



Contemporary Challenges in Short-Term Climate Forecasting

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Outline



- Commercial: NOAA Administrator's Award for Decisions Support Services Associated with 2015-2016 and Extended California Drought
- CPC timescale focus and background
- Strategic Priorities
 - Week 3-4 Temperature and Precipitation Outlooks
 - Monthly/Seasonal Arctic Sea Ice Prediction
 - Development of user-friendly tools
 - Deep dive on model forecasts of the 2015-2016 El Nino
 - Evidence-based design of subseasonal forecast system
 - Improving skill of subseasonal to seasonal precipitation forecasts
 - Decision Support Services for Deep-Relationship Core Partners
- Summary



Contemporary Challenges Inform Strategic Priorities



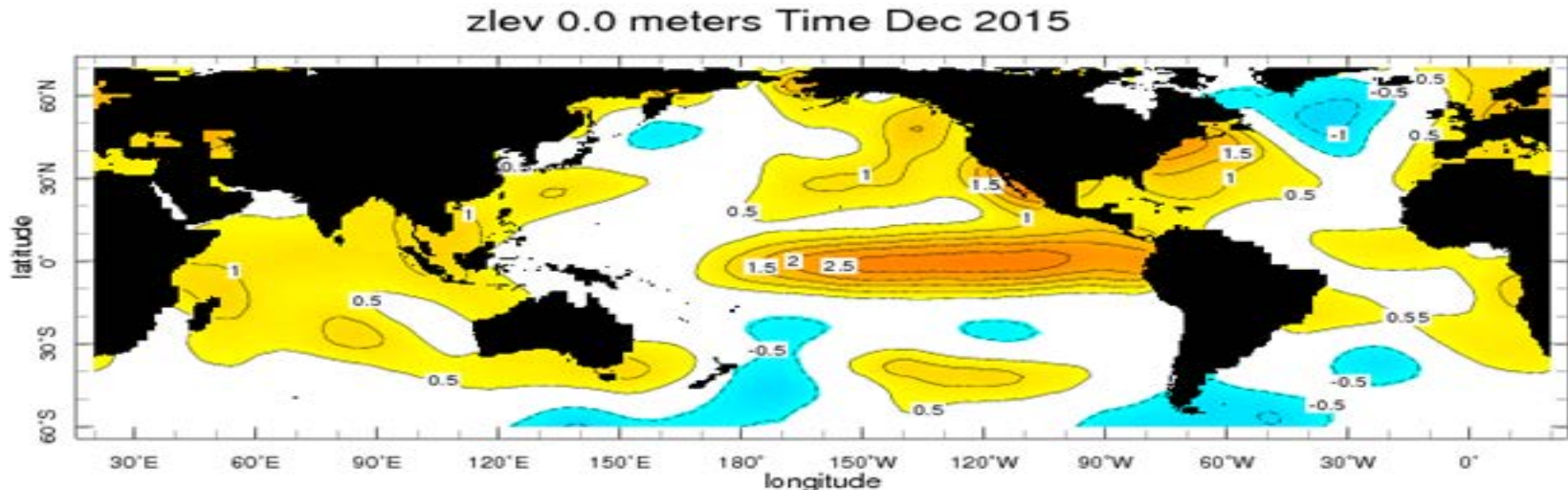
Short-term climate forecasting and monitoring is a difficult problem and the whole community needs to be engaged to ensure success.

I consider the talk a conversation starter for areas that NOAA is going to focus on and I encourage community to focus on these as well for our mutual benefit.

CPC and COMMS Staff Receive 2016 NOAA Administrator's Award

A team of CPC and COMMS staff received the NOAA Administrator's Award for "Extensive cutting edge and comprehensive decision support services associated with the near-record 2015–2016 El-Niño."

