

CMDV-RRM: Representation of clouds and convection across scales in ACME

2017 ARM/ASR PI Meeting
March 13-17, 2017
Vienna, VA

Chris Golaz
on behalf of the entire team

Team

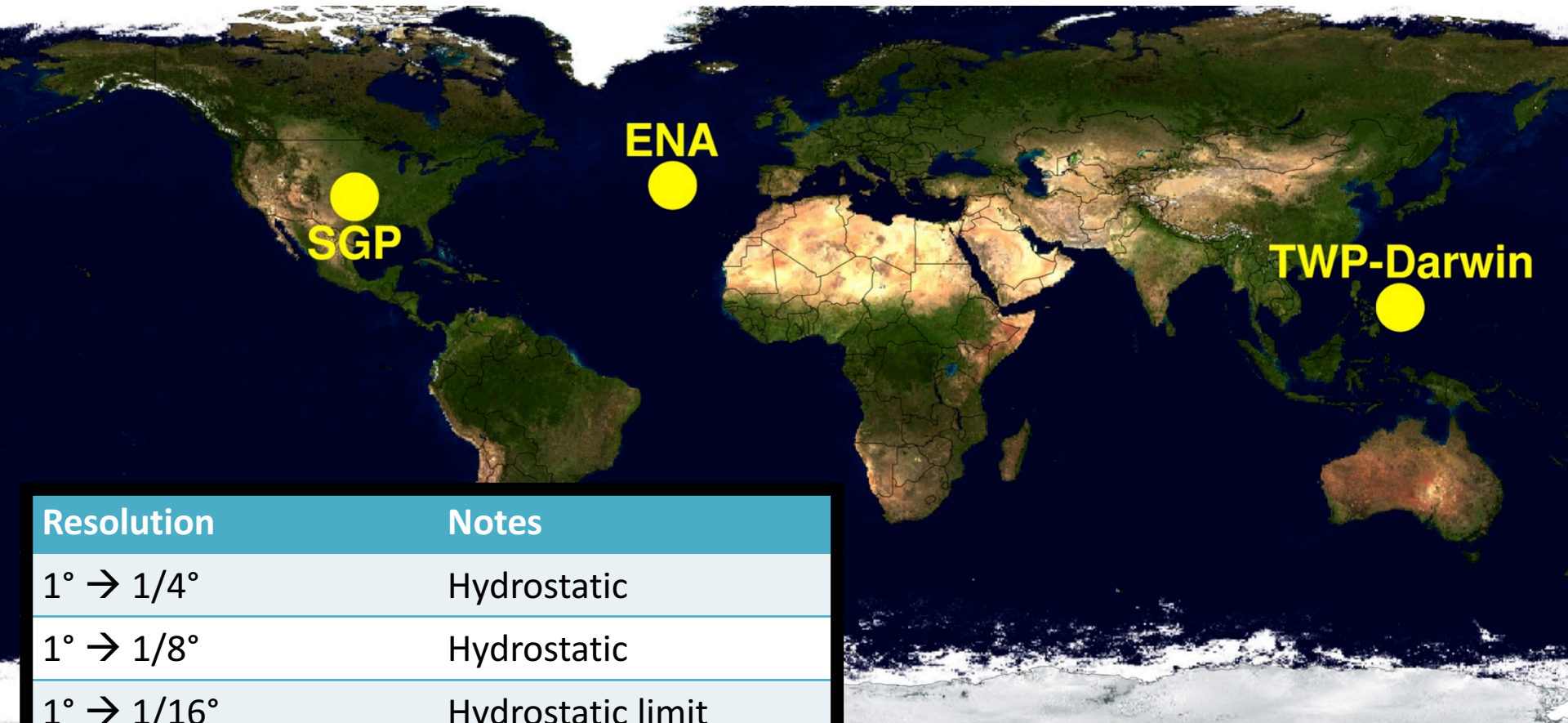
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*Funding anticipated around May 15, 2017.

