

Interpreting TDLIF data during WINTER

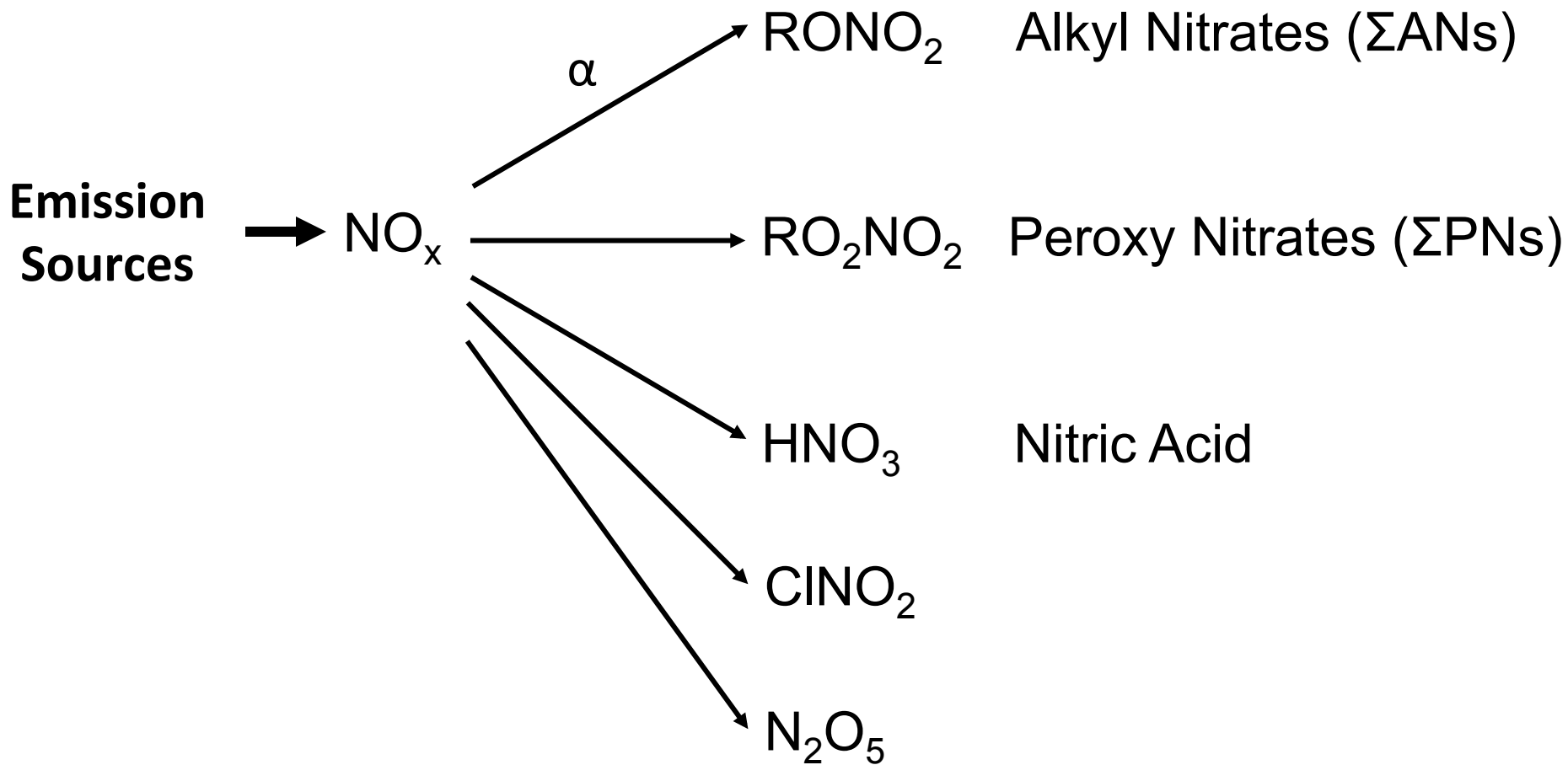
Tamara Sparks

WINTER Data Meeting

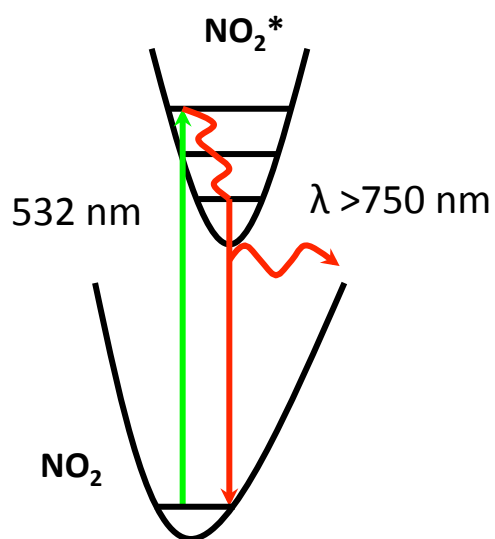
Sep 17, 2015



NO_x lifetime is controlled by its sinks

