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Extreme Convection of the Near-equatorial Americas, Africa, and Adjoining Oceans as Seen by TRMM: Climatological rainfall contribution

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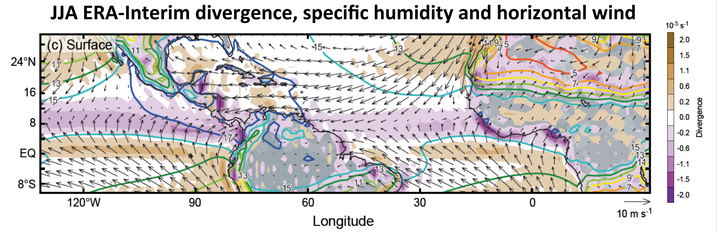
Introduction

JJA ERA-Interim divergence, specific humidity and horizontal wind



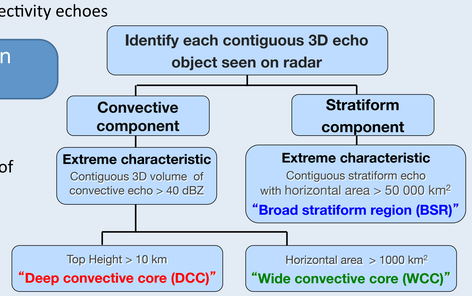
- The continents of America and Africa intersect the ITCZ, and the nature of convection over these landmasses differs distinctly from that of the oceanic ITCZ
- Convective storms over both land and ocean exhibit a variety of forms, engendered by different synoptic conditions and diurnal variability
- In this study we employ data from the Tropical Rainfall Measuring Mission (TRMM) satellite to identify different forms of extreme convection and analyze their contribution to the climatological rainfall in this region of the world

Data and methodology

- Use of TRMM 2A25 and 2A23 version 7 datasets for June-July-August from 1998-2012
- Interpolated attenuation-corrected reflectivity and rain-type classification separating convective and stratiform reflectivity echoes

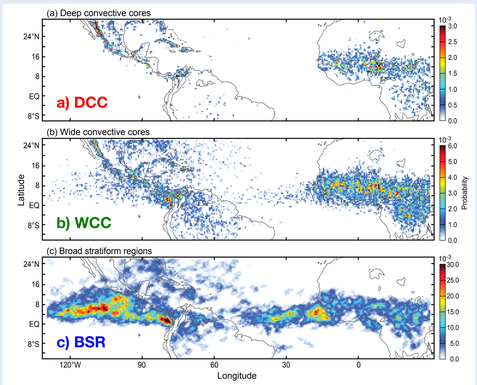
Objective identification technique

- Identify convective and stratiform echo events that develop extreme characteristics of intensity, height and horizontal extent (Houze et al. 2007; Romatschke and Houze 2010; Barnes and Houze 2013; Zuluaga and Houze 2013)



- A storm is defined as the region surrounding each echo core with contiguous reflectivity values greater than zero

Spatial distribution of extreme echo events

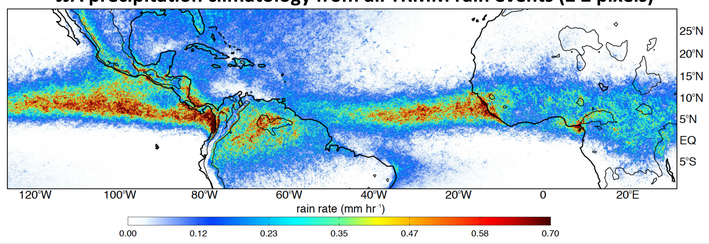


Spatial distribution of the probability of a location being under a (a) DCC, (b) WCC, and (c) BSR region during the months JJA of 1998-2012

- Storms with DCC are located exclusively over land, characterized by young and intense convective cells
- Storms with WCC are located in the same places as DCC but also extend to the oceans, characterized by mesoscale aggregation into MCS
- Storms with BSR mostly distributed over the ocean and near coastal monsoonal regions, characterized by final and more mature states of MCS life cycle

