



CPC Operations, Gaps, and Requirements

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Outline



- Disclaimer/forward
- Thoughts on effective collaboration between research and operations
- Example of collaborative product development
- Examples of gaps that need to be addressed
 - Improved forecast tools (seasonal as example)
 - Gaps that need to be filled to make progress
- Avoiding TRL inflation to chase funds. Attempt transition at suitable level of maturity.
- Foundational activities to support CPCs mission
- Large-scale top priorities



Disclaimer/Forward



I will talk about some high-level issues regarding:

- Collaboration between research and operations (as applied to CPC)
- Some current gaps that need to be addressed (some that don't fall under CTB)

Please note that there will be much more detailed discussion with CPC staff tomorrow on more granular detail regarding specific gaps.

I am always available to discuss potential collaborations (better response rate if you use my office phone)



Thoughts on effective collaboration between research and operations as applied to CPC circa November 2015



Need to have focused product development and supporting research. (Working on everything diminishes our ability to work on highest priorities).

- Sweet spot these days in terms of resourcing and user requests is week 2 out to first season (including week 3-4, months 1, 2, 3). Next priority is going out to season 2, 3.
 - Climate forecasts longer than 1 year are important but are being addressed by bright people in other parts of NOAA.
- Need to balance requests for new products with current state of the science. Educate customers about skill profile of products and potential products.
 - Need to maintain our status as **authoritative source of credible** short-term climate information.



Thoughts on effective collaboration between research and operations as applied to CPC circa November 2015



Need vigorous targeted collaboration with partners:

- Short-term climate forecasting and monitoring is a difficult problem and we need to engage the whole community to be successful.
- Engage in co-development (sooner in the process the better) but we can't be dogmatic (examples shown later).

Need to candid about strengths, weaknesses and potential of products and tools (existing and new):

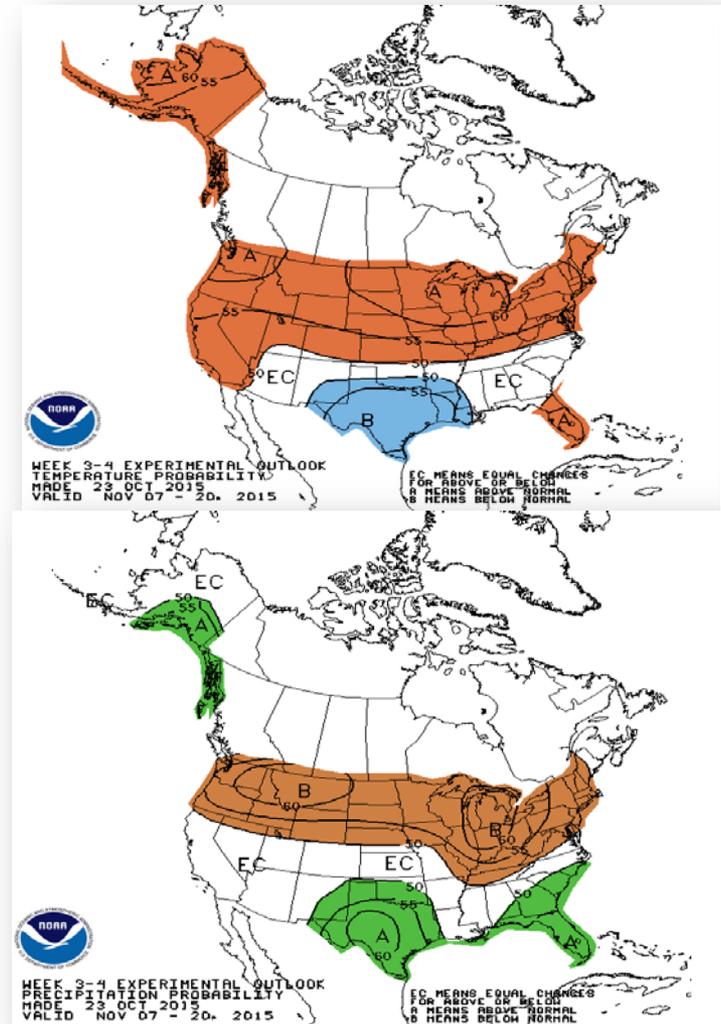
- Guard against overselling to enable effective management of expectations
- Overselling leads to disappointed funders and eventually to reduced funding.