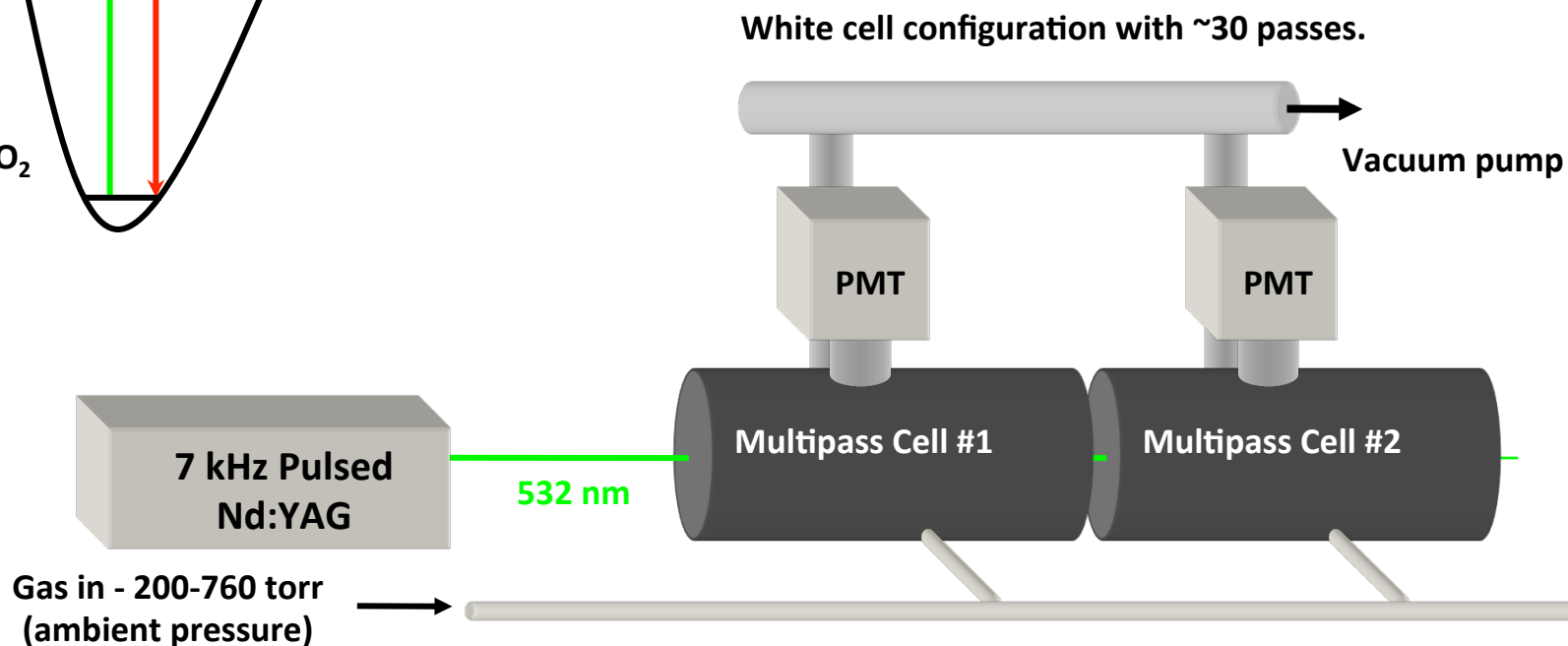


Laser-induced fluorescence (LIF) detection of NO₂

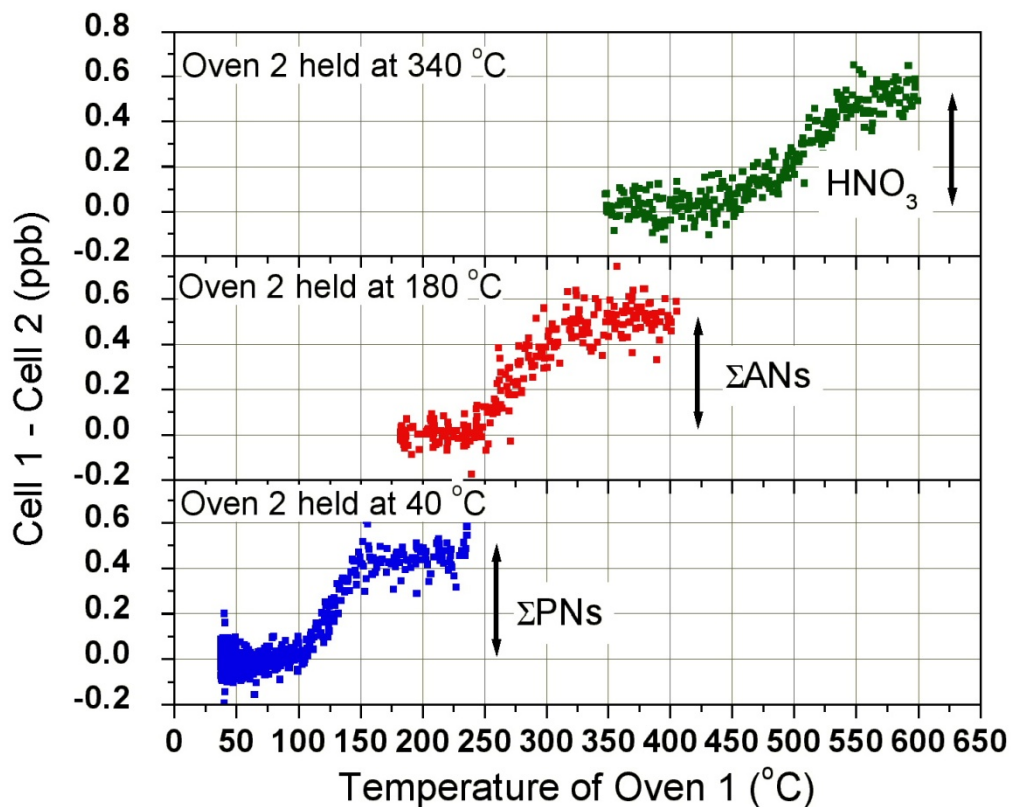


The limit of detection of the instrument is 15 pptv/10 s for NO₂ at $S/N=2$.

