GAUGE CONVERSION EFFECTS ON LONG-TERM PRECIPITATION COMPARISON AND RECORDS

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ABSTRACT

Climate sites measure precipitation using a variety of methods and sensors. Each individual sensor has its own catch efficiency which varies with solid and liquid precipitation. A climate site's precipitation record may contain data from two or more types of precipitation gauges. Using parallel data from the accumulation gauges at four SNOTEL sites in Alaska, comparisons were made of the effects gauge transitions have had on the long term record. The records of each site indicate that significant change in gauge catch can occur with gauge transitions, though the variations cannot be tied to gauge type alone. These transitions should be taken into consideration when developing long-term assessments and while comparing recent data with earlier years. (KEYWORDS: precipitation gauge, SNOTEL, long-term precipitation records)

INTRODUCTION

Types of Precipitation Gages Compared

Four common precipitation gages were compared in this study. These gauges are routinely used at both Natural Resources Conservation Service (NRCS) SNOTEL sites in the western U.S. and at National Weather Service cooperative sites across the U.S.

Rocket style accumulation gauge used at SNOTEL sites

Standard precipitation gauge used at COOP sites

Figure 1. Rocket storage gage and standard 8" unshielded NWS daily gauge

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Heated Tipping Bucket (HTB) precipitation gauge with wind shield used at AWOS sites.

All Weather Precipitation Accumulation Gauge (AWPAG) with Tretyakov style wind shield used at AWOS sites.

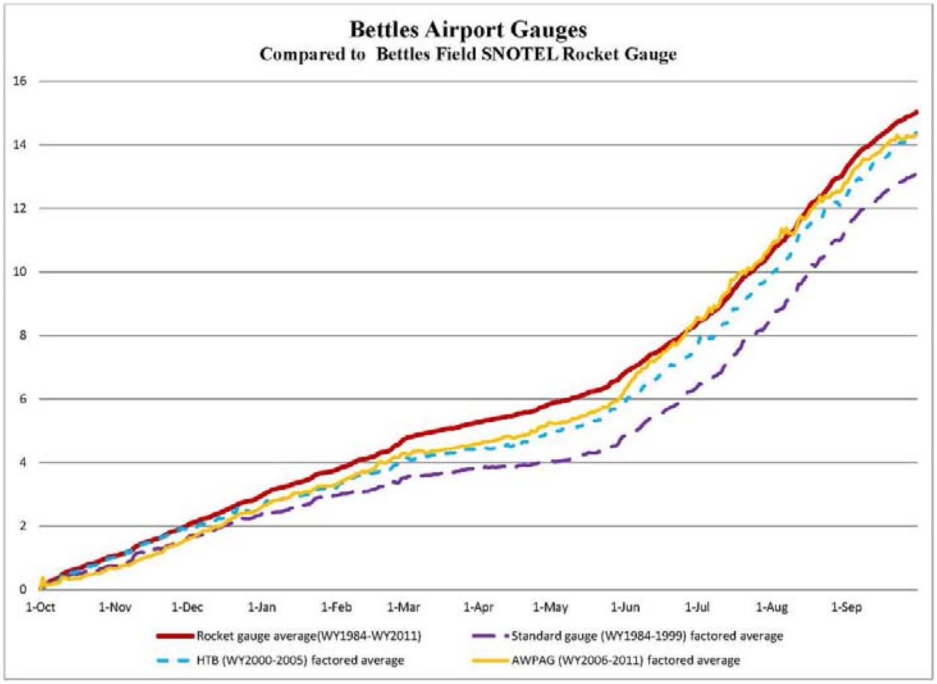
Figure 1, cont. Automated Weather Observing Stations (AWOS) examples, including a heated tipping bucket gage with modified Alter-type wind shield, and the all-weather precipitation accumulation gauge with a Tretyakov wind shield.

