



Model Diagnostics Task Force Efforts to Advance Process-Oriented Model Evaluation

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Thursday, June 22, 2017

5th WGNE workshop on systematic errors in weather and climate models

MAPP Team -- Annarita Mariotti (director), Heather Archambault (Program Manager), Ali Stevens (Program Assistant)





Modeling, Analysis, Predictions, and Projections (MAPP) program Mission

The CPO Modeling, Analysis, Predictions, and Projections program supports research that advances Earth system and climate models and their uses.

Primary objectives:

- 1) improving Earth system models;
- 2) supporting an integrated Earth System analysis capability;
- 3) improving methodologies for global to regional- scale analysis, predictions, and projections; and
- 4) developing prediction capabilities relevant to decision makers





MAPP Research Areas

Prediction -- Weeks to Decades

Climate Analysis, Reanalysis, and Data Assimilation

Climate and Earth System Modeling

+ Infrastructure

Drought and Other Applications

Climate Projections

- MAPP supports five core research areas primarily through two- to three-year competitive grants





Climate and Earth System Modeling

- Current support:
 - CPTs improving cloud and radiation biases in NCEP modeling suite
 - CPT focused on iceberg calving processes in GFDL model
 - Improvements to land modeling capabilities
 - Model Diagnostics Task Force activity developing an NCAR-, GFDL-, and community-owned process-oriented diagnostics and evaluation framework
- Accomplishments:
 - Implementation of the Climate Forecast System, Version 2
 - Advances in the operational model's physics package





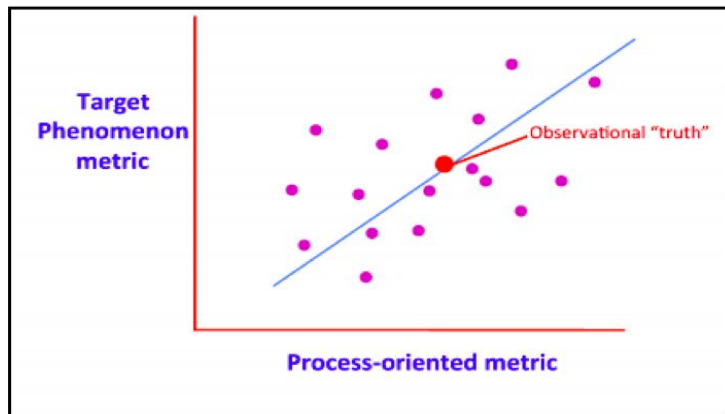
Climate Projections

- Current support:

- Model Diagnostics Task Force
 - many projects utilize CMIP data to develop and test new process-oriented metrics

- Accomplishments:

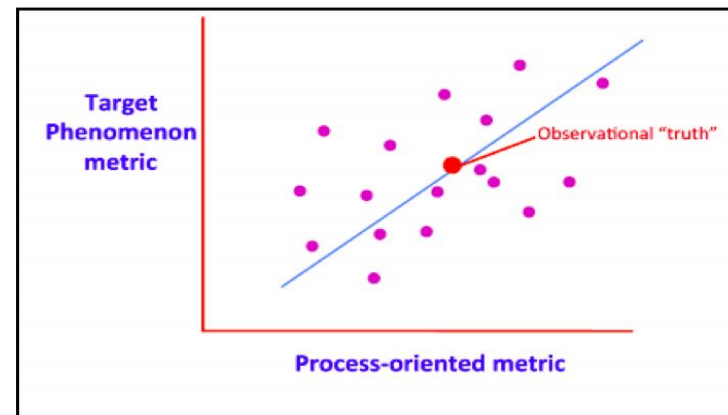
- CMIP5 Task Force (FY11-FY13)
 - Journal of Climate Special Collection
 - Input to the National Climate Assessment
 - Developed process oriented metrics framework





Process-Oriented Metrics

- Process-oriented metric: an evaluation of model performance in simulating critical phenomena or variables against aspects of the model's underpinning physical or chemical processes.
- Motivation: move beyond performance-oriented metrics toward evaluations that can enable targeted model testing and improvement





Process-Oriented Metrics

- A number of groups started focusing on this idea a few years ago:
 - WGNE Climate Model Metrics Panel
 - YOTC MJO Task Force
 - ESMValTool effort
 - PCMDI Metrics Package
 - MAPP CMIP5 Task Force
- Inspired by this community interest, in 2014, MAPP solicited proposals to:
 - Develop process-oriented metrics
 - Develop a software framework for these metrics





