



Subseasonal to Seasonal Science and Prediction Initiatives of the MAPP Program

Annarita Mariotti and Dan Barrie
NOAA Research, Climate Program Office

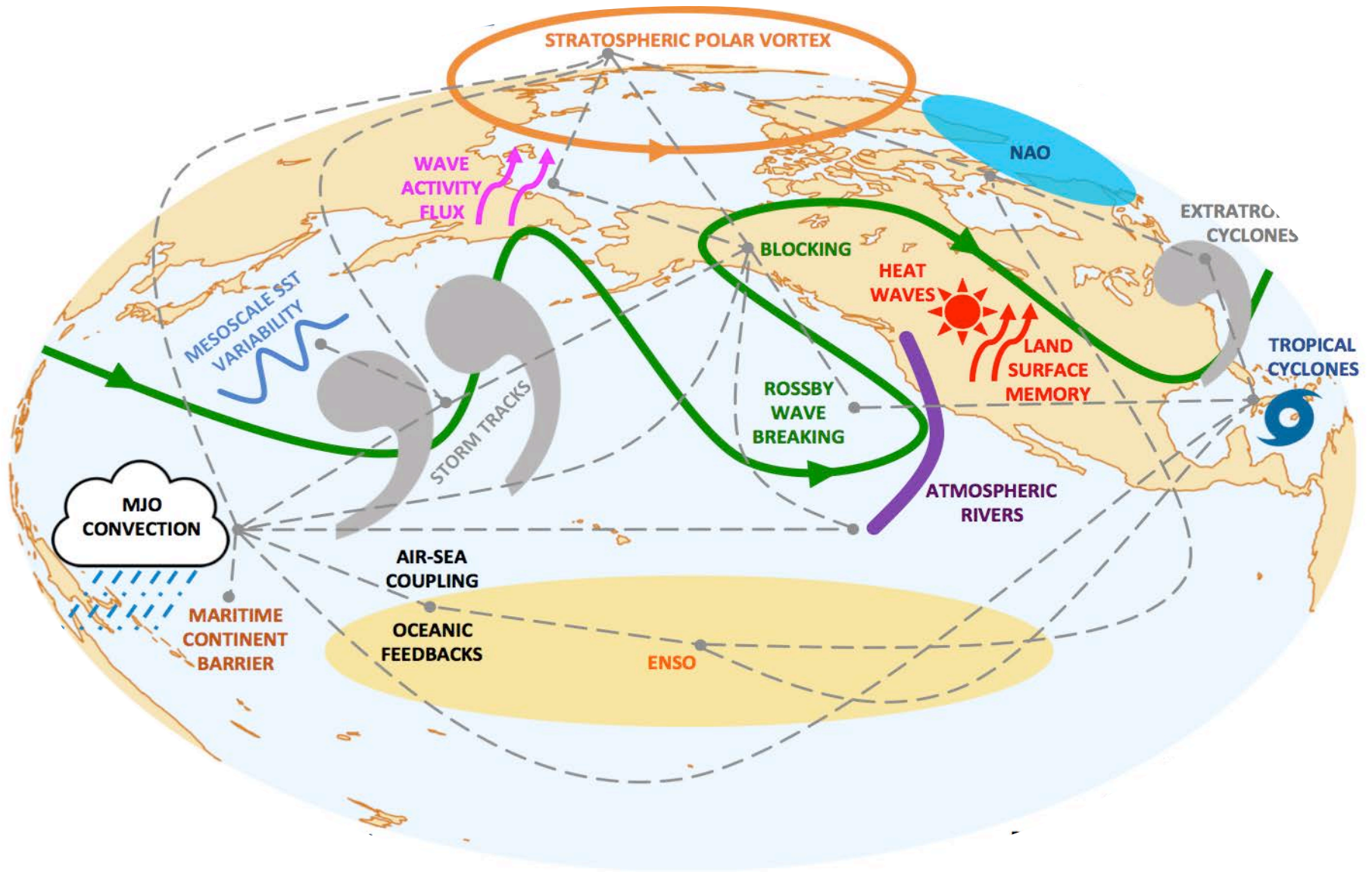


MAPP
Modeling, Analysis,
Predictions, and Projections



NOAA Research: Serving Society Through Science

The S2S Problem





The S2S Problem

Weather, Climate or Both?