Precipitation Gauge Locations

Four sites in Alaska were included in this study. Sites near Bettles and Fairbanks were used to represent continental climates while sites near Seward and Homer represent maritime climates. Bettles is located on the S.E. bank of the Koyukuk River and is located 35 miles north of the Arctic Circle just south of the Brooks Range. Fairbanks is about 250 miles south of Bettles at an elevation of 446 ft. Fairbanks is the largest city in the Interior region of Alaska, and second largest in the state behind Anchorage. Seward is a coastal city on the east side of the Kenai Peninsula in southern Alaska, while Homer is on the west side of the Kenai Peninsula. Both gauge sites are near sea level.

DATA AND RESULTS

Water-year precipitation was accumulated for each water year and then averaged over the period of record to produce an average annual precipitation curve for each gage, and the curves for all four gauges were plotted for each site. Displayed in Figure 2 is a comparison for the continental sites showing annual accumulated precipitation. The averages of the shorter term gauges were adjusted to correspond with the longer rocket gauge average. Figure 3 shows the comparison for the maritime sites.



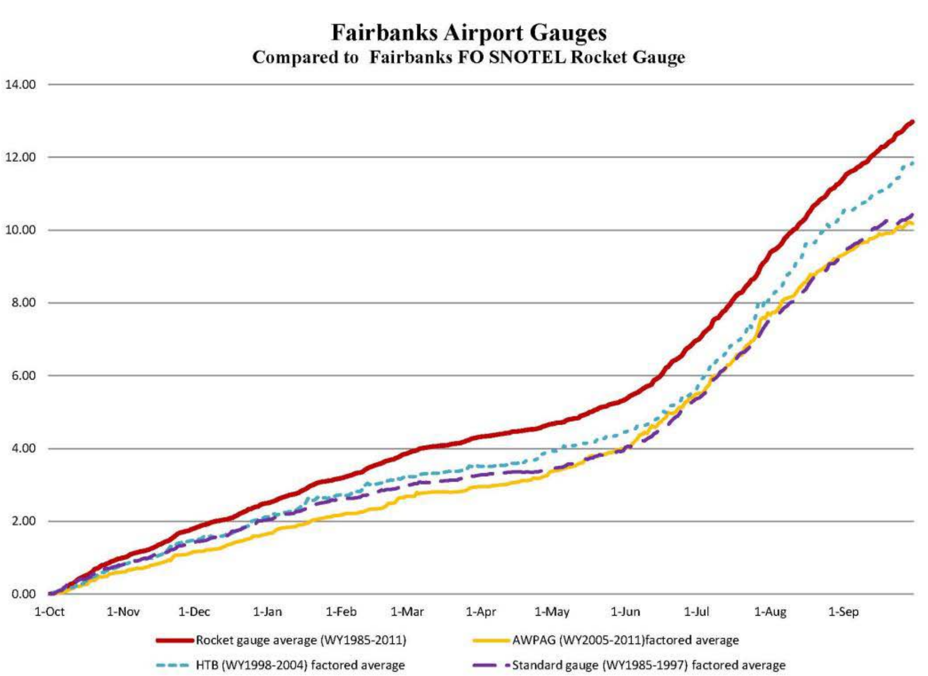
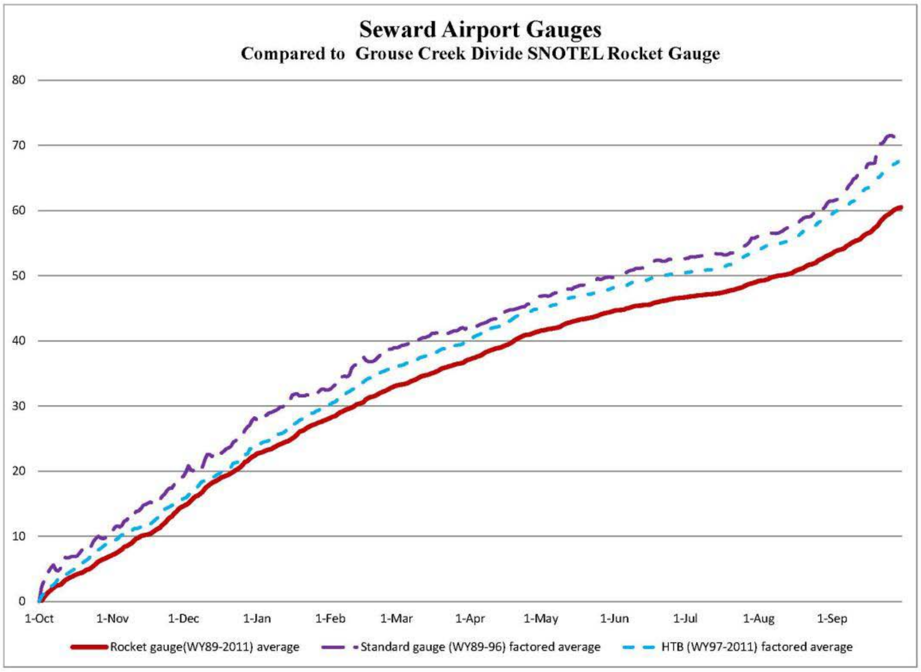