Strategic Product Development Leveraging Partnerships: Experimental Week3-4 Temperature and Precipitation Outlooks

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





Generation of Seasonal Forecasts at CPC



Human Forecasters Use Various Tools To Develop Seasonal Predictions:

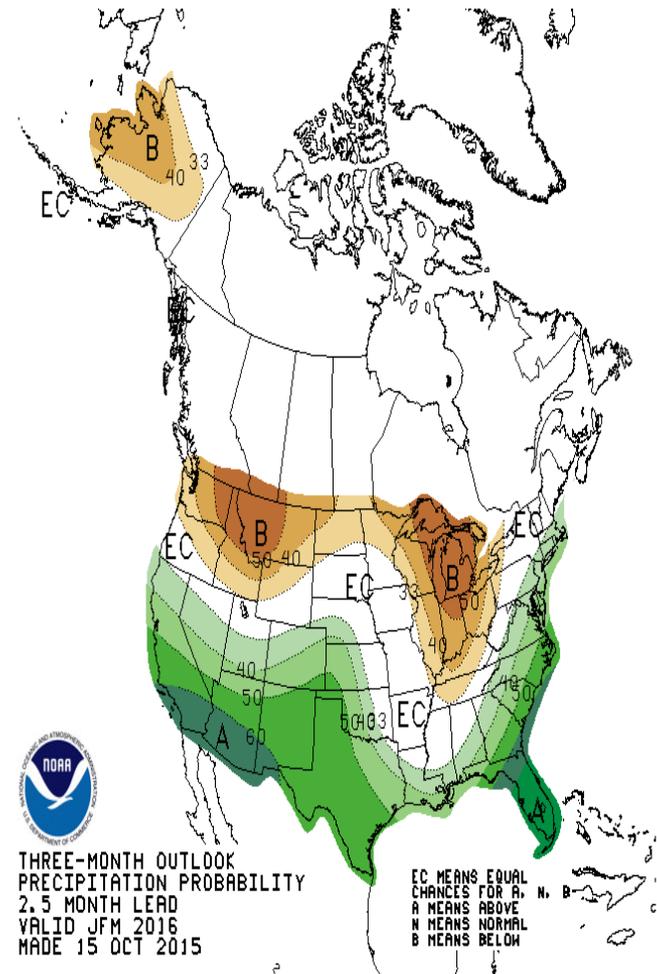
- ≡ Dynamical Models
- ≡ Statistical Models
- ≡ Historical Analogs
- ≡ Historical Composites

Goal is to leverage complementary skill between the tools.

Ultimately, skill of seasonal forecast depends on skill of tools made available to the forecaster.

Need to improve skill of forecast tools!

Need to invest in development of statistical tools!





Disclaimer: Adequacy of State of the Art Dynamical Tools (NNME in this case)



NNME:

- Example of effective collaboration between research and operations.
- Represents state of the art in seasonal forecast skill for dynamical models
 - Room for improvement in skill (at least we hope). Some examples.
 - From my perspective this motivates need to invest in improving the models not adding more similarly skilled models.