The S2S Problem

Weather, Climate or Both?

WWRP/WCRP Sub-seasonal to Seasonal Prediction Project (S2S) Phase II Proposal

(November 2018–December 2023)

WEATHER CLIMATE WATER



WORLD
METEOROLOGICAL
ORGANIZATION



nature.com > npj climate and atmospheric science > perspectives > article

npj | Climate and Atmospheric Science

Perspective | OPEN | Published: 26 March 2018

Progress in subseasonal to seasonal prediction through a joint weather and climate community effort

Annarita Mariotti , Paolo M. Ruti & Michel Rixen

npj Climate and Atmospheric Science **1**, Article number: 4 (2018) | [Download Citation](#) 





MAPP S2S Research Initiatives 2016-2019

Involving Weather and Climate Communities

1) Understand and model S2S processes

14 projects – S2S Prediction Task Force

2) Test S2S prediction tools

NOAA Climate Test Bed, 14 projects:

- Test experimental subseasonal ensemble prediction systems (SubX)
- Test statistical techniques for prediction of tropical–midlatitude teleconnections

MAPP's Partners



MAPP S2S Prediction Task Force



Lead
Elizabeth Barnes
Colorado State University



Co-Lead
Edmund Chang
Stony Brook University



Co-Lead
Paul Dirmeyer
George Mason University/COLA

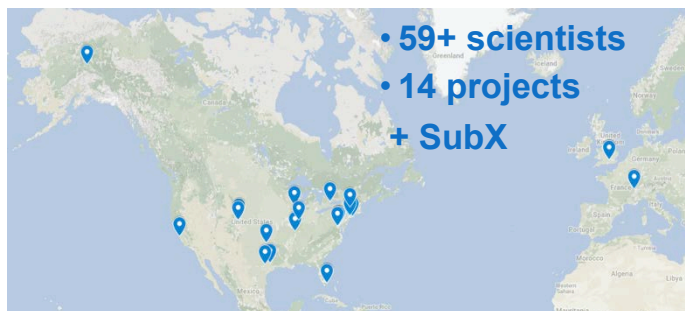


Co-Lead
Andrea Lang
University of Albany



Co-Lead
Kathy Pegion
George Mason University

14 projects to examine modeling and prediction of S2S phenomena – 2016-2019



Dec 2016

Bridge the gap in prediction skill and products between traditional weather and seasonal lead times

