



NOAA's Climate Program Office

*Modeling, Analysis, Predictions, and
Projections Program*

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Contents

- ☐ MAPP Program Overview
- ☐ Current Task Forces: Status and Plans
 - Drought TF
 - CMIP5 TF
 - Climate Prediction TF
- ☐ Plans for the Reanalysis TF



MAPP Program Overview



Climate Program Office

**Climate
Observations
and Monitoring**

**Earth System
Science**

**Climate Program
Office**

**Climate and
Societal
Interactions**

**Modeling Analysis,
Predictions, and
Projections**

NOAA/OAR/CPO/MAPP

A mission-oriented competitive research program at the interface between basic Earth system science and operational/service needs.



MAPP Research Goals

Advance understanding and prediction of natural variability and changes in Earth's climate system

Advance
Intraseasonal to
Interannual Climate
Prediction

Advance
Long-Term Climate
Outlooks

Modeling,
Analysis,
Predictions &
Projections

Advance Climate and
Earth System Models

Advance Drought
Understanding,
Monitoring and
Prediction

Advance Climate
Reanalysis

Infuse research advances into operational activities



Task Forces rationale & goals

- Organized by MAPP program to provide coordination and focus to MAPP research in strategic areas
- Building on competitively selected projects (with specific goals) to address broader community (cross-cutting) issues (the sum can be greater than individual parts)
- 3 year efforts – may be extended as needed
- Leveraging/linking/contributing to other relevant efforts, nationally/internationally (e.g. USCLIVAR)
- Most TFs involve a Climate Test bed component linking research advances to NOAA's operational activities/needs



Supporting MAPP's goals

Prediction Task Force
Advancing ISI Climate
Prediction

CMIP5 Task Force
Developing Projections for
North America

MAPP Webinars
Facilitating Communication

Climate Reanalysis
Task Force

Climate Process Teams

Drought Task Force
Advancing Drought Understanding,
Monitoring and Prediction

Connecting scientists in the external community with NOAA labs and operational centers, beyond a “grant” funding exercise



Task Forces status and plans

A presentation focusing on collective activities rather than individual projects and their achievements



The Drought Task Force

Established Oct. 2011



Drought Task Force

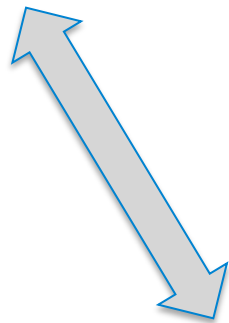
Underpinning Science

Basic scientific advances that support progress



Retrospective Drought Analyses

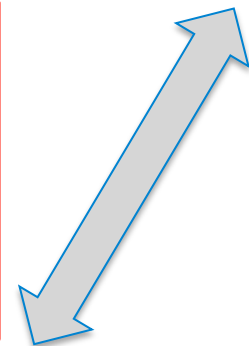
To improve understanding of U.S. drought



Drought Task Force

To advance drought understanding, monitoring and prediction

Led by S Schubert, K Mo, A Wood, C Peters-Lidard



Assessing and Improving Drought Capabilities

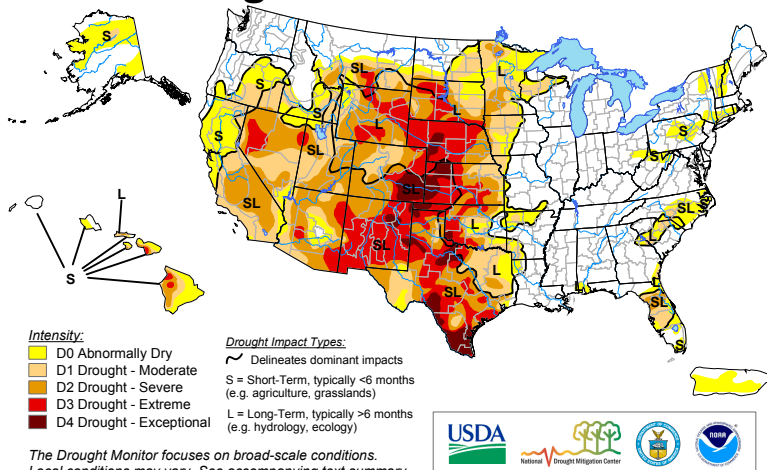
A testbed framework to advance drought systems