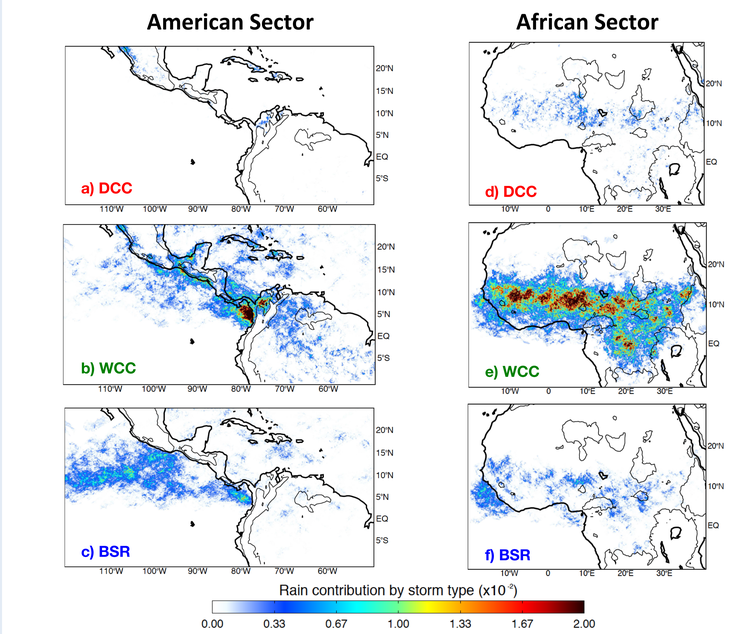
Rainfall Climatology

JJA precipitation climatology from all TRMM rain events (≥ 2 pixels)



- TRMM PR rainfall algorithm underestimates precipitation from deep convection over land (Iguchi et al. 2009)
- To mitigate this bias, we use a traditional *Z-R* method to compute rain rates from individual events (Rasmussen et al. 2013)
- Identifying all rain events with ≥ 2 contiguous pixels with reflectivity greater than zero

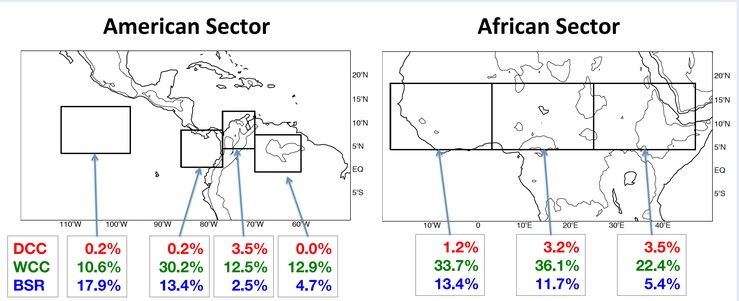
Rainfall contribution by storm type



Rainfall contribution to the total rain by each storm type during JJA for the 1998-2012 period

- The precipitation produced by each storm containing the extreme echo core was compared to the climatological rainfall for the entire region
- This ratio was multiplied by the probability of TRMM finding an extreme event to account for the differential coverage of the satellite
- Significant rainfall contribution from storms containing extreme convective elements for the Colombian coast, the northern fringes of the Andes, and a broad region in the Sudanian savannas of the African continent

Regional contribution



Percentage of the accumulated rainfall contribution from each storm type to the total accumulated precipitation in selected regions.

- Significant contribution to the rainfall total in regions affected by extreme convective categories (e.g., Colombian Coast and Sahel region)
- Comparatively, the tropical rain forest in the Amazon region does not have significant rainfall contribution from extreme events

Conclusions

- This study analyzes the most extreme precipitation elements that occur in conjunction with convective storms in the near-equatorial belt including Africa and the Americas
- Storms containing:
  - DCC are highly probable over continental regions.
  - WCC echoes maximize in the same places as DCC, but they also occur over oceanic regions
  - BSR occur most frequently over ocean off coastal regions and in the ITCZ
- Precipitation from mesoscale convective systems dominates the relative contribution to the total rain
- Regions that experience the most climatological rain are not necessarily collocated with regions that experience large rain contribution from extreme storms (e.g., Amazon region)

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