<http://cpo.noaa.gov/MAPP/S2STF>

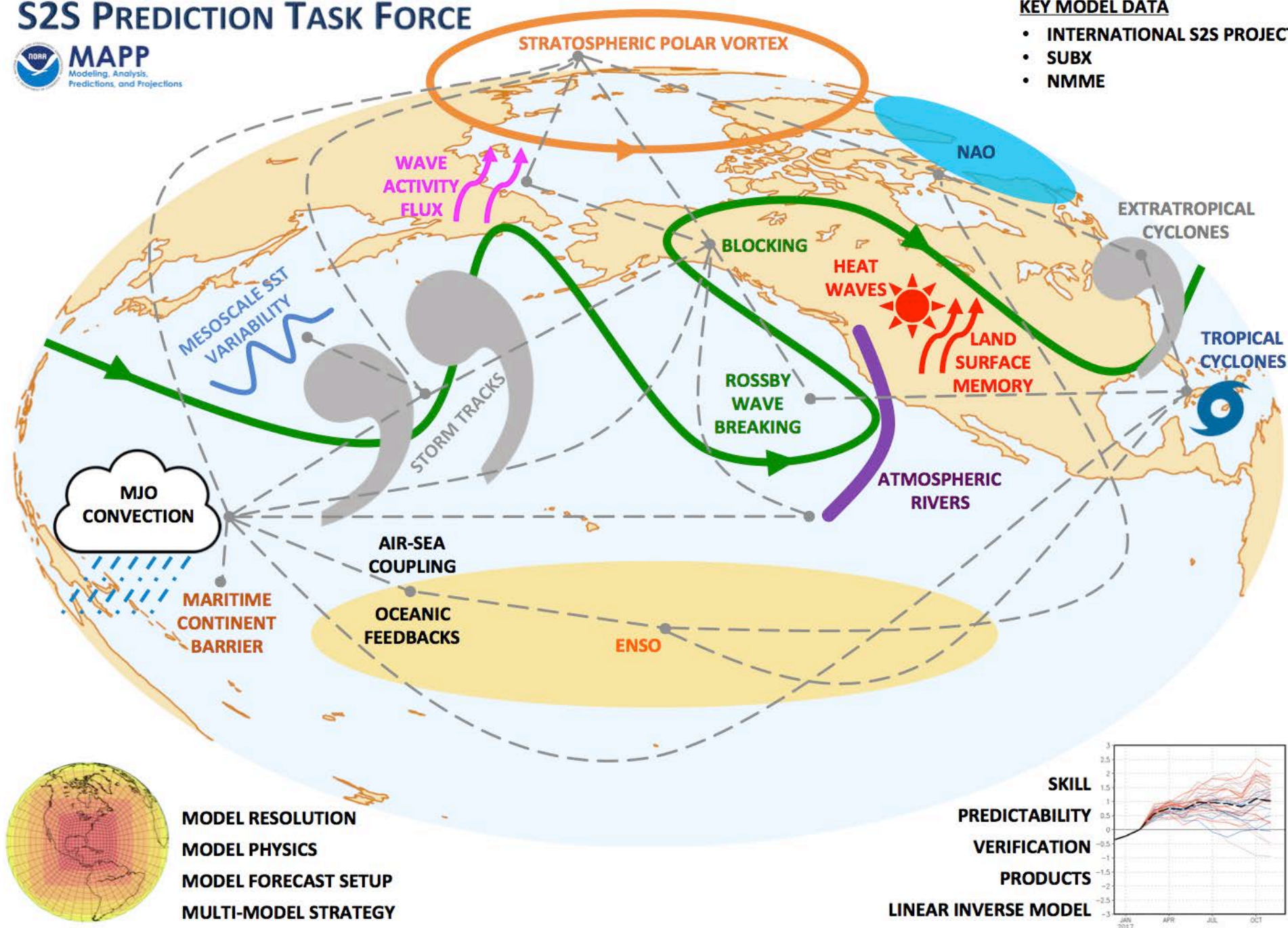


S2S PREDICTION TASK FORCE



KEY MODEL DATA

- INTERNATIONAL S2S PROJECT
- SUBX
- NMME

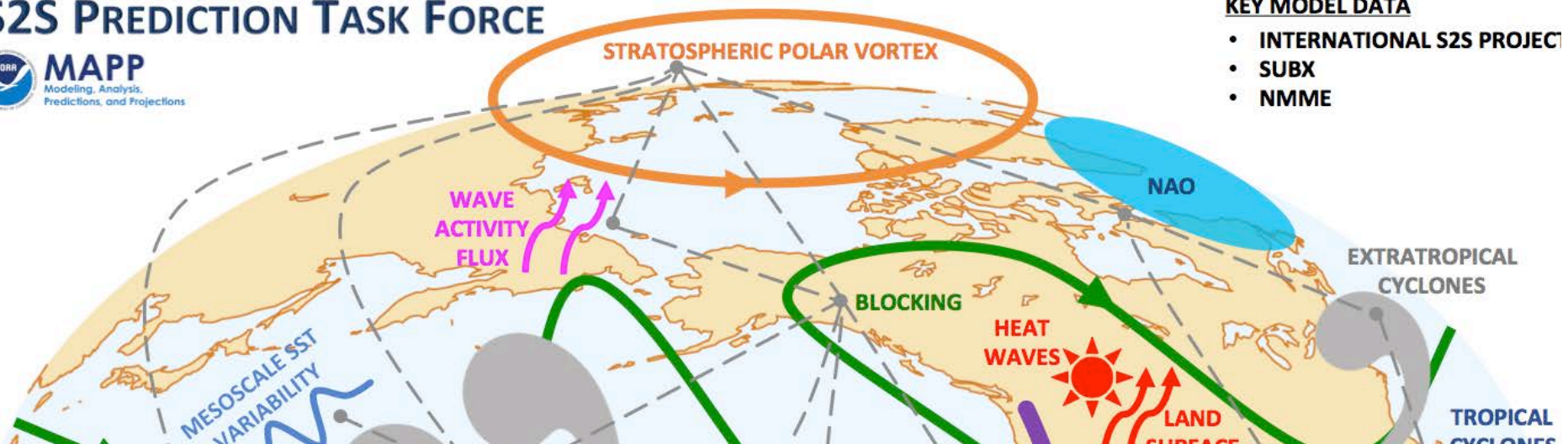


S2S PREDICTION TASK FORCE

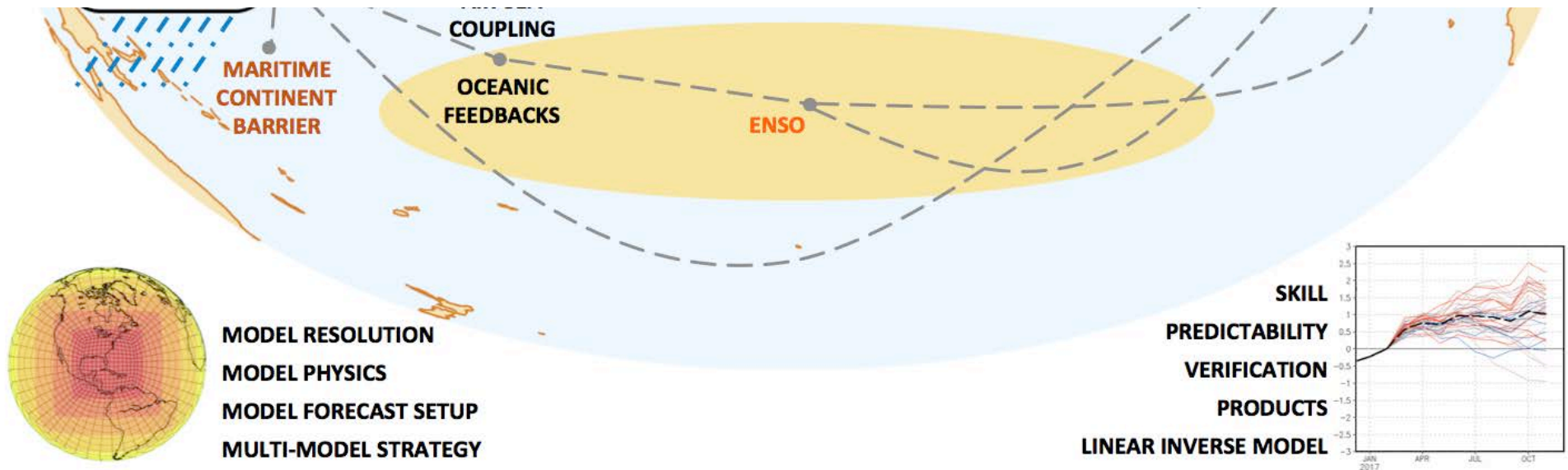


