Pacific Northwest
NATIONAL LABORATORY

Development of a Global High-resolution MCS Tracking Database

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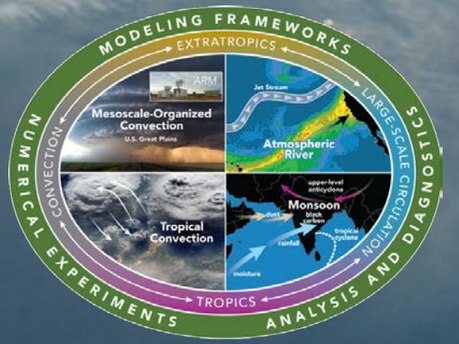

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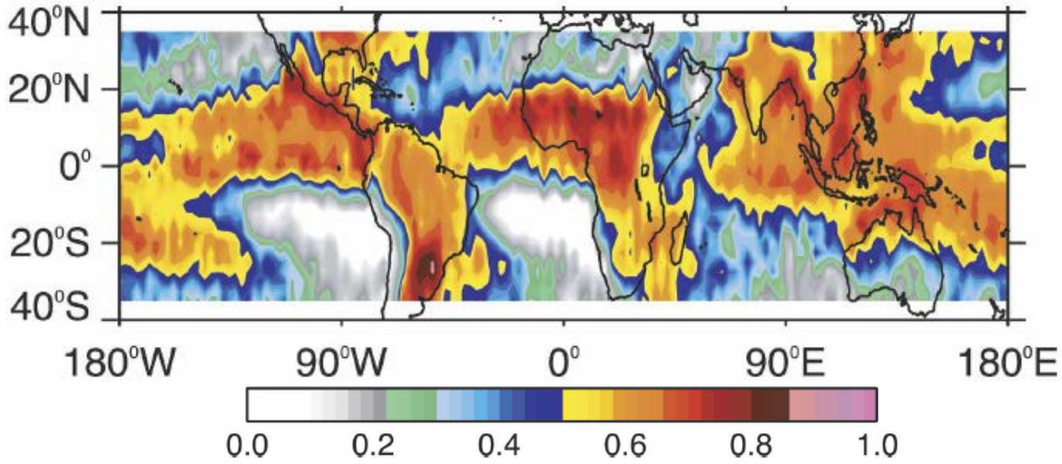
Motivations and Objectives

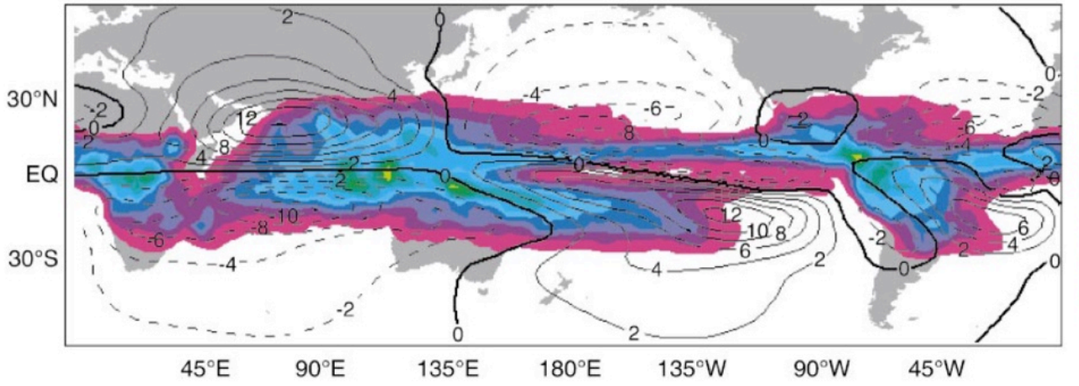
- Mesoscale convective system (MCS) accounts for over 50% of tropical rainfall in most regions, and have substantial impact on global circulations through latent heating
- A high-resolution global MCS dataset using state-of-the-art remote sensing measurements is lacking
- **Objectives**
  - Develop a new algorithm to track MCS using global high-resolution satellite datasets
  - Evaluate satellite-based MCS tracking with ground-based radar observations
  - Examine global MCS characteristics and their regional and seasonal variabilities

