Building Regionally Refined SCREAM (RRM-SCREAM) for ARM Sites

Science Focus Area (SFA)

Tying in High Resolution E3SM with ARM Data (THREAD)

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2022 ARM/ASR Meeting
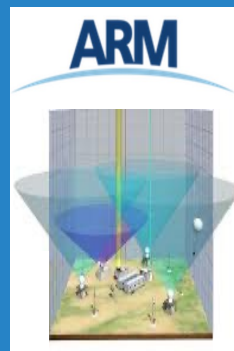
THREAD
LLNL ASR SFA

Storm Resolving

Motivation

- SCREAM is computationally expensive to run!

- A regionally refined model (RRM) is a model configuration that simulates a portion of the globe at high horizontal resolution and leaves the remaining area at coarse resolution.

- Realistic high-res topography, coastline features and boundary conditions are included in RRM-SCREAM simulations.

RRM → An effective and efficient tool for high-resolution model development and diagnosis
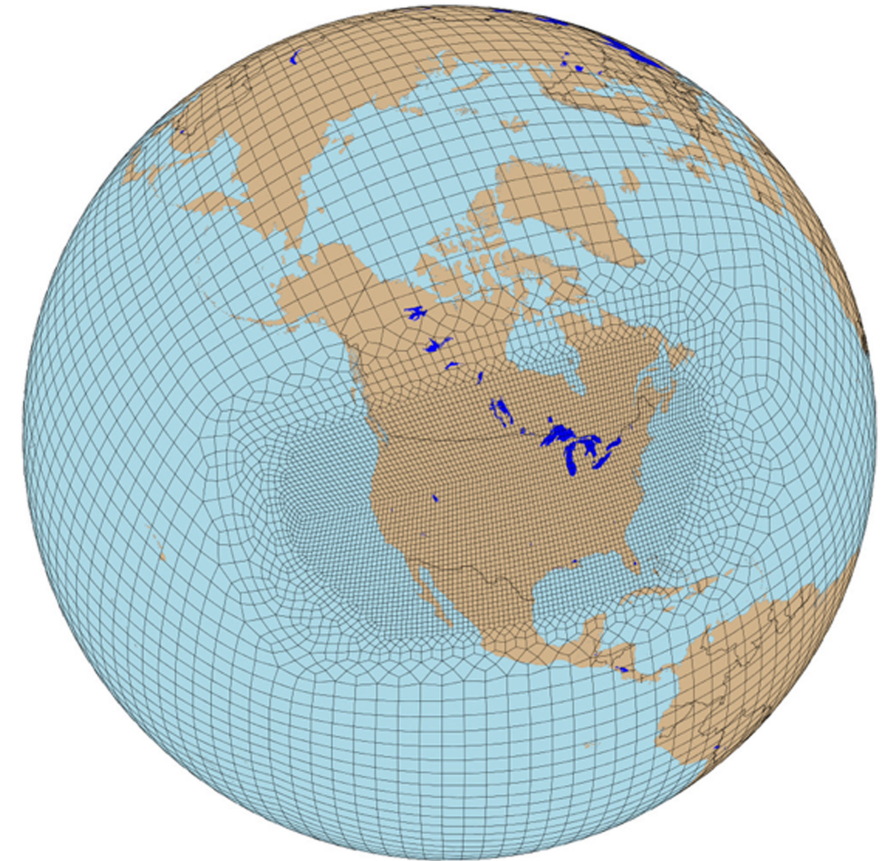
Previous RRM work: e.g., Zarzycki et al., (2014); Zarzycki and Jablonowski (2015); Huang and Ullrich (2017); Tang et al., (2019); Zheng et al, (2019)

Science Question:

- Can RRM-SCREAM well represent the regional short-time variabilities in clouds and convection, and their strong coupling with the heterogeneous land surface processes such as the life cycle of mesoscale convective systems, and the effects of topography and coastal urban areas subject to interactions with large-scale circulations?