Overview

- ACME with regionally refined meshes (RRM) is a powerful modeling framework
 - Evaluate *today* resolutions that will be only available globally *tomorrow*.
- Focus refinement around permanent ARM sites: SGP, ENA, TWP.
 - Sample a wide range of cloud regimes
 - Maximize use of ARM observations.
 - Cloud parameterizations in climate models must work everywhere and all the time.

RRM target areas



Resolution	Notes
$1^\circ \rightarrow 1/4^\circ$	Hydrostatic
$1^\circ \rightarrow 1/8^\circ$	Hydrostatic
$1^\circ \rightarrow 1/16^\circ$	Hydrostatic limit
$1^\circ \rightarrow 1/32^\circ$	Need non-hydrostatic

Components

- **ACME modeling**
 - RRM framework for SGP, ENA, TWP
 - Apply to evaluate physics, including (in)sensitivity to grid spacing.
- **Observations datasets**
 - 3D gridded ARM constrained variational analysis
 - Radar retrieved cloud and precipitation statistics
- Observational-based LES and CRM (**LASSO**)
- Expand ARM data-oriented **diagnostics package**.

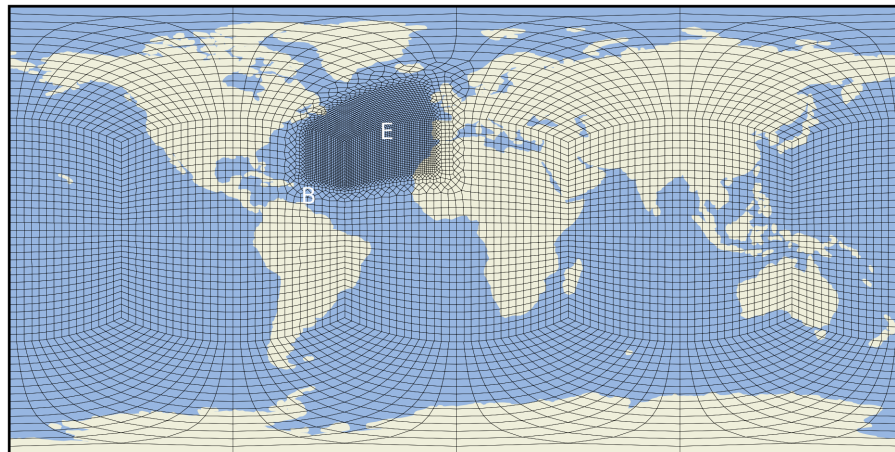
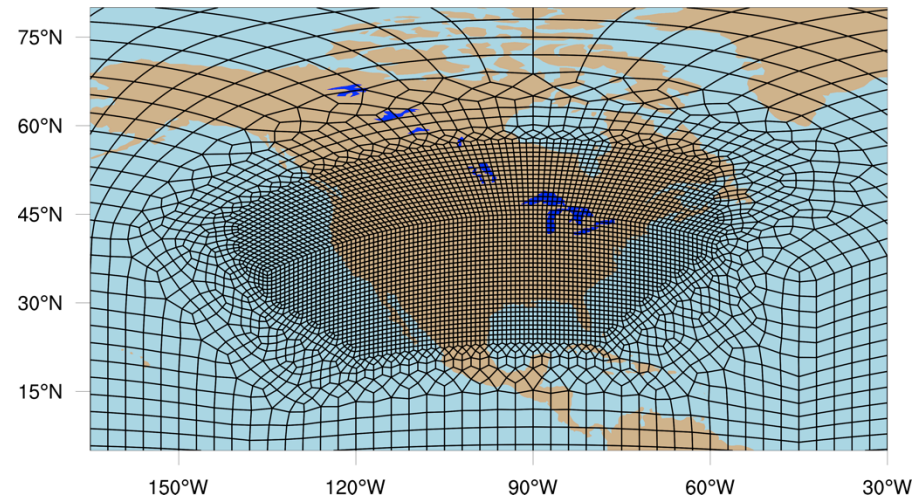
Initial Regionally Refined Meshes (RRM)

SGP

- Existing “CONUS” grid $1^\circ \rightarrow \frac{1}{4}^\circ$.
- **9905 elements.**