- Calibration done using NO₂ standard
- Zero air used to obtain instrument zero

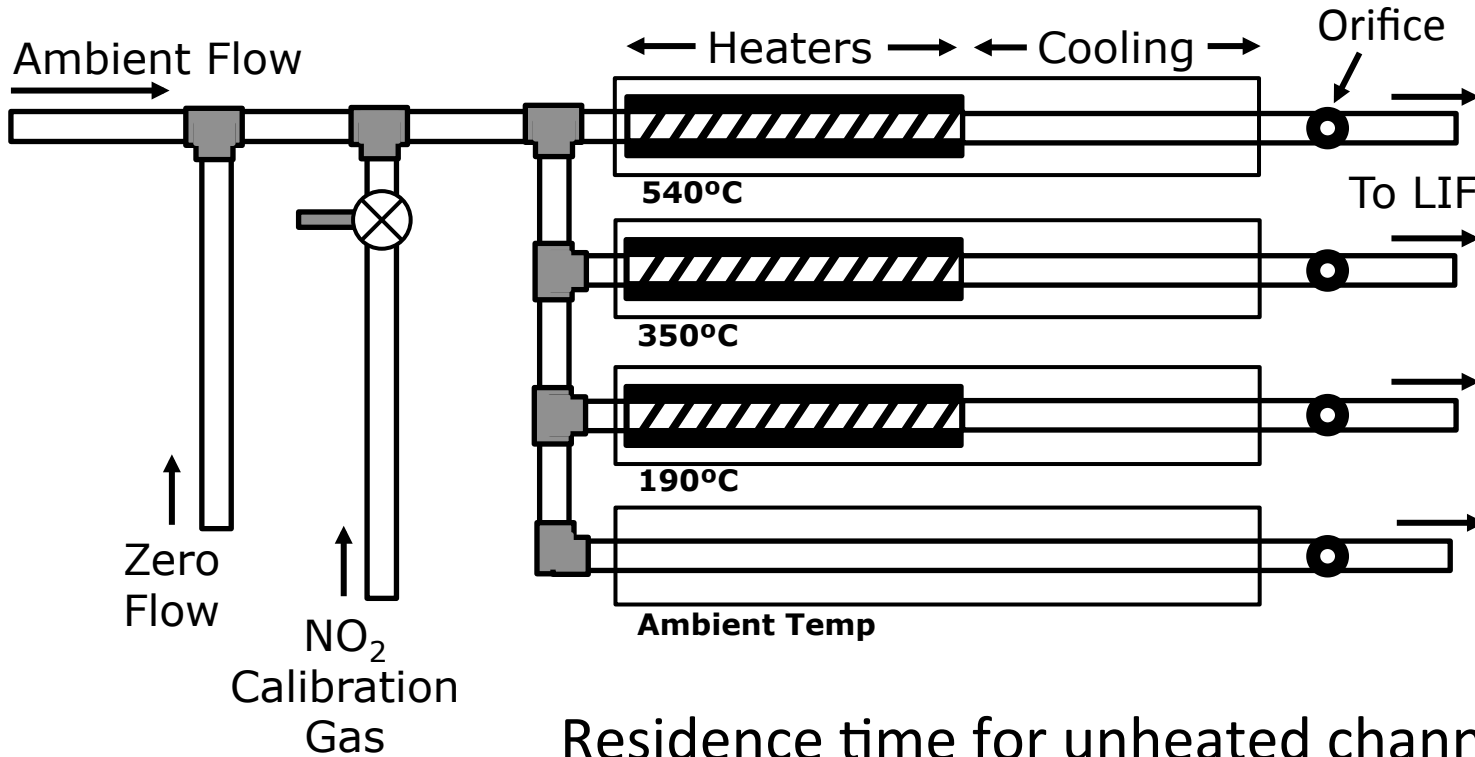


Thermal dissociation laser-induced fluorescence (TD-LIF)



- 540°C Channel:
 - HNO₃
- 350°C Channel:
 - Sum of alkyl nitrates (RONO₂)
