A Revised Comparison of Shippensburg University's Weather Datasets

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This report is a summary based upon the first author's Master's degree practical exam

This is an updated analysis of the climatic records of the Shippensburg University of Pennsylvania COOP and automated weather stations. Temperature variables examined included daily maximum temperature, daily minimum temperature, and daily average temperature. Precipitation variables examined included liquid precipitation, and liquid equivalency of solid, frozen precipitation. All temperature variables and liquid precipitation variables were analyzed based upon daily records from 9/1/06-11/30/14. Solid precipitation, due to the installation of a heater on the automated station, was examined based upon daily records from 10/1/08-11/30/14. Statistical parameters for these variables are denoted in Table 1.

Results appear to imply the existence of threshold variables where the relationships between precipitation variables across the datasets are noticeably weaker. These are evident at 0.75 inches for liquid precipitation, and 0.5 inches for the liquid equivalency of frozen precipitation. These results are graphically depicted in Figures 1 and 2, respectively. In addition, Table 2 details the statistical parameters of these subsets. Results also appear to indicate that, even with the influx of five years of new data, the majority of the conclusions drawn in the original analysis remain valid. However, there are some determinations that no longer retain validity. This is best exemplified by daily maximum temperature records transitioning to being statistically significantly different across the datasets. It was also noted that the discrepancies

between comparable variables are becoming more profound, and prevalent, with the passage of time.

In the previous analysis of the stations, it was recommended that the COOP station be the preferable dataset for climatic research, due to the higher levels of accuracy, particularly concerning precipitation. This updated analysis, with five years of additional data, concurs with that conclusion.

Table 1: Relevant Statistical Parameters. **Note:** Regression analysis for precipitation variables produced drastically different results between SPSS and Microsoft Excel. Although SPSS output is included, in Appendix C, Microsoft Excel r- square are reported here, and elsewhere throughout the paper. Microsoft Excel regression equations are also utilized through the paper, although SPSS t-values for precipitation variables are reported here. The difference is thought to arise from the processing of no data days by each software program. The asterices denote this discrepancy.

	Daily Max. Temp.	**Daily Avg. Temp.**	**Daily Min. Temp.**	**Daily Liq. Precip.**	**Daily Liq. Equiv. of Frozen Precip.**
Wilcoxon Z	-24.524	-20.333	-47.303	-21.323	-11.996
Wilcoxon Significance	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Adjusted r-square	0.999	0.994	0.997	0.9297*	0.8723*
ANOVA Significance	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
t value	1660.974	681.039	1077.969	8.788*	8.358*
t significance	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Spearman's rho	0.999	0.997	0.999	0.882	0.902
Spearman's Significance	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001