KEY MODEL DATA

- INTERNATIONAL S2S PROJECT
- SUBX
- NMME



A number of important preliminary findings..

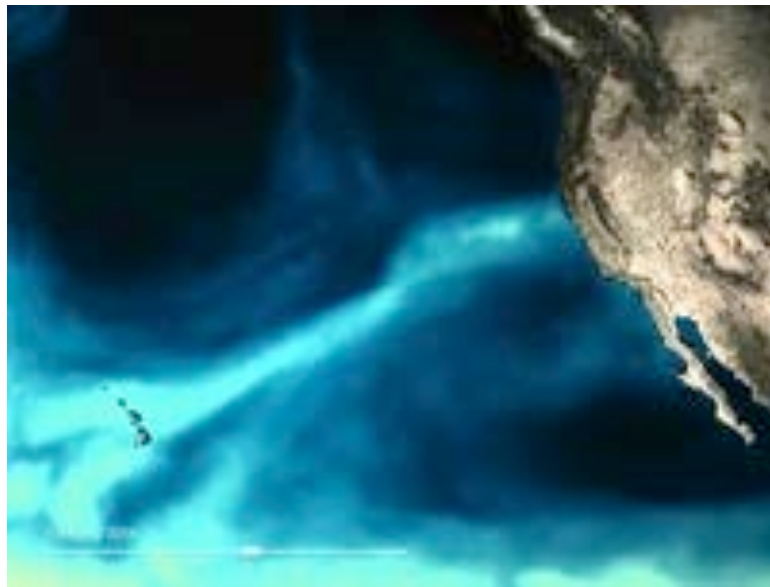




.. the important role that the stratosphere has in modulating the impact of tropical climate phenomena (e.g. MJO) on extremes in the U.S.