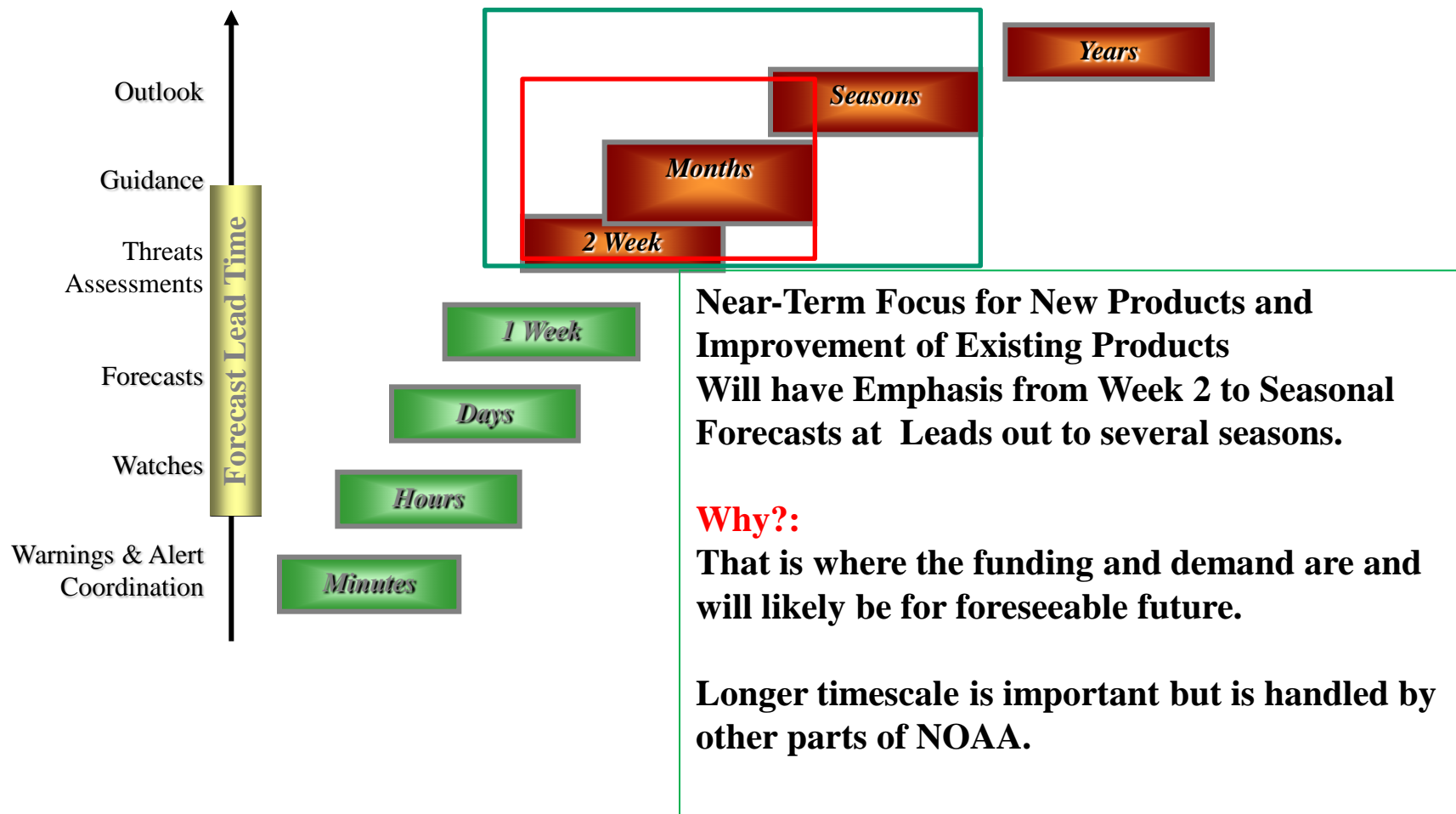
NOAA Administrator's Award is highest award Department of Commerce Employees can win.





