Assessment and comparison of hourly speciated atmospheric nitrogen measurements with integrated methods at a CASTNET site in Beltsville, MD

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The US EPA Clean Air Status and Trends Network (CASTNET) has more than 25-years of atmospheric nitrogen measurements at rural locations across the United States. Routine weekly filterpack measurements include the nitrogen species (HNO₃), nitrate (NO₃⁻), and ammonium (NH₄⁺). In 2007, CASTNET began participating in the National Atmospheric Deposition Program (NADP) Ammonia Monitoring Network (AMoN) which established a nationwide network of passive NH₃ monitors. Recently, the US EPA has been supplementing these measurements with hourly speciated concentrations of atmospheric nitrogen (HNO₃, NO₃⁻, NH₄⁺) and aerosols (NO₂, NOₓ) have been measured using the Monitor for Aerosols and Gases (MARGA) systems at the Beltsville, MD (BEL116) CASTNET site during extended sampling periods over the past two years. An experimental hourly trace level total reactive nitrogen sampling system, Nitrotrain, has been developed to analyze the components of the reactive nitrogen sample. The Nitrotrain consists of a solenoid sampling system to divert flows, a single commercially available chemiluminescence analyzer, and four converter boxes: a total nitrogen (TNx) stainless steel converter, two traditional molybdenum (Mo) converters (one at 10-m sample inlet for NOₓ and a second at the analyzer for NOₓ), and an LED photolytic NOx converter. Calculated and measured parameters include NO, NO₂, NH₃, NOₓ from the Molybdenum converter, and NOₓ (true) from the photolytic converter. Nitrogen measurements taken at the Beltsville site since December of 2014 will be compared and analyzed to assess instrument performance of the Nitrotrain and the MARGA against the established CASTNET integrated sampling methods.

Results

![MARGA Diagram](Image)

Nitrotrain

Schematic of experimental Nitrotrain instrument showing the four converters: TNx (850°C) and NOx converters (315°C) are placed at 10m. The NOx and photolytic NOx converter are located in the modified Teledyne API Model 501y analyzer box.

Nitrotrain constructed and tested in Gainesville, FL prior to site installation. Calibration gas was delivered to each channel separately at a range of concentrations to confirm that no cross-contamination was occurring. All four converters accurately converted NOₓ at high and mid-level concentrations. As expected, the photolytic NOx detector did not detect NPN, but the NOx Mo did. NOx converter captured NH₃ at 50% efficiency.

Reference

EPA-600/R-14/182 ‘Measurements of Atmospheric NH₃, NOx/Nx, and NOx and Deposition of Total Nitrogen at the Beaufort, NC CASTNET Site (BFT142) August 2014