Atmospheric Rivers, MJO and QBO..



MAPP award PI Barnes, CSU

Mundhenk et al, NPJ Climate, 2018

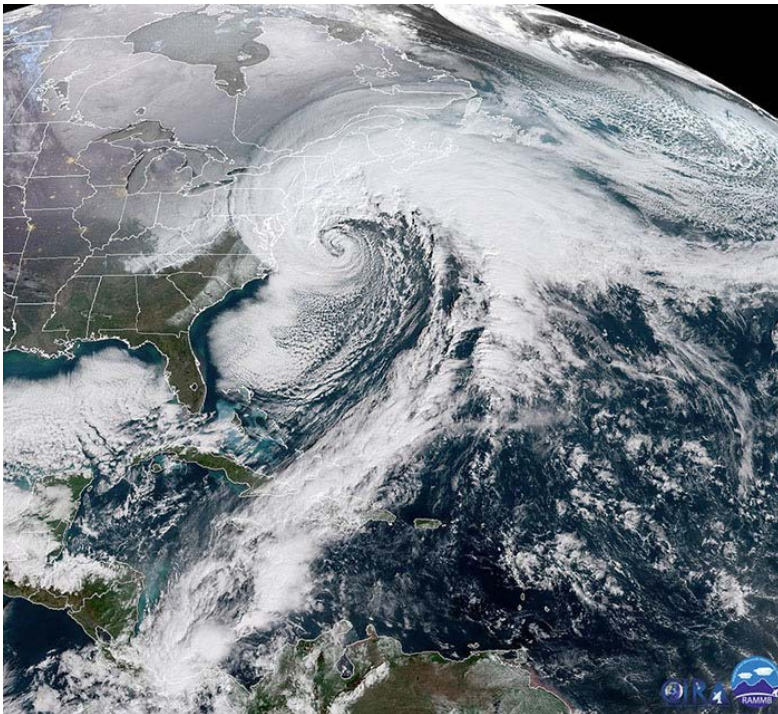
Baggett et al., GRL, 2017

The level of activity for Atmospheric Rivers striking the U.S. west coast is modulated simultaneously by the phase of the tropical MJO pattern and the state of the stratospheric QBO.

-> A new statistical tool shows promise to extend predictions of atmospheric river activity by 4+ weeks - several weeks beyond skillful lead times of current dynamical prediction systems.



Extratropical cyclones, storm tracks, MJO, QBO



The stratospheric QBO has been found to modulate the impact of the MJO on the North Pacific and North Atlantic extratropical storm tracks

-> Potential implications for the S2S prediction of surface weather, such as the rapidly intensifying “Bomb Cyclones”.

MAPP PI E Chang, Stony Brook U

Wang et al. (2018a, GRL; 2018b, JGR)
Zheng et al. 2018, J. Climate





..emerging new MJO remote impacts on
US extremes and their S2S prediction..



Tornados, Hail, Tropical Cyclones and the MJO



*“Skillful 5 Week Forecasts of
Tornado and Hail Activity”*

Baggett et al., 2018 JGRA
submitted

*“Sub-seasonal tropical cyclone
genesis prediction and MJO ..”*

Lee, et al., 2018 Wea. Forecast.

MAPP PI Barnes, CSU

MAPP PI Camargo, Columbia U





.. important effects of oceanic and land surface conditions on the prediction of S2S phenomena



Ocean-Atmosphere and Land-Atmosphere Interactions



Ocean model resolution and physical processes representation can impact ocean feedbacks and the MJO forecast skill..



Land surface initialization can impact heat wave predictability..

