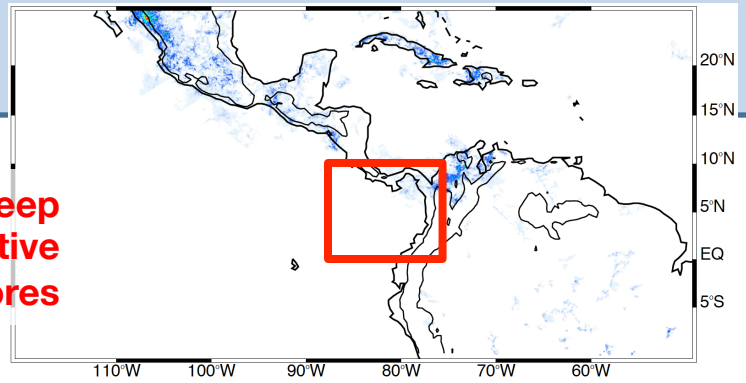


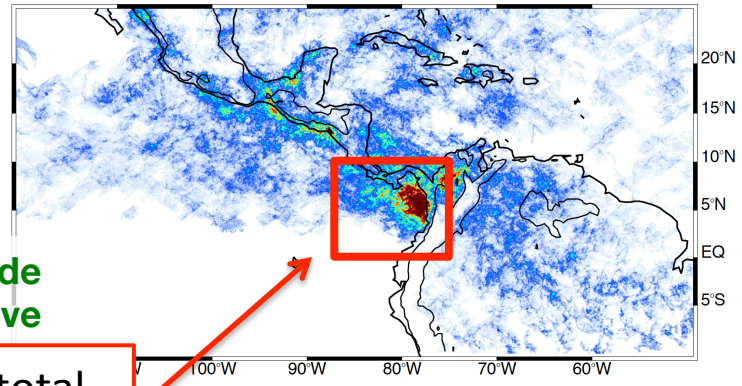
TRMM rainfall contribution by storm type

JJA TRMM rain rate climatology

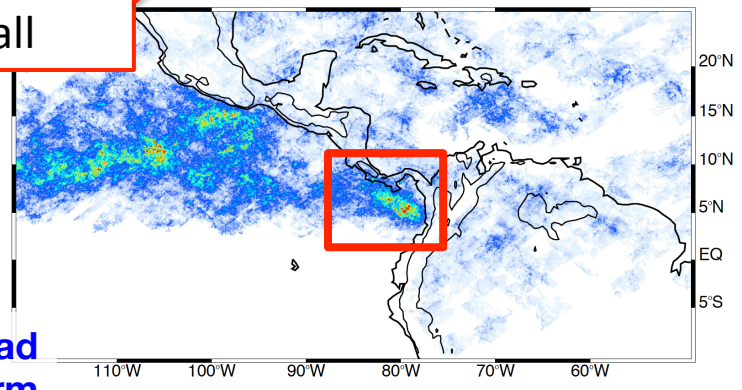


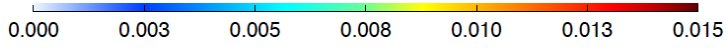
- Contribution of extreme categories in Colombian Coast: ~42%





30% of total rainfall





TRMM rainfall contribution by storm type

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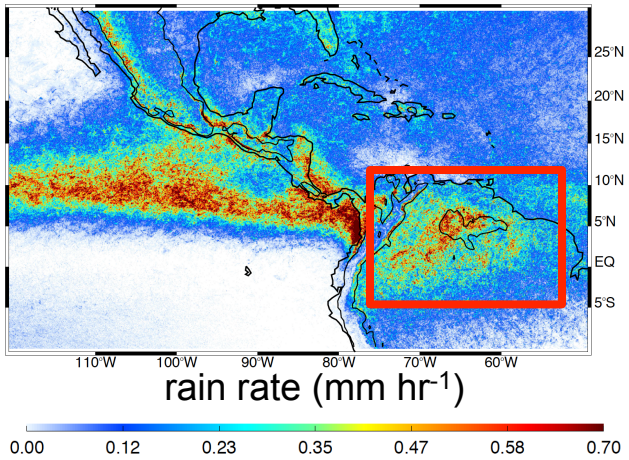
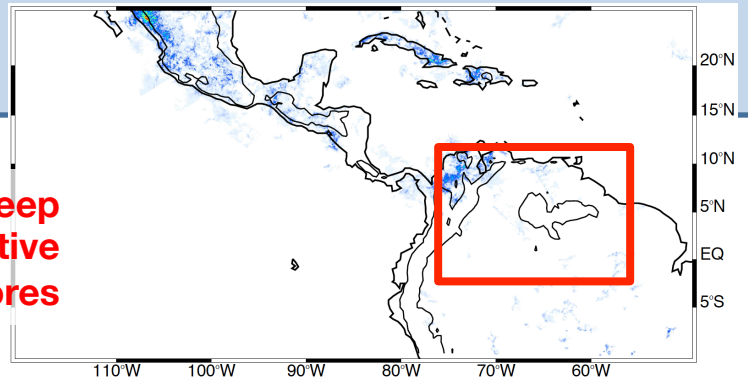


