2007-2008 Wet Season QPF Verification for Interior Northern California

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Introduction

With the onset of the 2007-2008 wet season, a standardized methodology for generating Quantitative Precipitation Forecasts (QPF) was employed in National Weather Service offices over much of the Western Region. This new methodology incorporated the use of the "QPF Helper" Smart Tool in the Graphical Forecast Editor (GFE) by each office, utilizing data supplied by Western Region River Forecast Centers to create better coordinated graphical forecasts.

This document describes the results of the standardization process for WFO Sacramento and illustrates the forecast and model implications.

Methodology

Quantitative Precipitation Forecasts were analyzed over the WFO Sacramento forecast area for 100 days prior to and including March 1, 2008. Comparisons of QPF were made between the GFS40, NAM12, and the official forecast based on 12Z model runs using the Boise Verify (BOIVerify) application in the Graphical Forecast Editor (GFE). Expected value histograms were generated to illustrate statistical biases. Graphical bias and mean absolute error (MAE) plots were also generated for the three datasets to illustrate spatial variability and correlations at 12, 36, and 60 hour time steps.

Expected Values

The graphics in figure 1 are 12 hour expected value plots over the entire Sacramento CWA for the verification period. Statistically, an unbiased forecast would show the colored line extending along the black diagonal. A forecast with a wet (dry) bias would plot beneath (above) the diagonal.

All 12 hour plots showed a slight tendency to over forecast precipitation, particularly when heavier amounts were predicted. This trend to over forecast precipitation grew throughout the forecast cycle, especially when expected amounts exceeded one inch. By 60 hours, the GFS displayed the smallest error growth rate (figure 2). However, even the GFS yielded an average of only 1.8 inches of observed precipitation with a forecast of 3 inches.

Location of Errors

Although the expected value histograms all pointed toward a tendency to over forecast precipitation for the three datasets in this study, more valuable insight was gained by illustrating where the errors occurred spatially.

In the first 12 hour period, the GFS showed a dry bias (in brown) over much of Shasta County, with a slight wet bias (blue and green shades) over much of the southern Sacramento Valley. Elsewhere, little bias was shown (figure 3). The NAM showed a fairly pronounced wet bias over much of the west slope of the Sierra, with little bias elsewhere (figure 4). Figure 5 shows the "Official" forecast QPF bias. While there was still a slight wet bias over the west slope of the Sierra, much of the remainder of the domain showed very little or no discernable bias.

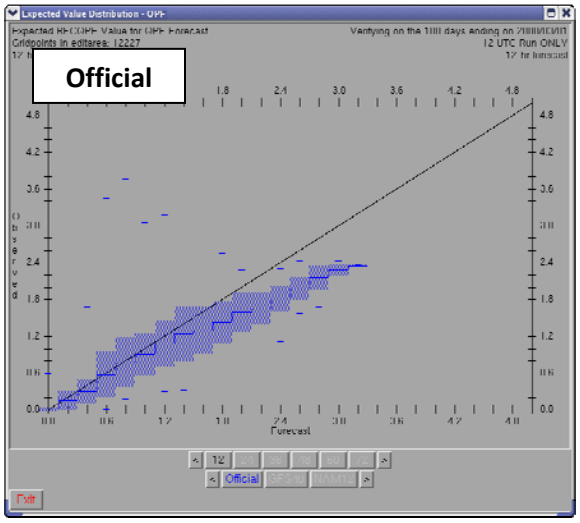
These trends were repeated, and amplified at the 36 and 60 hour time steps. Through the entire forecast cycle the areas with the greatest bias were focused over higher terrain. The three analyzed datasets focused a wet bias over the west slope of the Sierra at the 36 and 60 hour time steps. The GFS was the only model to show any area with a dry bias, which remained focused over Shasta County through 60 hours. Meanwhile, the least amount of bias was shown over the interior valleys of northern California (figures 6-8).