MCS Contribution to Tropical Rainfall



Nesbitt et al. (2006) MWR

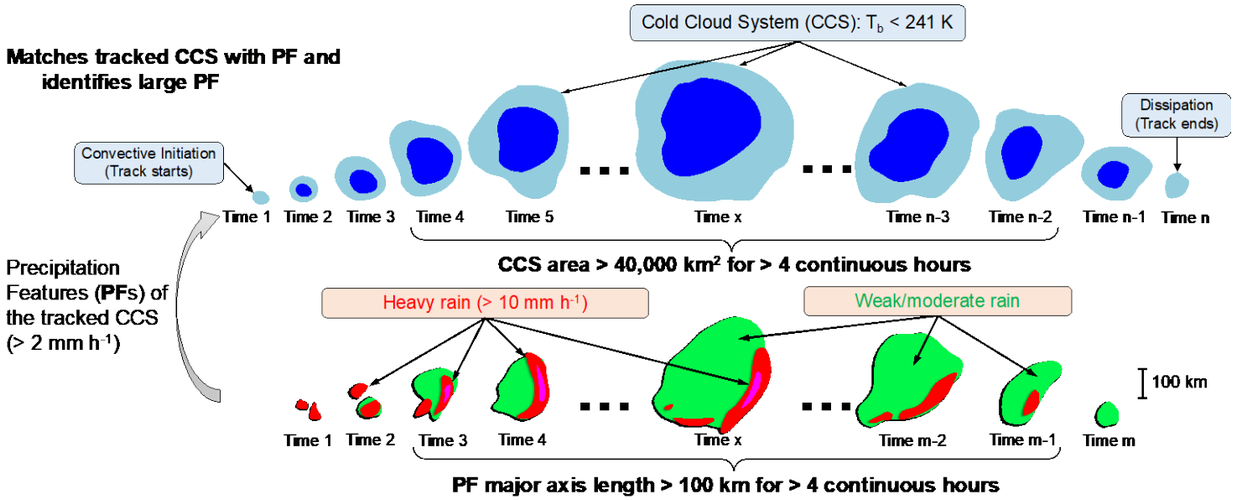
250hPa circulation response to stratiform heating

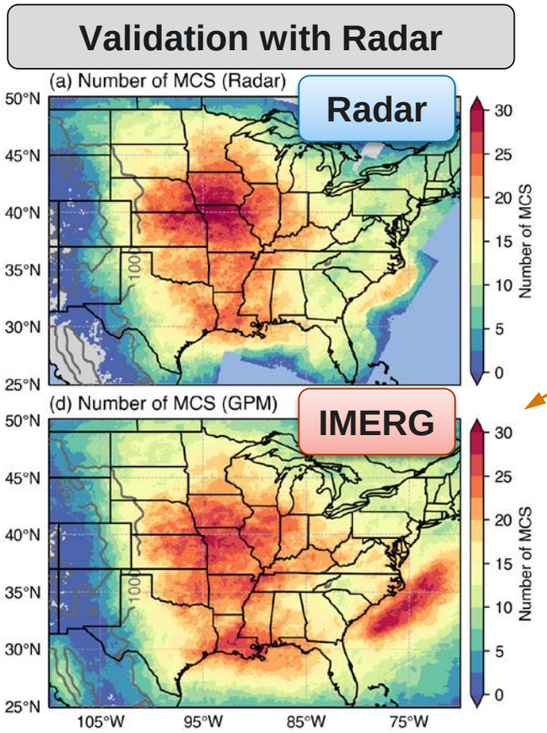


Schumacher et al. (2004) JAS

Approach and Validation

- MCS tracking is based on satellite observed cloud-top IR temperature and precipitation feature (PF) signatures from GPM IMERG
- **Global MCS tracking dataset**
  - Resolution: 10 km, 1 hourly. Period: 2000-2019.
  - MCS track statistics (location, time, lifetime, size, rainfall, etc.) & track masks on native 10 km grid