*MAPP PI DeMott, CSU
DeMott et al, 2018., in preparation.*

MAPP PI Ford, Southern Illinois U





..multi-model ensemble predictions and their careful combination enhance S2S skill..

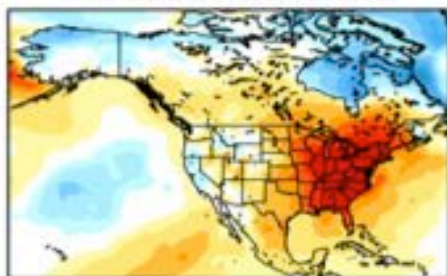
The Subseasonal eXperiment (SubX)

By the Numbers...

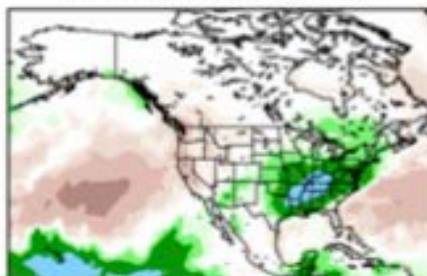
7 Global Models
17 Years of Retrospective Forecasts
1 Year of Real-time Forecasts
3-4 Week guidance for CPC Outlooks

Real-time Multi-model Forecasts

MME (63 Ensemble Members)



MME (63 Ensemble Members)



SubX Team



IRI Data Library



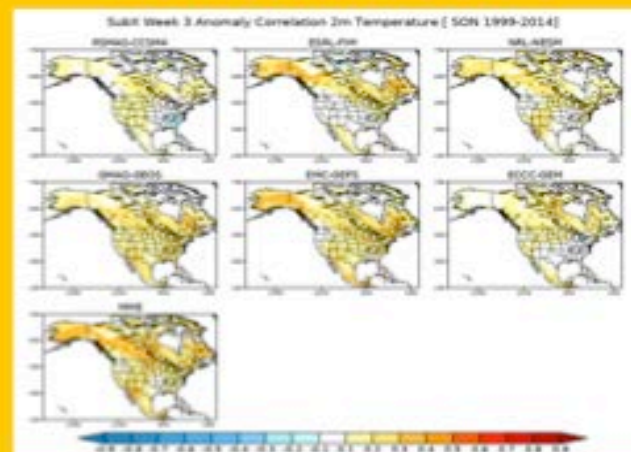
Forecast & Hindcast data
publicly available

Current Data Holdings (Last updated: Feb 14, 2018)

Model	Start	End	Interval	DT	Re	Obs	Years	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
CCCMA-CGCM3	1979-01-01	2014-12-31	1-day	00	00	00	1979-2014	00	00	00	00	00	00	00	00	00	00	00	00
CCCMA-CGCM3	1979-01-01	2014-12-31	1-day	00	00	00	1979-2014	00	00	00	00	00	00	00	00	00	00	00	00
CCCMA-CGCM3	1979-01-01	2014-12-31	1-day	00	00	00	1979-2014	00	00	00	00	00	00	00	00	00	00	00	00
CCCMA-CGCM3	1979-01-01	2014-12-31	1-day	00	00	00	1979-2014	00	00	00	00	00	00	00	00	00	00	00	00
CCCMA-CGCM3	1979-01-01	2014-12-31	1-day	00	00	00	1979-2014	00	00	00	00	00	00	00	00	00	00	00	00
CCCMA-CGCM3	1979-01-01	2014-12-31	1-day	00	00	00	1979-2014	00	00	00	00	00	00	00	00	00	00	00	00
CCCMA-CGCM3	1979-01-01	2014-12-31	1-day	00	00	00	1979-2014	00	00	00	00	00	00	00	00	00	00	00	00
CCCMA-CGCM3	1979-01-01	2014-12-31	1-day	00	00	00	1979-2014	00	00	00	00	00	00	00	00	00	00	00	00
CCCMA-CGCM3	1979-01-01	2014-12-31	1-day	00	00	00	1979-2014	00	00	00	00	00	00	00	00	00	00	00	00
CCCMA-CGCM3	1979-01-01	2014-12-31	1-day	00	00	00	1979-2014	00	00	00	00	00	00	00	00	00	00	00	00