Model Diagnostics Task Force

- MAPP is funding investigators who are applying this concept in a number of areas:
 - Warm cloud microphysics (K. Suzuki)
 - Tropical (S. Camargo) and extratropical (J. Booth) Cyclones
 - ENSO teleconnections (H. Annamalai)
 - Land/atmosphere coupling (E. Wood)
 - MJO (X. Jiang)
 - Diurnal cycle (A. Dai)
 - AMOC (X. Xu co-support from CVP program)





Model Diagnostics Task Force

Attending workshop

Eric Maloney (Colorado State University; **TF lead**)

Yi Ming (GFDL; **TF co-lead**)

Andrew Gettelman (NCAR; **TF co-lead**)

Aiguo Dai (University at Albany; **TF co-lead**)

Kentaro Suzuki (University of Tokyo)

Huan Guo (GFDL)

Peter Bogenschutz (NCAR)

Xianwen Jing (University of Tokyo)

Suzana Camargo (Columbia University)

Daehyun Kim (University of Washington)

Adam Sobel (Columbia University)

Anthony Del Genio (NASA GISS)

James Booth (City University of New York)

Catherine Naud (Columbia University)

Leo Donner (NOAA GFDL)

Eric Wood (Princeton University)

Zhengzhao Luo (CUNY)

H. Annamalai (University of Hawaii)

Arun Kumar (NOAA CPC)

Xianan Jiang (UCLA)

Ming Zhao (NOAA GFDL)

Yumin Moon (University of Washington)

Shian-Jiann Lin (NOAA GFDL)

Alexis Berg (Princeton University)

Angel Adames (NOAA GFDL)

David Neelin (UCLA)

Junhong Wang (University at Albany)

Ming Zhao (NOAA GFDL)

Xiaobiao Xu (Florida State University)

Molly Basinger (NOAA AOML)

Eric Chassignet (FSU)

Shenfu Dong (NOAA AOML)





MDTF activities so far

- Sharing research results on monthly calls
- Coding Moist Static Energy budget calculation
- Group-designed NCAR and GFDL time slice experiments with developmental models for group evaluation
- First version of software framework (introduced by David Neelin; see Eric Maloney poster)
 - Python-based, flexible to use any graphic package desired
 - A description is available at:
http://cpo.noaa.gov/sites/cpo/MAPP/pdf/MDTF_API.pdf
- Organizing forthcoming AMS special collection (topical papers in technical journals; overview paper in BAMS) -- ***let us know if you'd like to contribute!***





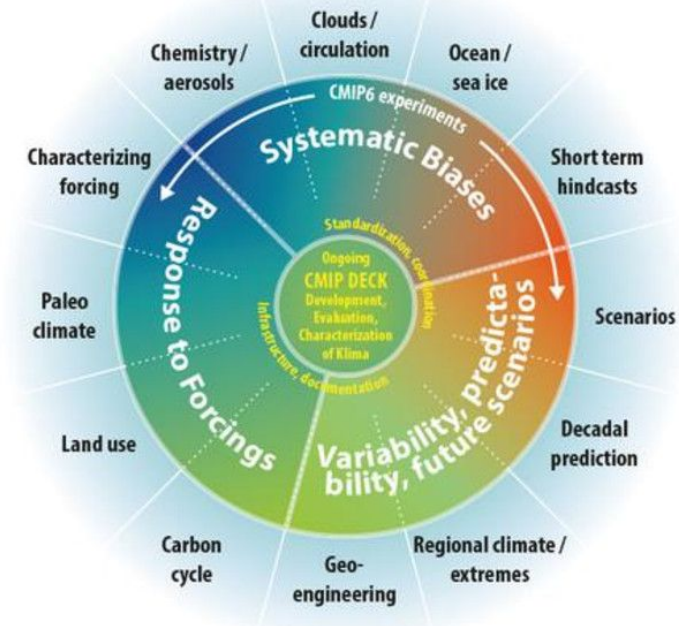
Current call for proposals

Research projects focused on:

- Understanding the sources of model bias in CMIP6-class models, and developing process-oriented metrics to inform model development
 - Requirements:
 - Define pathways for model improvement
 - Develop process-oriented metrics and contribute to a metrics framework
 - Focus on cryosphere, extremes, or sea level and coastal dynamics with possible cross-cutting focus on clouds or the Arctic.
- Funding levels: up to \$170K/yr for up to 3 yrs
- A team approach to advancing a metrics framework, leadership of a Task Force, and integration of individual metrics into the framework.

