The NHWC Transmission

May 2016

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Verification of Seasonal and Water Year Forecasts from the California Nevada River Forecast Center

Alan Haynes, Brett Whitin, National Weather Service

Since about 2010 the National Oceanic and Atmospheric Administration's (NOAA) California Nevada River Forecast Center (CNRFC) has made probabilistic hydrologic forecasts available that incorporate short-term weather forecasts.   While these forecasts potentially have the most value in short-term decision making, such as during the first five days of the forecast, they also can provide value in long-term water management decision making. For example, as much as 50% of the annual precipitation in California comes in the form of several large storms commonly referred to as atmospheric rivers. One of these storms can produce over 10 inches of precipitation in the Sierra Nevada Mountains over the period of just a few days. As these storms come into view of the short-term weather forecasts, they can significantly impact the seasonal volume forecasts produced by the CNRFC, mainly in the spring when the signal from large storms is high compared to climatology. However, for users to have confidence in utilizing probabilistic forecasts it's important for them to understand the error characteristics and reliability of these forecasts.   The CNRFC began compiling verification statistics for seasonal forecasts in the winter of 2015-2016 and made plots of these statistics available for select locations in early 2016.

The methodology for generating these initial verification statistics for probabilistic forecasts started with producing a consistent dataset by running retrospective streamflow forecasts, also called reforecasts, for 42 locations using the Hydrologic Ensemble Forecast System (HEFS) for the 1985-2010 period. These forecasts required inputs of precipitation and temperature from the National Centers for Environmental Prediction's (NCEP) Global Ensemble Forecast System (GEFS) reforecasts out to 15 days and from climatology for days 16 to 365.   Each streamflow reforecast was sampled to include 60 ensemble members with lead times out to 365 days in daily increments. The streamflow reforecasts at each of these locations were aggregated to two accumulation periods for verification, seasonal (April-July) and water year (October-September). Accumulated volumes were expressed in thousands of acre-feet (kaf).

Reforecasts produced during the accumulation period were constructed by combining observed totals to date with the residual forecast for the remaining forecast period, similar to how daily operational forecasts are produced. Since the historical GEFS input data was only available for the 1985-2010 period, the streamflow observations for the 1985-2010 period were used to verify the forecasts. Five verification products were produced to help assess forecast skill and bias: Correlation Plots, Scatter Plots, Percent Error Plots, Box Plots, and Reliability Histograms. Highlighting one of these products, Correlation Plots depict the characteristic seasonal variation in the correlation coefficient between the median forecast and the