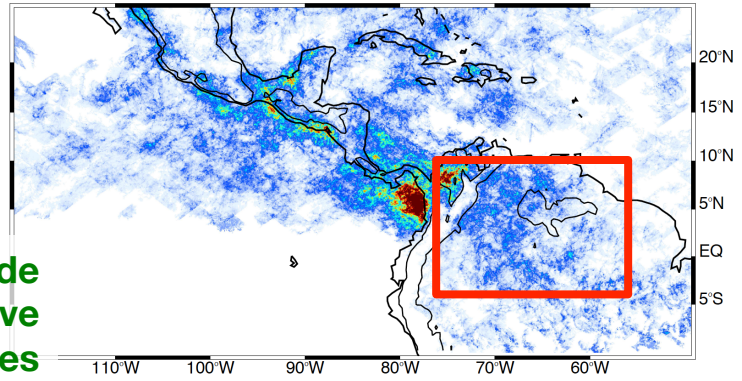
- Contribution of extreme categories in Colombian Coast: ~42%

- Not a large contribution from storms containing extreme categories over the Orinoco and Amazon basins

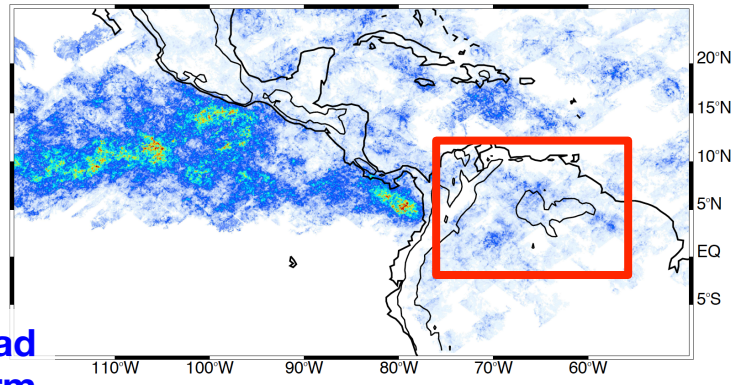
Deep Convective Cores

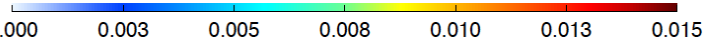


Wide Convective Cores