- Activities are interconnected and build on individual MAPP projects (17 projects, 30plus PIs); leverages many other internal/external investments
- A spectrum of activities from more basic research to improving systems
- Focus on U.S. drought but in connection with global efforts on drought (e.g. GDIS)

MAPP Partnership with NIDIS

U.S. Drought Monitor

April 23, 2013
Valid 7 a.m. EDT



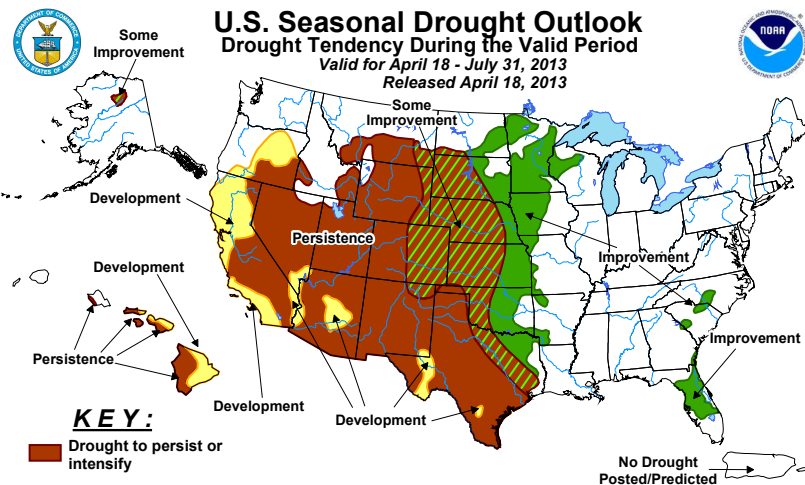
Released Thursday, April 25, 2013

Author: Eric Luebbehusen, U.S. Department of Agriculture

<http://droughtmonitor.unl.edu/>

U.S. Seasonal Drought Outlook

Drought Tendency During the Valid Period
Valid for April 18 - July 31, 2013
Released April 18, 2013



Depicts large-scale trends based on subjectively derived probabilities guided by short- and long-range statistical and dynamical forecasts. Short-term events -- such as individual storms -- cannot be accurately forecast more than a few days in advance. Use caution for applications -- such as crops -- that can be affected by such events. "Ongoing" drought areas are approximated from the Drought Monitor (D1 to D4 intensity). For weekly drought updates, see the latest U.S. Drought Monitor. NOTE: the green improvement areas imply at least a 1-category improvement in the Drought Monitor intensity levels, but do not necessarily imply drought elimination.

- ◆ MAPP-NIDIS partnership to advance the development of a national drought monitoring and prediction system.
- ◆ The official USDM and USDO are fundamental contributions to the National Drought Information system (NIDIS) – many inputs go into generating these products
- ◆ These can be improved through research:
 - Drought monitoring improvements can be obtained by research providing better data and improved methodologies to exploit them
 - Drought prediction research is needed to 1) better understand predictability 2) improve the forecast systems.

Understanding U.S. drought

Research questions:

Why do droughts occur? Which drought precursors can be leveraged to improve prediction? Which processes regulate drought development?

Which past droughts were more predictable and why? Were they well predicted and if not, why?

DTF Research is exploring:

- Role of initial conditions (soil moisture, snow cover, ground water, vegetation) and land-atmospheric interactions in drought initiation and evolution
- Role of remote SSTs in drought initiation and evolution
- Sub-seasonal to seasonal drought predictability and prediction

A Narrative Team focusing on retrospective drought analyses.

Led by M Hoerling, S Schubert and K Mo. Benefiting from past USCLIVAR Drought WG activities.