CPC Near-Term Focus within NOAA

Seamless Suite of Forecast Products

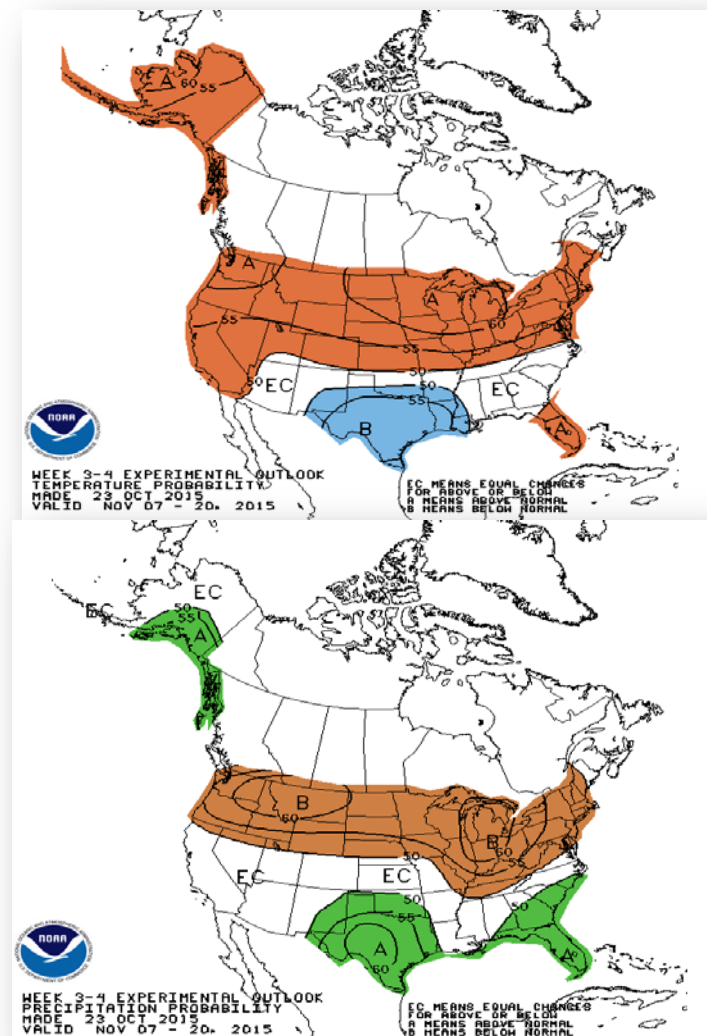


Strategic Priority: Evaluating Potential for Temperature and Precipitation Outlooks on Week 3-4 Timescale

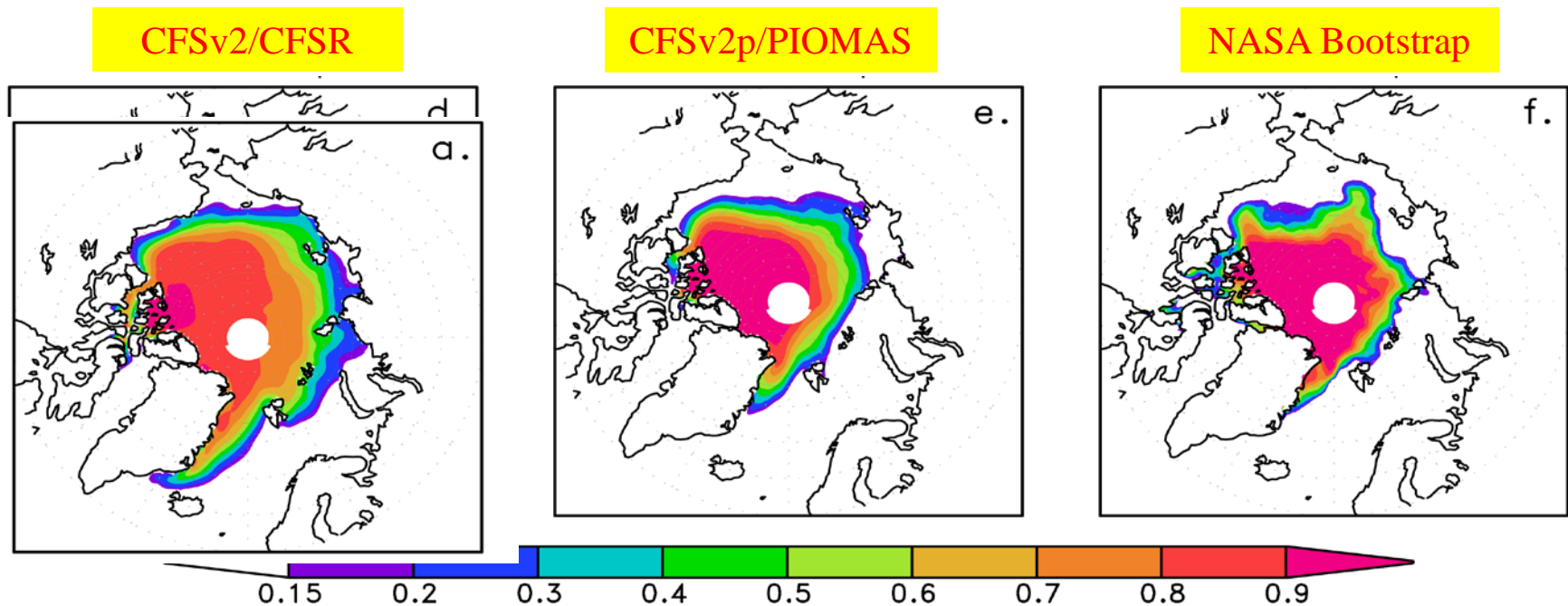
CPC started issuing Experimental combined Weeks 3-4 Temperature and Precipitation Outlooks on September 18, 2015.