observations. These plots help answer as a function of lead time when during the season the forecast obtains appreciable skill. Using the Merced River at Pohono Bridge for example (Figure 1), one can see that over the reforecast period it isn't until late January that 50 percent of the observed variance is explained by the forecasts. Much of the skill in seasonal forecasts comes from knowledge of the accumulated snowpack. On average, about 50 percent of the seasonal snowpack in the Sierra Nevada has accumulated by mid-January. One question that frequently comes up around probabilistic forecasts is: Are the probabilistic forecasts reliable? For example, 80 percent of the observations should ideally fall within the 10% and 90% forecast exceedance probabilities, with 10% below the 90% exceedance and 10% above the 10% exceedance. Figure 2 shows an example of Reliability Histograms.
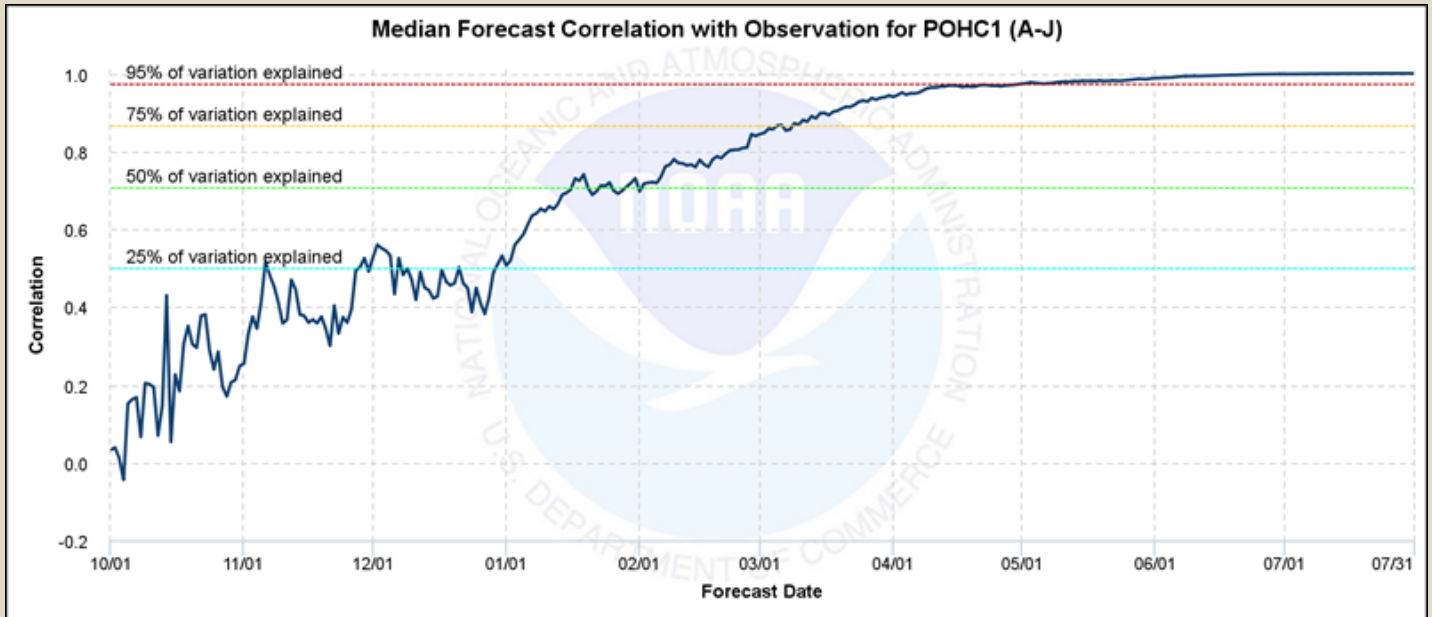

