Modeling, Analysis, Predictions and Projections (MAPP) Program Overview

Annarita Mariotti, Dan Barrie, Heather Archambault, Ali Stevens, Emily Read
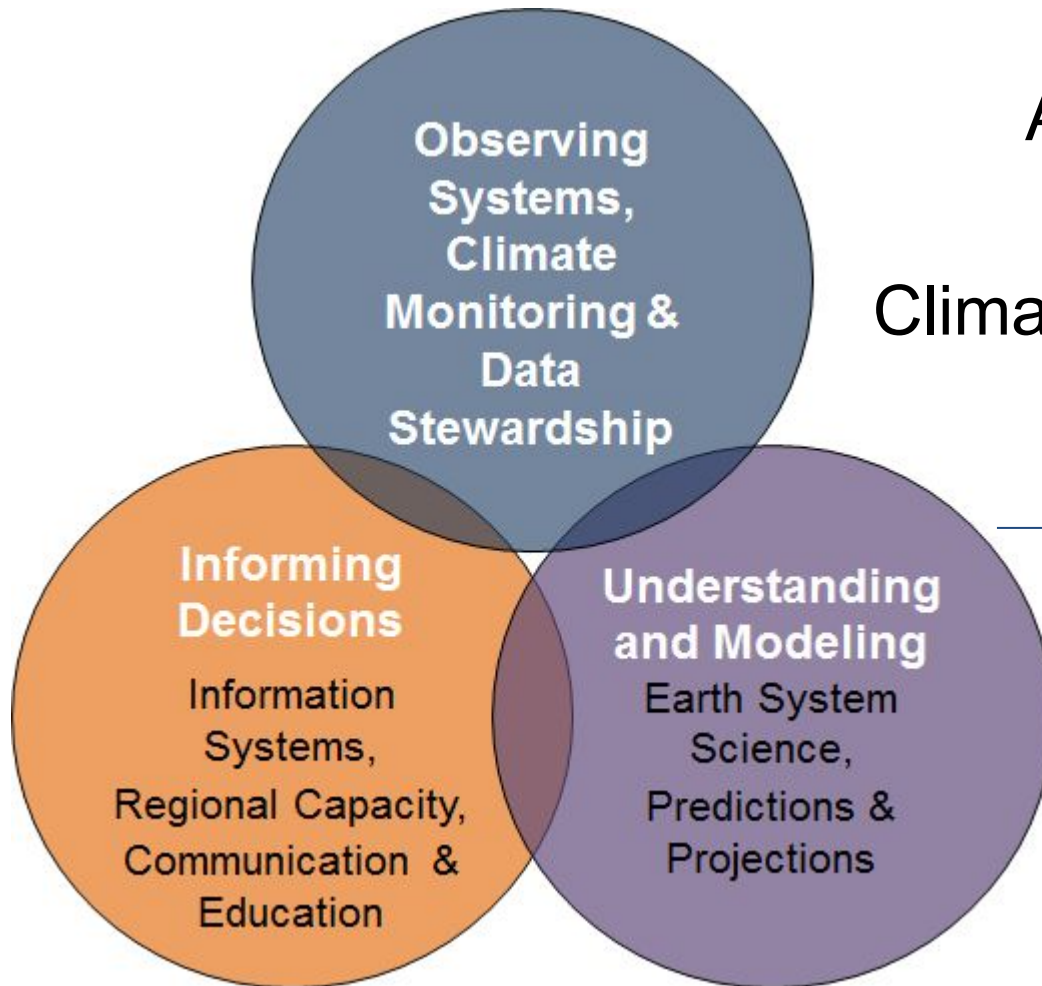
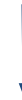Part 1: General MAPP Program Overview
Part 2: Overview of Modeling Activities

CPO Research Areas

Office of Oceanic & Atmospheric Research

Climate Program Office (CPO)