- Cross-branch activity within CPC with contributions from **Scripps/GFDL, ESSIC, and ESRL PSD.**
- Utilizes dynamical model output from CFS, ECMWF, and JMA.
- Utilizes **statistical tools** including:
 - MJO-ENSO Phase Model (**CTB project.**)
 - Coupled Linear-Inverse Model (C-LIM).
 - Constructed Analog
- Issued once per week on Friday afternoon
- Forecasts are 2-class (above/below) as opposed to traditional 3-class tercile probabilities.
- Users can provide feedback on product via web
- Forecasts of opportunity depending on presence of large-scale climate drivers

Forecasts Valid for Nov. 7-20, 2015



Strategic Priority: Improved Monthly/Seasonal Arctic Sea Ice Forecasts



CPC started producing Experimental Arctic Sea Ice Outlooks for the NWS Alaskan Region March 2015.

Improvements over baseline CFSV2 system:

- Improved sea-ice initial conditions (PIOMAS; U. Washington)
- Modified atmospheric physics (stratus clouds)
- Modified ocean physics (heat flux constraint)

Thoughts on Evolving CPC Product Suite Over Next 5 Years:

- CPC needs to maintain our status as authoritative source of credible short-term climate information.
- Evolve the product suite in 3 ways:
 - Collaborate with social scientists to evolve static maps in order to better meet stakeholder needs (current collaborative project with CICS-MD)
 - Provide user-friendly tools that allow stakeholders to tailor official outlook and monitoring information to their own needs/risk profile*
 - For core partners, provide access to more of the tools used by forecasters.
- Need to maintain critical mass of effort on ensuring current products and services remain state of the art.
- Main areas for future product development:
 - Week 2-4: Temperature and precipitation outlooks, severe weather, global tropical hazards, excessive heat, Arctic Sea Ice
 - Upgrades to guidance for seasonal outlooks including drought
 - Explore potential for climate products in support of health applications in Africa

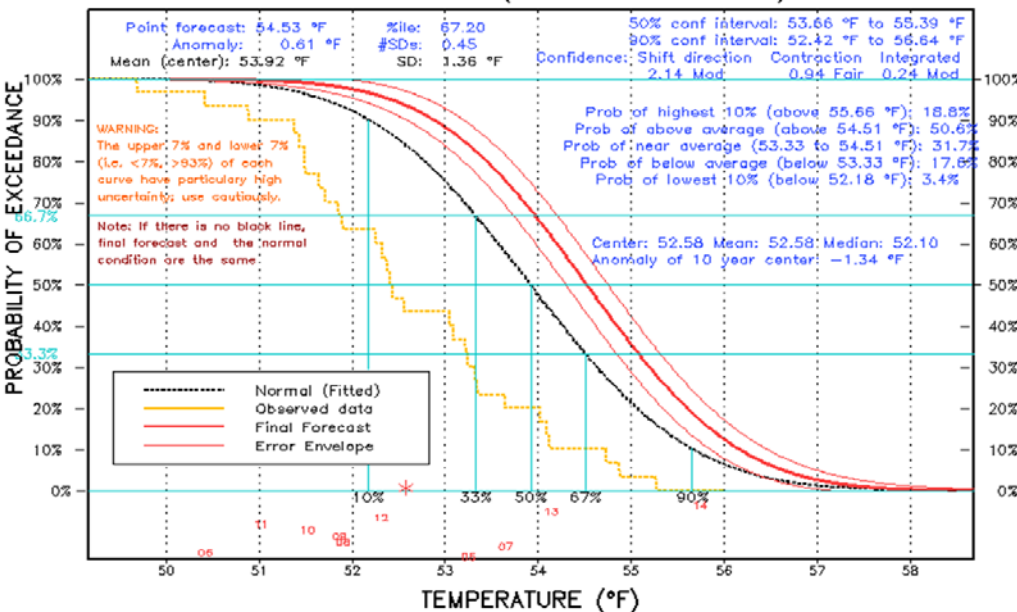


Strategic Priority: Providing User-Friendly Tools for People to Sample Forecast PDF