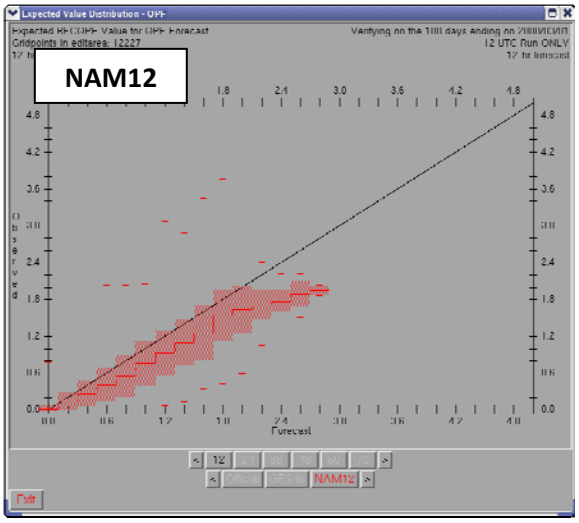
Mean Absolute Error (MAE) graphics were also generated for the three datasets over the verification period (figures 9-11). As implied by the bias statistics, the areas showing the greatest MAE were also focused over higher terrain, with the smallest MAE over the interior valleys. Statistically, the "Official" forecast outperformed the GFS and the NAM with the smallest MAE over the verification period.

Conclusions

With the adoption of a standardized forecast methodology for QPF, the Sacramento "Official" forecast was statistically a better performer than either the GFS40 or the NAM12 for the 2007-2008 wet season. The "Official" dataset showed the lowest Bias and MAE scores for the 100 days leading up to and including March 1, 2008. The portion of the WFO Sacramento forecast area that showed the largest errors was contained mainly over the west slope of the Sierra, where bias and MAE scores were maximized. Very little bias was displayed over the interior valleys of northern California.

Fig 1. 12 Hour Expected Value Histograms





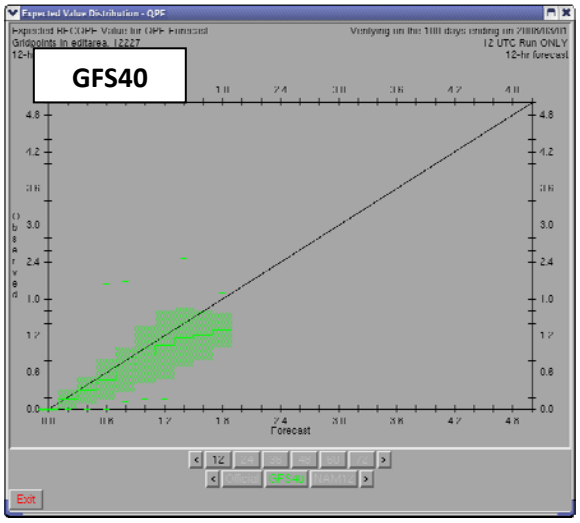
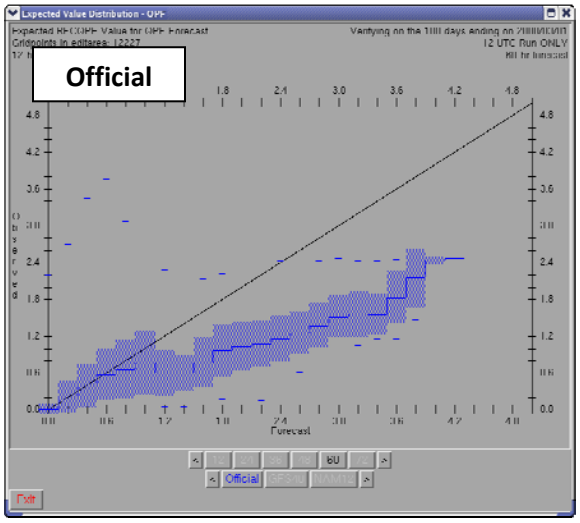
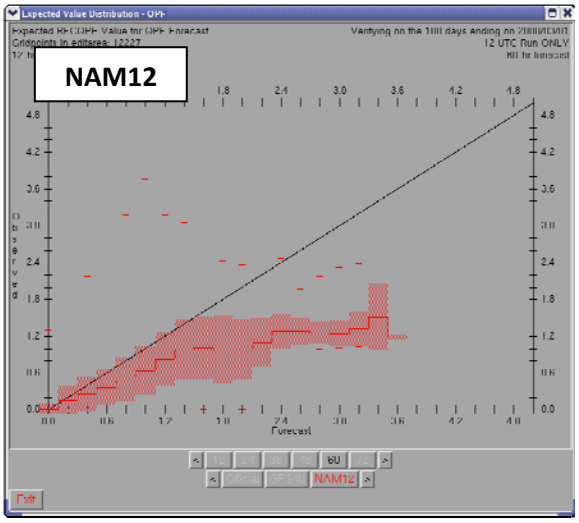
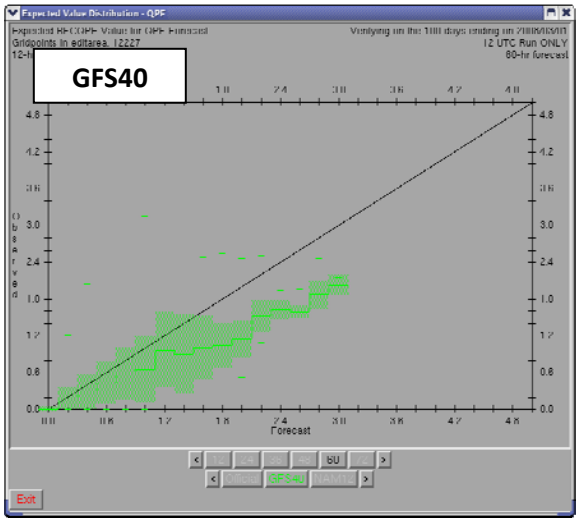