Assessing and improving systems

Research questions:

What is the current state of drought monitoring and predictive capabilities? Which research advances can lead improved drought monitoring and predictions? Are we seeing improvements?

Research is exploring:

- Advanced land and hydrologic models
- Soil moisture and snow depictions (exploiting different data, data assimilation systems; these are predictions IC)
- Advanced meteorological prediction systems for monthly-seasonal drought prediction
- Advanced hydrological prediction systems

A **Research to Capability Team** applying a test-bed framework (including cases, metrics, benchmarks) to assess status and progress. Led by J Huang, A Wood, C Peters-Lidard, M Svoboda

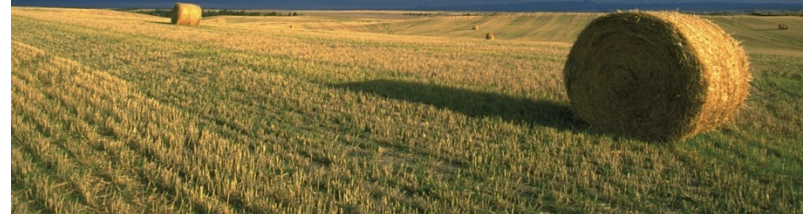


Drought Task Force Achievements and plans

Coordination and focus to national drought research efforts in support of NIDIS

- A Journal of Hydrometeorology Special Collection in preparation by the DTF on “Advances in Drought Monitoring and Prediction”; ~20 papers including an overview.
- DTF leading community efforts to assess understanding of past U.S. droughts: a report on the 2012 summer GP drought and another in preparation.
- The development of a DTF assessment protocol as the backbone of a testbed framework to assess capabilities and progress

An Interpretation of the Origins of the 2012 Central Great Plains Drought



Assessment Report

NOAA Drought Task Force
Narrative Team

Lead: Martin Hoerling

Co-Leads: Siegfried Schubert & Kingtse Mo

20 March 2013

The CMIP5 Task Force

Established Nov. 2011



The CMIP5 Task Force


- **Goal:** Advance knowledge of long-term climate outlooks for North America
- **Membership:** 30 scientists funded by MAPP evaluating long-term climate predictions and projections and simulations of 20th century climate (included a couple of CMEP-II projects)
- **Leadership:** Jim Kinter (COLA; lead), Justin Sheffield (Princeton; co-lead), Eric Maloney (Colorado State; co-lead)




The CMIP5 Task Force: Accomplishments and Current Foci

- Special Collection in the Journal of Climate on “North American Climate in CMIP5” including 20+ papers submitted by Task Force members and 3 papers co-authored by the majority of the group membership
- Organized a session at the 2012 AGU Annual Meeting
- Contributed findings to the IPCC AR5 WGI report
- Planning a contribution to the IPCC AR5 WGII report

Two current foci



Process-based model evaluation metrics geared toward informing model development.



Projections of North American climate informing applications (e.g., National Climate Assessment)



The CMIP5 Task Force: Process-Based Metrics

- A diagnostic approach providing physical insight into climate model performance; beyond simple analysis of model skill
 - Examples: Great Plains precipitation bias and LLJ vs. SST biases in Pacific and Atlantic; Southeast U.S. precipitation versus tropical cyclone number/track biases
- Integrating the model development and diagnostic communities (engaging modeling centers, e.g., NCAR)
- Organizing a session for the 2014 AMS meeting in Atlanta




Process-based model
evaluation metrics geared
toward informing model
development.

Initiative led by Eric Maloney

The CMIP5 Task Force: Informing Applications

- Addressing the application community's demand for scientifically-validated climate model projection analysis for North America
- Working with the National Climate Assessment on two primary questions:
 - How have 21st century climate projections changed between CMIP3 and CMIP5?
 - What are ongoing issues with the projections, and how trustworthy are projections in specific regions, particular models, and certain variables?

