

A New Precipitation Collector for use by the National Atmospheric Deposition Program - Results of Phase I Field Trial

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The current precipitation collector (PC) used by the AIRMoN, MDN and NTN was first developed in the early 1970s after a DOE-Health and Safety Lab design. The PC exhibits several performance characteristics which suggest improvements; particularly: insensitivity to light snow, potential contamination from raindrop splash and poor driving strength. In addition, the PC design pre-dates micro-processor controllers and their potential for increased power efficiency, durability, data transfer utility and user customization.

The NADP Program Office has operated a side-by-side high resolution intercomparison among 3 candidate and the current NADP PC.

This poster will detail the results of 24 grouped events from the 4 PCs using the NADP/AIRMoN protocol (event based, refrigeration until analysis for inorganic constituents).

In general; differences among the 4 PCs seem a function of sensor design (optical interference and/or contact grid), drive motor response and chassis mass. **For Central Illinois**, concentration differences ranged upwards to 25% on an event basis, especially for snow conditions. In all but 2 events (where raindrop splash may have effected the loading into the NADP PC) the candidate PCs show higher analyte concentrations. Estimates of potential changes in deposition results for NTN will be discussed.



ACM 301



YES TPC 3000

Data Summary Table
ACM-candidate, cool and warm season

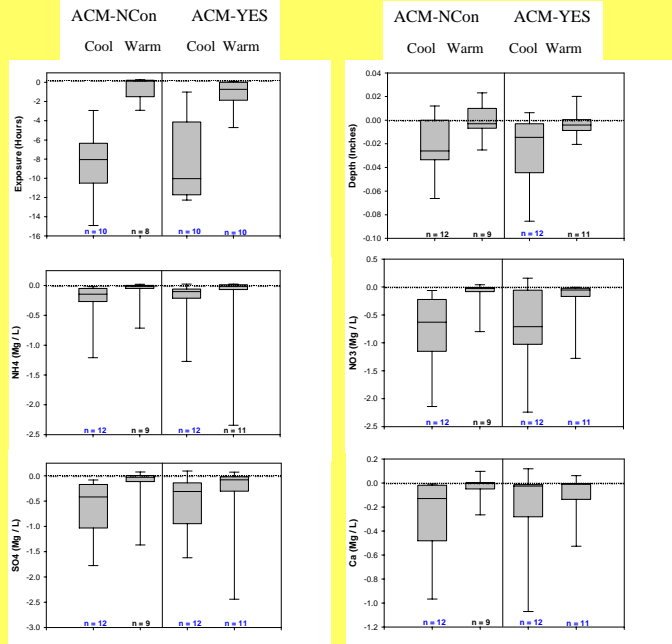
	pH	Conductance us/L	Ca mg/L	K mg/L	Mg mg/L	Na mg/L	Cl mg/L	NO3 mg/L	SO4 mg/L	NH4 mg/L	PO4 mg/L	Depth inches	Exposure hours
ACM - NCon													
Cool Season													
Mean Difference	-0.12	-6.8	-0.3002	-0.0076	-0.0263	-0.1136	-0.193	-0.900	-0.661	-0.362	-0.003	-0.021	-8.48
n	11	12	12	12	12	12	11	12	12	12	10	9	10
Warm Season													
Mean Difference	-0.12	-1.0	-0.0389	-0.0019	-0.0021	-0.0445	-0.064	-0.162	-0.269	-0.139	0.005	0.000	-0.65
n	8	9	9	9	9	8	8	8	9	9	9	9	8
ACM - YES													
Cool Season													
Mean Difference	-0.10	-6.4	-0.2233	-0.0039	-0.0202	-0.0576	-0.112	-0.804	-0.556	-0.379	-0.001	-0.027	-8.24
n	12	12	12	12	12	12	12	12	12	12	10	11	10
Warm Season													
Mean Difference	-0.22	-5.2	-0.1238	-0.1888	-0.0221	-0.0887	-0.114	-0.321	-0.549	-0.489	-0.187	-0.003	-1.46
n	11	10	11	11	11	10	10	11	11	8	11	10	10

Blue values denote a statistically significant difference using Wilcoxon Signed-Rank Test (Two-tailed, alpha=0.05)
*Differences in sample size within a seasonal comparison are due to paired ties

Deposition percent differences
ACM-candidate/ACM

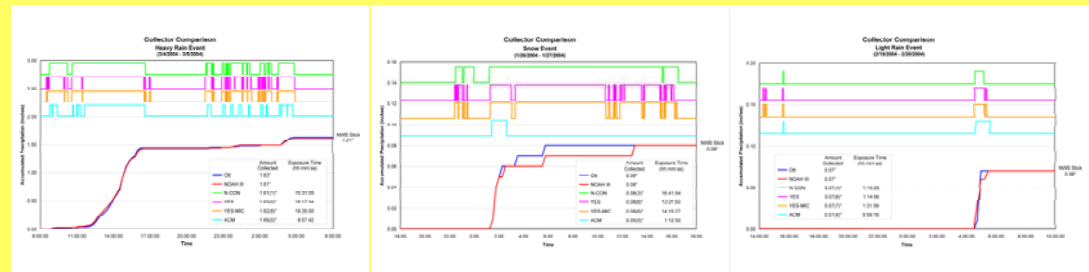
NCon		Ca	NO3	SO4	NH4
	Cool				
	%Diff	-57%	-66%	-28%	-52%
	Warm				
	%Diff	9%	6%	5%	5%
YES		Ca	NO3	SO4	NH4
	Cool				
	%Diff	-48%	-71%	-32%	-58%
	Warm				
	%Diff	-11%	-7%	-8%	-45%

Distribution of differences for select parameters
Blue denotes significance (P < 0.05)



NCon ADS

High resolution event recorder graphs from CR10X



Features Description and Summary

Based on criteria developed by NADP Infrastructure Committee – Artz, Birnbaum, Bowersox, Lear, Nilles, Riebau, Prestbo (available upon request)

ACM- performance is well documented due to long period of use. Problems historically noted include: weak drive motor, poor sensitivity to snow and splash producing chassis. No failures during trial.

NCon- problems still exist in the mounting and use of the lid rest. During study is was removed due to it's poor alignment and carry-over of contamination to the wet side bucket. No DC back-up capability. Event recorder circuit problems to be resolved. One failure (due to inadequate relay mount) during trial.

Yes- Collector was noted open during dry events on a few occasions. Adjustments needed to bucket holder (would not accept all buckets). IrDA data query worked well. One failure (main system board malfunction) during trial.

Conclusions

- * Performance differences among the collectors were markedly different between the cool and warm seasons.

- * In general, both the NCon and YES showed superior cool season performance (analyte concentration, catch and opening duration) compared to the ACM. Overall, the ACM ranked poorest with the YES slightly poorer than the NCon.

- * No significant differences were found for warm season performance between the ACM and NCon collectors. However, during the warm season, the YES collector exhibited significantly higher results than the ACM for six of the thirteen measured variables.

Additional work needed

- * The data set needs to be explored for instances of false positive openings. Anecdotal evidence suggests that both the NCON and YES collectors were open briefly during non-rain events. However, this was not tested for in this poster.