MAPP Program

A competitive grants program at the interface between science and services

Our Mission:
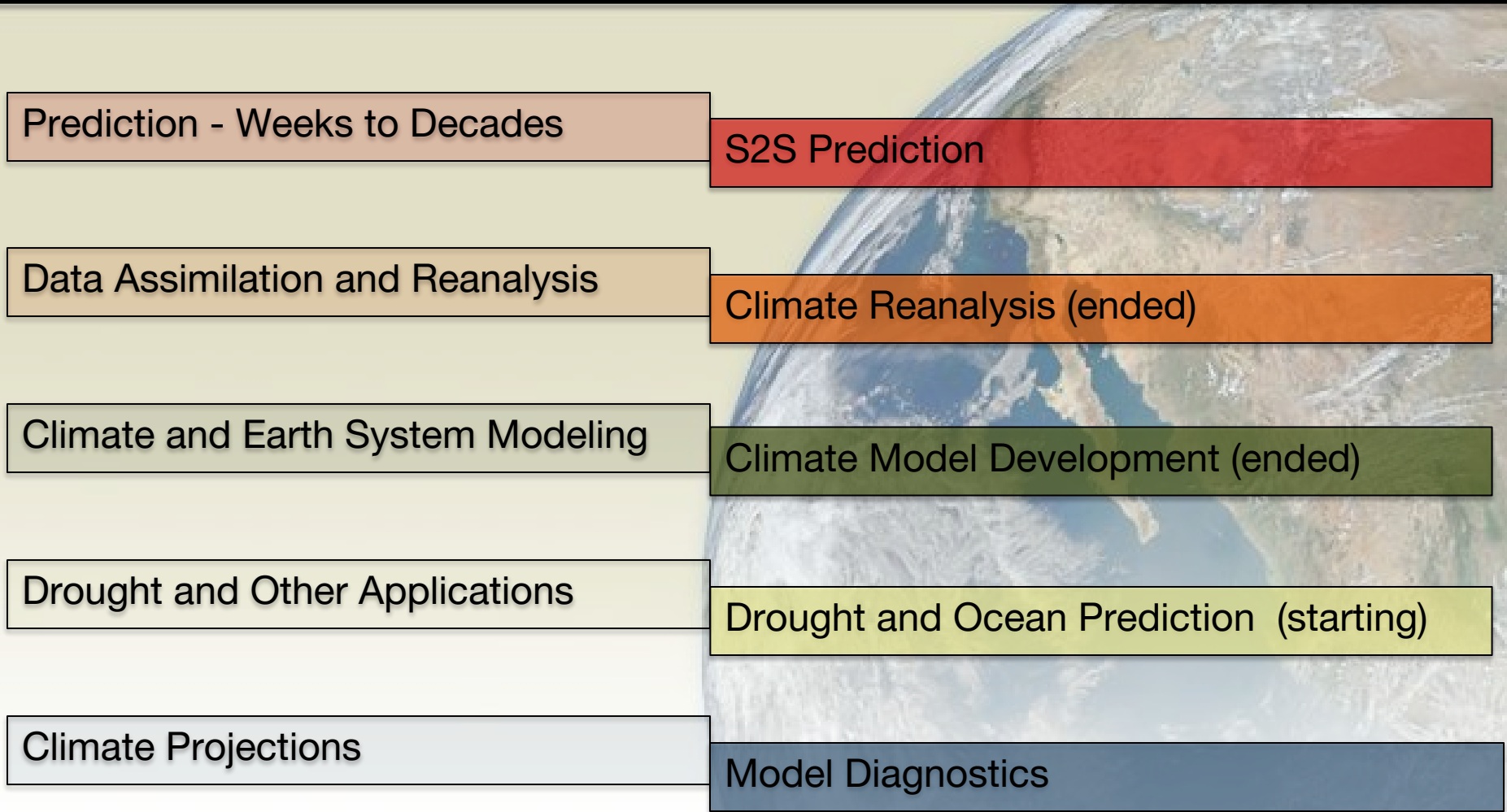*To enhance the Nation's capability to understand and predict natural variability and changes in Earth's climate system.*

- Support research and transition of research into operations (R2O) focused on development & application of Earth system models

- Coordinate research with partners inside NOAA and in other agencies

- Engage with external research community to extend NOAA's capabilities

Our Task Forces

MAPP — Modeling, Analysis, Predictions, and Projections

Prediction - Weeks to Decades	S2S Prediction
Data Assimilation and Reanalysis	Climate Reanalysis (ended)
Climate and Earth System Modeling	Climate Model Development (ended)
Drought and Other Applications	Drought and Ocean Prediction (starting)
Climate Projections	Model Diagnostics

- A Task Force is a coordinated research effort by MAPP investigators focused on the topic of a particular MAPP grant competition

The **NOAA Climate Test Bed** is a joint effort of CPO/MAPP and the National Centers for Environmental Prediction to advance operational climate monitoring, models, and prediction capabilities by accelerating transition of research into operations

The Climate Test Bed fosters the service–science link between NOAA and the broader scientific community.

