The Indian Ocean-Maritime Continent Regionally Refined SCREAM Configuration for MJO studies

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With

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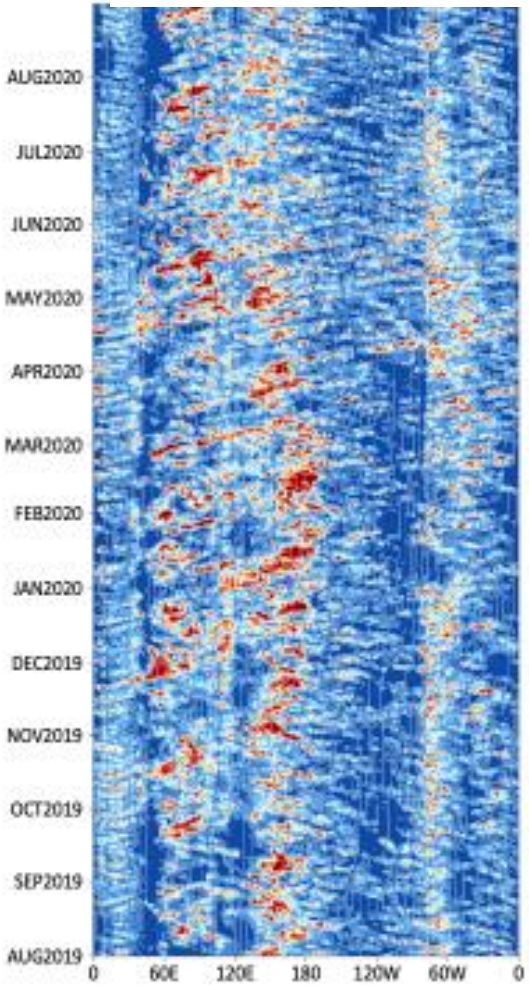
ASR Atmospheric System Research

RGMA PCMDI

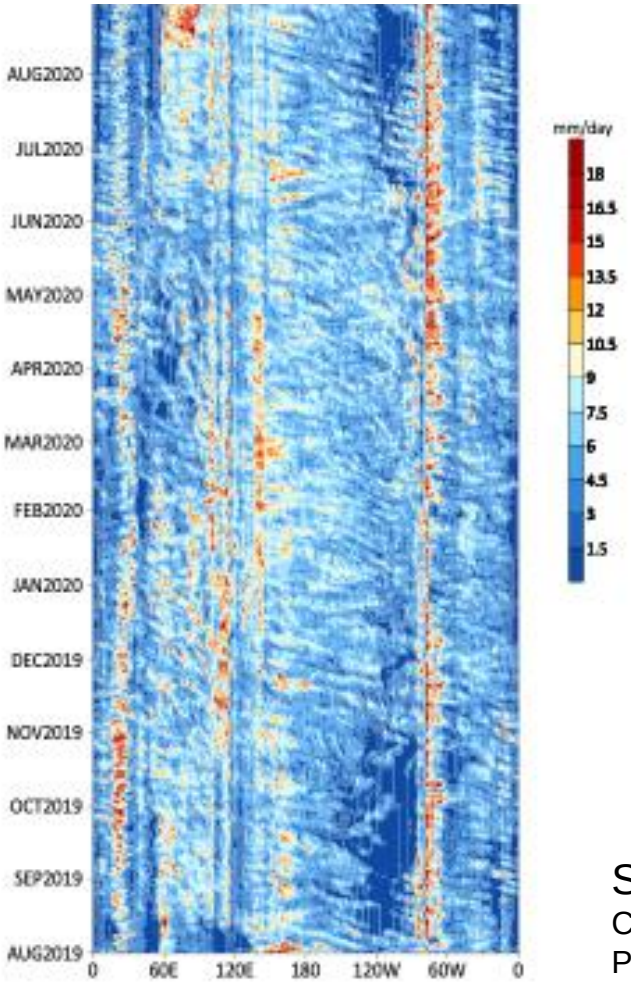
SCREAM's performance on tropical variability

Evolution of Precipitation (10S-10N, 201908-202008)