Fig 2. 60 Hour Expected Value Histograms







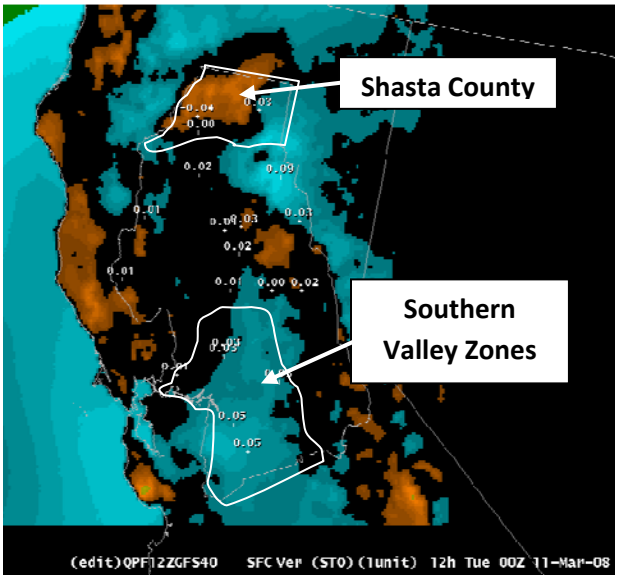


Fig 3. 12 Hour QPF Bias - GFS40

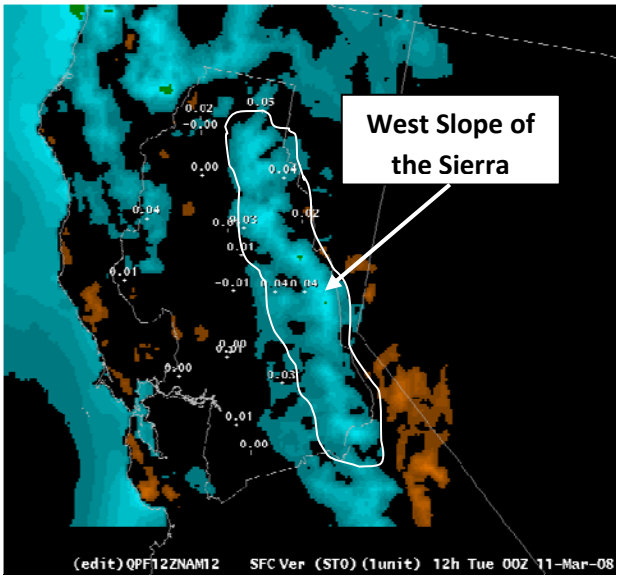


Fig 4. 12 Hour QPF Bias - NAM12

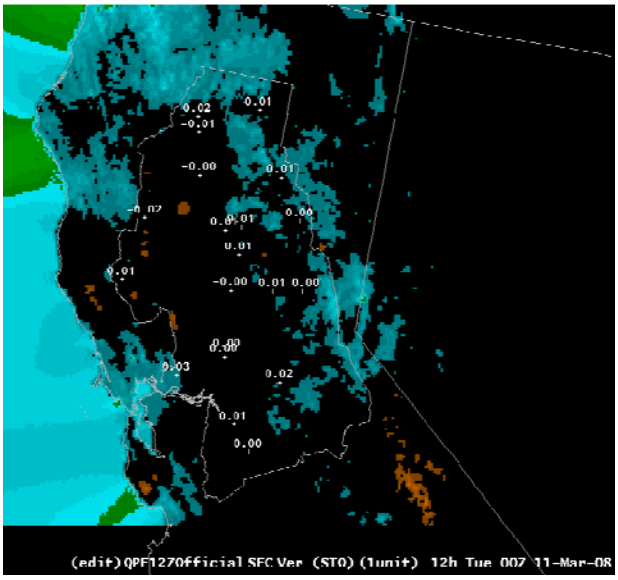


