ASSESSMENT OF MULTISENSOR QUANTITATIVE PRECIPITATION ESTIMATION IN THE RUSSIAN RIVER BASIN

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THE PROBLEM

This study aims to evaluate the impact of a commercial C-band radar for QPE in an area of poor NEXRAD radar coverage and to determine the relative performance of different QPE methods. The primary area of interest in this study is concentrated around the National Oceanic and Atmospheric Administration (NOAA) Hydrometeorology Testbed (HMT) in the Russian River basin north of San Francisco, CA (Figure 1). In this mountainous terrain, the challenge of obtaining reliable QPE’s is limited by beam blockage and overshooting, and orographic enhancement. Even if a perfect empirical Z-R relation can be applied, the accuracy is subject to factors such as: radar calibration, ground clutter, attenuation, beam blockages, bright bands and anomalous propagation, etc.

In development of Z-R algorithms, rain gauges provide ground truth to the estimation of Z-R coefficients for a given region. In this study, radar data is taken from the surrounding NEXRAD WSR-88D radars (KMUX, KODAX, KBHX, and KBBX) as well as the C-band TV station radar KPIX. The KPIX radar scans the same area of interest but, unlike the NEXRADs, is closer and has a nearly unobstructed view of the Russian River basin. Rain gauge data from the California Data Exchange Center (CDEC) was used for ingestion into QPE processing, and the rain gauges used for validation came from the NOAA HMT and Sonoma County wineyard gauges (Figure 2).

METHODOLOGY

The QPE precipitation fields, generated by NMQ, include: gauge only, radar-only, and radar with VPR and gauge correction. Along with radar input, 52 gauges are used by NMQ for gauge analysis. The computed QPE output are gridded into common lat-lon-longitude coordinates and compared to an independent validation gauge set consisting of 10 gauges (Figure 2). The domain of interest for this study is shown in Figure 1. The independent HMT/Sonoma wineyard gauge QPE is created by gridding the hourly gauge data into lat-lon using inverse distance weighting (IDW) (Figure 3).

MPE QPE fields were produced using Digital Precipitation Array (DPA) files that use the same radar set and gauge data input as mentioned above for NMQ. This QPE processing, takes advantage of the PRISM (Parameter-elevation Regressions on Independent Slopes Model) climate mapping system for scaling the multisensory estimates in MPE. The MPE output generated follows the 4km by 4km grid used by the Hydrologic Rainfall Analysis Project (HRAP) grid system. The HRAP grid is then converted to lat-lon grid and then compared to the independent gauge data.

The simple KPIX QPE field is calculated using the Mather Z-R relationship. This technique determines rainfall rate from reflectivity, similar to NMQ and MPE. However, no VPR or gauge information is used in order to minimize the complexity in the analysis. The radar reflectivity measurements are gridded to a 0.01 degree lat-lon grid covering the domain of interest using 4/3 earth radius model. The rainfall QPE hourly amounts are obtained by summing the rainfall amount between each consecutive radar scan.

\[
D(x,y) = \sum_{i=1}^{n} w_i \cdot \frac{f_i}{d^b}
\]

- \( f_i \) = gauge value
- \( d \) = distance from interpolation point to gauge
- \( g_i \) is the gauge number
- \( b=2 \) and a 2km radius of influence.

Comparison done with common area.


RESULTS

Statistics of interest for this study focused on the correlation coefficient, normalized mean bias and the normalized standard error which are calculated by comparing the common grid points between the NMQ QPE fields and the independent gauge.

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The daily statistics for 1 and 6 hour rainfall accumulation can be seen in Figures 4, 5, and 6 for normalized mean bias, normalized standard error, and correlation coefficient respectively. The red indicates NMQ gauge only, black is NMQ radar only, green shows NMQ with VPR and gauge correction, blue plots the simple KPIX QPE, and the magenta shows the MPE QPE’s. The missing data for 0315 and 1220 stem from the application of the 6 hour rainfall threshold.

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