ENA

- New $1^\circ \rightarrow \frac{1}{4}^\circ$ grid.
- **8756 elements.**



Uniform grids

- 1° : **5400 elements.**
- $\frac{1}{4}^\circ$: **86,400 elements.**

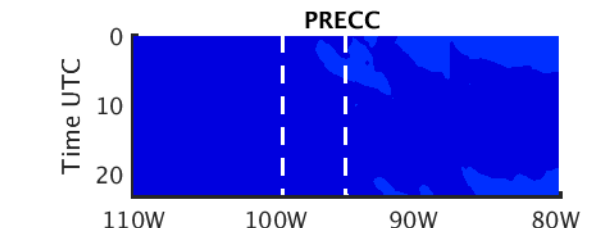
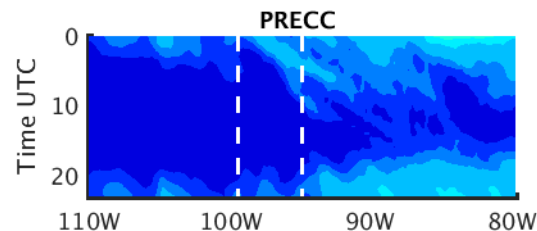
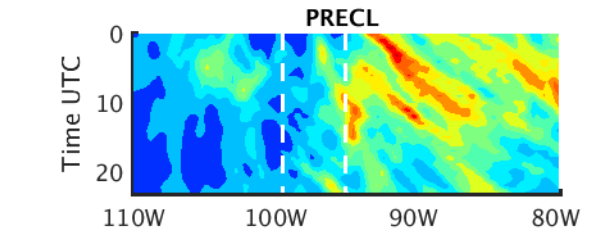
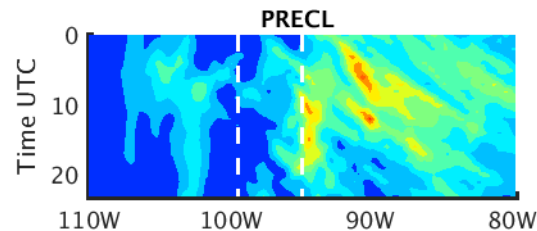
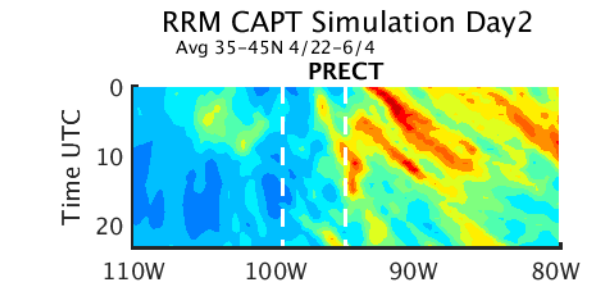
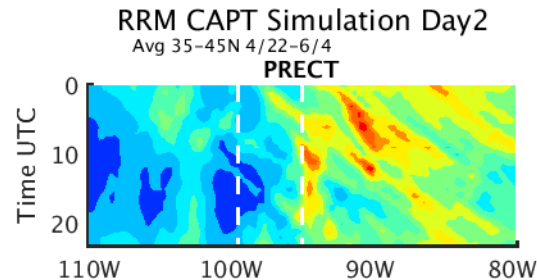
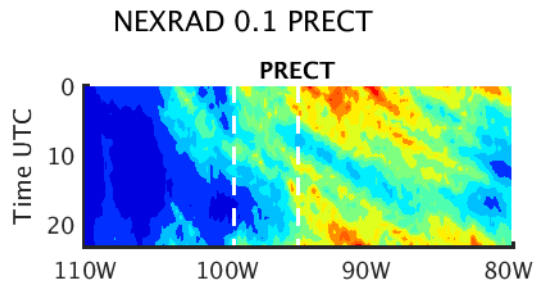
SGP: ACME-RRM CAPT simulations

MC3E campaign 04/22/2011-06/06/2011 (LLNL)

Scale-aware parameters: Sensitivity test on convective adjustment time-scale in ZM deep convection scheme