<http://iridl.ldeo.columbia.edu/SOURCES/.Models/.SubX/>

Skill Evaluation



<http://cola.gmu.edu/kpregon/subx>



Courtesy of Kathy Pregon



NOAA Research: Serving Society Through Science

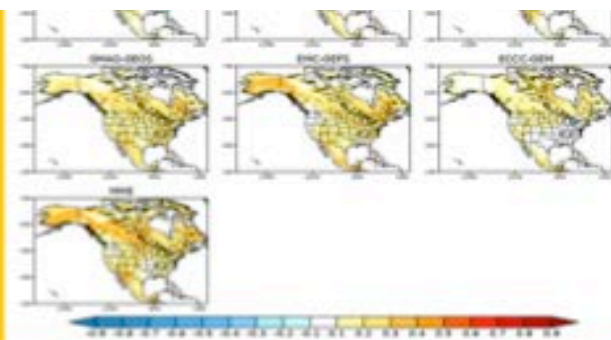
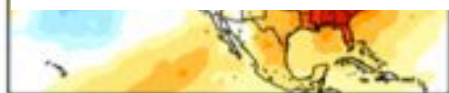
The Subseasonal eXperiment (SubX)

IRI Data Library

The SubX multimodel ensemble is more skillful than any individual model overall

-> useful contributions to NOAA's operational forecast guidance

Pegion et al., 2018 In prep.



SubX Team



<http://cola.gmu.edu/kpegion/subx>



Courtesy of Kathy Pegion



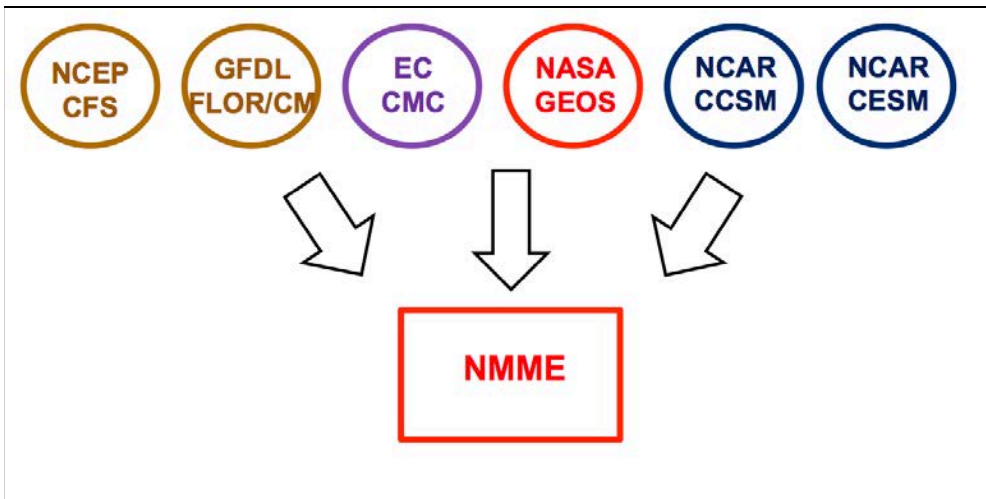
NOAA Research: Serving Society Through Science



Outcomes from 2 prior MAPP projects..



The North American Multi-Model Ensemble (NMME)



Climate Dynamics special issue on the NMME
22 papers to date

Back in 2011, a research project to test a multi-model seasonal prediction system, involving multiple agencies and many partners.

-> Since 2016, providing operational monthly seasonal predictions for NOAA and serving as a community research platform.