Figure 1 - Correlation Plot for April-July Seasonal Accumulation for Merced River - Yosemite National Park at Pohono Bridge.
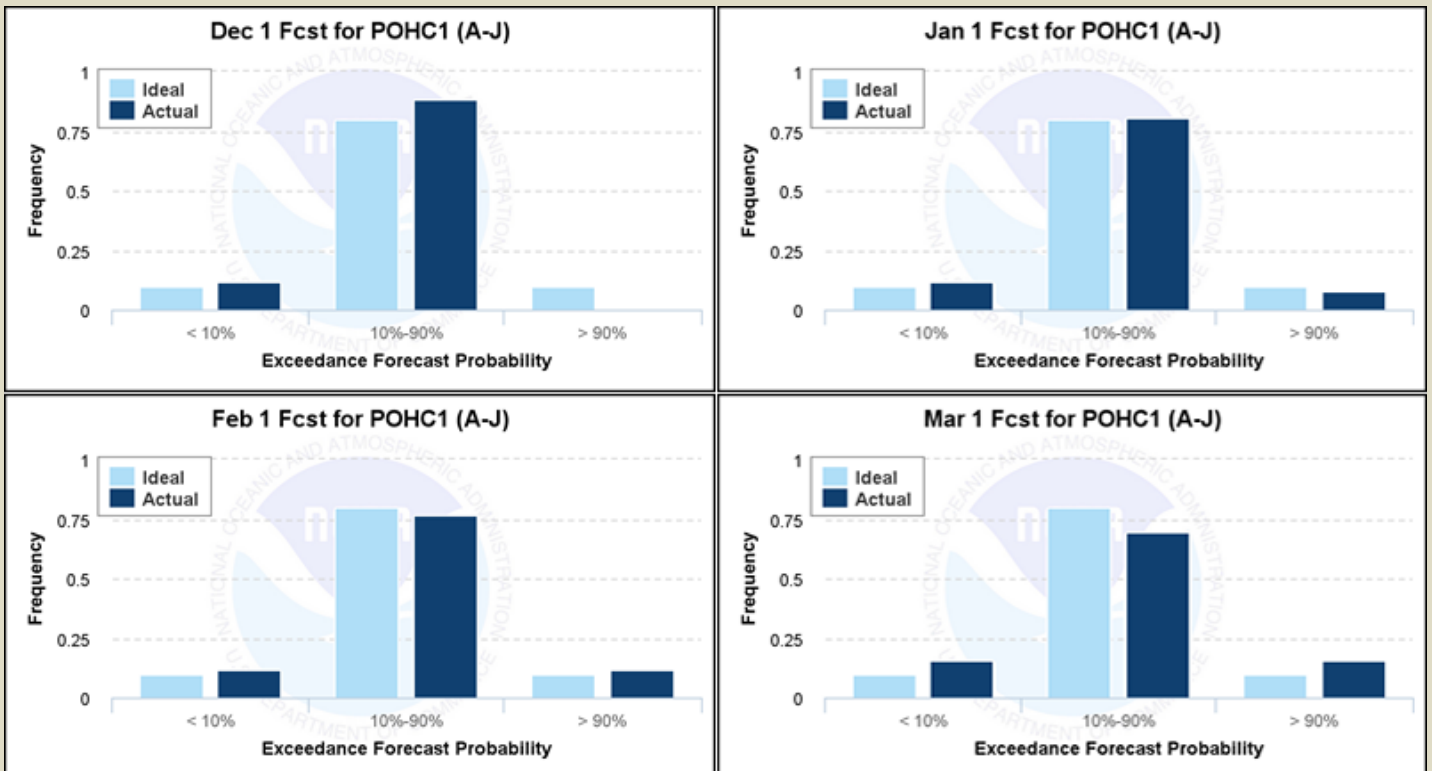

Figure 2 - Reliability Histograms for April-July Seasonal Accumulation for Merced River - Yosemite National Park at Pohono Bridge.

These verification plots are available on the CNRFC website (http://www.cnrfc.noaa.gov) for a subset of ensemble forecast locations, primarily in the Sierra Nevada and Shasta regions. There is a package of forecast products associated with each ensemble forecast point, such as a 10-day plot of the individual ensemble traces, 10-day accumulation volumes, etc., and where available, the verification plots are accessible from the default matrix of choices that appear when choosing an ensemble forecast location. Here's a link to the help section for interpreting the verification plots:

http://www.cnrfc.noaa.gov/WRverification_help.php.

For context, the CNRFC has recently added a plot of historical flows and a plot of multiple years of accumulated volume. Thus, users can interpret forecasts in relation to past events and look at accumulated deficits or surpluses. The new verification plots give added context as to the skill and reliability of these probabilistic forecasts as a function of lead time over a much richer data set (25 years of forecasts).   The initial focus for providing verification context is on traditional water supply forecast points, but users can expect verification products to eventually become available for all ensemble forecast points.

What Does El Niño Mean to You and Your Community This Spring?

FloodSmart

You may associate El Niño with increased rain in California and areas in the Southwest. However, you may not realize that strong El Niño conditions can cause unpredictable weather across the United States. Although weather experts hesitate to attribute specific extreme weather events solely to El Niño, the National Oceanic and Atmospheric Administration is warning residents from coast to coast to expect higher-than-average precipitation for the next few months.