Hypothesis:

- RRM-SCREAM can faithfully represent regional weather and climate features within the refined region and significantly reduce the computation cost of global SCREAM, however with some sensitivity to resolution changes.
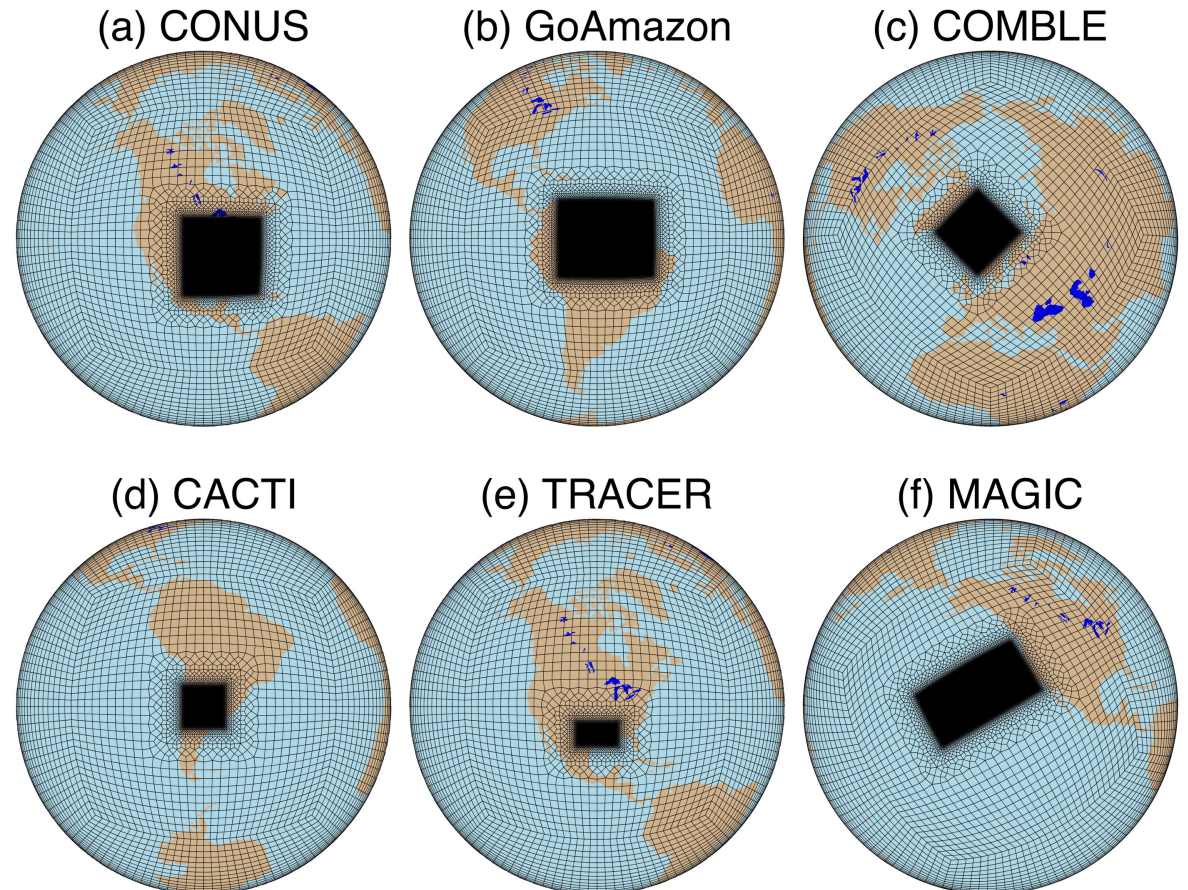
Research areas

We will build and validate various RRM-SCREAM configurations for ARM sites to conduct and address various science questions for (1) marine low clouds (COMBLE, MAGIC), (2) convection transition over land (GoAmazon, CACTI, SGP), and (3) land-atmosphere interactions (TRACER).

Construction of RRM-SCREAM

- Six RRM-SCREAM configurations are proposed : CONUS, GoAmazon, COMBLE, CACTI, TRACER and MAGIC.

- Inner domain (refined region) will be ~3.25 km or 1.6 km, and will be free-running.

- Outer domain will be ~100 km, and the dynamical fields in the outer domain will be nudged toward the ERA5 reanalysis

RRM-SCREAM configurations

(a) CONUS (b) GoAmazon (c) COMBLE

(d) CACTI (e) TRACER (f) MAGIC

Future outlook

- We are looking for ideas on how to better utilize RRM-SCREAM for relevant cloud, convection and L-A interactions with ARM data.

- We are also looking for collaboration on these research areas and welcome people to analyze the simulations if interested.

- Any comments are mostly appreciated!