Initiative led by Justin Sheffield



Projections of North American
climate **informing applications**
(e.g., National Climate
Assessment)

The Climate Prediction Task Force

Established Sep. 2012

Slides courtesy of Ben Kirtman and other TF leads

Climate Prediction Task Force

Goal: achieve significant new advances in current capabilities to understand and predict intra-seasonal to inter-annual (ISI) climate variability

Builds on 12 MAPP-funded research projects; 30 plus PIs, leading experts from NOAA, academia and other scientific institutions:

- Evaluating/comparing different prediction methodologies
- Developing best prediction and post-processing practices
- Testing and optimizing MME prediction systems for intraseasonal and seasonal predictions (including NMME)
- Exploring the potential to develop outlooks for hurricanes and tornadoes)



CPTF Members

- **Tony Barnston**
- **Chris Ferro**
- **Lisa Goddard**
- **Jon Gottschalk**
- **Xianan Jiang**
- **Jim Kinter**
- **Ben Kirtman (lead)**
- **Nir Krakauer**
- **Arun Kumar (co-lead; new)**
- **Sang-Ki Lee**
- **Malaquias Mendez**
- **Eric Maloney**
- **Vasu Misra (co-lead)**
- **Rym Msadek**
- **Matt Newman (co-lead)**
- **Kathy Pegion**
- **Tony Rosati**
- **Jae Schemm**
- **Siegfried Schubert**
- **Mike Tippett**
- **Joe Tribbia**
- **Stefan Tulich**
- **Huug van den Dool**
- **Gabriel Vecchi**
- **Duane Waliser**
- **Chunzai Wang**
- **Wanqui Wang**
- **Scott Weaver (co-lead; stepping down)**
- **Eric Wood**
- **Shang-Ping Xie**
- **Ming Zhao**

Developing Objectives

- Need to Feedback to Operational Prediction
- Leverage Funded CPO Prediction and Predictability Research
- Focus on Sub-Seasonal to Interannual Time-Scales (not decadal or climate change)



