Contribution of Dry Deposited Mercury to Urban Run-Off

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Introduction

Mercury deposition has recently been shown to relate directly to urban run-off. In the urban environment, mercury deposition tends to be 10x greater than in the rural setting. Traditionally, measurement of mercury deposition has been limited to wet deposition monitoring. This has often led to the overestimation of total mercury deposition, as the urban environment is known to have a higher deposition velocity relative to the rural setting. The measurement of dry deposition is critical to the understanding of atmospheric deposition. However, the methods available for measuring dry deposition have many shortcomings. One such method is the surrogate surface, which has been used to determine dry deposition velocities. This method has been shown to overestimate dry deposition to urban surfaces by up to an order of magnitude. This suggests that the actual dry deposition is likely higher than what has been measured.

Methods

In order to measure the efficacy of surrogate surfaces and to compare dry deposition to urban surfaces, a series of dry deposition experiments were conducted. A total of 30 experiments were conducted over the course of 12 months. The experiments were conducted in a large-scale urban environment and were designed to simulate different meteorological conditions. A surface such as a Teflon sheet or empty wet deposition bucket is only able to capture RGM. This means that surrogate surfaces can only be used to determine rain-labile dry-deposited Hg. Surfaces were deployed in a working ship canal and dry dock, multiple factories and a road that were used in the surrounding poster were chosen because they were known to have high levels of atmospheric deposition.

Total Hg dry deposition was determined using static water surface samplers and RGM dry deposition was determined using (IX) membranes, both of which were deployed in an urban environment. Multiple factors were measured during the experiments, including temperature, humidity, wind speed, and rainfall. The sampled surfaces were exposed for 6 days then cut sections that were digested in duplicate in 1.12M HCl, 0.004M BrCl and 0.02M BrCl. An analyzer was then used to determine the concentration of Hg in the samples. Blanks consisted of jars left capped for 6 days and stored in a 1.12M HCl solution.

Results

Figure 3. Normalized IX Membrane Digestion

The measured urban surface deposition values were compared with data collected from the same area using traditional methods. The results showed that the surrogate surface method overestimated dry deposition by an average of 3x. This result could be due to the incomplete digestion performed on the samples. The analysis of the data showed that the surrogate surfaces were able to capture RGM dry deposition, but were unable to capture the total dry deposition.

Conclusion

The measured urban surface deposition values were compared with data collected from the same area using traditional methods. The results showed that the surrogate surface method overestimated dry deposition by an average of 3x. This result suggests that the actual dry deposition is likely higher than what has been measured. The surrogate surface method is a useful tool for determining dry deposition, but it is important to consider the limitations of this method when interpreting the results.

References


NADP Annual Summary. 2006