IMPROVING SUB-SEASONAL TO SEASON PRECIPITATION FORECASTING FOR WATER MANAGEMENT
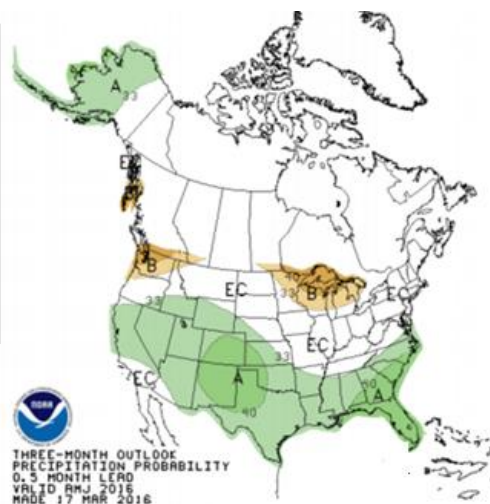
EXECUTIVE SUMMARY

The Western States Water Council (WSWC) has long supported federal programs that have the potential to increase our ability to forecast precipitation over longer timeframes. Specifically, the sub-seasonal to seasonal (S2S) forecasting period, if possible, would have substantial benefits to water management by providing advanced projections beyond a 15-day horizon to a year of wet or dry conditions. This in turn, could enable better operation of reservoirs and other water infrastructure, allow for optimal allocation of resources in response to forecasted conditions, enable state and local water managers to prepare for increased workloads, and also allow them to evaluate environmental and other regulatory constraints.

To determine the state of the science and what might be done to advance S2S programs, the Western States Water Council (WSWC) and the California Department of Water Resources (CDWR) co-hosted a series of workshops, to discuss program organization and budgets, to identify program knowledge gaps and other questions surrounding S2S forecasting, and also identify the resources necessary and obstacles to achieving greater skill levels. Ultimately, the workshops' goal was to call on the federal government to place a higher priority on the science, research, infrastructure, coordination, and financial resources that will be required to improve forecasts to a level where they can be useful for optimally managing water for the benefit of cities, towns, farms, and the environment.

A SUSTAINED VISION

Real improvements in sub-seasonal to seasonal (S2S) forecasting skill will require a substantial and sustained commitment of resources, and a need to leverage all members of the short-term climate prediction community including operational centers, federal labs, and other academic partners. WSWC will continue to work with the federal agencies, and state and local water resource managers to address opportunities for and challenges to advancing research and modeling to improve S2S forecasting and predictive capabilities.
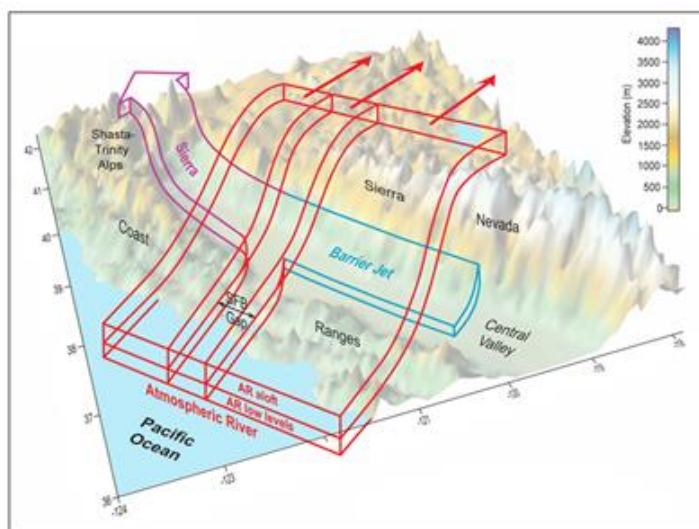

CHALLENGES AND DATA GAPS

Our ability to increase the skill of S2S forecasting faces a number of challenges.

• Knowledge Gaps – There is a need for additional monitoring data, both in situ and satellite data, as well as better spatial distribution of sensors. Finer resolution models and improved physics within dynamical earth system models are an avenue for improvements, but their benefits and applications for hydrologic prediction and water management are not well understood.

• More and Better Tools – Improving the basic building blocks of forecasts, including enhancing observation networks, increasing data resolution, data assimilation between modeling steps, correction of modeling errors, exploring hybrid models (statistical/dynamical) and multi-model ensembles (MME), post-processing, etc.

• High Performance Computing (HPC) and modeling involves enormous amounts of data, an "order-of-magnitude" improvement in computer processing power, providing for much greater resolution and interactions between the ocean/atmosphere/land systems, with an increasing in the number of variables.

• Data Access and Understanding – Better communication and ways of presenting the data are needed so that consumers can readily understand and use new products or tools.

• Quantifying Benefits – accurate S2S forecasting will result in many benefits, but many of them are "avoided costs" or "losses", which are difficult to measure.

• Measuring Improvements - Methods for estimating baseline skill and improvements need to be further developed and made easier to portray to the public, interested parties, and decision-makers.

• Sustained Funding – increasing S2S forecasting capabilities within federal agencies will require dedicated and sustained funding for related programs.

RECOMMENDATIONS AND STRATEGIES FOR INCREASING S2S SKILL

• Crafting a narrative surrounding tangible benefits, including specific goals for increasing skill (e.g., a 20% improvement in forecast skill over the first-year baseline in 5 years)

• Further refine estimates of the funding requirement for a sustained program and find/seek congressional support (currently $10 - $15M per year over a ten to fifteen-year period).

• Develop a whitepaper/pathway toward S2S prediction skill improvements.

• Continue study of the mechanics and physics of weather phenomena that provide sources for additional skill, such as sea-surface temperatures (SST), El Niño, Madden-Julian Oscillation (MJO), atmospheric rivers (ARs), etc.

• Create a national plan for cyberinfrastructure that can address the lack of high-performance computing (HPC) capabilities