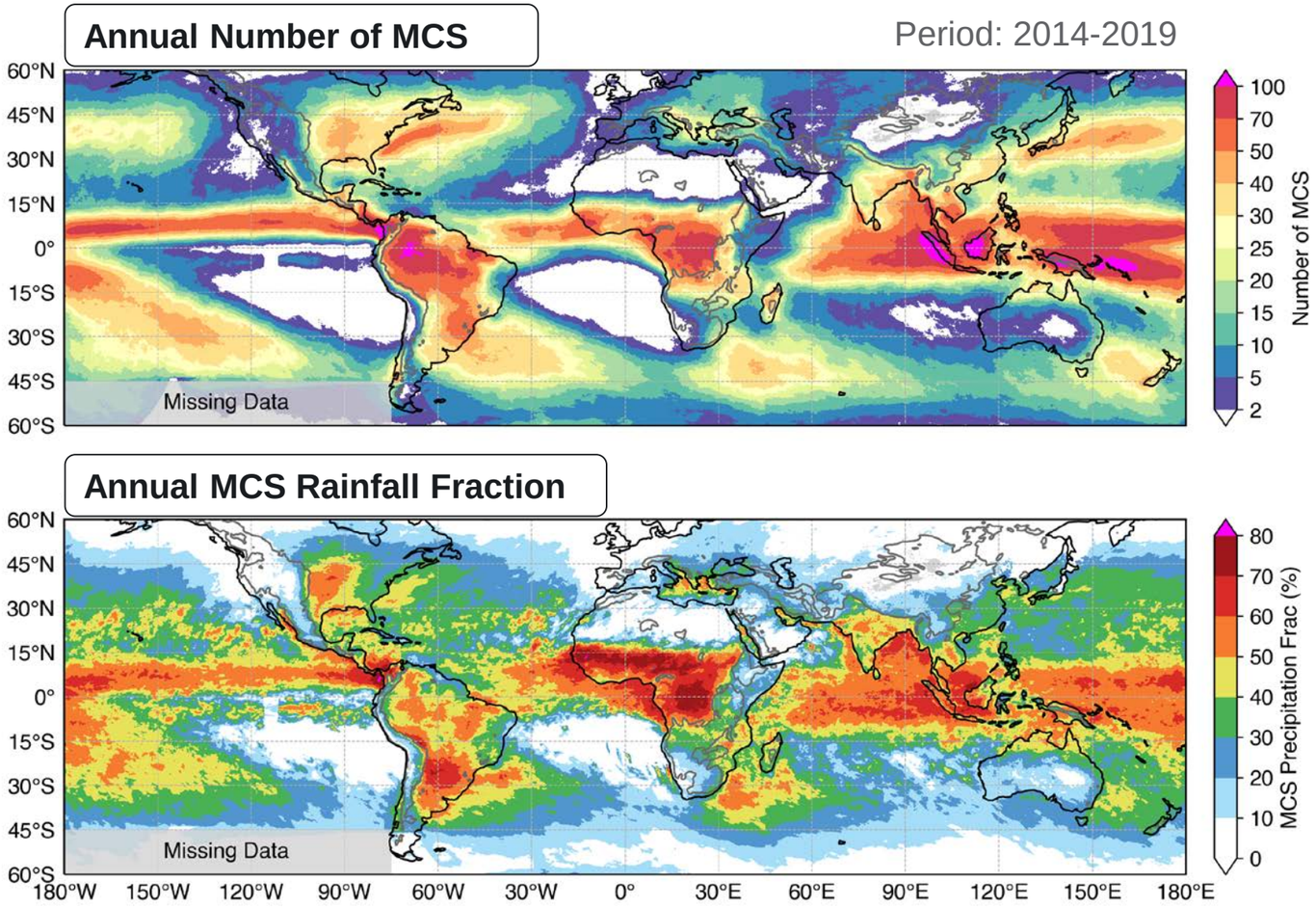


- **Validation**
  - MCS Tracking by IMERG reproduces warm season MCS statistics from ground-based radar data over U.S. and China

