A Cyan-Light-Emitting Diode Cavity-Enhanced Absorption Spectrometer for the Measurement of Reactive Iodine Species

Nick R. Yordanov [1], Rebecca Washenfelder [2,3], Steven S. Brown [2], Hans D. Osthoff [1]*
[1]*Department of Chemistry, University of Calgary, Calgary, AB, Canada (hosthoff@ucalgary.ca, 1-403-220-8689)*
[2]*Earth System Research Laboratory, National Oceanic and Atmospheric Administration, Boulder, CO 80303, USA*
[3]*Cooperative Institute for Research in the Environmental Sciences (CIRES), University of Colorado, Boulder, CO 80303, USA*
**Corresponding author*

Atomic iodine (I), molecular iodine (I_2) and iodine oxides (e.g., IO, OIO, I_2O_3, I_2O_5) are important trace gas constituents of the troposphere, in particular in coastal regions and at the poles. Even though the natural abundances of iodine species are often quite low (typically less than 100 parts per trillion by volume, pptv), iodine species have been found to contribute to the production and destruction of ozone (O_3) and to new particle formation. A recent review paper has identified the need for more ambient measurements to gain a better understanding of the global tropospheric distribution of iodine species. Mixing ratios of I_2, IO and OIO have been quantified using their visible absorption lines (between 400 and 600 nm) by open path differential optical absorption spectroscopy (DOAS) and cavity enhanced absorption spectroscopy (CEAS) in both open and closed cells. In this spectral region other molecules (e.g. O_4, NO_2, glyoxal, methyl glyoxal) and aerosols also extinguish light. In this presentation, a CEAS spectrometer to quantify NO_2, I_2, and OIO in ambient air is described. The instrument uses a cyan light emitting diode (LED) mounted on a temperature stabilized driver circuit. The absorption cell consists of a pair of concave (radius of curvature, r = 1 m) highly reflective mirrors that are situated approximately 1 m apart in a stable resonator configuration. The light source is coupled passively to the cavity. Light exiting the optical cavity is digitized using a Czerny-Turner spectrograph equipped with a CCD camera controlled using software written in National Instruments Labview. The instrument response to NO_2 was verified by blue diode cavity ring-down absorption spectroscopy (CRDS).