Recommendations to NOAA: “Precipitation Prediction Grand Challenge Strategic Plan Review”

Presented by Joellen Russell, PhD
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August 27, 2020

The Request

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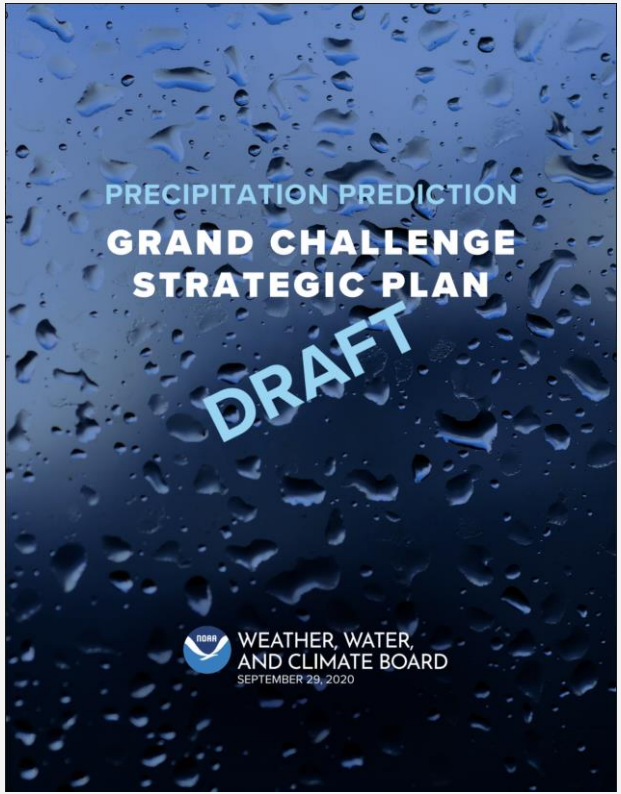


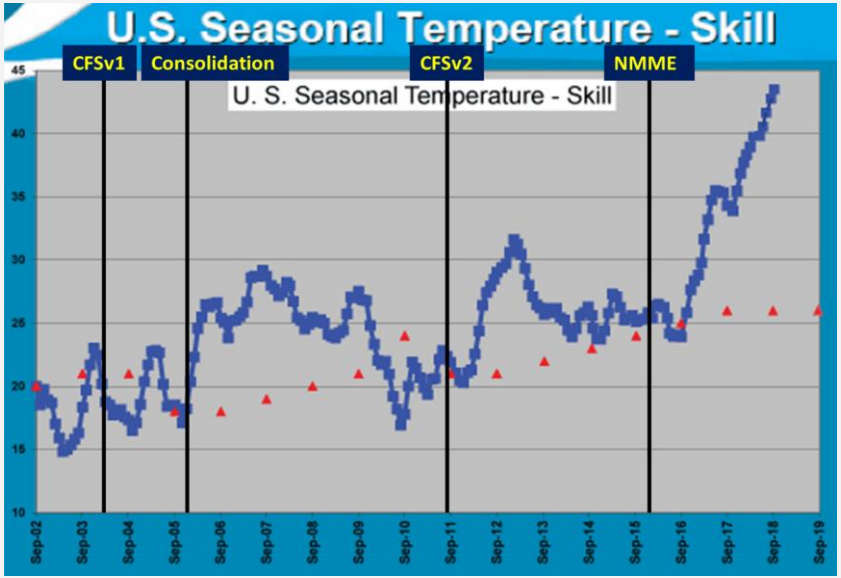
Version 1.0 of the Strategic Plan was distributed on July 24th for review and comment by the NOAA Weather Team, the NOAA Water Team, and the NOAA Climate Team, as well as the Climate Working Group (CWG) in collaboration with the Environmental Information Services Working Group (EISWG); additionally, notification about the report was distributed to other NOAA stakeholders.

The Grand Challenge Goal

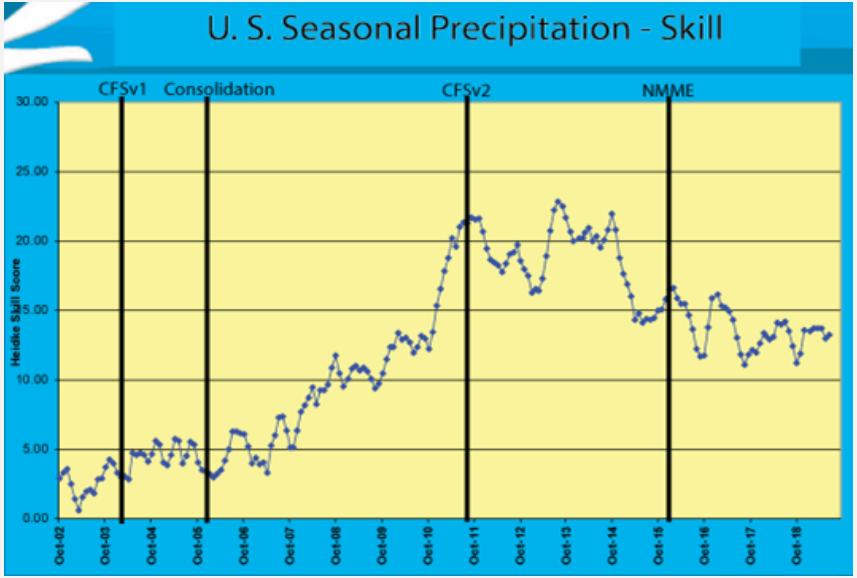
“To provide more accurate, reliable, and timely precipitation forecasts across timescales from weather to subseasonal-to-seasonal (S2S) to seasonal-to-decadal (S2D) through the development and application of a fully coupled Earth system prediction model.”