A MAPP Climate Test Bed project

Kirtman et al., 2014

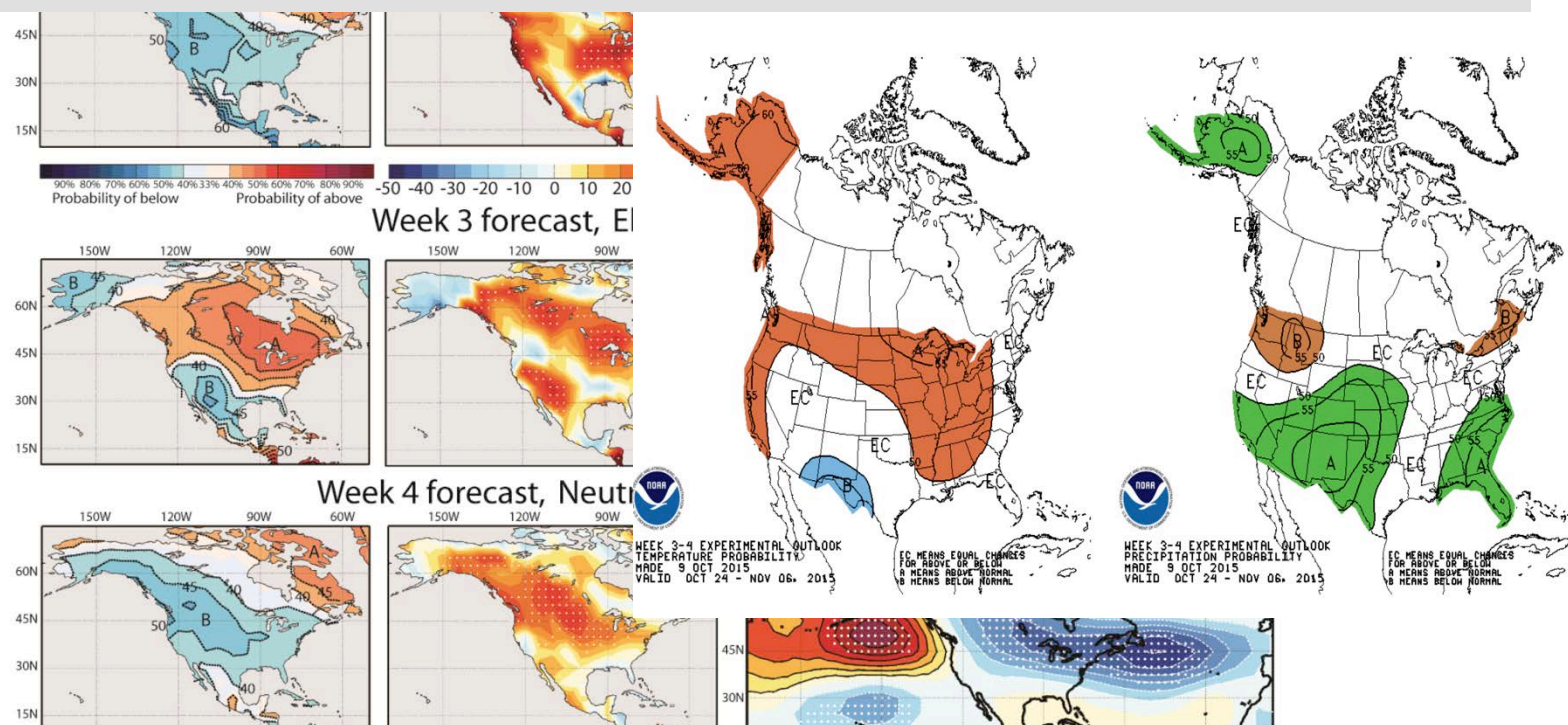




New Week 3-4 Temperature and Precipitation Forecast Tools

Tested new statistical tools that leverage the relationship between the state of the MJO/ENSO and Temperature/Precipitation for forecasts of opportunity

-> Now providing guidance for NOAA NCEP experimental week 3-4 outlooks



A MAPP Climate Test Bed project

Johnson et al., 2014



Want to Know More?

- Many talks during this meeting!
- Joint JGR & GRL Special Collection “*Bridging Weather and Climate: Subseasonal-to-Seasonal (S2S) Prediction*”
Submissions May 1, 2018 - April 30, 2019, open to the entire international S2S
- “Bridging the weather-to-climate prediction gap: progress by the NOAA S2S Prediction Task Force”, EOS submitted





Summary

Past MAPP S2S community research has resulted in several new operational capabilities for NOAA and science advances.

The MAPP S2S Prediction Task Force is a milestone contribution to broad weather and climate communities efforts.

Working to advance understanding and modeling of S2S phenomena and the development of new S2S prediction products.



<http://cpo.noaa.gov/MAPP>

