MAPP Program contributions to the SIP and longer-term EMC development

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MAPP
Modeling, Analysis, Predictions, and Projections

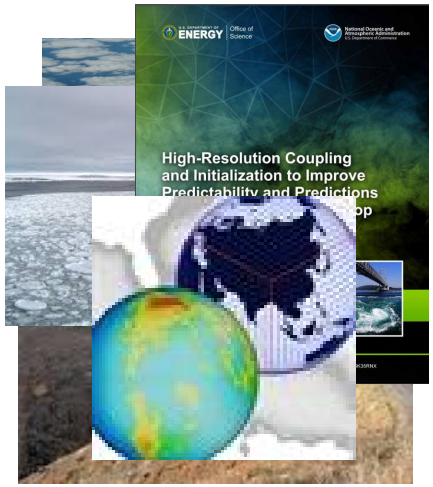
MAPP Mission and Priority Areas

Modeling, **A**nalysis, Predictions and Projections

- MAPP is a NOAA OAR/Climate Program Office competitive grants program to address NOAA's global coupled modeling, prediction & projection needs
- We coordinate with other NOAA programs and Line Offices, e.g. NWS/NGGPS, NESDIS/JPSS, NMFS/S&T, and with other agencies via USGCRP, US-CLIVAR and contribute to WCRP research
- We support R&D projects, as well as transition (R2O) activities via the Climate Test Bed (jointly supported with NCEP)

MAPP's Priority Areas:

Prediction -- Weeks to Decades
Drought and Other Applications
Reanalysis and Data Assimilation
Climate and Earth System Modeling
Climate Projections



Takeaways from this talk

- Significant and sustained partnership between the MAPP and NGGPS programs on transition projects
  - Co-funded projects competitively selected in the external community, leveraging climate community expertize
  - Many projects outcomes are being/will be integrated in the SIP

- A balance of transition and exploratory research to support the needed long term development of NOAA models

- MAPP provides a critical connection between NCEP and:
  - CMIP community activities, consistent with NOAA's new unified modeling paradigm, GFDL's long term approach, also new WMO approach
  - Modeling applications across NOAA's LOs

MAPP's FY14 Climate Test Bed - Physics Projects

Land - "Improving the NCEP Climate Forecast System (CFS) through Enhancing the Representation of Soil-Hydrology-Vegetation Interactions" - JUST ENDED
Fei Chen (NCAR), Mike Ek, Rongqian Yang and Jessie Meng (EMC)

Cloud Microphysics and Aerosols - "Improving Cloud Microphysics and Their Interactions with Aerosols in the NCEP Global Models" - JUST ENDED
Sarah Lu (SUNY); Hou YT, and Moorthi (EMC)

Lake - "Advances in Lake-Effect Process Prediction within NOAA's Climate Forecast System for North America" - ON-GOING
Jiming Jin (USU), Ek (EMC) Yihua Wu (EMC)

All above MAPP Projects have been co-supported by the NWS/STI/NGGPS Program

Project Outcomes and SIP relevance

Post-Project EMC Review of the land and aerosol/microphysics projects on Jan 17th

Cloud Microphysics and Aerosols Project (Lu et al)

"Operational transition of the advanced Morrison and Gellman (MG) microphysics element has reached RL8 and should be considered for advanced physics option..progress was limited by the switchover from the GSM to the FV3 dynamical core in the GFS..progress was impressive and we look forward to further integrating new approaches to aerosol processes in the FV3-based Unified Forecast System"

Land Project (Chen et al)

"Noah MP will go to the operational system during Q2FY19 as a part of GFSv15 implementation. In order to increase RL from 8 to 9, extensive parallel runs have to be carried out to finalize the optimal selection of Noah MP physics options during FY18."