 - ClNO₂
- 190°C Channel:
 - Sum of peroxy nitrates (RO₂NO₂) such as PAN
 - N₂O₅

Inlet diagram



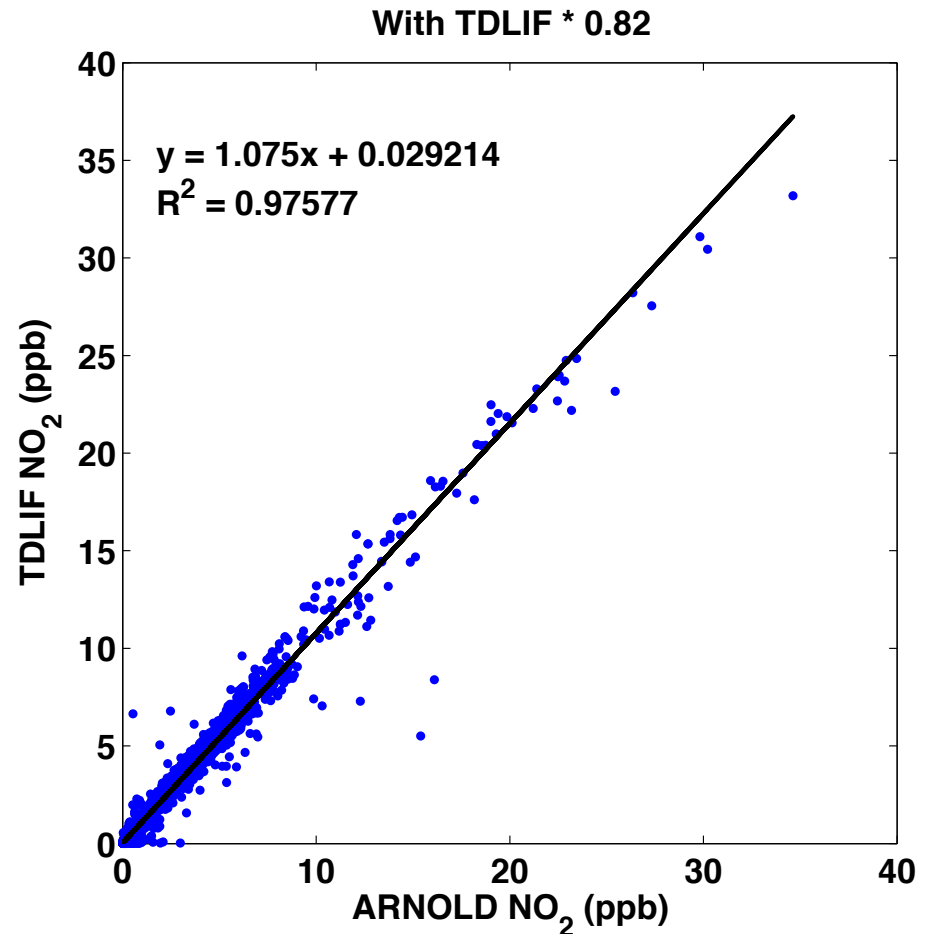
Residence time for unheated channel: 1 s
Residence time for heated channels: ~ 1.7 s
Tubing material: PFA Teflon