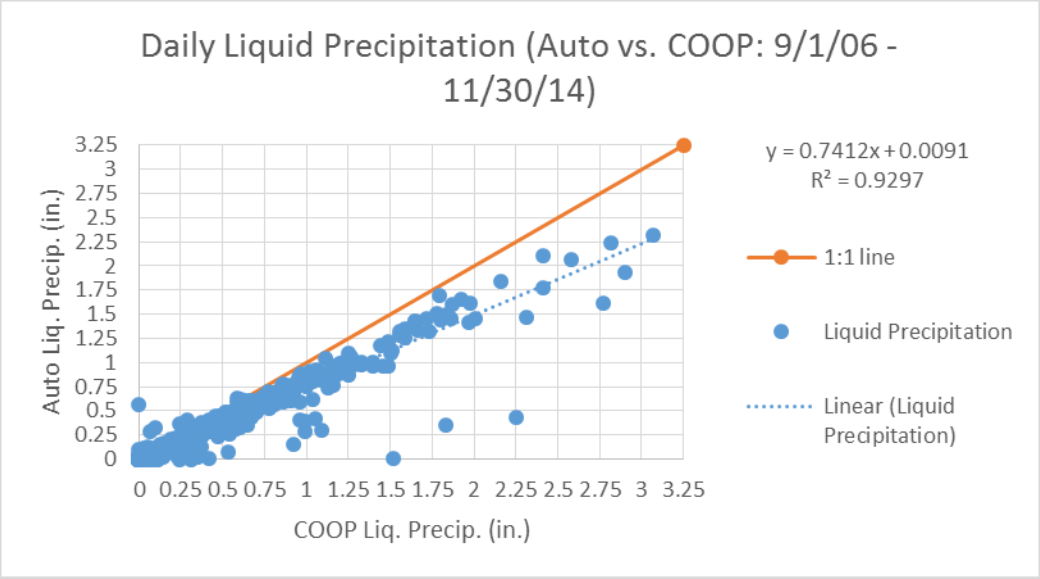

Fig. 1: Daily liquid precipitation records between the datasets. Note that once precipitation levels reach above 0.75 inches, the Automated station appears to consistently record less than the manual COOP station.

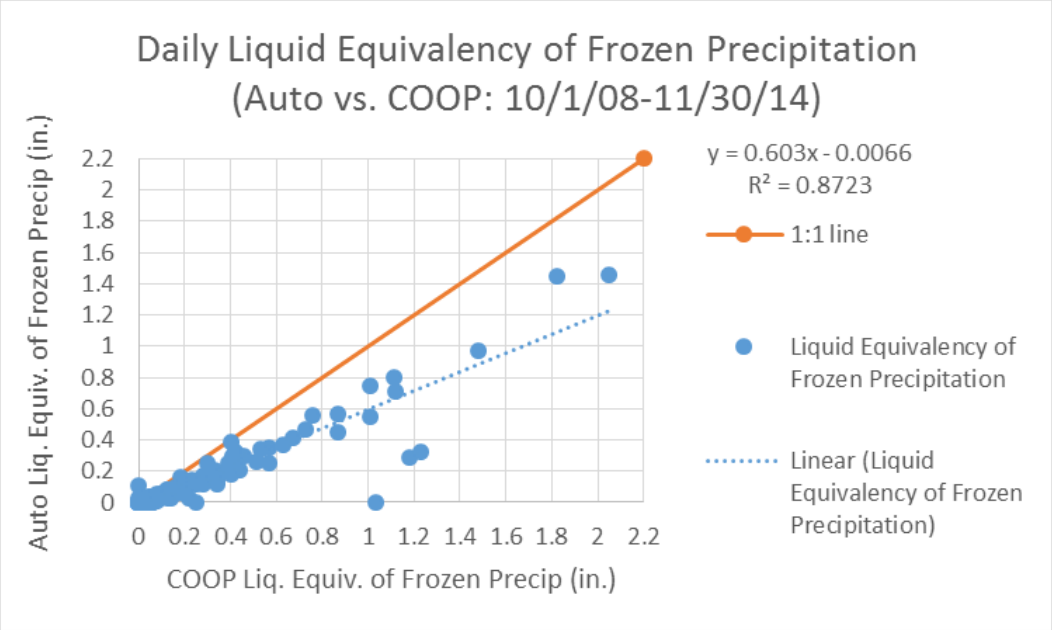

Fig. 2: Daily liquid equivalency of frozen precipitation. Note that at values greater than 0.5 inches, the automated station consistently records less than the manual COOP station.

Table 2: Reanalyses of data above and below precipitation variable threshold values. Note the very weak correlation between datasets for the liquid equivalency of frozen precipitation when recorded COOP values are >= 0.5 in.

	Liq. Precip. (< 0.75 in.)	**Liq. Precip. (>= 0.75 in.)**	**Liq. Equiv. of Frozen Precip (< 0.5 in.)**	**Liq. Equiv. of Frozen Precip (>=0.5 in.)**
r-square value	0.9259	0.7072	0.8838	0.6547
regression equation	y = 0.7906x + 0.0015	y = 0.6948x + 0.0662	y = 0.6028x - 0.0042	y = 0.7241x - 0.1485
Spearman's rho	0.932	0.803	0.892	0.567
Spearman's Significance	< 0.001	< 0.001	< 0.001	0.009