NCAR NO-NO_2 & O_3 Instruments

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Instrument Description and Background:

The 2-channel NO-NO_2 instrument is integrated with the 1-channel O_3 instrument. Both are based on chemiluminescence detection employing the reaction of NO with O_3 to form excited NO_2, which is detected via photon counting. For NO-NO_2, one sample channel is used to measure nitric oxide via addition of reagent O_3, and the second measures nitrogen dioxide by first flowing sample air through a glass cell illuminated by light-emitting diodes at 395 nm, for the conversion of NO_2 to NO via photolysis. The instrument is similar to instruments previously built at NCAR [Ridley and Grahek, 1990]. The O_3 instrument operates similarly, except with addition of reagent NO to the sample stream.

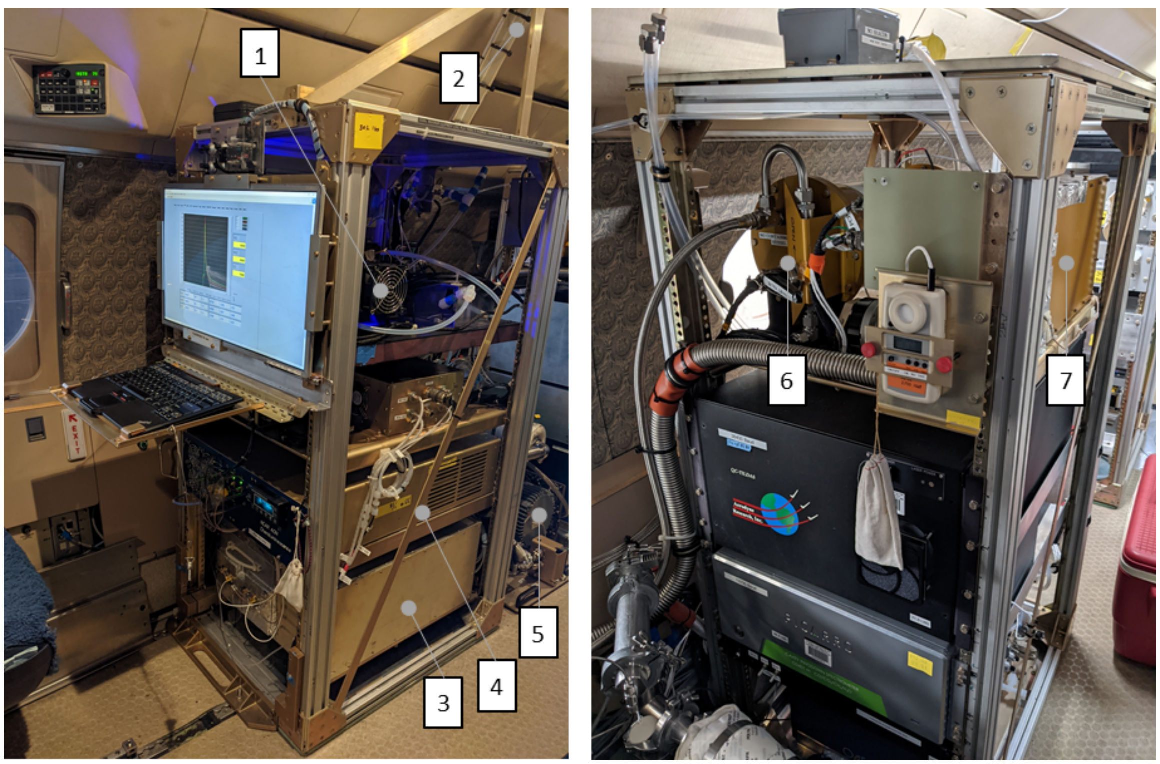

Figure1. Left: NO-NO2 instrument. [1]photolysis cell, [2] inlet line, [3] chemiluminescence instrument, [4] data acquisition system, [5] pump. Right: O_3 instrument. [6] rection vessel for the pure NO reagent, [7] chemiluminescence instrument.

Configuration on GV for ACCLIP:

The instruments can fly as stand-alone instruments, but for ACCLIP there will be a significant sharing of components. This will result in considerable weight, space, and power savings for the overall payload. The items to be shared include these: data acquisition and control system, power distribution and power supplies, vacuum pump, pressure-control valve, zero air bottle, and inlet. The entire installation will occupy approximately three-fourths of a pair of racks plus some floor space. One rack is devoted to NO-NO_2, and the companion rack is devoted to O_3 along with the Aerodyne instrument for CO, N_2O etc., and the Picarro instrument for CO_2 and CH_4. Thus the O_3 instrument is fully integrated with NO-NO_2, electrically and in the plumbing and in the data acquisition, and the rack pair houses NO-NO_2, O_3, CO, N_2O and CO_2-CH_4 instruments.

Data:

Data will be recorded at 10 Hz, though the true frequency response is not that fast, and data will be archived at 1 Hz. The precision of 1-s values of NO and NO_2 are estimated to be in the range of 5-10 pptv, dependent on performance characteristics to be determined in flight. Overall uncertainty of 1-sec values is estimated to be 10% or better for large mixing ratios (> 50 pptv). For O_3, overall uncertainty is 5% and the detection limit is better than 0.1 ppbv.

Reference:

Ridley, B.A.; Grahek, F.E. (1990), A small, low flow, high-sensitivity reaction vessel for NO chemiluminescence detectors, J. Atmos. Oceanic Technol, 7, 307-311.