Example project: Subseasonal Experiment (SubX)

- Goal: Address gaps in NOAA and ESPC operational prediction capabilities at sub-seasonal to seasonal (S2S) timescales

- Activity: Coordinated subseasonal hindcasting and real time forecasting experiment targeting subseasonal timescales

- Models involved: CFS, Navy, NASA/GEOS5, NCAR/CCSM, CanCM

- Project plan: first year - run hindcasts, second year - real time forecasts

Part 2: Overview of Model Development Activities

- Advance models and prediction systems used by the National Weather Service for data assimilation and predictions on weeks to seasons.

- Advance GFDL Earth System Models used as tools for research (e.g. CMIP) and the development of climate projections.

- Advance modeling applications (e.g. drought, coastal flooding, marine resources) in support of NOAA services.

Many partners: USGCRP, ESPC, WMO, WCRP..

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Modeling, Analysis, Predictions, and Projections

MAPP supports both research & R2O activities

- Assess benefits of high-resolution modeling
- Test new physical representations in models via Climate Process Teams
- Coupled data assimilation for monitoring and prediction (FY18 research call)
- Process level diagnostics for model improvement
- Modeling software infrastructure (NEMS) and data CFS data access (NCMA)

Advancing NOAA's New Unified Modeling Approach

> NOAA has embraced a unified modeling approach to improve the way it develops and operates models

- Unified modeling could reduce costs and optimize resources for NOAA, while utilizing community efforts more effectively

> MAPP & NGGPS programs coordinate to support research & transition to advance NWS unified modeling and prediction suite

- Coordinated or joint solicitations; project co-funding
- Joint meetings (e.g. this one!)

<u>Examples of past co-funding</u>: model physics, model infrastructure, S2S prediction

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![NOAA logo]

High-level NOAA Unified Modeling Overview

Prepared by
NOAA Unified Modeling Task Force

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A report by NOAA's Unified Modeling Task Force, formed by the Office of the Chief Scientists, including members from all NOAA Line Offices.

A joint MAPP-CTB initiative to advance NOAA's coupled modeling capability for predictions on subseasonal and seasonal timescales

- Participants: Academia; NOAA NCEP, GFDL and ESRL; NASA and Navy

- Planning contributions: O2R requirements, model configurations and output, metrics for model evaluation

- Key contributions to NWS NGGPS/ next-generation unified prediction system (next slide)

NOAA Technical Report OAR CPO-6

Climate Model Development Task Force Final Report
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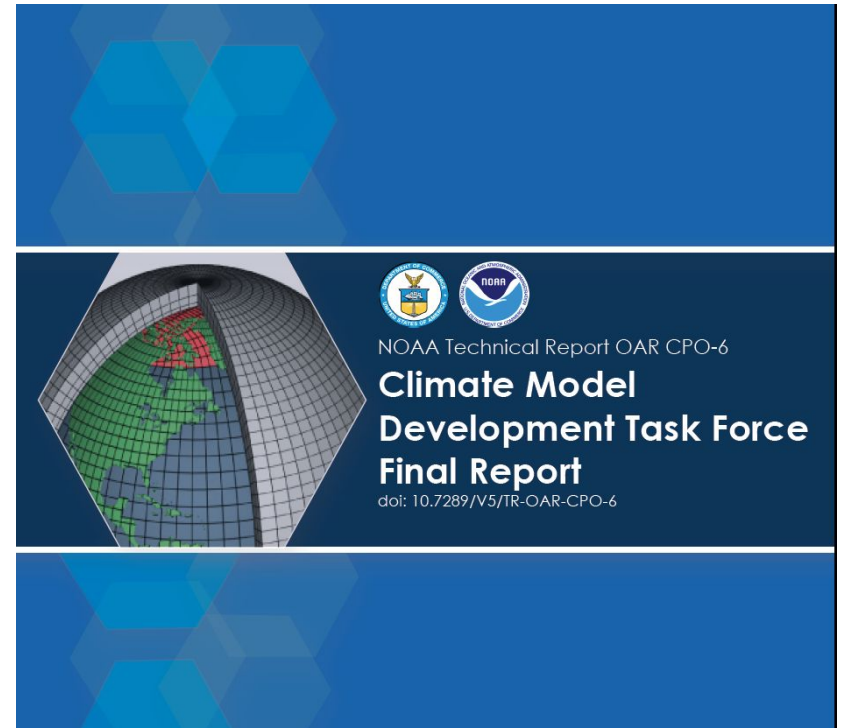
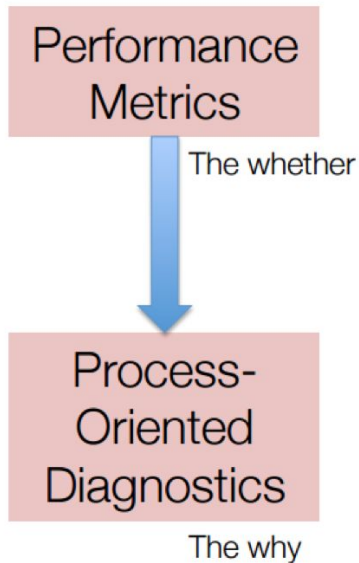Just published; copies available at the registration desk and online

