NOAA/WSWC Meeting on advancing a Seasonal Precipitation Forecast Improvement Project

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1. What are the knowledge gaps to advance seasonal forecast skill for western watersheds?

- Understanding
  - Controls on variability of precipitation events on seasonal timescales (e.g., what modulates AR event frequency, duration, and intensity on seasonal timescales?)
  - How predictable were past drought events and what lessons can we learn from studying them?
  - What are other sources of seasonal skill beyond the usual culprits?
- Modeling challenges
  - Do model resolution increases help in the prediction mode?
    - In a forever HPC-limited world, what tradeoffs do we make between resolution (including ocean/atmosphere resolution tradeoffs), ensemble size, complexity?
  - What model processes are leading to biases in precipitation and low skill?
    - E.g., convection, microphysics
  - How much more information can be extracted from multi-model ensembles?
    - E.g., are there intelligent ensembling techniques which can extract more skill from NMME?
  - What data assimilation advances are most needed to improve initialization of the hydrological cycle and other conditions (e.g., aerosols)?
  - Measuring irrigation forcing of water cycle and including obs. and processes in models.
- Forecast challenges
  - Are forecasts targeting the right questions (e.g., gridpoint vs. basin-scale)?
  - What type of information do water users most need and do the products target that?
    - E.g. For West Coast, October 1 ONDJFM forecast/December 1 DJFM update, i.e., a seasonal precipitation outlook similar to the seasonal hurricane outlook?

2. What are the priority research questions that need to be answered to advance seasonal forecast skill for western watersheds?

- Understanding
  - Study AR frequency, duration, and intensity and modulation of AR events on seasonal timescales. Includes need for modeling and observational work.
  - Examine past drought and pluvial events in seasonal forecasting systems and climate models to understand whether the systems faithfully capture sources of predictability.
- Modeling
  - Examine resolution impacts on precipitation skill in global models.
  - Develop methods to initialize high resolution prediction systems.
  - Work on scale-aware parameterizations at high resolution, or in the grey zone (between explicit and parameterized spatial scales).
  - Develop and examine models with diagnostics that can illuminate shortcomings in model physics or other elements of model construction, e.g., cumulus convection, boundary-layer turbulence, cloud-aerosol microphysics.
  - Develop and test multi-model ensembling techniques to extract enhanced skill from existing forecast systems.
  - Develop, test, and implement dynamic mesh refinement/adaptive grid techniques in global models.
  - Capturing precipitation phase dynamics and corresponding surface hydrology (temperature is important).
  - Develop, test, and implement statistical or statistical-dynamical seasonal prediction techniques (e.g., LIM).
  - Develop and implement advanced data assimilation techniques for land as well as atmosphere/ocean.
  - Include irrigation processes in models to capture important water recycling in the West.
- Forecast Products
  - Work with water managers and other impacted stakeholders to understand the types of forecast products needed for decisionmaking and collect feedback on existing products.

3. What are the strengths and weaknesses of the white paper as currently presented?

- Strengths
  - Covers span of issues -- dynamical/statistical tools, new forecast products, HPC.
  - Acknowledges that the science needs to be targeted broadly; a geographically limited approach will not work.
  - Many other strengths...
- Suggestions
  - Who is this whitepaper for?
  - Why doesn't the timescale map onto full set of CPC timescales?
  - Organization
    - Value proposition should be up front.
    - Project framework section could be tightened; design purpose could go elsewhere.
  - Demonstrate gap at 2+ month lead (e.g. Figure 1).
  - Need to decisively explore high resolution prediction systems and include significant HPC to do so
  - Does not include observational system needs.
  - Include support for sustained R2O2R process.
    - Includes demonstration projects involving federal and non-federal researchers, operational deployment, infrastructure for transition (e.g., CTB and related support), HPC.
  - 5 and 10 year goals seem ambitious. Low-hanging fruit gone after 5 years.
  - Need discussion of most-needed products and acceptable uncertainty levels for managers.
  - Data assimilation for the prediction systems w/ new obs (e.g., soil moisture, etc.)
  - Seasonal precipitation prediction has been a problem forever; need to provide convincing case that this Project will really deliver a solution.
    - Make the current failures clearer and the value of the potential successes stronger.
  - Clarify discussion of temperature -- focus is on precipitation; temperature critical for precipitation phase question and overall work would have general co-benefits for other climate predictands.
  - Atmospheric Rivers not a source of predictability, but well worth some focus in the paper.
  - Need emphasis on model development for the land surface in 3b
    - In addition to 2010 NRC ISI report, should cite to 2012 NRC climate modeling report.