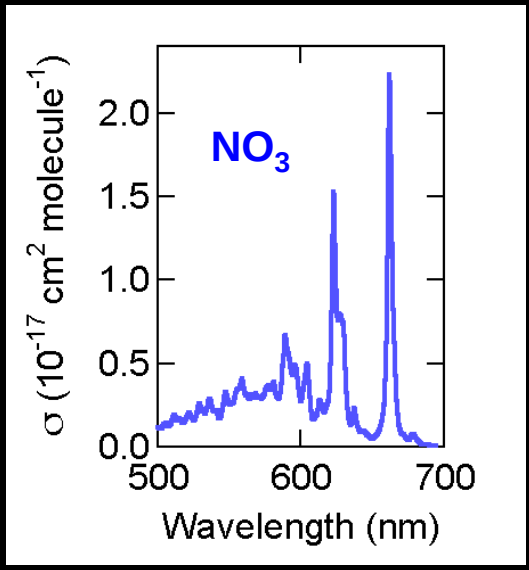
"ARNOLD" = Airborne Ring-down Nitrogen Oxide Laser Detector

Dubé *et. al.*, Rev. Sci. Instr. (2006)
Wagner *et al.* Atmos. Meas. Tech. (2011)

Bill Dubé

6-Channel, Diode Laser Cavity Ring-Down Spectrometer



662 nm direct absorption

Detect NO_3 directly, zero with NO

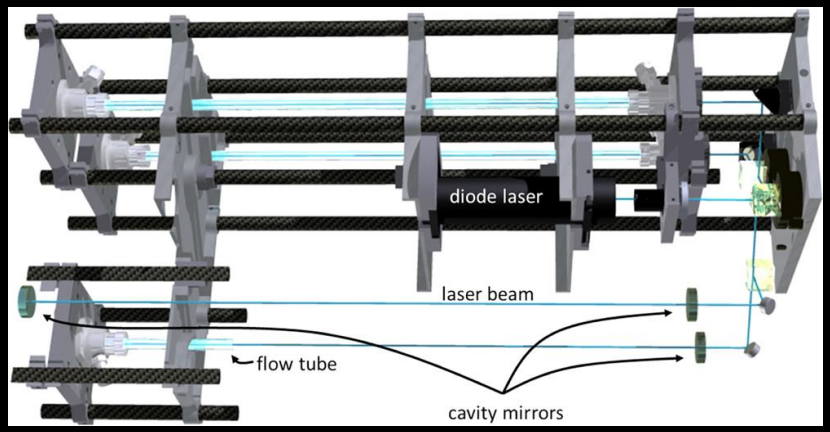
Convert N_2O_5 to NO_3 via:

N_2O_5 + heat ➔ NO_3 + NO_2

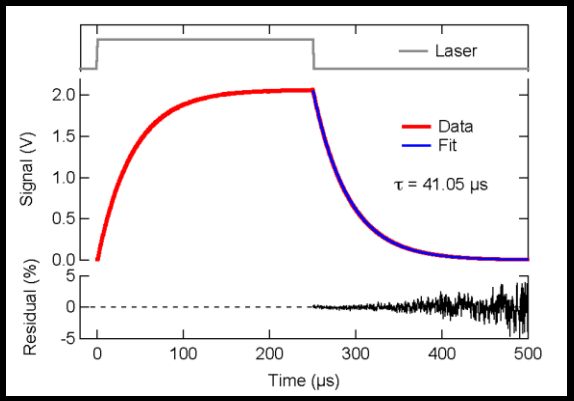
L.O.D = 0.2 - 3 pptv, 10-20% Accuracy

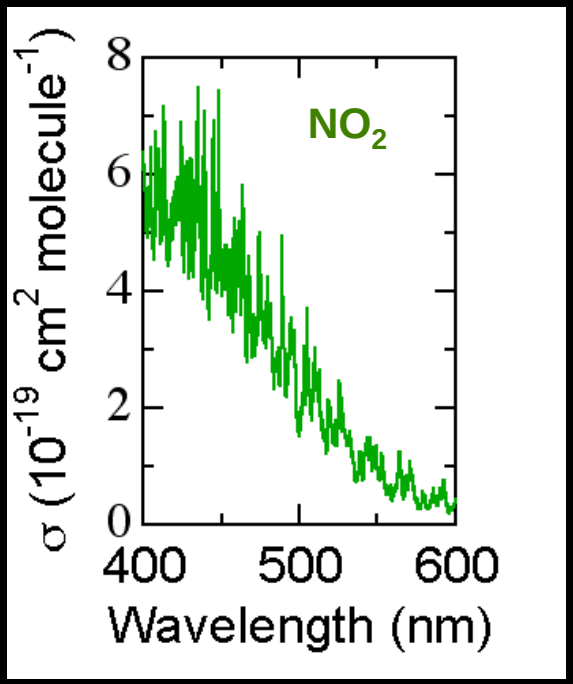
High precision, fast response NO, NO_2, NO_y, O_3, NO_3, N_2O_5 with single calibration standard