Figure 2. Accumulation curves for the continental sites, the Bettels and Fairbanks airport gauges



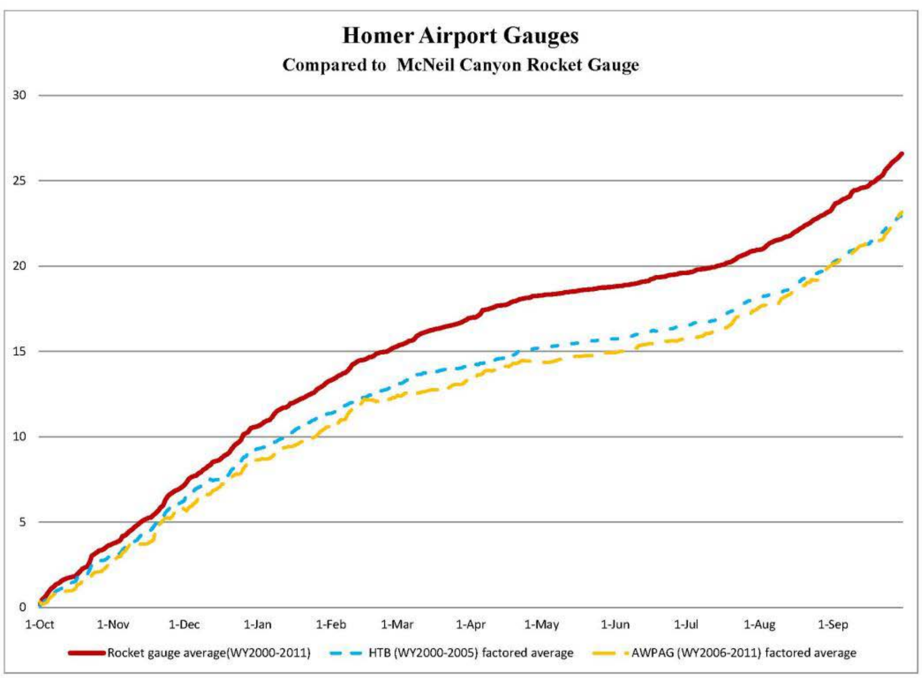


Figure 3. Accumulation curves for the maritime sites, the Seward and Homer airport gauges