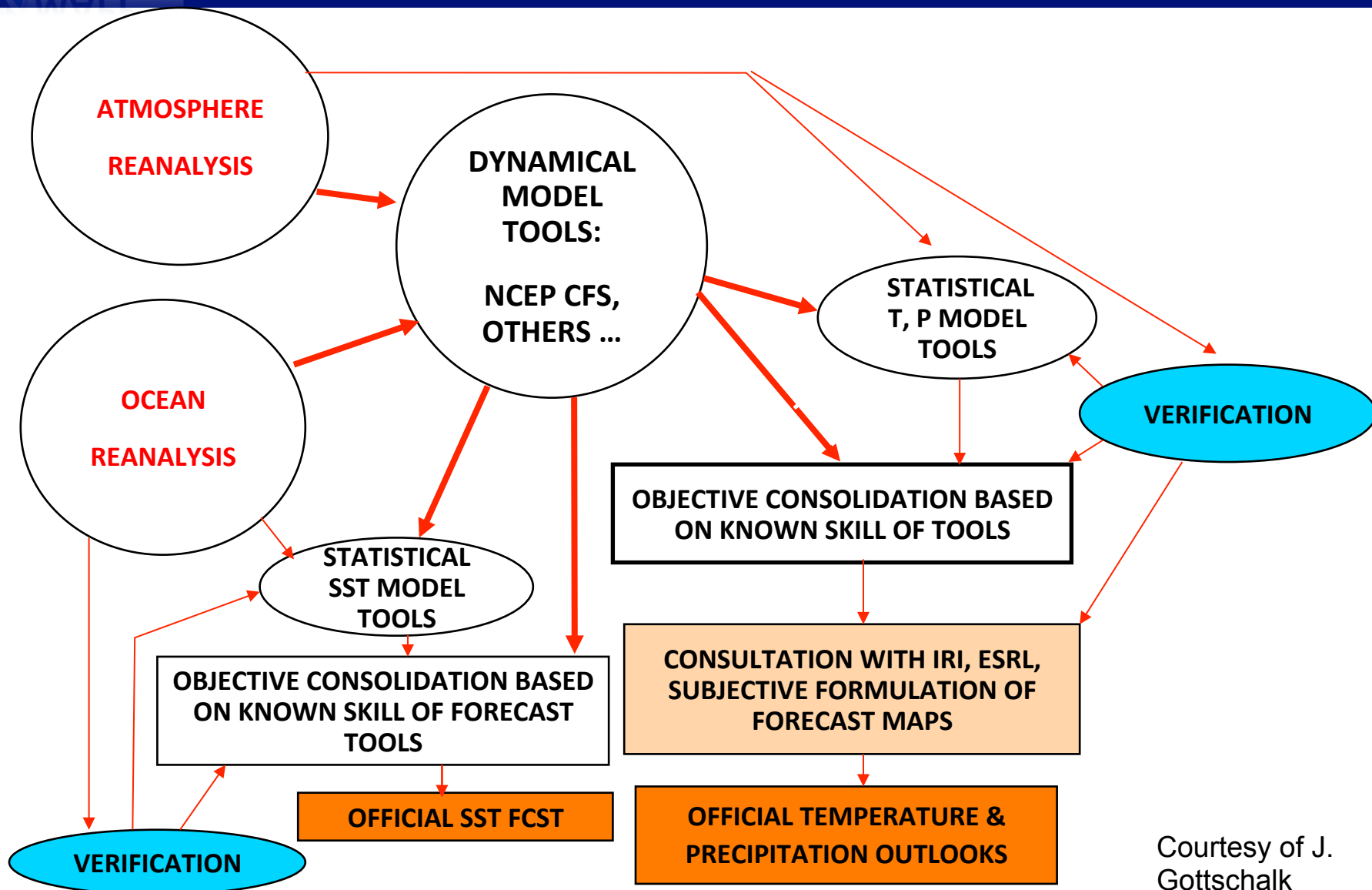
Presentations

- SPECS EU Project (Doblas-Reyes)
- CPC Forecast Process (Gottschalk)
- Possible Skill Mask (Pegion and Kumar)
- Two Tiered Predictions (Misra)
- Predictability in a Linear Model (Newman)
- Deterministic vs. Probabilistic Predictions (Misra)
- Spread vs. Skill (Barnston and Lyon)
- SST Predictability in NMME (Kirtman)

A couple of examples..