0.82 data adjustment

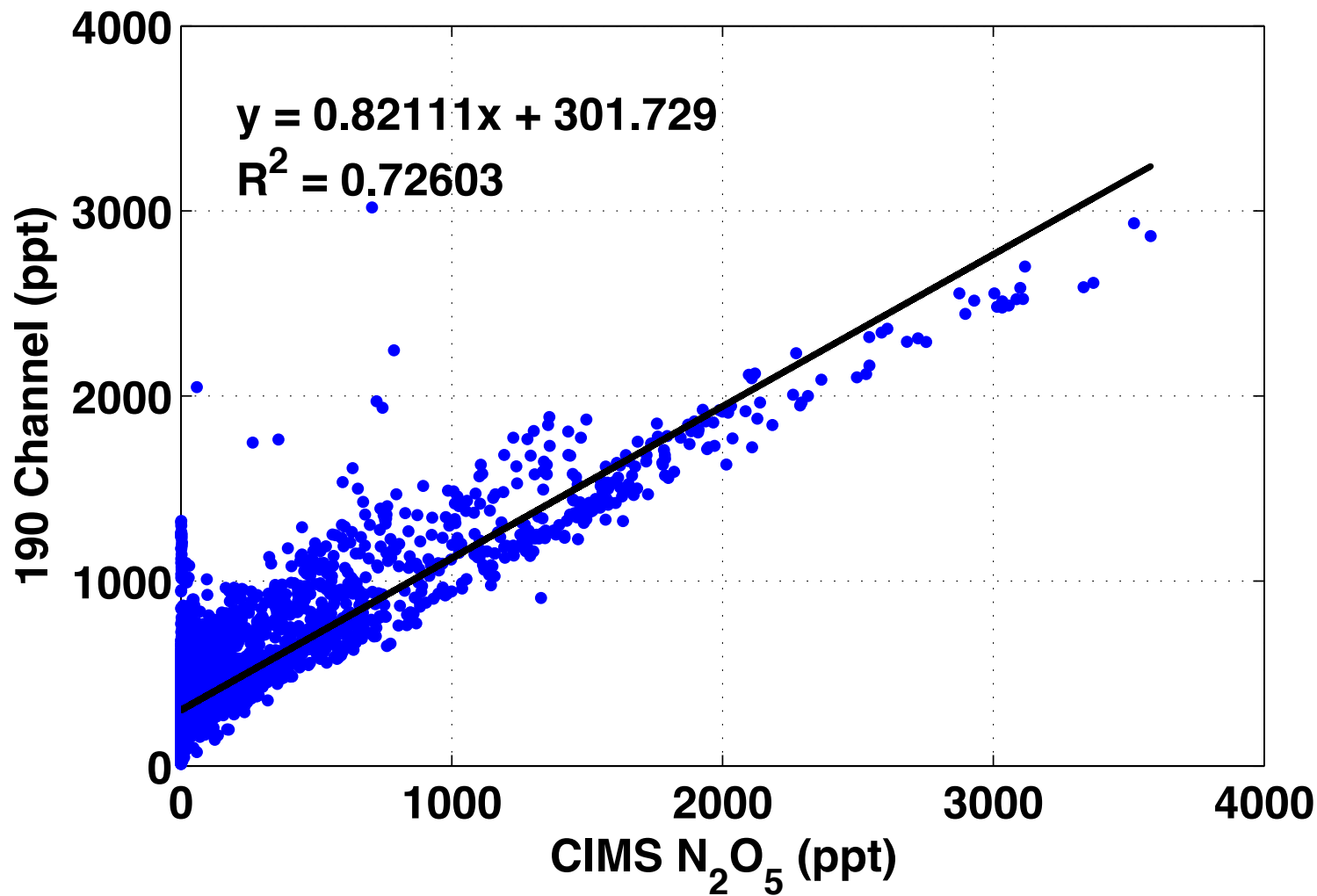
After recalibrating our NO₂ tank, we reported out data should be adjusted by 0.82.