Based on MAPP research and test bed (CTB) projects ([+]), some projects ([*]) were co-funded with the NGGPS program

Projects by PI name (many presentations at this meeting):

- **Atmospheric Processes**
  - Cloud and boundary layer Climate Process Teams (Krueger[+]; Bretherton[+])
  - Cloud microphysics and aerosols (Lu[*+])
  - Ozone parametrization (Compo)

- **Land Processes**
  - Soil-Hydrology-Vegetation modeling (Chen[*+])
  - Lake effects (Jin[*+])

- **Data Assimilation**
  - Ocean (Carton), land (Ek)

- **Model Evaluation**
  - Coupled processes at COLA (Kinter), air-sea fluxes (Yu), test harness (Saha)

- **Modeling Infrastructure**
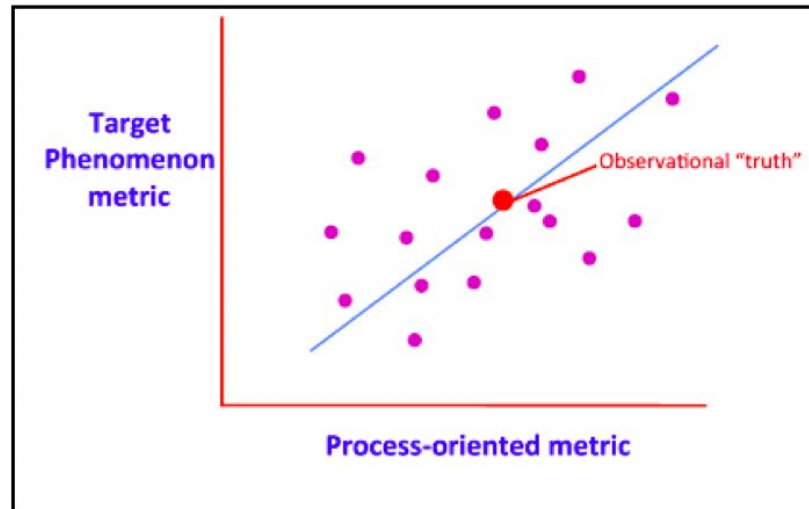 - NEMS development (DeLuca, complementary NGGPS funding)

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Performance Metrics

The whether

Process-Oriented Diagnostics

The why

- Focused on process-oriented metrics
  - Diagnostics relating how processes lead to biases.
  - Beyond performance bias diagnostics for common fields; provide physical insight.

- 9 Projects selected from FY15 MAPP Competition "Process-oriented evaluation of climate and earth system models and derived projections"

- Focal areas
  - Cloud microphysics
  - Land-atmosphere coupling
  - ENSO teleconnections
  - T/ET cyclogenesis
  - MJO variability/skill
  - Water mass transport
  - Diurnal cycle

Target Phenomenon metric

Observational "truth"

Process-oriented metric

NCAR
NATIONAL CENTER FOR ATMOSPHERIC RESEARCH

GFDL Geophysical Fluid Dynamics Laboratory

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Three solicitations:

- "Advancing Earth System Data Assimilation" (Joint with NGGPS and JPSS programs)
  - Developing a new methodology, or significantly advancing an existing methodology, for coupled DA
  - Developing a new or experimental DA-based approach to monitoring products for the cryosphere, ocean, land surface, or atmospheric composition
- "Addressing Key Issues in CMIP6-era Earth System Models"
  - Understanding the sources of coupled model bias in CMIP6-class models, and developing process-oriented metrics to inform model development
- "MAPP-Climate Test Bed - Advancing NOAA's Operational Subseasonal to Seasonal Prediction Capability" (Joint with NGGPS Program)