Intercomparison of Radar and Rain Gauge Observations over the Arkansas-Red River Basin

Christopher Grassotti and Ross Hoffman
Atmospheric and Environmental Research, Inc.
131 Hartwell Avenue
Lexington, Massachusetts 02421
E-mail: cgrass@aer.com,rhoffman@aer.com

Enrique Vivoni and Dara Entekhabi
Massachusetts Institute of Technology
Ralph M. Parsons Lab
Department of Civil and Environmental Engineering
77 Massachusetts Avenue
Cambridge, Massachusetts 02139
E-mail: vivoni@mit.edu,darae@mit.edu

We have performed a detailed intercomparison for the period January 1998 - June 1999 of three different sets of rainfall observations over the watershed covered by the National Weather Service Arkansas-Red Basin River Forecast Center (ABRFC). The rainfall data sets were (1) hourly 4-km resolution ABRFC-produced Stage III estimates, (2) 15-minute 2-km resolution NOWrad estimates produced and marketed by Weather Services International, Inc. (WSI), and (3) conventional hourly rain gauge observations available from the operational observing network. Precipitation estimates from the three products were compared at monthly, daily, and hourly timescales. Results indicate that the Stage III products had a higher correlation and smaller bias relative to rain gauges than did the WSI products. The fact that the Stage III estimates are bias-corrected using gauges themselves makes an independent assessment difficult. WSI monthly and daily accumulations seemed to overestimate (underestimate) total rainfall relative to gauges during the warm (cold) season. Figure 1 shows the difference statistics, binned by month for 1998. The top panel also shows the sample size used in each month. The mean difference plots show that there is a clear tendency for the WSI data to underestimate daily precipitation with respect to gauges during winter months and to overestimate precipitation during the summer. The magnitude of these differences ranges between $\pm\ 3-5\ mm/day$ for rainy days. This pattern was present in both 1998 and 1999 data and may be related to either radar underestimation of precipitation rates due to frozen hydrometeors during winter or beam overshooting during low-level wintertime stratiform precipitation events. In any case, WSI and Stage III estimates had very good agreement overall with correlation coefficients of daily accumulations generally greater than 0.7. Stage III hourly estimates sometimes exhibited unrealistic artifacts characterized by extensive areas of very low precipitation rates (less than $1\ mm/hr$). This is likely to be an artifact of the Stage III local bias correction algorithms in areas with sparse gauge coverage.

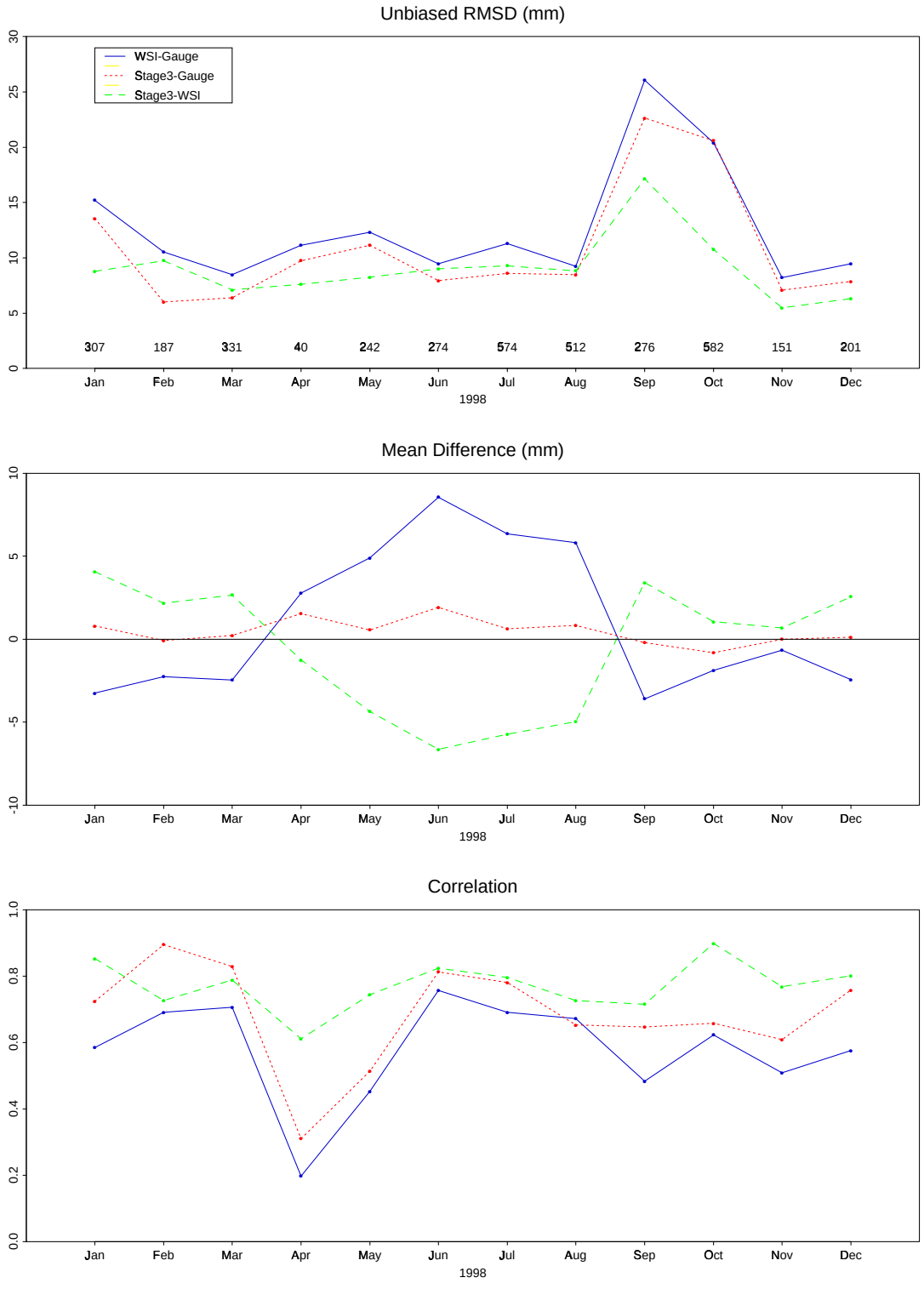

Figure 1: Statistics of daily precipitation differences for 1998, binned by month. Differences statistics are for WSI-Gauge (blue), Stage III-gauge (red), and WSI-Stage III (green).