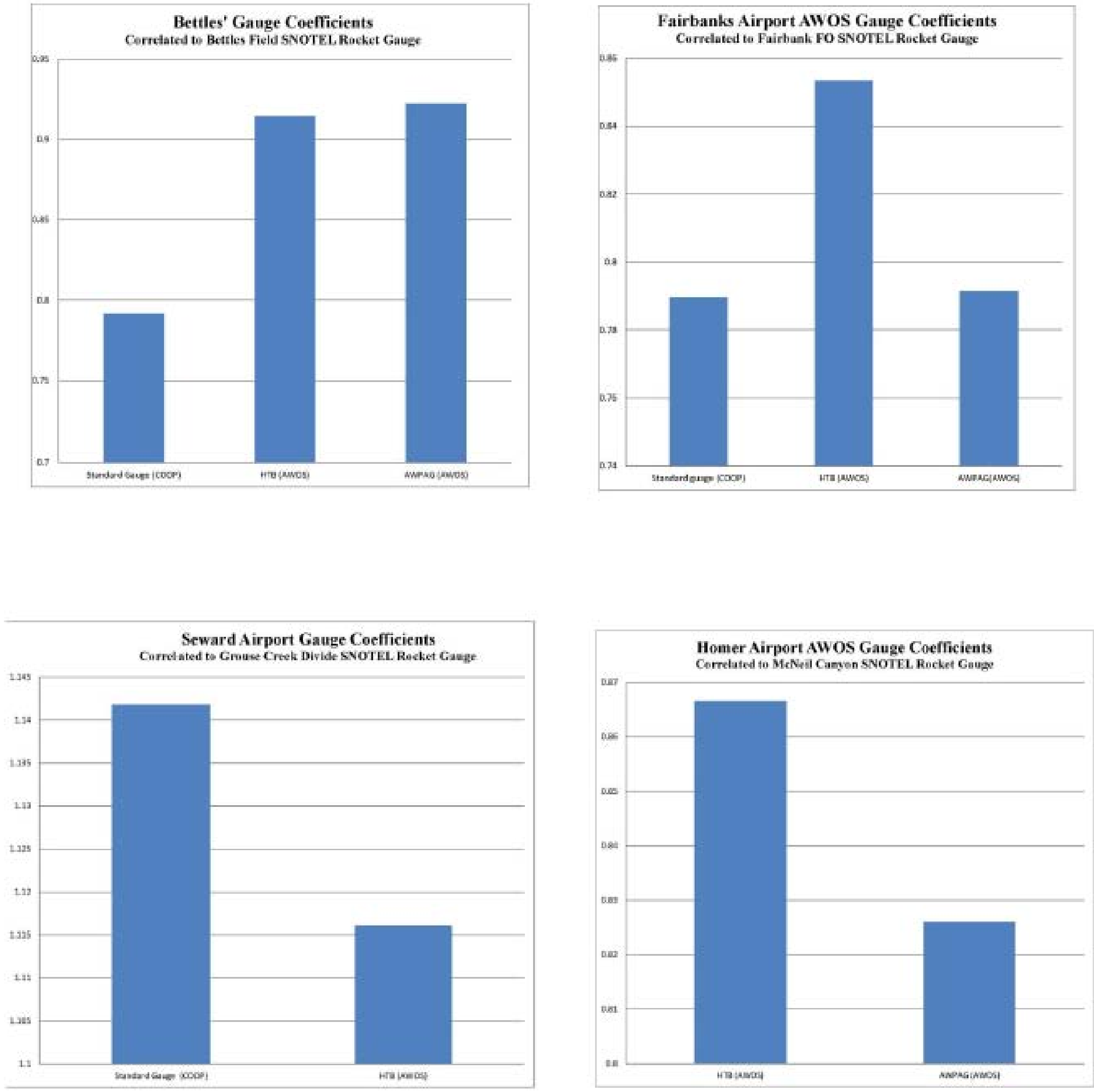


Figure 4. Regression coefficients as measures of the undercatch or overcatch of the gauge being compared to the reference gauge.

Coefficients were developed from regressions which covered the history of the gauges (Figure 4). Differences in these coefficients indicate changes in each gauge's effectiveness in measuring precipitation. These values do not represent absolute sensor efficiency, but also incorporate gauge location changes and other factors.

CONCLUSION

The records of each site indicate that significant change in catchment can occur with gauge transitions, though the variations cannot be tied to gauge type alone. These transitions should be taken into consideration when developing long term assessments and while comparing recent data with earlier years.