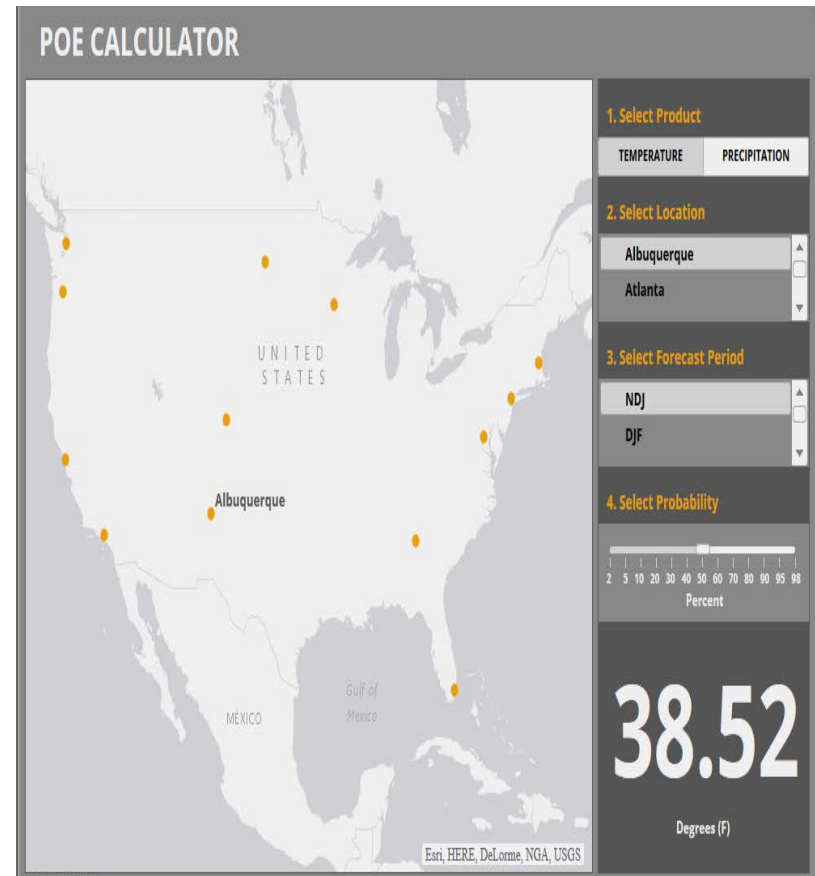


User-Friendly POE Tool will allow users to tailor forecast to their own needs/risk profile.

MEAN TEMPERATURE OUTLOOK FOR FMA 2015
0.5 MONTH LEAD OUTLOOK – MADE Jan 15 2015
Climate Division 92 (Central California Coast)



Current POE Tool



Mock-Up of Interactive
POE Tool



Strategic Priority: Understanding why Models Didn't Perform Well in Predicting 2015-16 Winter Precipitation



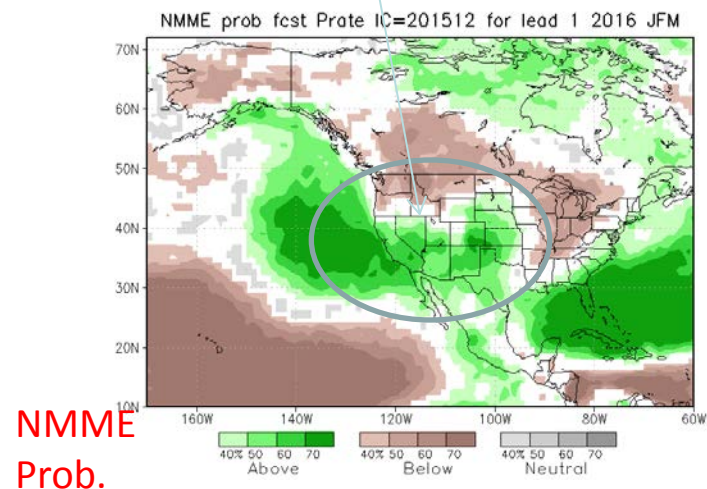
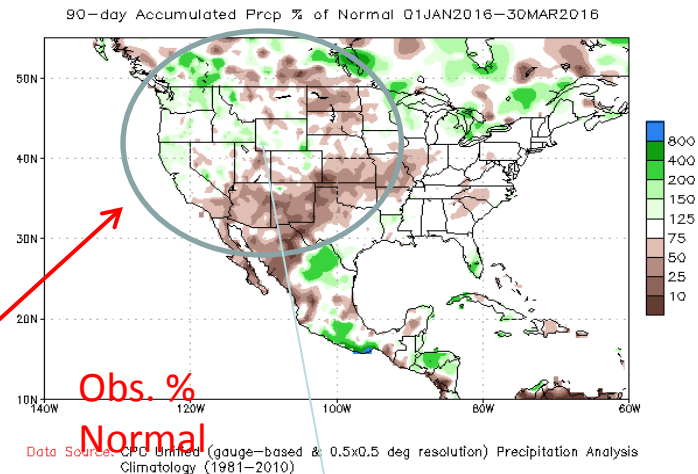
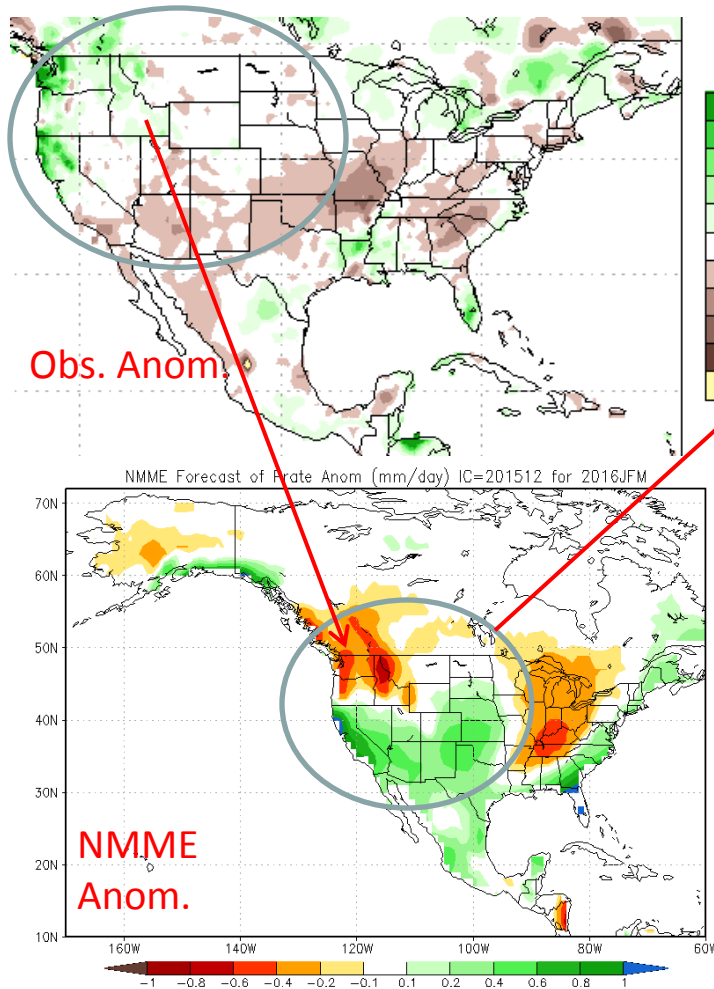
Is there less predictability in the system than we previously believed?
Do the current generation of models misrepresent or not represent at all key processes?
Was the forced signal overwhelmed by atmospheric transients?