405 nm CRDS for NO, NO_2, NO_y, O_3



NO_2: Total gas phase optical extinction at 405 nm attributable to NO_2





NO: Quantitative conversion of NO to NO_2 in excess O_3 to measure total NO_x

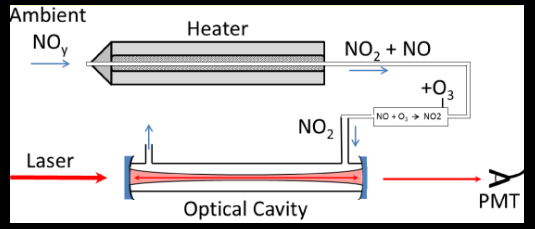
$O_3 + \mathbf{NO} \rightarrow NO_2 + O_2$

O_3: Quantitative conversion of O_3 to NO_2 in excess NO to measure total NO_x

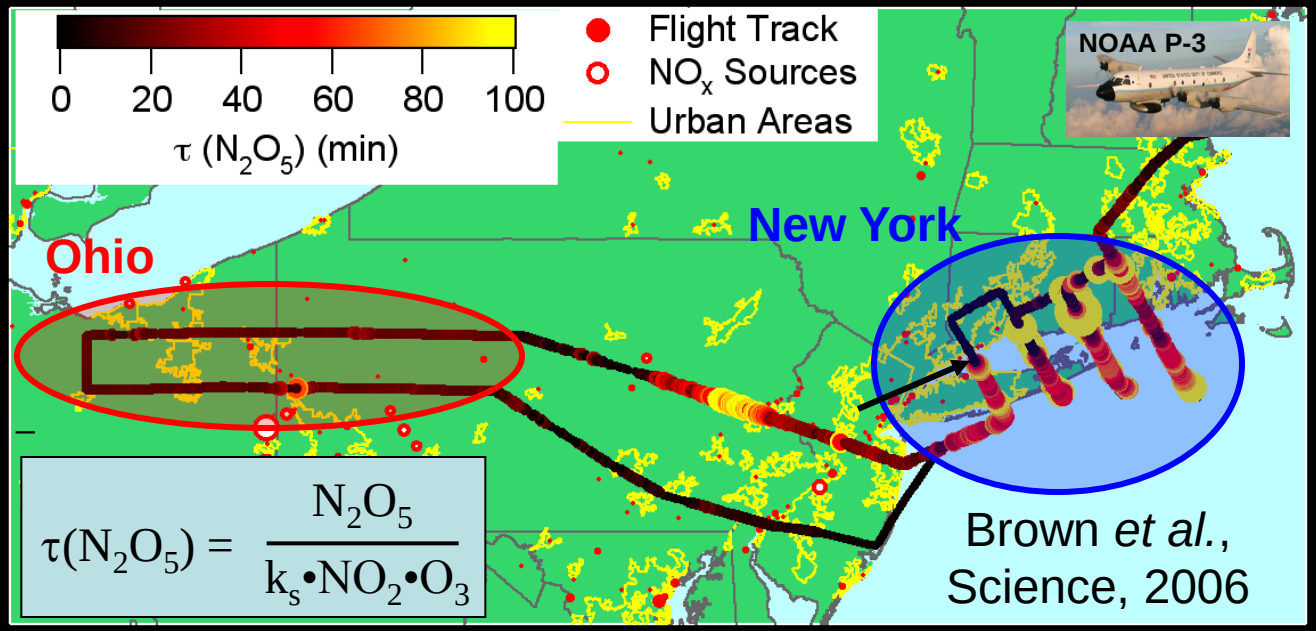
$NO + \mathbf{O_3} \rightarrow NO_2 + O_2$

NO_y: Conversion of all reactive nitrogen to NO_2; conversion of any NO to NO_2 in excess O_3

$NO_y + \text{Heat} + \mathbf{O_3} \rightarrow NO_2$



What Will These Measurements Tell Us?



$N_2O_5 + H_2O \xrightarrow{Het} 2HNO_3$

New England 2004:

N_2O_5 uptake to aerosol variable by at least a factor of 10 and highly dependent on aerosol sulfate and organic

$N_2O_5 + Cl^- \rightarrow ClNO_2 + HNO_3$

CalNex 2010:

$ClNO_2$ in East LA basin to nearly 4 ppbv, but strong function of altitude

Roberts *in prep*