IMERG



SCREAM CESS

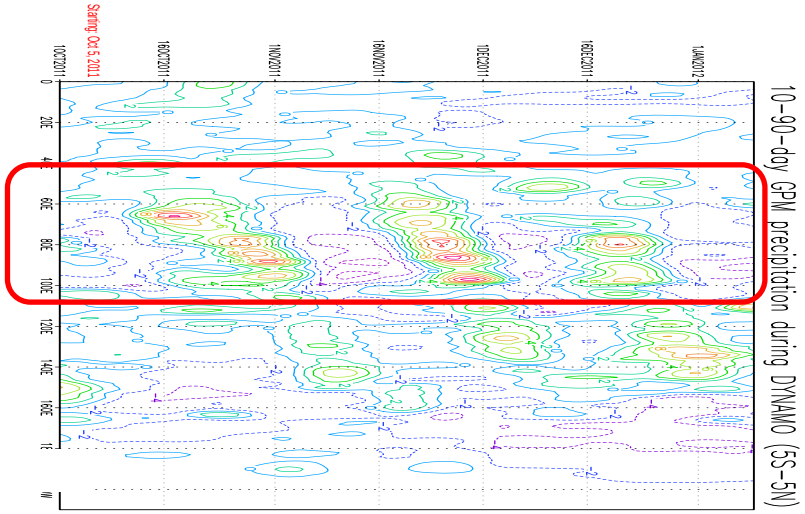


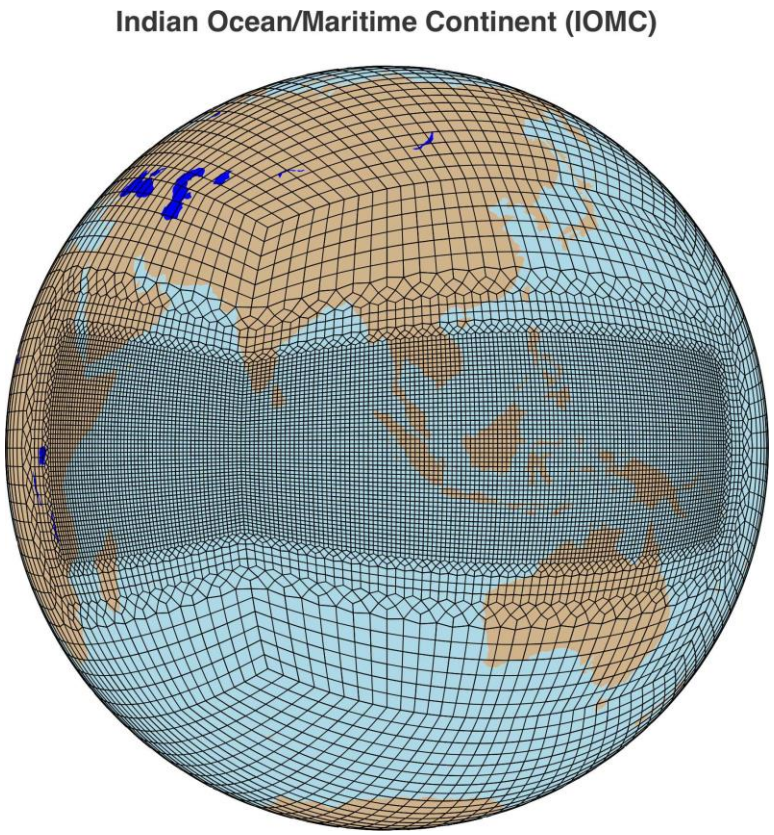
- **Weak tropical variability**
- **Lack of eastward propagation of convection**