MAPP's FY16 Data Assimilation Climate Test Bed Projects

Ocean - **"Upgrading the CPC operational ocean monitoring to an eddy-permitting global ocean analysis using the Hybrid Global Ocean Data Assimilation System as a replacement for GODAS"** (NESDIS & NWS/STI co-support) - ON-GOING
S Penny (UMD), J Carton (UMD), Y Xue (CPC), D Behringer and L Miller (EMC)

Waves - **"Development toward NCEP's fully-coupled global forecast and data assimilation system: A coupled wave–ocean system"** (NWS/STI co-support)- ON-GOING
S Griffies (GFDL), R Hallberg (GFDL), A Adcroft (GFDL & Princeton), A Chawla and S Saha (EMC), S Penny (UMD/NCEP)

Land - **"Operational Transition of Soil Moisture and Snow Data Assimilation in the North American Land Data Assimilation System (NLDAS)"** (NWS/STI co-support)- ON-GOING
C Peters-Lidard (NASA), M Ek and J Dong (EMC), D Mocko (Goddard), S Kumar (NASA), Y Xia (EMC)

Ice - **"Development of ensemble-based sea ice analysis and forecasting in the Climate Forecast System"** - ON-GOING
J Carton (UMD), S Penny (UMD/NCEP), Bob Grumbine (EMC), S Saha (EMC)

Broader MAPP Efforts and Importance to NCEP

- As GFDL, MAPP draws from its CMIP related activities to support NCEP
  - physics, process understanding, modeling infrastructure
  - A broad community of experts and modeling activities, robust national and international research programs

- NOAA has adopted a unified modeling approach. Consistently MAPP supports modeling across NOAA LO providing a linkage to those activities

- Such a unified approach is consistent with WMO's future framework, increasingly linking weather and climate modeling

Some Examples

Multi-model ensembles involve CMIP models

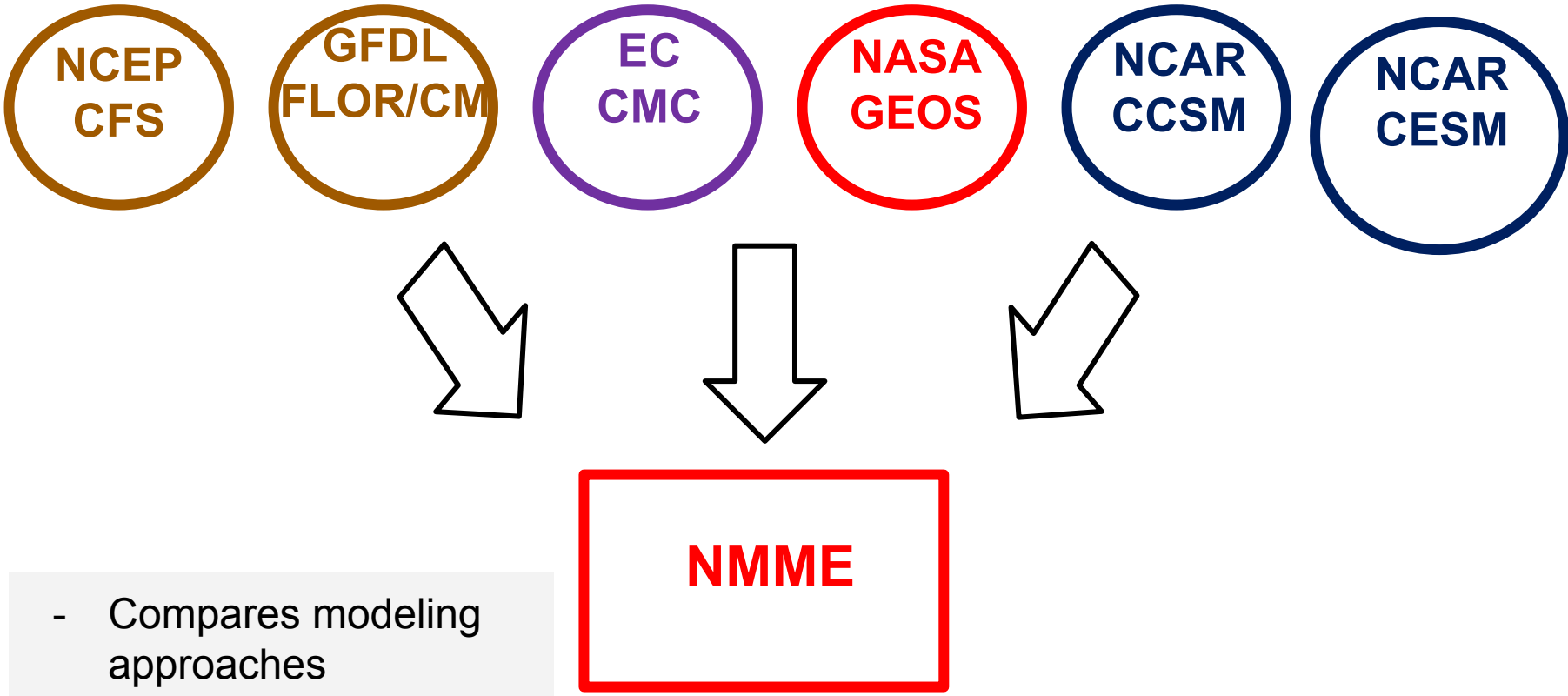
- Multi-Model Ensemble Climate Test Bed projects involve CMIP models: NMME, SubX