Fig 5. 12 Hour QPF Bias – Official

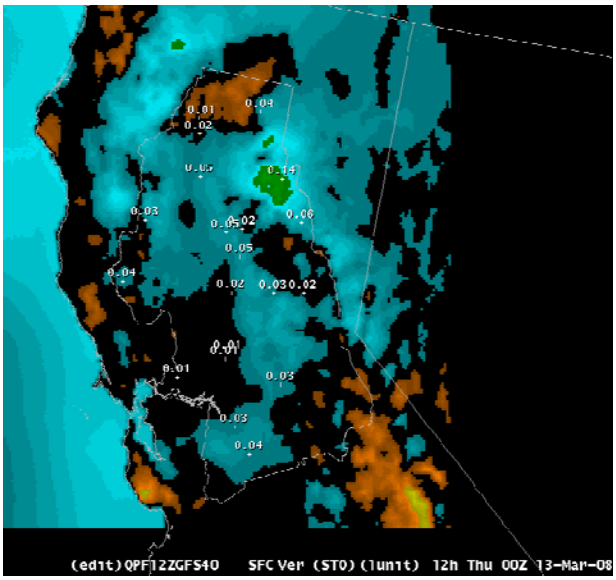


Fig 6. 60 Hour QPF Bias - GFS40

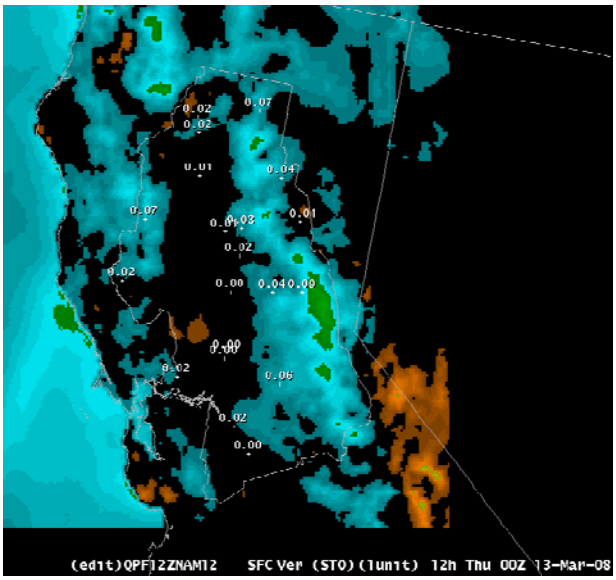


Fig 7. 60 Hour QPF Bias - NAM12

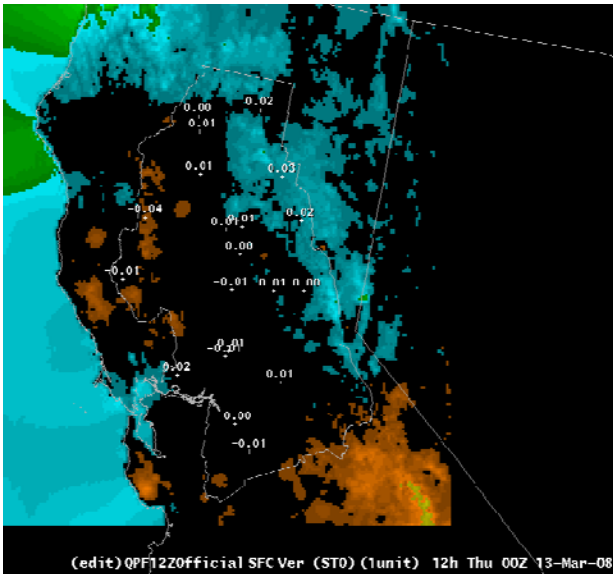


Fig 8. 60 Hour QPF Bias – Official