This is a golden opportunity for the short-term climate forecasting community to explore these issues to see if this was predictable and, if so, why our tools fell short.

NB: Circa 1999 based on successful predictions for record 1997-98 El-Nino and 1999 La-Nina then CPC Director Ants Leetma declared that seasonal prediction problem was solved. Unfortunately, this proved to not be the case!

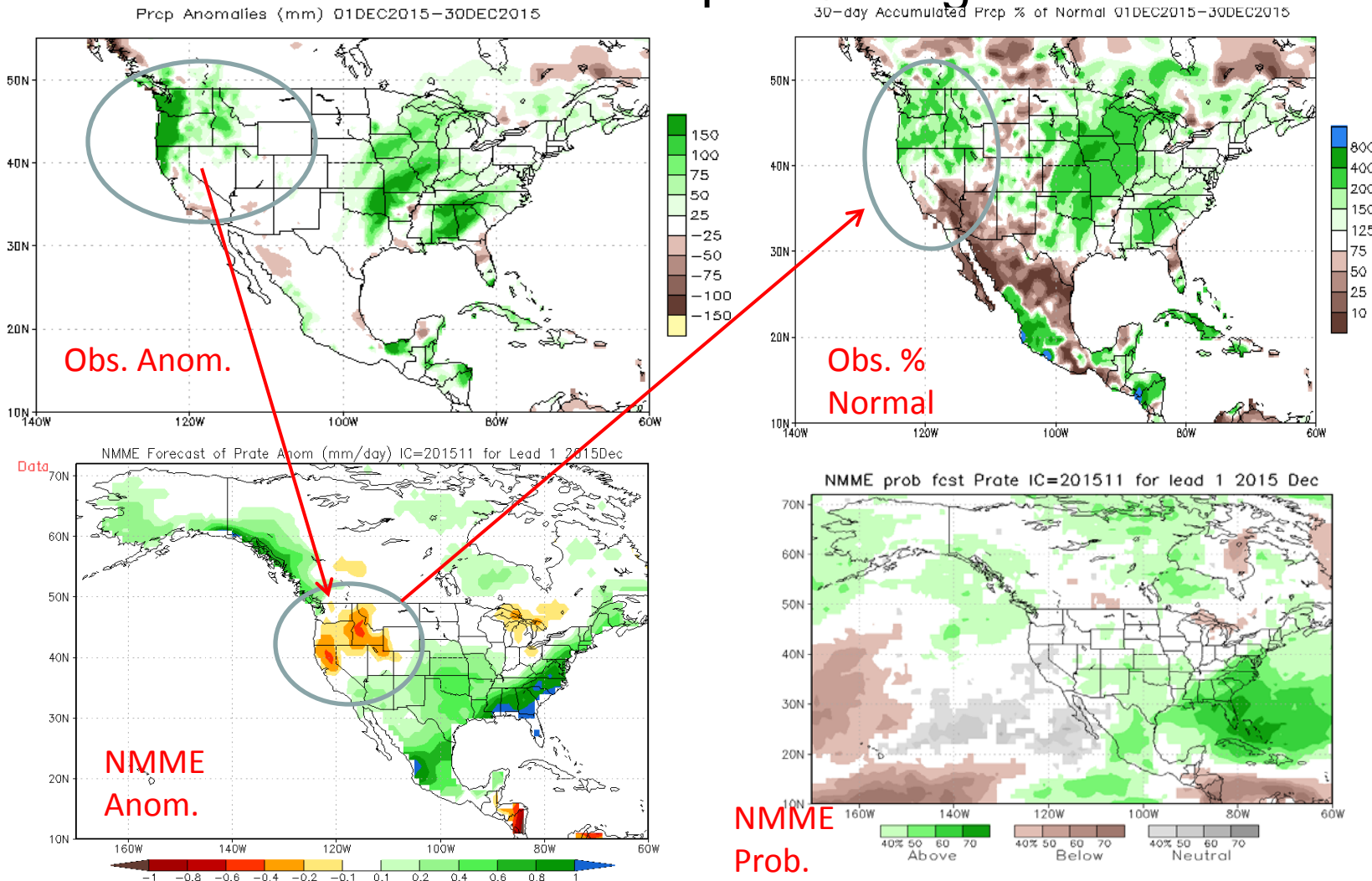
NMME Precipitation Forecast for JFM 2015-16