Requirements:

- Funding levels: up to \$500K/yr for up to 3 yrs



For more information: <http://cpo.noaa.gov>
Click "Grants and Projects"
LOIs due 6/28, Proposals due 9/11





More information

Please speak with me or any other MDTF participants at this workshop about this activity.

Send me an e-mail with any questions at daniel.barrie@noaa.gov

Thank you to the organizers





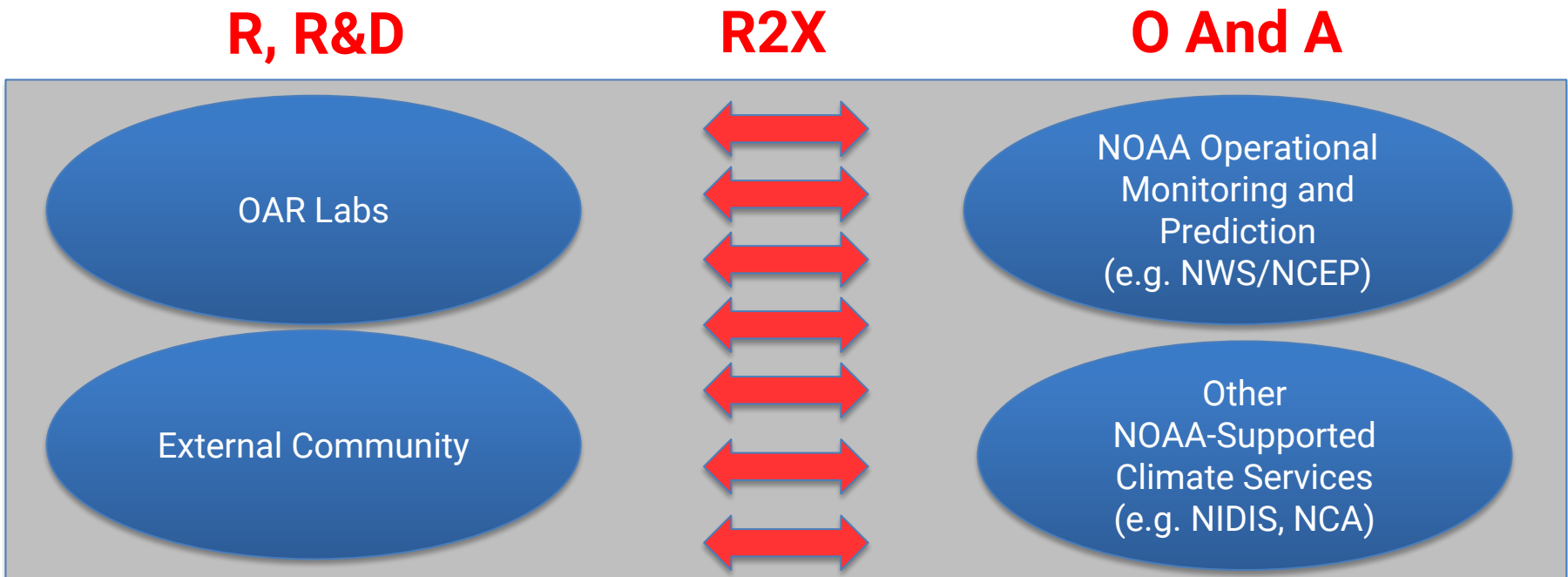
Extra Slides





Transition to Applications

- MAPP funds projects at a variety of technical readiness levels (readiness of research for transition to operations)





Other MAPP Activities

- Publications
 - Reports: California Drought, Great Plains Drought, High Resolution Coupling and Initialization, etc.
 - Special Collections: *J Climate* CMIP5, *J Hydrometeorology* Drought Monitoring and Prediction, *Climate Dynamics* NMME, etc.
- Workshops
 - U.S. Climate Modeling Summit, S2S Task Force Meeting, High Resolution Coupling and Initialization, etc.
- Webinar series
 - Annual webinar series (currently in its sixth year). Over 4,000 attendees, 50,000 website views, hundreds of views of the archived recordings.
- Newsletter (quarterly)
- Scientist profiles
- Science stories