SCREAM CESS simulation
Courtesy of Chris Terai, Noel Keen, Peter Caldwell

Indian Ocean-Maritime Continent RRM-SCREAM

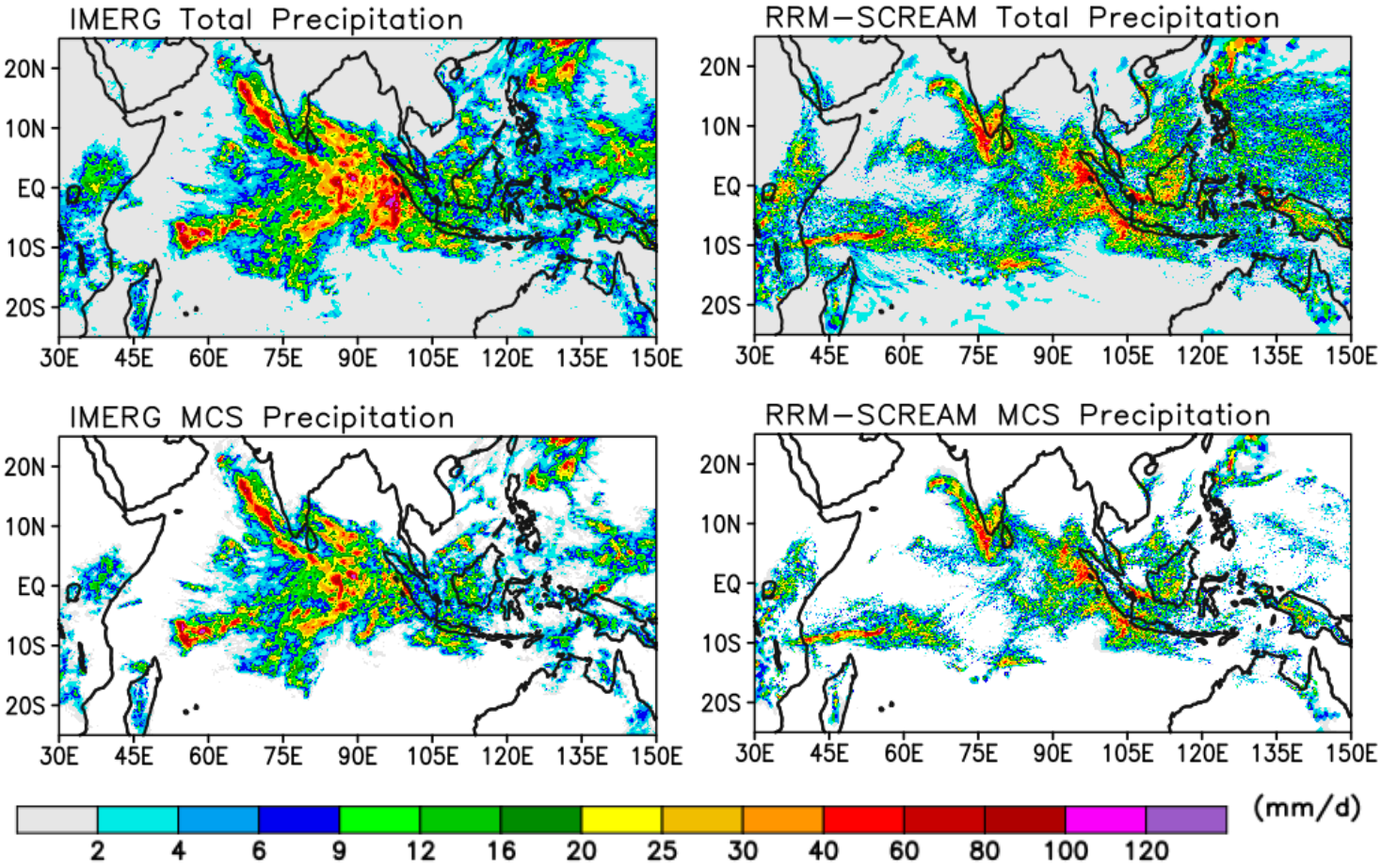
- RRM (Regionally-refined model): An effective and efficient tool for high-resolution model development and diagnosis.
- Inner domain (refined region) is 3.25 km and outer domain is ~100 km.
- A MJO case study during DYNAMO:
  - 2011-11-24 to 2011-12-02





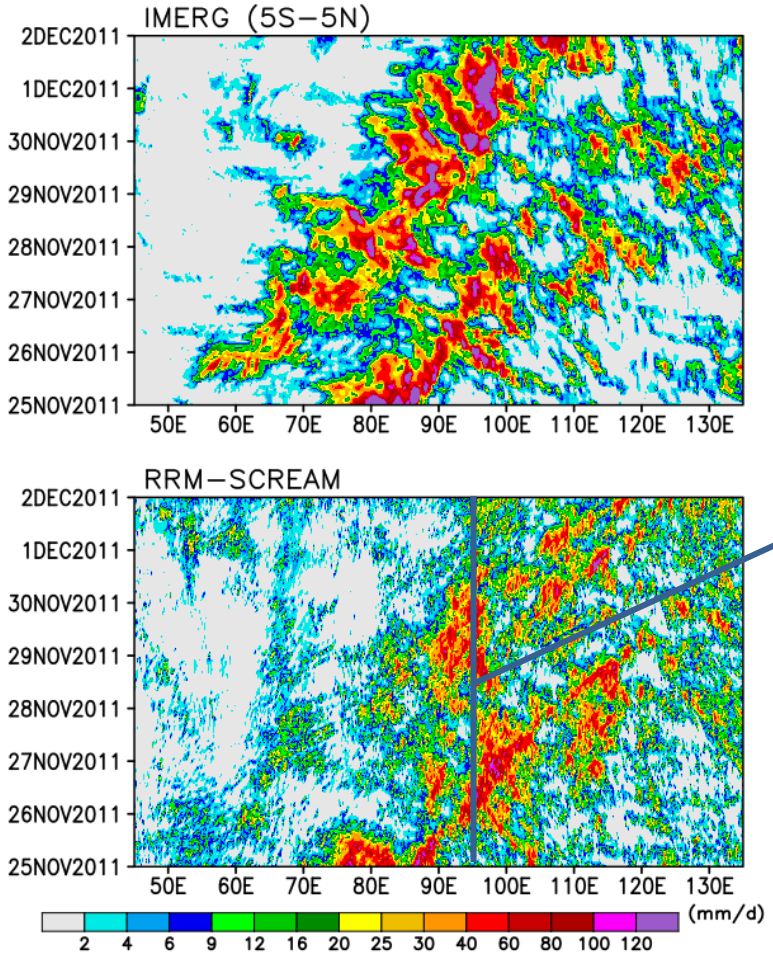
Project: Representation of the interactions between the Madden-Julian Oscillation and the Maritime Continent in the RRM-SCREAM (PI: Xianan Jiang)