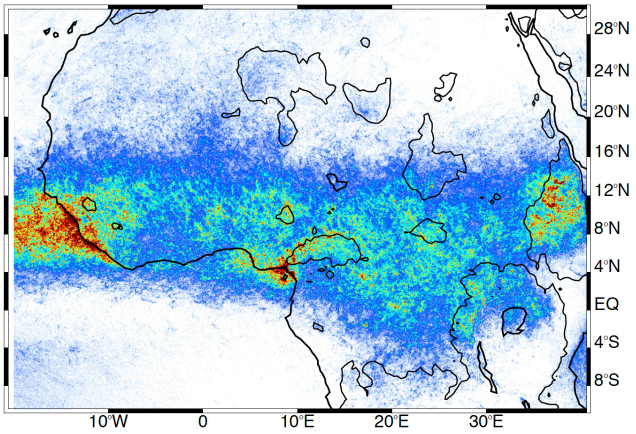


Broad Stratiform Regions



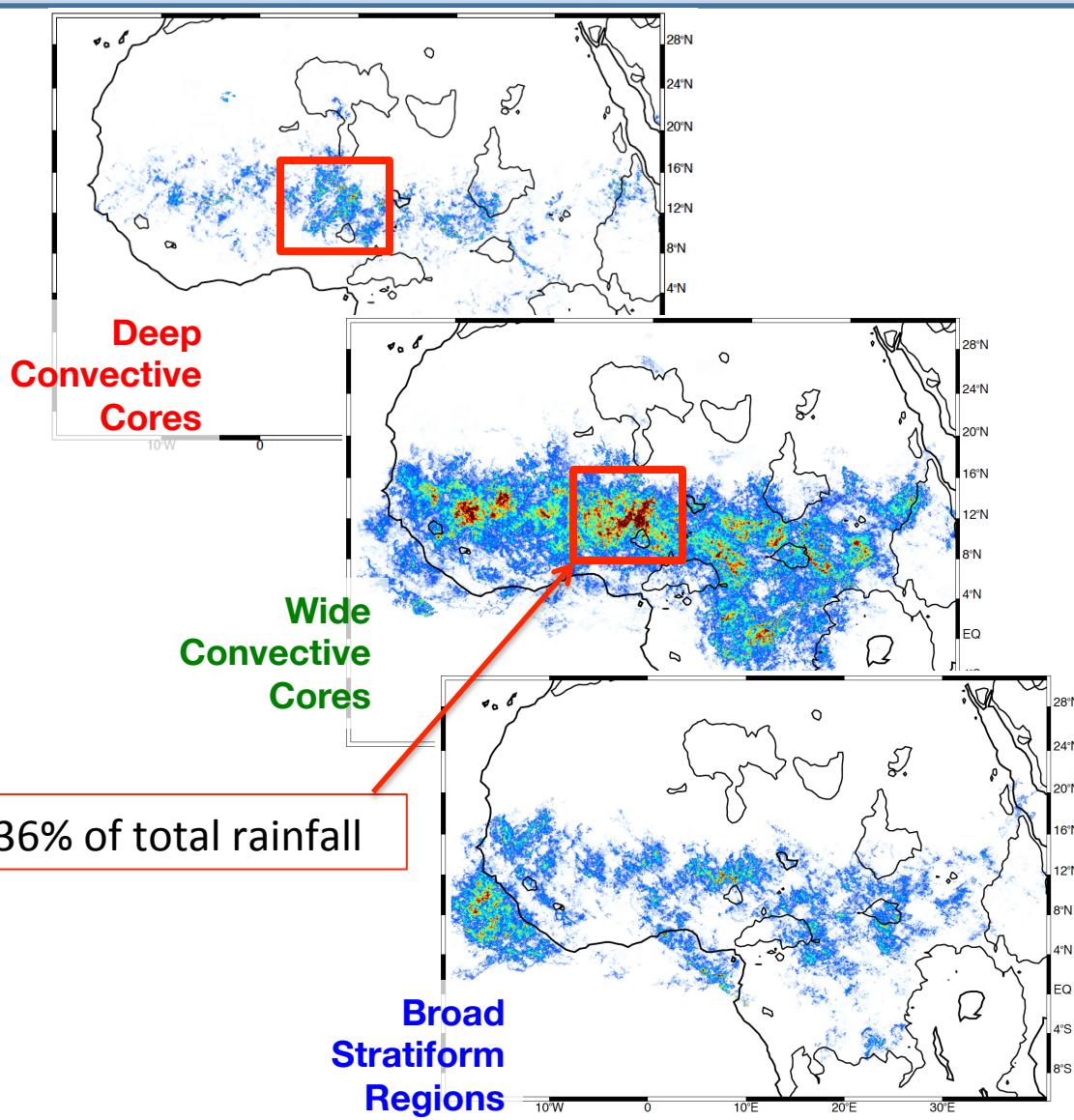


JJA rainfall climatology



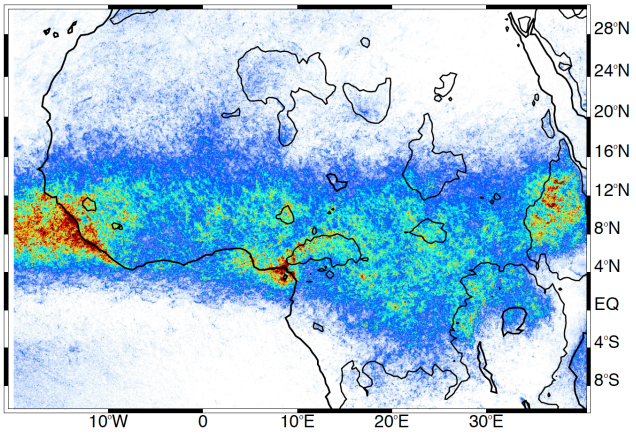
- Contribution of convective categories to the total warm season rainfall: ~ 47%

TRMM rainfall contribution by storm type



Rasmussen et al. in prep.