CPC Forecast Process Flowchart

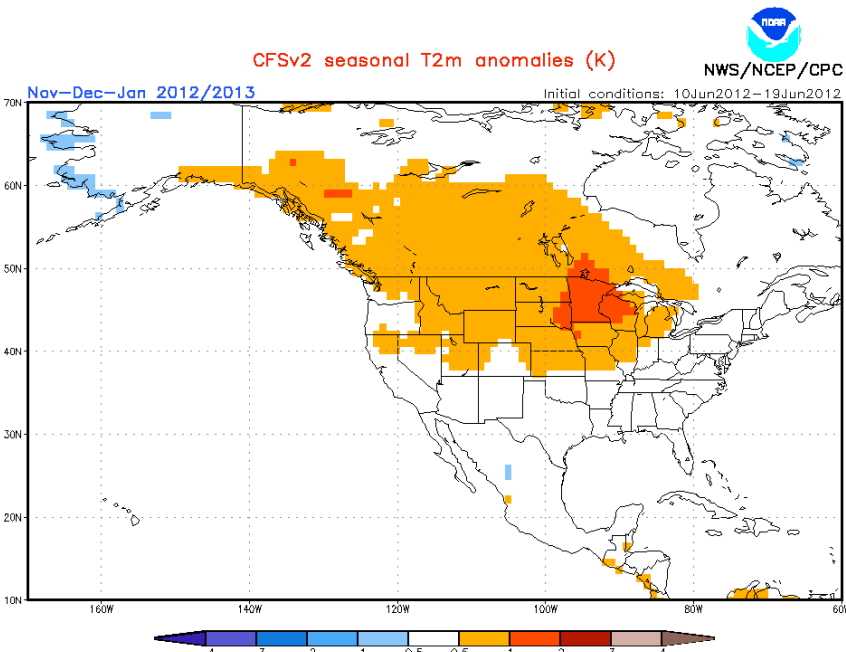


Courtesy of J. Gottschalk

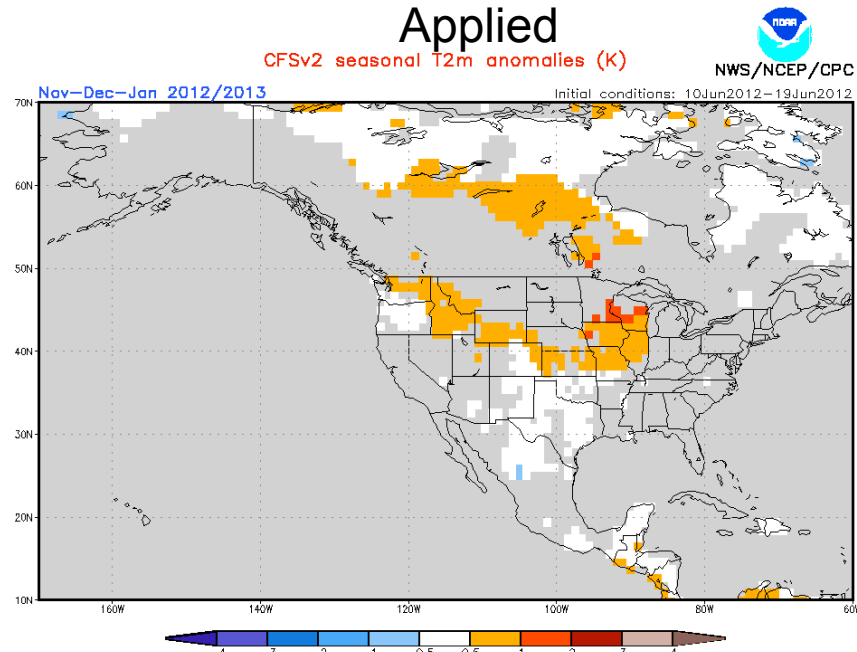
What is a Skill Mask?

ICs: 20120609 -20120619

CFSv2 T2M Forecast



CFSv2 Forecast w/Skill Mask Applied



From NOAA/NWS/NCEP/CPC (<http://www.cpc.ncep.noaa.gov/products/people/wwang/cfsv2fcst/>)

- Skill Mask is Determined from Re-forecasts
- Average anomaly correlation skill over 1982-2009
- Function of initial month and lead-time
- Average AC skill < 0.3 is considered not skillful

Skill mask is a simple model to forecast forecast skill



Honing Objectives

- Link Predictability Research to Understanding Predictions
- Can We Make a Forecast of the Forecast Skill?
- How to Make a Case-by-Case Skill Mask?
- Developing Forecasts of Opportunity?



Future Plans

- **BAMS Paper on “Linking Predictability Research to Real Prediction”**
 - How has predictability theory contributed to prediction?
 - What needs to be done to accelerate/facilitate predictability research in real prediction
 - Specific examples from NMME and Sub-seasonal prediction activities
- **Commissioned Papers on Specific Issues for Linking Predictability Research to Real Prediction**
 - Mini-Workshop(s) (Electronic) to Develop Commissioned Papers

Climate Prediction Task Force Meeting Oct 22-23, 2013 College Park
(Joint with NOAA's CDPWS) – Abstract submission closes July 15.



The Reanalysis Task Force

Planned, Fall 2013



The Climate Reanalysis Task Force - Research in preparation for the next generation of NOAA's climate reanalysis

- A FY13 - FY15 NOAA-led effort involving the external community
- Builds on 7 MAPP-funded research projects, about 20 PIs
 - Overcoming issues with the past generation of NOAA atmospheric reanalyses (CFSR, 20CR) including: inhomogeneities, data and model biases, stratospheric and Arctic issues
 - Exploring more-integrated Earth system reanalysis (ocean-atmosphere coupling and land-atmosphere coupling)
- Encourages linkages and partnerships with other national and international reanalysis efforts



For more info Google “MAPP Task Forces”

THANKS!