All it takes is one storm to cause a flood, and just a few inches of water can cause tens of thousands of dollars in damage. Without flood insurance, residents could be left paying for the damage out of pocket since homeowners, renters, and business policies typically don't cover flood damage. Don't wait until hurricane season to encourage residents to protect what matters, because it's not just a house—it's their home.

Talk to Residents about Flood Insurance

Flood insurance may not prevent a flood, but it can help homeowners get back on their feet in the event of a flood. A flood insurance policy will give them peace of mind knowing that they are covered if the unexpected happens. Provide them with the right information to protect their investment.

To educate residents in your community about their flood risk and financial preparedness,

FloodSmart—the marketing and education campaign of the National Flood Insurance Program—offers several tools and resources on FloodSmart.gov that you can use, including:

- The One-Step Flood Risk Profile to provide an estimation of a property's flood risk and direct residents to local insurance agents, who can provide additional information on a flood insurance policy.

- The Cost of Flooding tool, which you can embed on your website to illustrate how just a few inches of water can cost tens of thousands of dollars in damage.

- Consumer and business checklists to help residents prepare before the next disaster strikes.

- Seasonal social media messages that you can share through your own Facebook and Twitter platforms to educate residents.

- Marketing webinars that review FloodSmart's tools and resources and how to use them in your outreach efforts.

This spring El Niño brings an increased risk of flooding to your area. Now is the time to reach out to residents to help them better understand their flood risk, and encourage them to protect what matters with a flood insurance policy. Visit FloodSmart.gov/partners to learn more.


2016 International Atmospheric Rivers Conference

August 8-11, 2016

The 2016 International Atmospheric Rivers Conference will convene at 8am on Monday 8 August 2016 in the beautiful Robert Paine Scripps Forum at the Scripps Institution of Oceanography in La Jolla, California.

Four full days of presentations will cover global regional perspectives on atmospheric river science including associated and parallel processes. A poster session will be held late Tuesday afternoon and will be followed by a buffet dinner on Tuesday evening (lasting until approximately 8pm). Other conference days are expected to end at approximately 5pm.
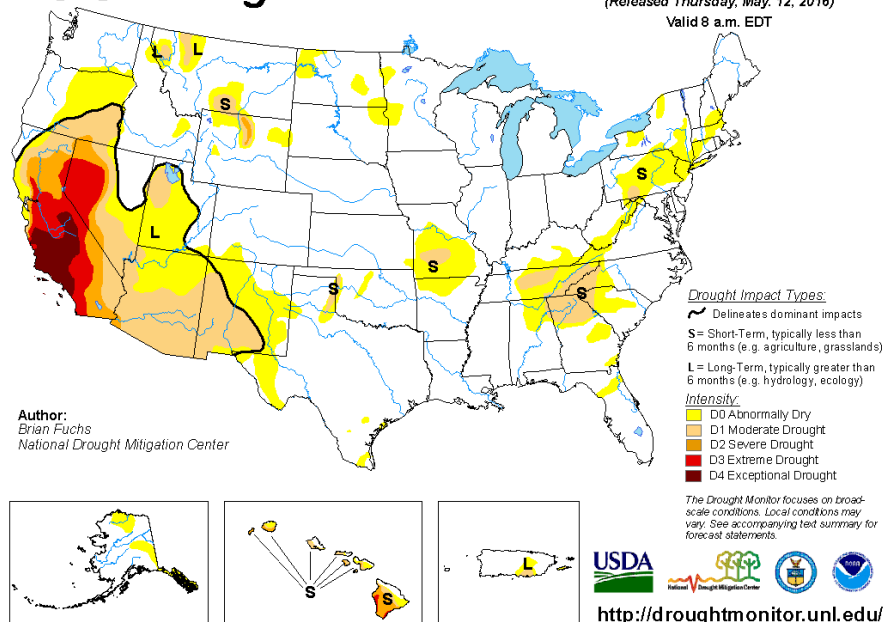
Click **here** for more conference information