Slope: 1.31 -> 1.08

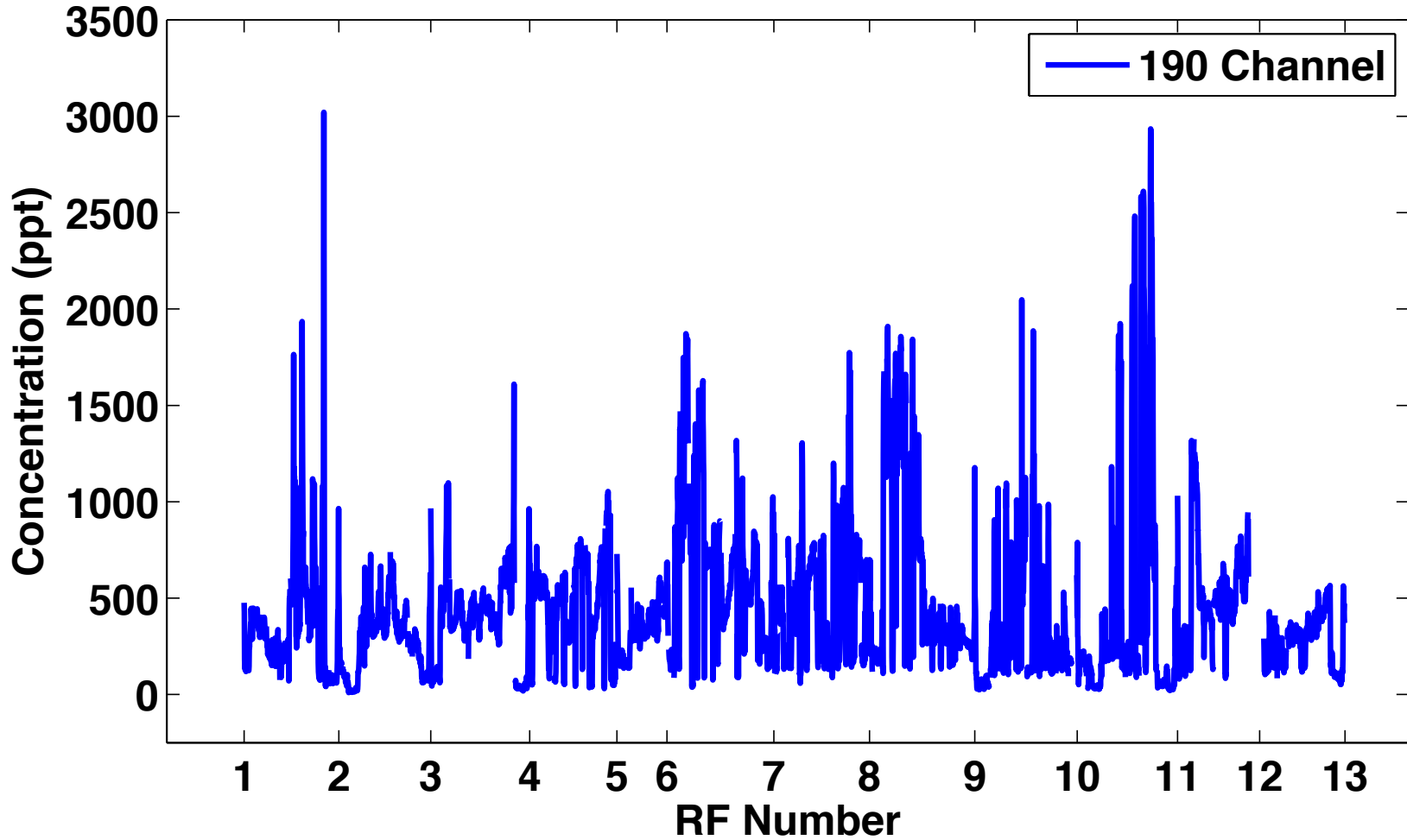
Final data will include adjustment, so make sure to stop multiplying when using our final data