- Ensembles provide terms of comparison for EMC development and highlight issues (real-time and retrospective)

- Can help inform future UFS set-up both via SIP and the long-term development plans

Seasonal to decadal Prediction

NMME - combines the best North American CMIP models, serves as benchmark for EMC development



- Compares modeling approaches
- Has Revealed CFS issues e.g. IC

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SubX - provides a baseline for future EMC S2S model development

7 Global Models

ECCC	EMC	NRL	CPC
GEM	GEFS	NESM	CFS2

GMAO	RSMAS	ESRL
GEOS_V2	CCSM4	FIMr1p1

1 Year of *Real-time* Forecasts

3-4 week guidance for Climate Prediction Center Outlooks

17 Years of *Retrospective* Forecasts

Funding for 2016-2019

MAPP Modeling, Analysis, Predictions, and Projections

National Weather Service

Office of Naval Research ONR Science & Technology

Environment Canada

NASA

MAPP's Climate Process Teams - Cloud Physics

Under CLIVAR, MAPP's Climate Process Teams to improve unified physics for NOAA models

- "A CPT for Improving Turbulence and Cloud Processes in the NCEP Global Models"- ON-GOING
  Krueger (Utah SU), Moorthi (EMC) et al.

- "CPT to improve cloud and boundary layer processes in GFS/CFS"- ON-GOING
  Bretherton (U Washington), Jiongil han, Rui-Yu Sun (EMC) et al.

- Supported under MAPP modeling efforts and co-supported by the NWS/STI/NGGPS Program
- Projects will end in FY18, outcomes are relevant to the SIP

MAPP FY18 Earth System Data Assimilation Research Initiative

FY18 MAPP Research Call - Advancing Earth System Data Assimilation
Cross NOAA LO relevance, co-developed with NESDIS

- Two Research Foci:
  1) Methodologies for coupled DA of relevance to Earth system prediction and/or monitoring needs of all NOAA Line Offices

  2) New or experimental DA-based approaches to monitoring products for the cryosphere, ocean,land surface, or atmospheric composition.
     - Assimilation of climate-quality NOAA data; reprocessed satellite-based products available from JPSS.