* Note: By addressing systematic errors in global models, improvements in many other parameters, not just precipitation, will be realized

The Issue: Precipitation Skill Is Decreasing



Operational Success



Operational Challenge

The Review Team

- **Dr. Joellen Russell:** Professor, University of Arizona, Professor, Thomas R. Brown Distinguished Chair of Integrative Sciences
  (Co-Chair of the SAB's Climate Working Group)
- **Dr. Michael Anderson:** California State Climatologist, California Department of Water Resources (SAB's Climate Working Group)
- **Dr. Rong Fu:** Professor, University of California, Los Angeles
  (SAB's Climate Working Group)
- **Dr. Le Jiang:** Chief Scientist and Vice President, I.M. Systems Group Inc.
  (SAB's Climate Working Group)
- **Dr. Xubin Zeng:** Professor, Hydrology and Atmospheric Sciences, Agnese Nelms Haury Endowed Chair in Environment
  (SAB's Environmental Information Services Working Group)

The Recommendations

Grand Recommendation

Emphasize the grand in the plan: What is the biggest push that will make the biggest difference?

- Consider emphasizing the three top outcomes, even if they are expensive or difficult.
- For each, clarify: Why now? How will NOAA know the time is right?
- Emphasize and support those three top outcomes in scientific, policy, and budget conversations.

Recommendation #1

Structure the strategic plan for R2O2R, from the identification of needs in science of prediction and predictability, to the co-development of products to service.

- Consider realigning the structure of the document to the standard process steps
- Begin with observations and end with the users
- Encourage focus on all of the parts of the process that NOAA and partners control and require.

Recommendation #2

Explain the specific sources (decisions, observations, processes, etc.) of the substantial improvement (or the lack thereof) in precipitation prediction from the last 20 years, especially lessons learned from observations, modeling, and prediction.

- What are the explanatory factors for historical improvements?
- What were the primary reasons for the substantial improvement in the skill score between 2003-2011 (based on Figure 1 in the Report), and why have skill scores decreased since then?
- Does research suggest the changes in prediction skill are caused by model and data assimilation revisions, observations systems, or predictability of the system itself over time?

Recommendation #3

Explain the specific sources that will lead to substantial improvement in precipitation prediction over the next 20 years.

- Enhance the integration between Subseasonal-to-Seasonal (S2S) and Seasonal-to-Decadal (S2D) research and prediction efforts;
- Integrate interdisciplinary observations from the root zone to the entire tropospheric column; including the “storm lifecycle” time scale; and
- Enhance the action to bridge the gaps between short-term numerical weather prediction (NWP) model forecasting and data-driven nowcasting (see also Action 5.2).

Recommendation #4

Highlight clear, quantitative goals and connect those to the improvements distinguished in Recommendation #3.

- If the precipitation predictions are intended to beat the European Centre for Medium-Range Weather Forecasts, on which metrics and over what period of time?
- How might NOAA measure the amount of learning about sources of predictability as researchers integrate precipitation datasets?
- What is the feasibility of the goal to improve precipitation forecast skill? What is the baseline skill score that will be used to determine percent improvement? Consider taking the average historical peak performance as the baseline for percentage improvement.
- Connect each objective and action to a key question and add a crosswalk to other NOAA initiatives.

Recommendation #5

Consider delineating the role of the community (different NOAA line offices, NOAA Cooperative Institutes, academia, private sector, states, and other federal agencies) and how NOAA and partners will work together to achieve these outcomes.

- “All hands on deck” requires coordination between and among NOAA and partners.
- Roles of entities within NOAA should be defined and partners should be more clearly described.
- Clearly characterize community engagement:
  - Which structures already exist?
  - Which need building to scale, inventing, or reimagining?
- How do engagement opportunities under other initiatives affect this strategic plan?

Comments

Comment #1. Highlight the mechanism of integrating precipitation process datasets (including clouds and precipitation rate), seamless approaches to understand and model the processes behind precipitation predictability from weather to decadal scales, and establish traceability of error sources to evaluate improvements in precipitation prediction skill.

Comment #2. Clarify the focus of the plan to exclude or include precipitation prediction improvement over the ocean.

Thank You