An assessment of the performance of the Monitor for AeRosols and GAses in ambient air (MARGA): a semi-continuous method for soluble compounds

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Ambient air monitoring as part of the U.S. Environmental Protection Agency's (U.S. EPA) Clean Air Status and Trends Network (CASTNet) currently uses filter packs to measure weekly integrated concentrations. The U.S. EPA is interested in supplementing CASTNet with semi-continuous monitoring systems at select sites to examine ecosystem exposure to nitrogen and sulfur compounds at higher time resolution and with greater accuracy than the filter pack. The Monitor for AeRosols and GAses in ambient air (MARGA) measures water-soluble gases and aerosols at hourly temporal resolution. The performance of the MARGA was assessed under the U.S. EPA Environmental Technology Verification (ETV) program. The assessment was conducted in Research Triangle Park, NC from September 8th-October 8th, 2010. Precision of the MARGA was evaluated by comparing duplicate units and accuracy was evaluated by comparing duplicate MARGAs to duplicate reference denuder/filter packs. The MARGA utilizes a Wet Rotating Denuder (WRD) to collect gases, while aerosols are collected by a Steam Jet Aerosol Collector (SJAC). Both the WRD and the SJAC produce aqueous sample streams, which are analyzed by online ion chromatography for anions and cations. The reference denuder/filter pack consisted of sodium carbonate (Na_2CO_3) and phosphorous acid (H_3PO_3) coated denuders followed by a Teflon filter, a nylon filter, and a citric acid coated cellulose filter. The assessment of the MARGA units focused on gaseous SO_2, HNO_3 and NH_3 and aerosol SO_4^-, NO_3^- and NH_4^+. The MARGA units performed well for SO_2, SO_4^-, NH_3 and NH_4^+, with these compounds meeting the accuracy and precision goals. The MARGA units did not perform as well for HNO_3 and NO_3^-, with both species linear regression slopes not achieving the accuracy target of having a slope between 0.8-1.2. Furthermore, for NO_3^-, the median absolute relative percent difference between both MARGA units and the reference filter pack was greater than the performance goal of 40%. Comparison of total nitrate ($HNO_3 + NO_3^-$) suggests that the lesser performance of the MARGA units for these compounds likely results from aerosol volatility in the MARGA inlet/tubing or the reference filter pack and exchange of HNO_3 with tubing walls. In addition, the NO_3^- concentrations were low (<0.5 □g m^{-3}) for significant periods of the ETV assessment. Details of the comparison will be examined and suggested instrument improvements will be discussed.

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