- Proposals in review, expected start date Summer 2018

- Of relevance to long-term development of the UFS

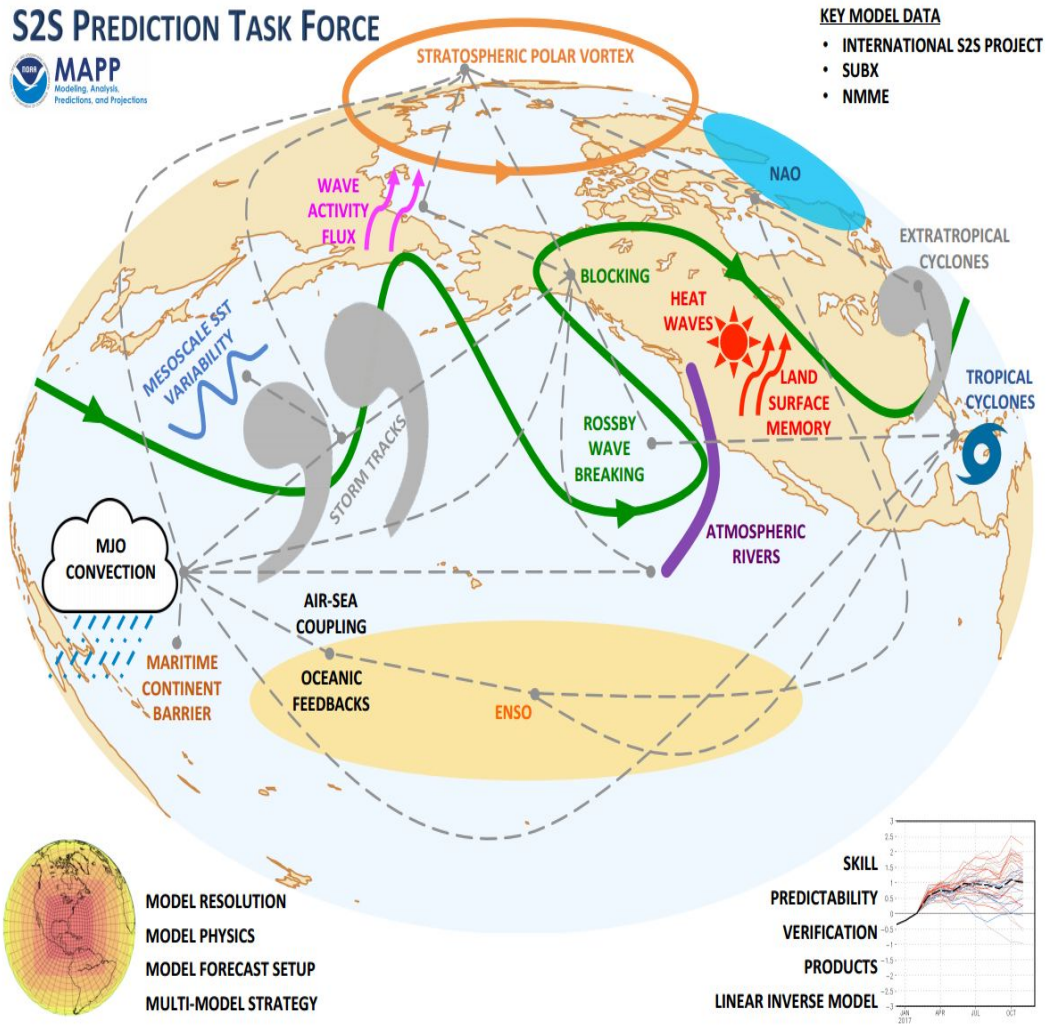
S2S predictability stems from coupled processes

The WMO S2S Project is joint between WCRP and WWRP, for good reasons

- coupled processes
- coupled modeling

MAPP's S2S Prediction Task Force draws from CMIP science and links with weather community

- MJO and ENSO are WCRP, USCLIVAR long-term foci



CMIP Modeling Infrastructure: ESMF

- Long-term MAPP broad support of ESMF for CMIP/NOAA modeling needs is now resulting in the new NEMS modeling infrastructure for NCEP (co-supported with NGGPS)

- FY15 Project: "Modeling and Data Infrastructure in Support of NOAA's Global Models"
  Deluca (NESII/CIRES), Kinter (COLA), Balaji (GFDL)

  - > NEMS UFS infrastructure is part of the SIP

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