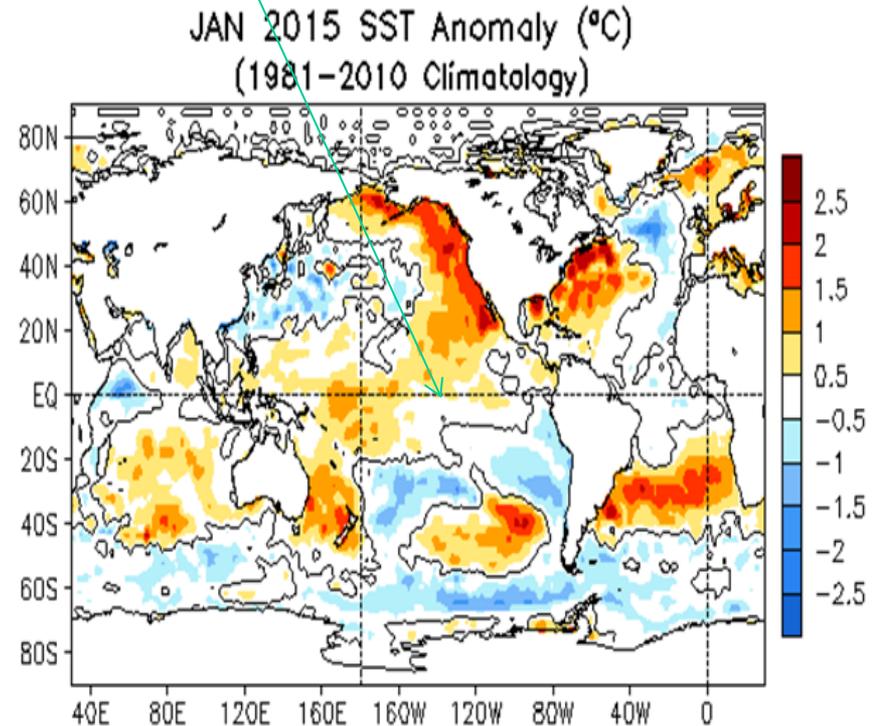
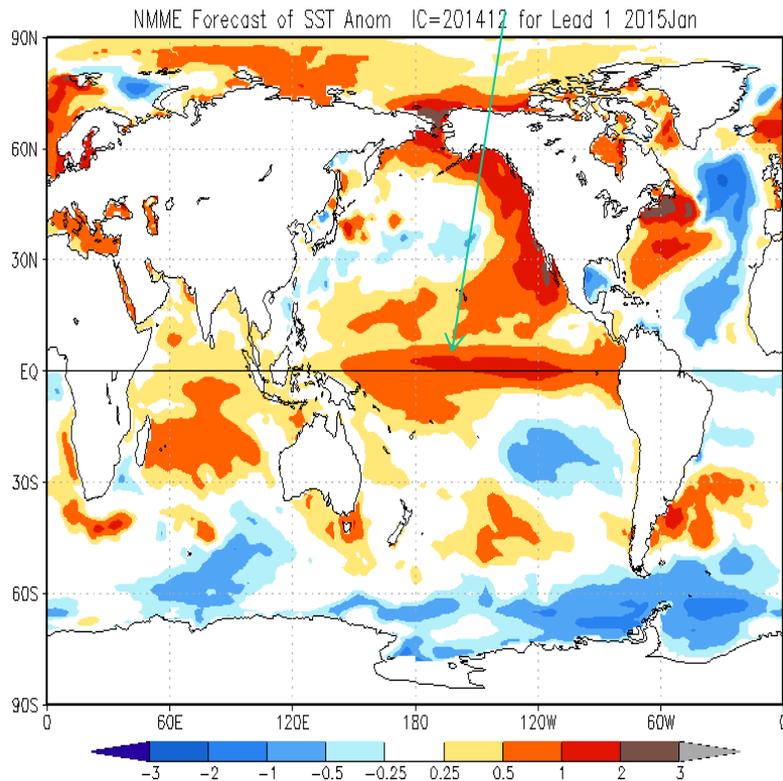


Need to acknowledge strengths and weaknesses of tools

Lead 1 NMME SST Forecast Bust for January 2015



1 month lead NMME forecast calls for moderate canonical El-Nino while observed anomalies were confined to western Pacific. Indicates gap in understanding of air-sea coupling processes.