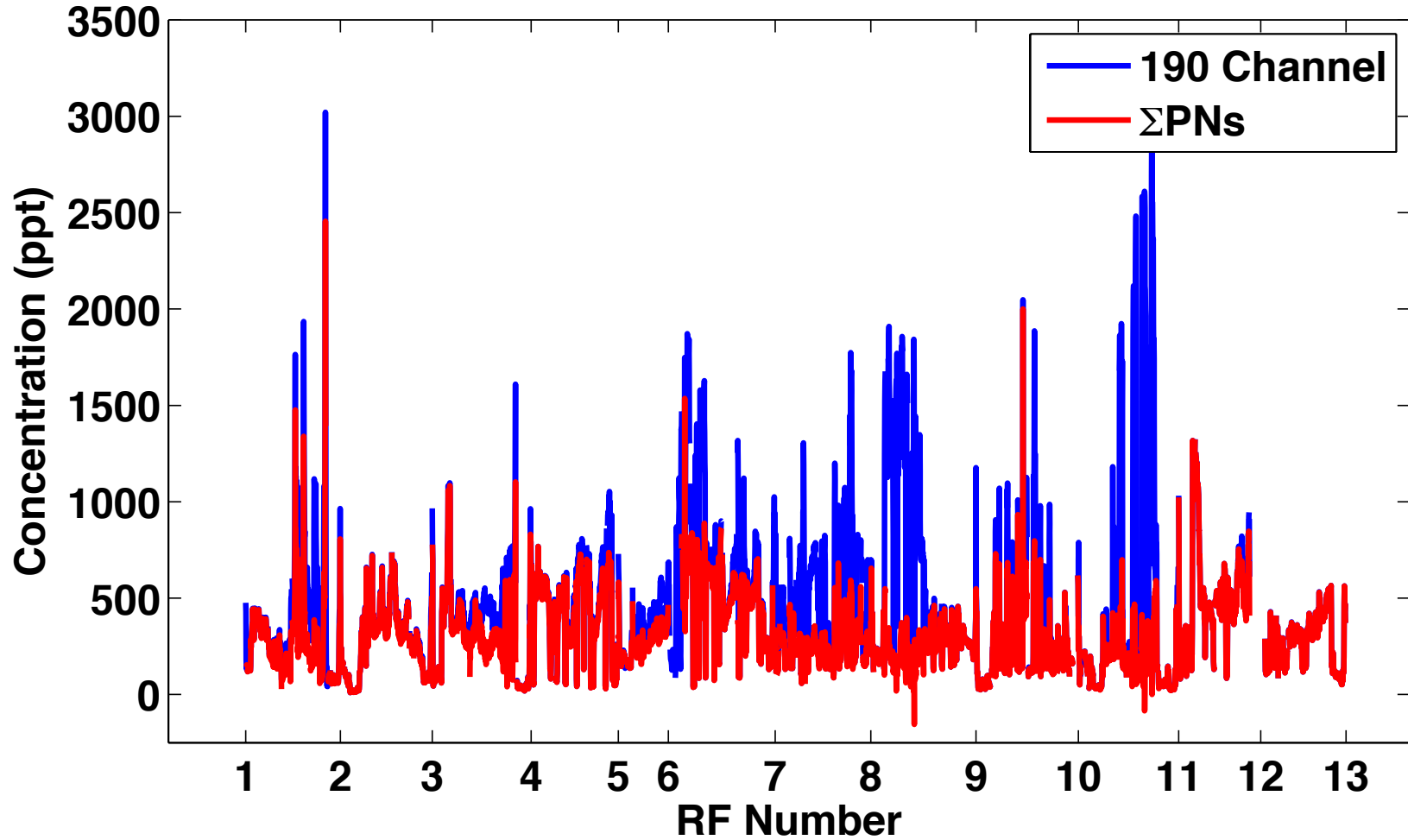
190°C Channel



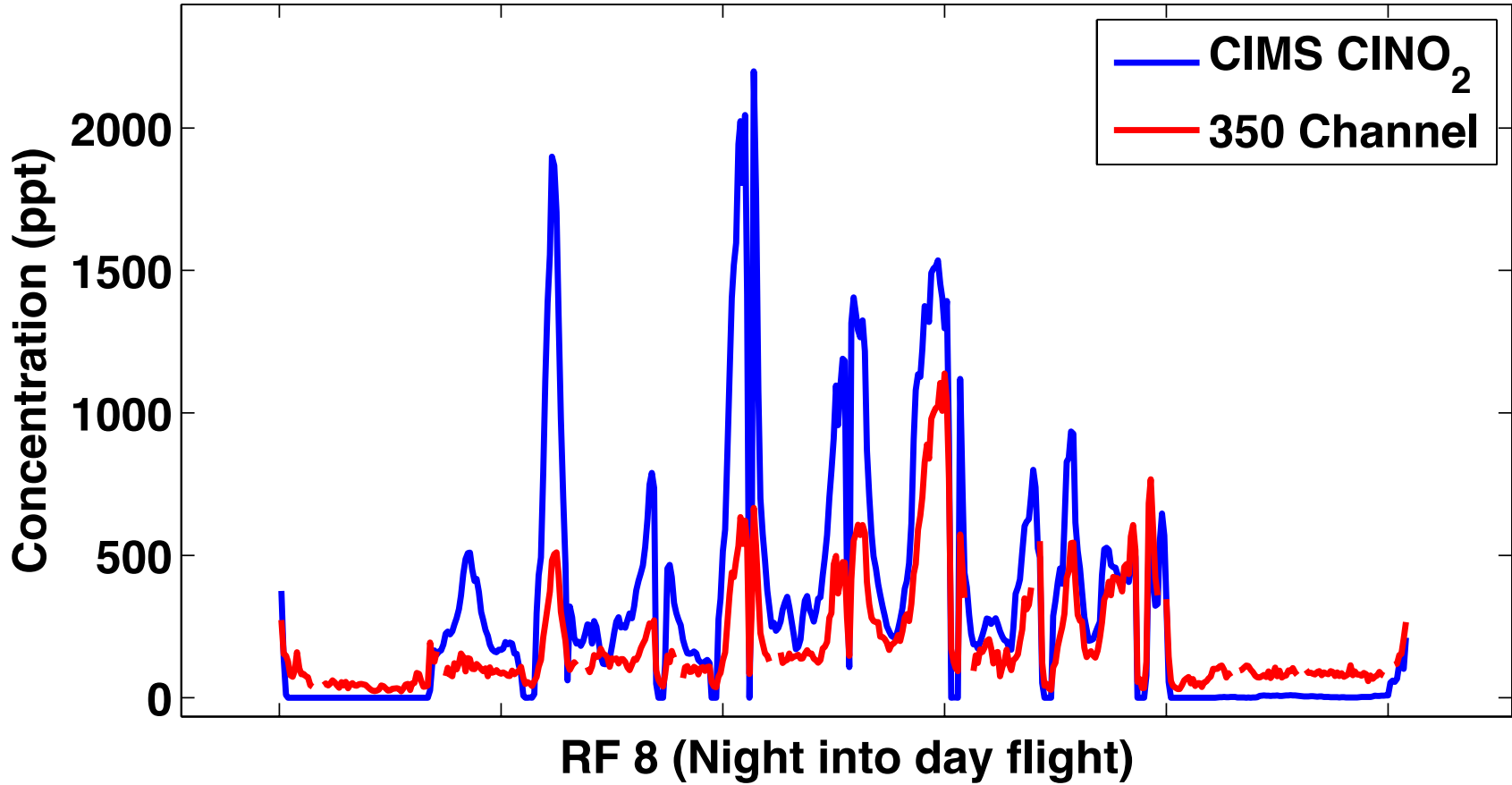