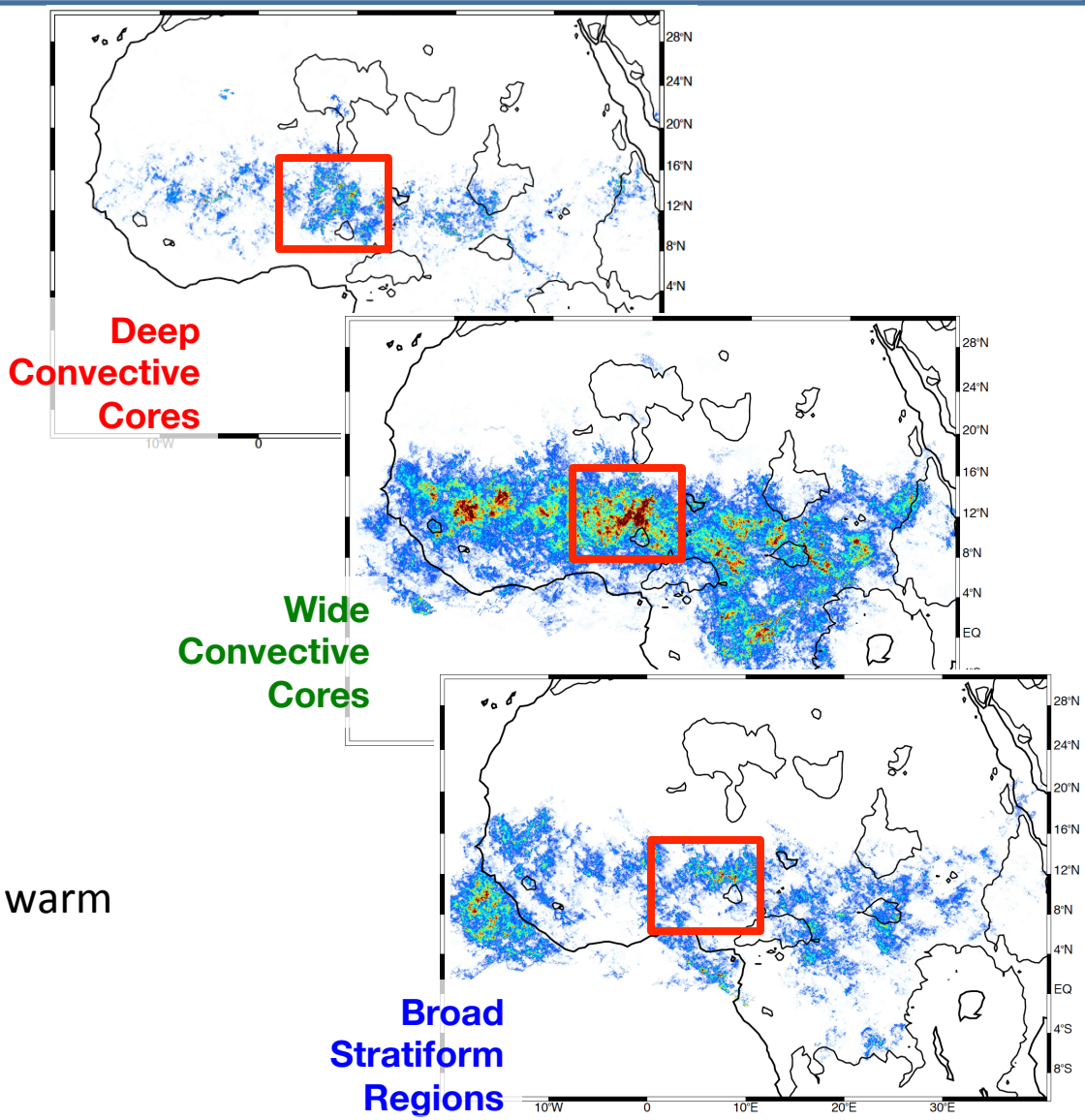
JJA rainfall climatology



- Contribution of convective categories to the total warm season rainfall: ~ 47%

- Including BSR, ~ 58% of the total warm season rainfall

TRMM rainfall contribution by storm type



Rasmussen et al. in prep.

Conclusions

- The occurrence of storms containing:
  - **Deep Convective Cores** are highly probable over continental regions, with a pronounced peak in frequency late in the afternoon, they are rare over oceans. Not significant in climatological rainfall contribution
  - **Wide Convective Cores** are located in the same regions as DCC over land, with a broader peak in frequency from mid-night to early morning. Significant rainfall contribution in regions affected by these type of storms
  - **Broad Stratiform Regions** are most frequent over the ocean, with less diurnal variation. Have important rainfall contribution, especially for events occurring over the ocean
- Systematic behavior of diurnal frequencies, DCC echoes preceding WCC, and WCC preceding BSR

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