One Month Lead Despite Strong El-Nino



State of the art NMME misses major precipitation anomalies in Western/Central US despite record El-Nino.

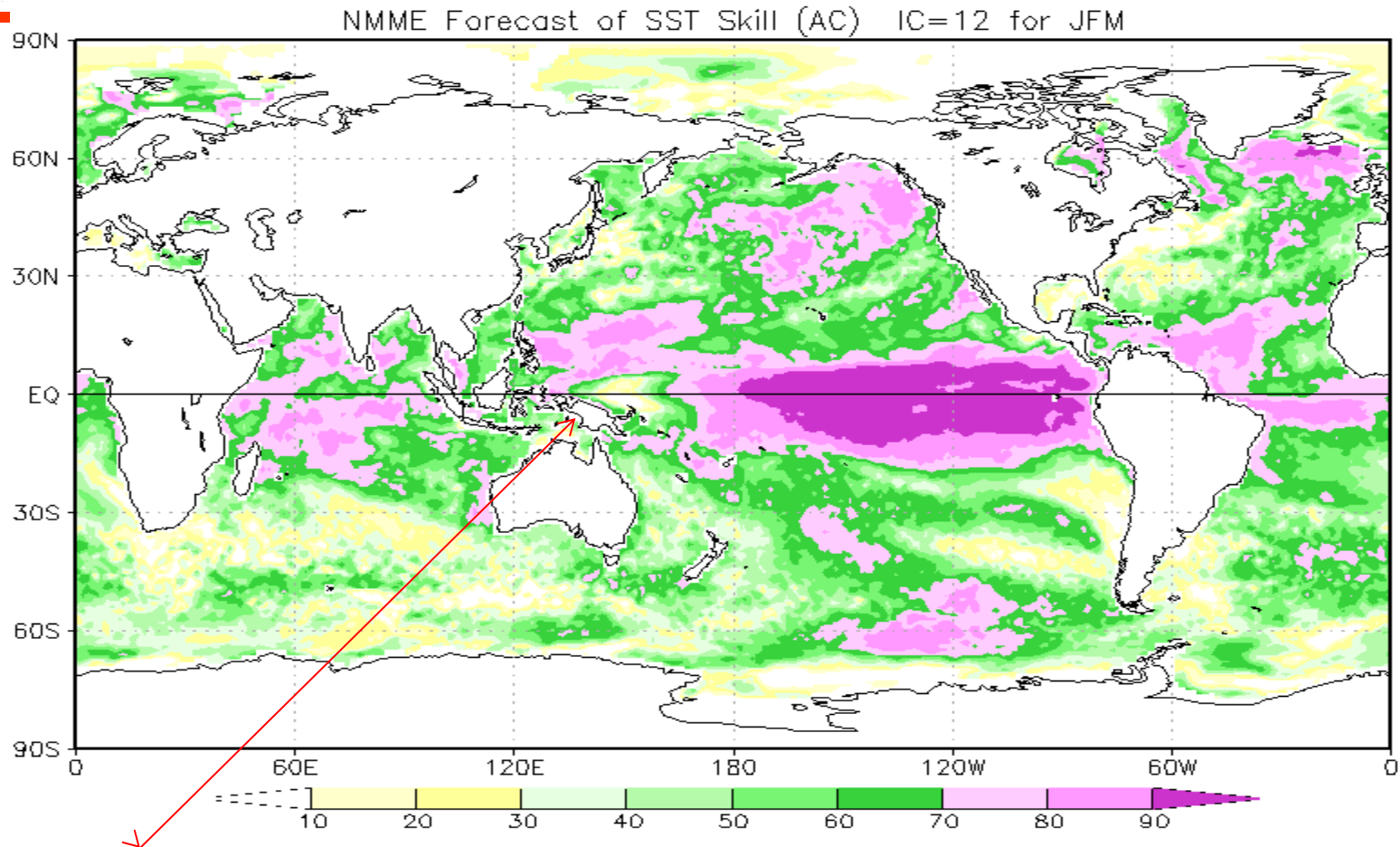
NMME Precipitation Forecast for December 2015 at One Month Lead Despite Strong El-Nino