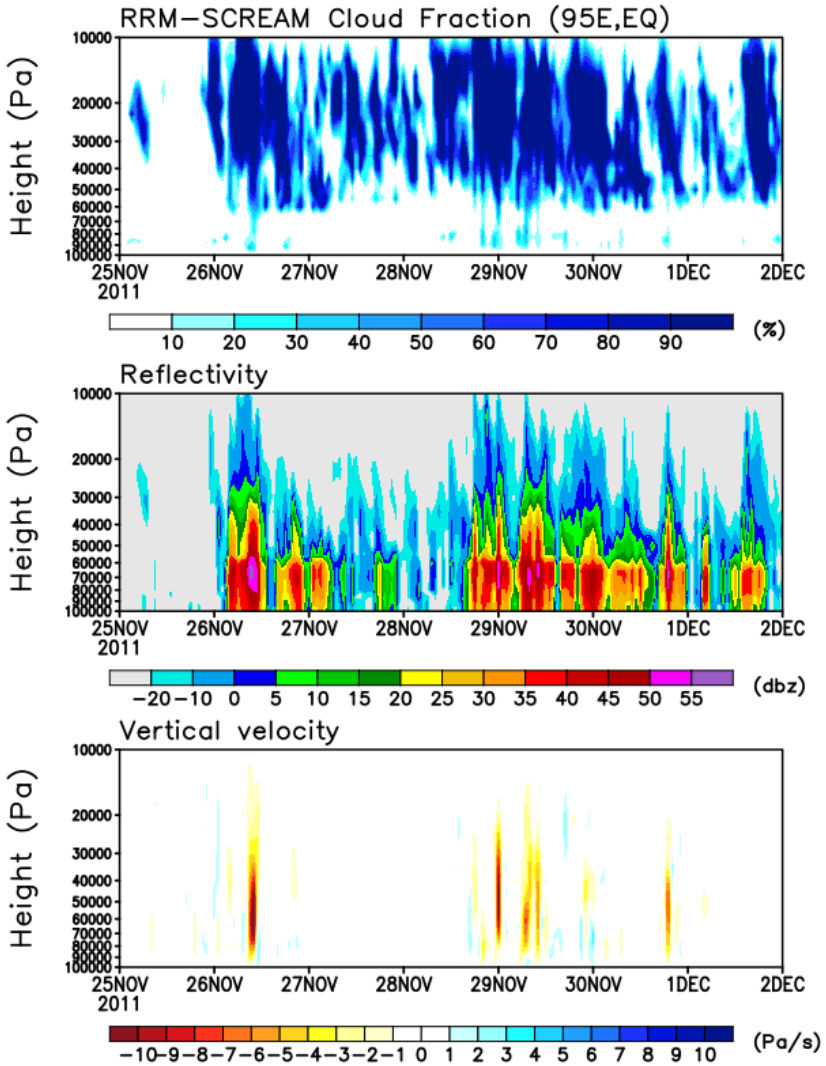
Precipitation (2011/11/25-2011/12/01)



- We applied PyFLEXTRKR to identify MCSs.
- SCREAM simulates weaker MJO and MCSs even with realistic initial conditions from ERA5.

Propagation of MJO





- SCREAM can capture eastward propagation of the convective system particularly when initialized from its mature stage

Discussion

- What are the current and unique strengths and foundational capabilities of DOE local/regional testbeds?
  - RRM-SCREAM, an computational efficient tool compared to global 3.25km SCREAM. Run on CPU nodes on Perlmutter. Can be speed up with GPU nodes when run with C++ codes.
- What do you see as a grand challenge for the development and enhanced utility of the testbed framework for integrated research in EESM?
  - The RRM configuration development could be challenging for general users who are not familiar with model grid and mapping files, land surface data construction, atm/lnd initial condition generation. (e.g., High-resolution (3.25 or finer) land component files could be difficult to generate due to memory issue)
  - Longer simulations could still be expensive to run
  - Not many high-res observation data (both spatial and temporal) are available for model validation
- What are the gaps in research / infrastructure / coordination that prevent advances using testbeds?
  - No apparent coordination for available RRM-SCREAM configurations for general users. Configurations are generally not available in the github. Potential users will have to reach out to certain people who develops these configurations.
- What opportunities, new technologies, observational systems and approaches exist to overcome each of those gaps?
  - ARM obs and LES (LASSO) are helpful in evaluating these simulations. However, they are still limited to certain locations. Ensemble LES simulations with large domain could be expensive to run. ML/AI could be helpful to generate valued added data product.