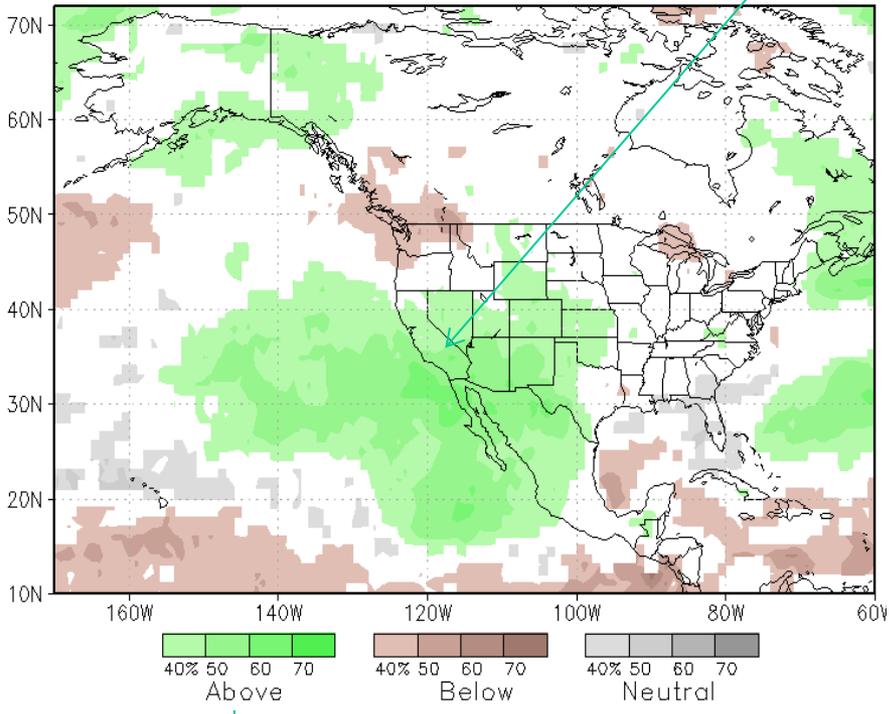
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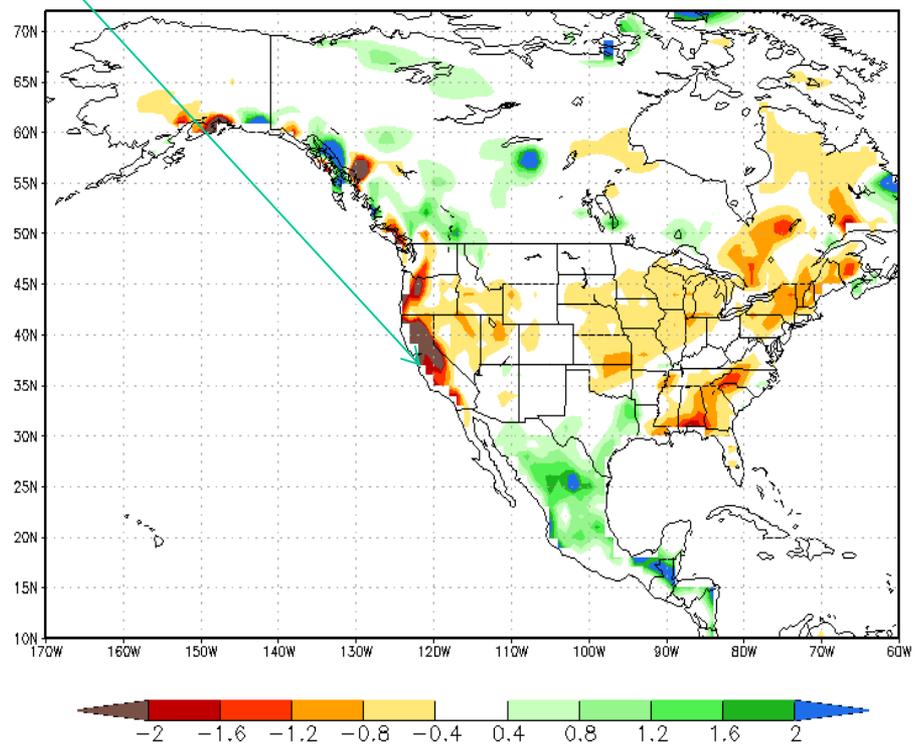
Lead 1 NMME Precipitation Forecast Bust for JFM 2015

Associated precipitation forecast calls for modest probability of above normal precipitation, while record breaking drought was observed.