Hydrologic Conditions in the United States
Through May 10, 2016
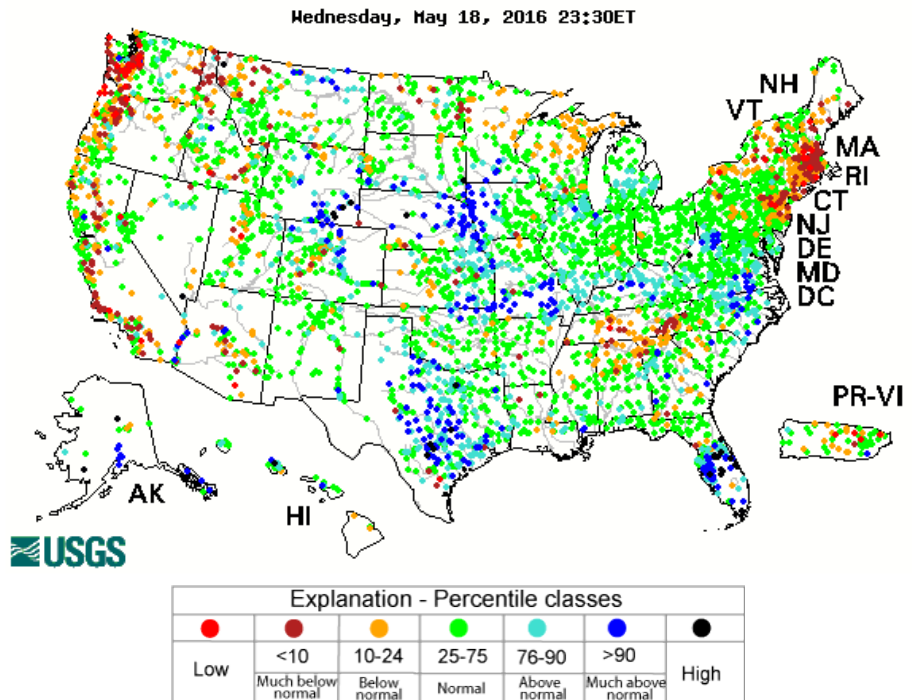
Latest stream flow conditions in the United States. (courtesy USGS)

**Latest drought conditions in the United States.
(courtesy National Drought Mitigation Center)**

The NHWC is requesting articles that focus on practices, technologies and tools used to gather and disseminate real-time hydro-meteorological data.

Please consider writing an article that highlights how your organization collects and disseminates real-time data.

Submit your article to:

editor@hydrologicwarning.org

June 8th is the deadline for inclusion in the June issue.

Future Newsletter Articles Focus

To give you more time to prepare articles, below is the article focus schedule for the next four months:

Jun - Data Collection
Jul - Hydrology
Aug- Hazard Communication & Public Awareness
Sep- Modeling/Analysis

NHWC Calendar

September 20-21, 2016 - NHWC Northeast Regional Workshop, Albany, New York

June 5-8, 2017 – NHWC 2017 Training Conference & Exposition, Squaw Valley, California

General Interest Calendar

June 19-24, 2016 - ASFPM 2016 40th Annual National Conference, Grand Rapids, Michigan.

August 8-11, 2016 – 2016 International Atmospheric Rivers Conference, La Jolla, California

August 22-25, 2016 – National Association of Flood & Stormwater Management Agencies Annual Meeting, Portland, Oregon

(see the event calendar on the NHWC website for more information)

Parting Shot
Yosemite Valley, California: April 19, 2016

37º 44' 39" N, 119º 35' 24" W

Jim Roche, Park Hydrologist for Yosemite National Park led ALERT Users Group conference attendees on a tour through Cook's Meadow.

Photo by Brian Iserman, NHWC Editor
JE Fuller

National Hydrologic Warning Council
Providing Timely, Quality Hydrologic Information to Protect Lives, Property, and the Environment

http://www.hydrologicwarning.org