Untangling Seasonal Predictions over California During 2015/16 El Niño and the Parable of Blind Men and an Elephant: What next?

Arun Kumar
arun.kumar@noaa.gov

Mingyue Chen
Climate Prediction Center
Outline

• The context: The performance of the seasonal forecast over the US west coast during winter of 2015/16.

• What are the science issues?

• What next?
The 2011-2017 California Drought
Predictions for 2015-16 El Niño (from spring/summer 2015)

**Consistent indications for a strong El Niño during the winter of 2015/16**
Predictions for enhanced chances for above normal rainfall...

- Models and CPC forecast for DJF 2015/16 precipitation indicated above normal precipitation over California.
- Predicted pattern was consistent with canonical El Niño response.
but...

The observed rainfall anomaly and composite for El Niño
Outline

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• Was the forecast the best it could have been?

• Was the inference about the response to different boundary forcings correct?

Horel and Wallace 1981
Boundary forcings

- Sea ice decline
- Dry conditions over CA
- Warming in tropical oceans
- The Blob
- CP El Niño
• Were the inferences about the response to different boundary forcings correct?
  — Did uniqueness of 2015/16 El Niño SSTs (ENSO flavor) alter the El Niño response?
  — Did warming of tropical SSTs alter the El Niño response?
  — Did drying over California modulated the seasonal mean response?
  — Did decline in sea ice influence the wintertime anomalies?

• Were the boundary conditions themselves well predicted?

• How could model biases have influenced conclusions about the El Niño response?
Attribution attempts for DJF 2015/16 CA rainfall

• ~ 15 papers in literature so far. Causes for discrepancy between observations and forecast attributed to
  – Decline in sea ice;
  – Atmospheric internal variability (e.g., on sub-seasonal time-scale);
  – Flavors of El Niño (i.e., dominance of warm anomalies in central Pacific);
  – Errors in the predictions of SSTs in NMME forecast;
  – Dry land conditions over California.

• The diverse range of possibilities and conclusions is, at best, baffling.
- Even for one of the largest El Niño events on record, we are unable to reach a consensus on some very basic questions.

- Historical context of understanding global influence of ENSO SSTs is 35+ years long.

- **Ensemble** of model simulations (AMIP) came along in 1995; 20+ years.

- And yet...
Outline

• The context: The performance of the seasonal forecast over the US west coast during winter of 2015/16.

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• What next?
• Some of the fundamental questions:
  — How linear is the ENSO response?
  — How much do ENSO flavors matter?
  — How does the spread of the seasonal mean change under the influence of ENSO SSTs?
  — If the spread is large and SNR is small, how to manage expectations?
  — Adverse role of model biases and resolution on inferring the response?

• How to provide answers or reach some consensus?
A thought on “what next?”

• Observational data; but data record is not enough.

• Rely on models, and to be able to do that
  – Need to establish metrics to assess if models are good enough to address the questions we have.
  – Need to establish **what really matters.** Not everything can be important.

Scale analysis (Taylor’s expansion) is one of the basic tenets of making scientific advances.
A thought on “what next?”

• Rely on models, and to be able to do that
  – Periodic coordinated multimodal assessment of ENSO responses to a set of forcings;
  – The approach would be a combination of what was done under the US CLIVAR Drought Working Group + periodic CMIP assessment. effort.
Thanks