State of the art NMME misses major precipitation anomalies in Western US despite Strong El-Nino.



Retrospective Forecast Skill of Lead 1 NMME SST Forecast for JFM from NMME



State of the Art MME Dynamical Forecast System has Low Skill in Predicting Near-Equatorial Western Pacific SST. If SST in this region drove the large-scale pattern past two years there is an issue.



Strategic Priority: Evidence Based Decision Making for Designing Subseasonal Forecast Systems



Do benefits of atmosphere-ocean coupling outweigh the liability due to systematic errors in the SST?

Is it possible to determine which models in a multi-model ensemble (MME) add significant forecast skill? How many models do we need in an MME?

How many ensemble members do we need to sample the PDF with sufficient fidelity?

How much skill improvement can be realized on the subseasonal timescale when we start to approach model resolutions of 10-20 KM combined with improved physics and data assimilation?



Strategic Priority: Improving Skill of Subseasonal to Seasonal Precipitation Forecasts



The National Climatic Data Center has recorded droughts in the United States having severe economic impacts (more than \$1 billion in damages) during 16 of the 21 years from 1980 to 2011, with an estimated annual average direct drought loss of \$9.5 billion (adjusted to 2011 dollars; Smith and Katz, 2013)).



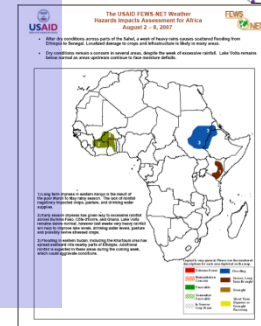
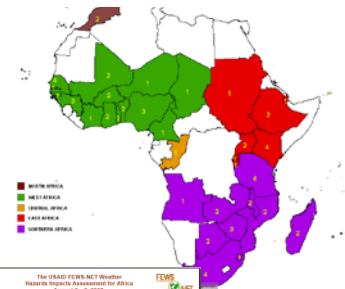
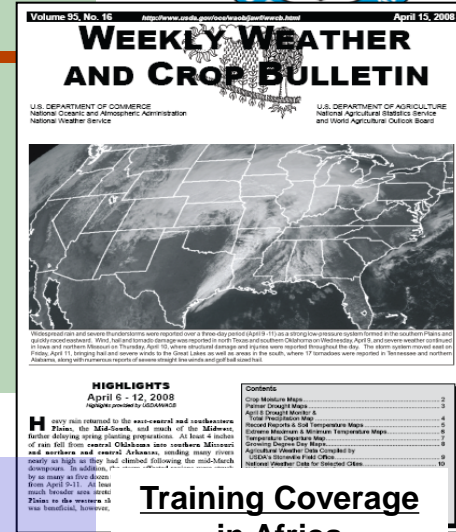


- ***USDA – DOC partnership***
 - ***Weekly Weather and Crop Bulletin***
 - ***Briefings & Weather Summaries on global weather and crop conditions***

- *African Desk*
- *Monsoon Forecaster Training Desk*
- *Activities*

- **Training and Education**
- **Partnerships**
- **Products**

Famine Early Warning System
Hazards Assessments (Africa, global tropics)
Tropical Cyclone Monitoring





Summary



- Many challenges to improving short-term climate prediction. This occurs at same time as there is large and increasing demand for such products. We need to partner effectively to meet stakeholder needs.
- If you have any questions or want to discuss collaborating with CPC please contact me: david.dewitt@noaa.gov