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TROPOSPHERIC NITRIC OXIDE MEASUREMENTS

by

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Nitric oxide (NO) plays a key role in tropospheric photochemistry. The photochemical oxidation of hydrocarbons, for example, can serve as either a source or a sink for ozone, depending on the local abundance of NO. Nitric oxide also helps govern atmospheric concentrations of the hydroxyl (OH) radical. The OH radical is the single most important player in photochemical transformations because it controls the atmospheric lifetimes of so many chemical species.

Although NO serves as a very effective catalyst in many important chemical processes, its concentration is low enough to normally be expressed in units of parts per trillion by volume (pptv). Consequently, commercially available detectors for NO (with detection limits of about one part per billion) have proven to be unsuitable for use anywhere except in urban areas and near other local pollution sources. Under the sponsorship of NASA's Global Tropospheric Experiment (GTE), Wallops has developed an extremely sensitive detector with a detection limit of a few pptv. The system was specifically designed for aircraft use, with the objective of applying it in global aircraft studies of tropospheric chemistry.

The Wallops instrument has logged several hundreds of flight hours on NASA aircraft, primarily through participation in various GTE missions. These include the Chemical Instrumentation Test and Evaluation (CITE-1) missions aimed at demonstrating NO measurement capabilities, the CITE-2 mission to evaluate nitrogen dioxide (NO_2) sensors, and the Amazon Boundary Layer Experiments, (ABLE-2A and ABLE-2B).

The most recent mission was ABLE-2B which took place in April-May of 1987. This mission was designed to investigate tropospheric chemistry over tropical rain forests during the wet season, and complemented the results obtained during the ABLE-2A dry-season mission. Daytime mixing ratios of NO over the Amazon Basin during this mission were among the lowest ever observed over continental areas. The NO mixing ratio averaged 12 pptv for altitudes below 0.3 km and 6 pptv at higher altitudes. These concentrations bracket the level above which tropospheric photochemistry is expected to produce rather than consume ozone. During the dry season, 25-60 pptv was found at the lower altitudes, and 10-12 pptv were common at the higher altitudes. The higher values observed during the dry season reflect a combination of more biomass burning and more active soil-production of NO.

Planning is now underway to develop techniques for measuring other nitrogen species such as NO_2 and total reactive nitrogen.