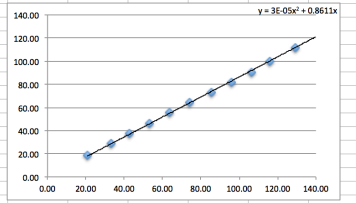


Dynamic Rain Gauge Calibration System

Introduction

A new dynamic rain gauge calibration system for tipping bucket rain gauges was developed for use at the SGP Calibration Facility in effort to mitigate underestimation of high precipitation rates. The goal is to provide field-corrected data to users, in addition to raw gauge output, resulting in reliable estimates of true precipitation rates despite gauge biases.

NovoLynx flag	SN#	121 rate (mm/hr)	rate rpm	rate %	rate mL/hr	volume ml	time (calc) s	volt (meas) mV - CV04	PUMPCAL weight g	PUMPCAL real_rate mm/hr	RG_CAL time s	RG_CAL meas_rate mm/hr
1	20	251.97	14.00	322.52	100	247	-3700	104.9	20.96	1550	18.88	18.88
2	30	377.95	21.00	483.78	100	153	-2950	102.8	35.17	1000	29.27	29.27
3	40	503.94	28.00	645.04	100	120	-2380	103.6	42.62	784	37.34	37.34
4	50	629.92	35.00	806.30	100	95	-1720	102.6	53.31	635	46.10	46.10
5	60	755.91	41.99	967.56	100	80	-1070	102.9	63.49	526	55.65	55.65
6	70	881.89	48.99	1128.82	100	68	-410	102.3	74.26	453	64.62	64.62
7	80	1007.87	55.99	1290.08	100	60	240	103.8	85.40	401	72.99	72.99
8	90	1133.86	62.99	1451.34	100	54	900	105.1	96.08	357	81.99	81.99
9	100	1259.84	69.99	1612.60	100	48	1550	103.6	106.54	323	90.62	90.62
10	110	1385.83	76.99	1773.86	100	44	2210	103.2	115.78	293	99.90	99.90
11	120	1511.81	83.99	1935.12	100	40	2870	104.7	129.21	262	111.72	111.72
12	130	1637.80	90.99	2096.38	100	36	3520	102.5	140.55	238	122.99	122.99



Methodology

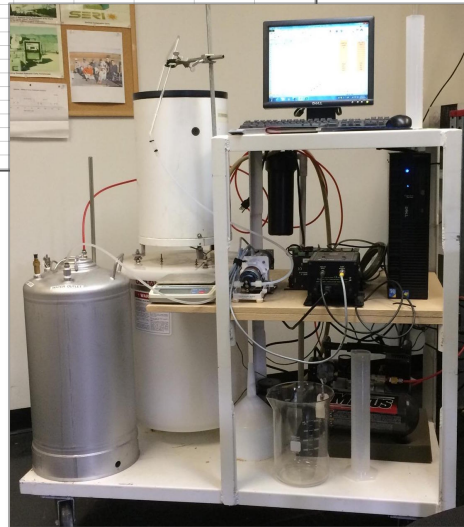
Two calibrations are run: calibration of the pump, and calibration of the rain gauge. The pump calibration takes target (simulated) precipitation rates and measures actual pump output. The gauge calibration takes the same target precipitation rates from the pump calibration and measures actual gauge output. After both the pump and gauge calibrations are run for a series of target rates, the "real" (pump) and "actual" (gauge) rates are scatter-plotted (real vs. actual). A regression line is fit to the plotted data, and the equation of best-fit (2nd order polynomial, intercept at 0) is determined. The best-fit equation is then used to correct the data within the logger program when the corresponding rain gauge is installed.

Uncertainty

Scale: 0.1% of measurement;
 0.1 g linearity; 0.1 g repeatability
 CVO₄: 0.13% of set voltage ±2.5 mV
 Rain Gauge: 1% of measurement for 1-3"/hr rain;
 3% of measurement for 0-6"/hr
 Pump Controller: 1% of voltage;
 1.5% linearity

Limitations

Rainfall rates above 120 mm/hr are not repeatable with the current design due to tube slippage and splashing. Also, the correction factors provided do not account for wind catchment errors. They only assume dependency on rainfall intensity.



The calibration procedures closely follow the recommendations by the WMO CIMO-XIV (2007), and the methods of Humphrey et al. (1997).

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