Feng et al. (2020) *In Prep.*

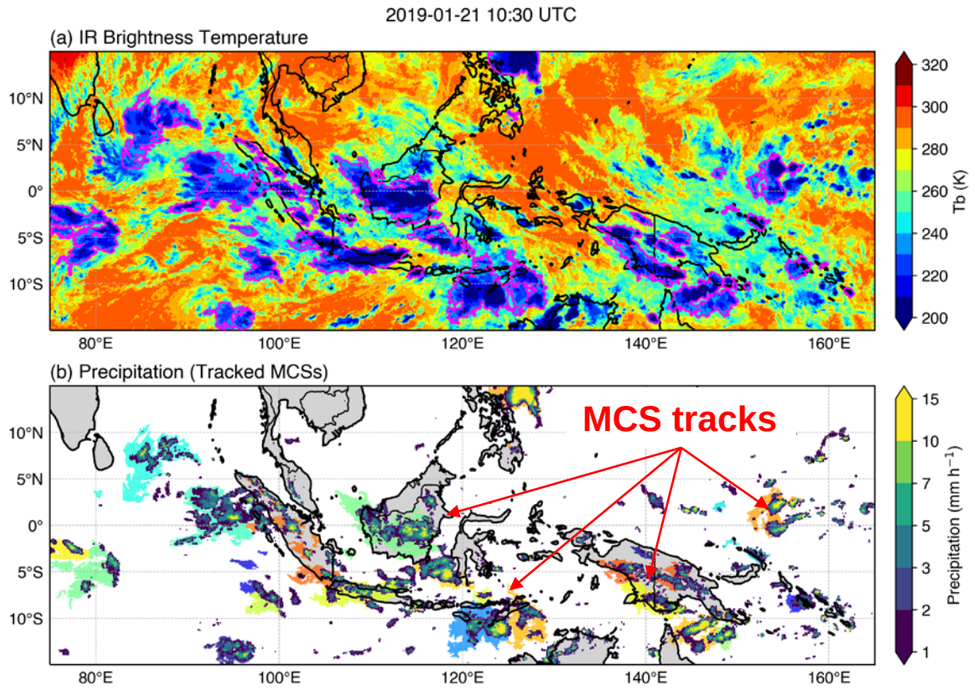
Global MCS Annual Mean Statistics

- Tropical MCSs are most frequent over Indo-Pacific warm pool, Central Africa, Amazon & tropical Eastern Pacific
- Midlatitude MCSs are found in U.S., Argentina, offshore east coast of N. America, S. America, East Asia and South Africa
- MCS accounts for over 50% rainfall in:
  - Most of tropical belt
  - Ocean: TWP warm pool, Bay of Bangel, E. Pacific & E. Atlantic (> 60%)
  - Continent: Africa, S. America (>70%), Amazon, N. America, India (40-60%)
- Interesting land vs. ocean, tropics vs. mid-latitude MCS contrasts are found, but a lot more to be explored



Feng et al. (2020) *In Prep.*

Research Opportunities



- A new high-resolution global MCS tracking dataset is developed
  - Period: 2000-2019. Resolution: 10 km, 1 hourly.
  - Development of different level of data products are on-going: daily, monthly, etc.

- **Research opportunities**
  - Understanding the diverse environmental factors that impacts MCS evolution over different geographic regions
  - The role of MCS in global hydrological extremes
  - Interactions between MCS and large-scale variabilities such as MJO, monsoon systems, ENSO, etc.
  - Evaluation for high-resolution global and regional models, including E3SM

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