NMME prob fcst Prate IC=201412 for lead 1 2015 JFM



Observed Prate anom JFM 2015

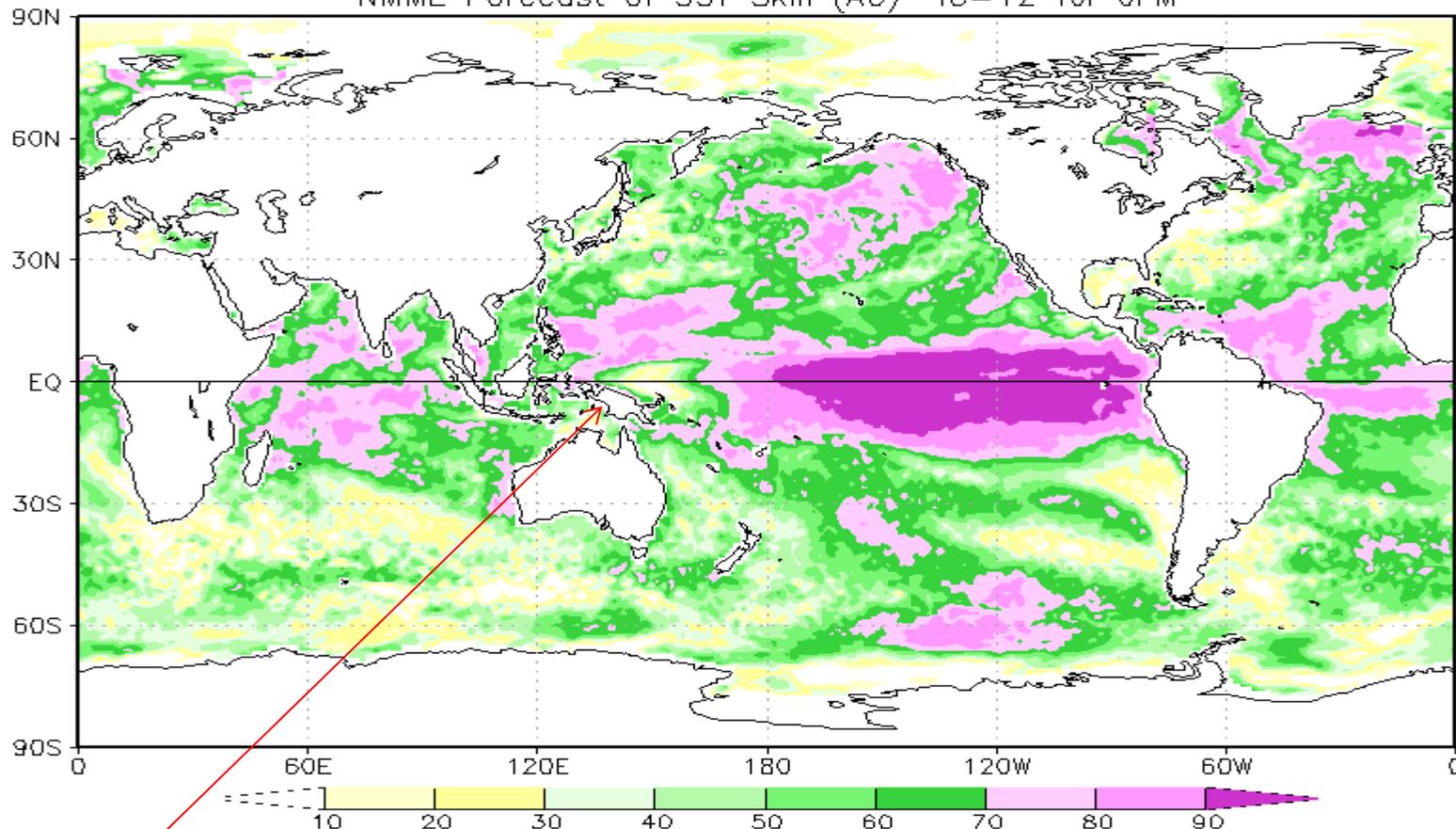




Retrospective Forecast Skill of Lead 1 NMME SST Forecast for JFM from NMME



NMME Forecast of SST Skill (AC) IC=12 for JFM



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.



Personal Perspective on Improving Seasonal Forecasting Skill (Gaps)