$\tau = 3600$ s

$\tau = 14400$ s



Latitude: 35N-45N
MC3E period

TWP: radar derived products

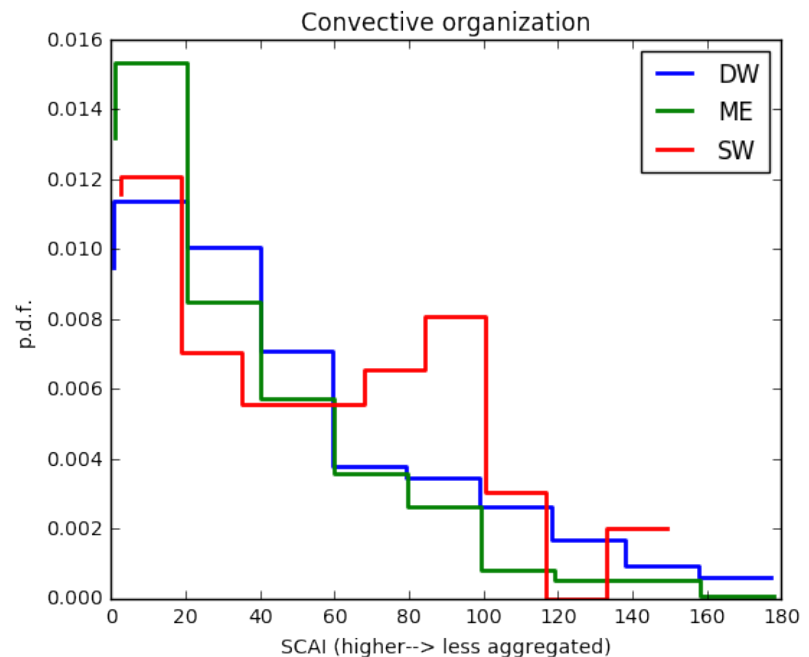
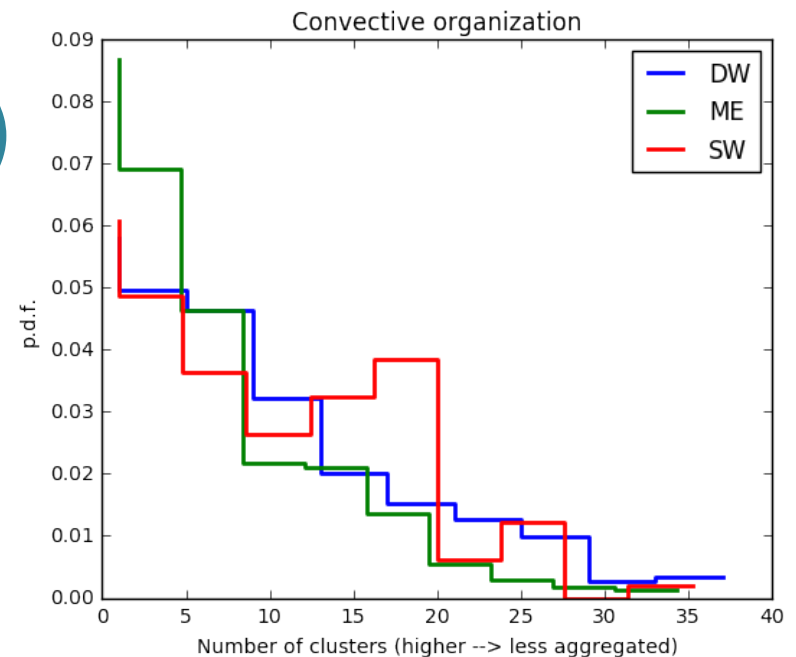
Convective organization (ANL)

Histograms of number of clusters (top) and SCAI (bottom) for January and February 2006 for the deep west (DW), moist east (ME), and shallow west (SW) regimes identified using the algorithm of Pope et al. (2008)

Convective organization

[based on Tobin et al. (2012)]

- **Convective clusters** defined from brightness temperatures derived from satellite gridded to a 5 km resolution.
- **Simplified convective aggregation index (SCAI)** is the number of clusters/(maximum possible number of clusters in domain)*(average distance between clusters/characteristic length of domain)



Summary

Components