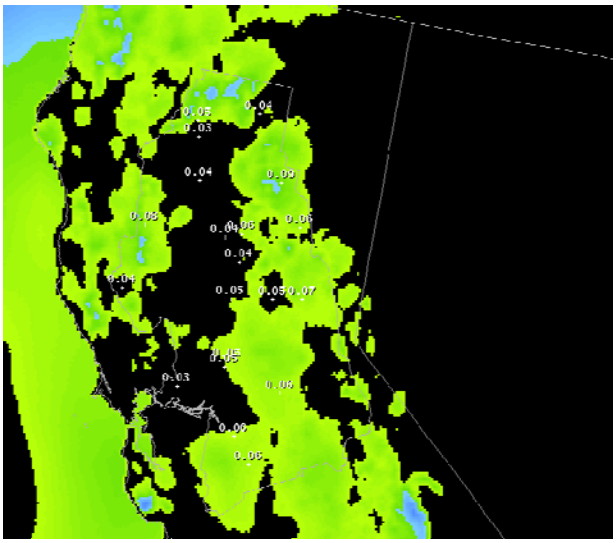


Fig 9. 12 Hour Mean Absolute Error - GFS40

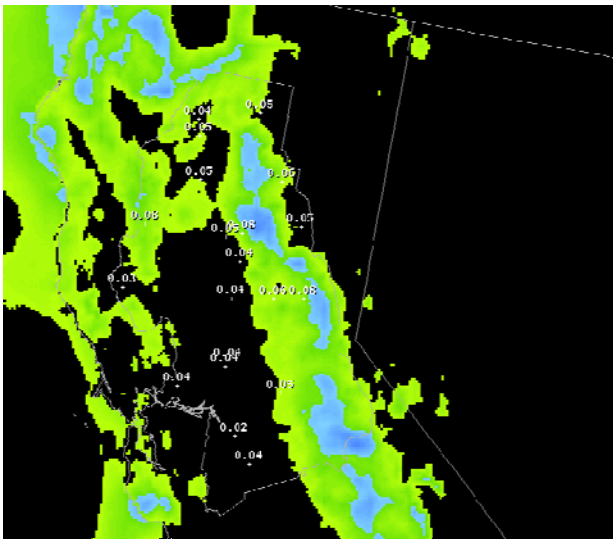


Fig 10. 12 Hour Mean Absolute Error - NAM12

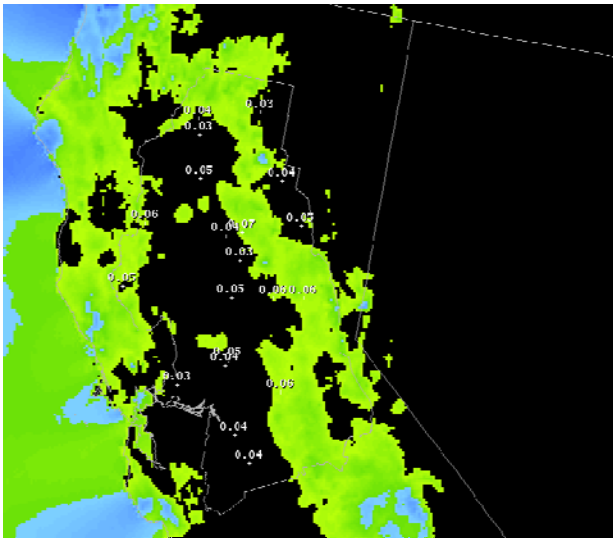


Fig 11. 12 Hour Mean Absolute Error – Official