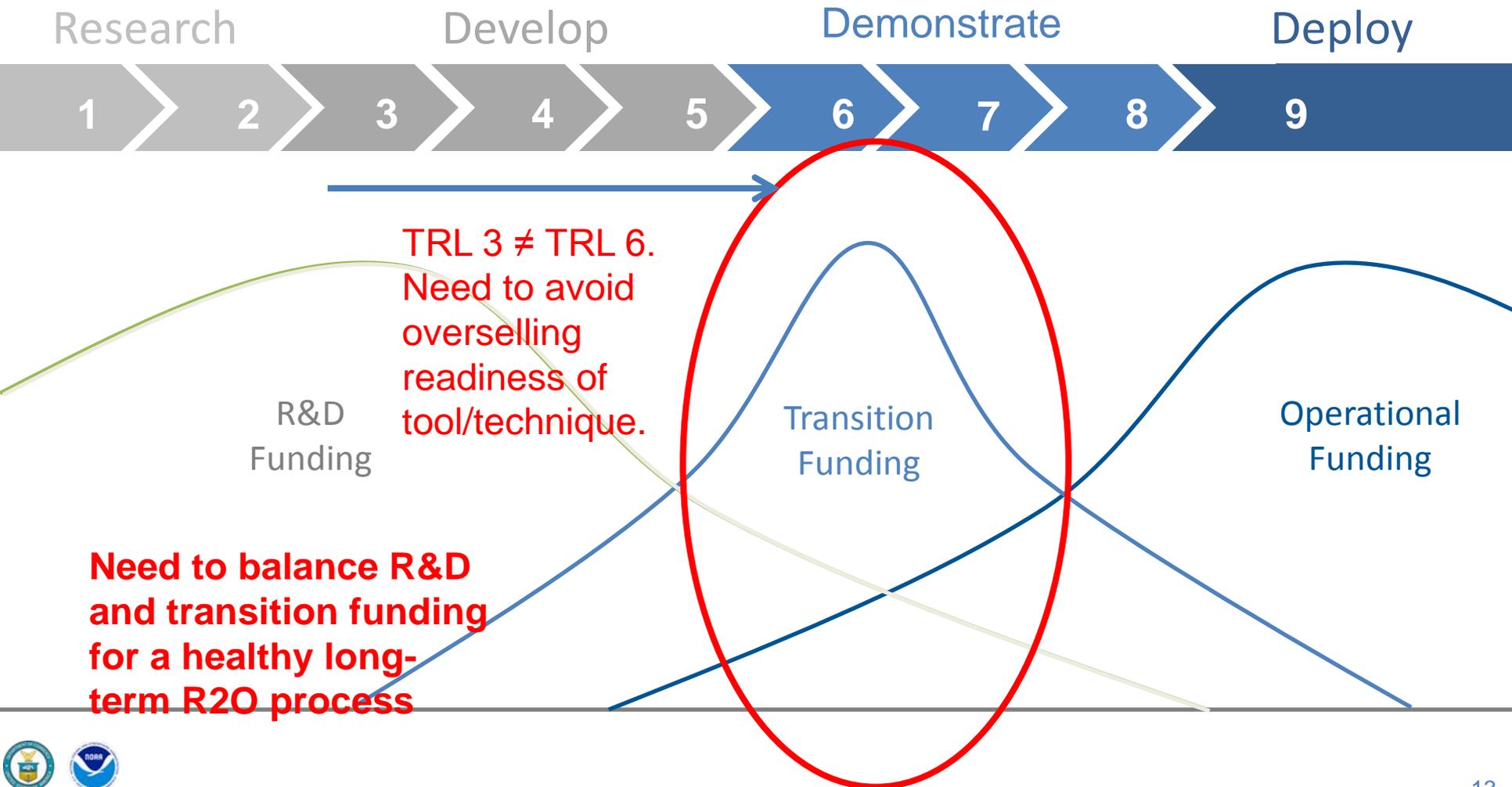


Need sufficient investment in:

- Updating current and exploring new statistical and hybrid-statistical dynamical tools (including ensemble post-processing and multi-model combination techniques).
- Improving key processes in current generation of coupled models, especially atmospheric convection and PBL, and oceanic PBL.
- Improved understanding (and eventually modeling) of sources of predictability beyond ENSO
 - Need to evolve beyond measuring predictability using idealized twin experiments with 500 MB heights as metric.

Need to avoid Technical Readiness Level (TRL) inflation to chase funding.

Need to Avoid TRL Inflation to Chase Transition Funding. Development Work/Improved Understanding Are Critical to Ultimate Success



Foundational Activities Needed to Support CPC Mission

Forecast tool development / improvement

Climate monitoring tool development / improvement

Climate model diagnostics and evaluation

Understanding atmospheric and oceanic predictability

Understanding climate trends

Weather / climate links

Attribution of climate anomalies

Predicting drought / floods and other extreme events



Large-Scale High-Priority Needs



New Reanalysis/Reforecasts for Extended Range Forecast systems. (Established team working on this (Hamill/Whitaker et al. PI's): **New activities need to complement this.**

An updated climate reanalysis for monitoring (Established team working on this (Compo and Kumar, PI's): **New activities need to complement this.**

Updated version of CFS and associated analysis (ASAP) with these features:

- Reduced analysis discontinuities
- Improved sea-ice initialization
- Higher resolution
- Better simulation of known sources of predictability and major modes of short-term climate variability on timescale from week 2 to seasonal