190°C Channel



190°C Channel



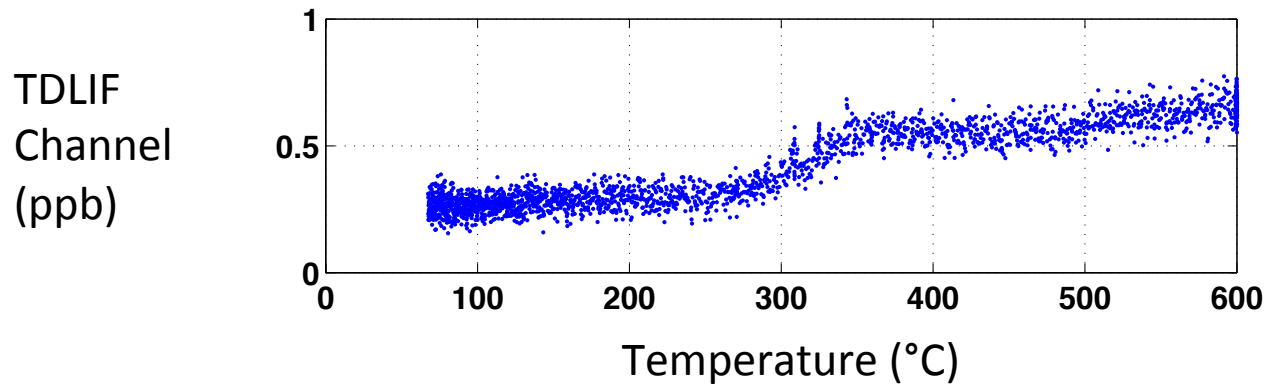
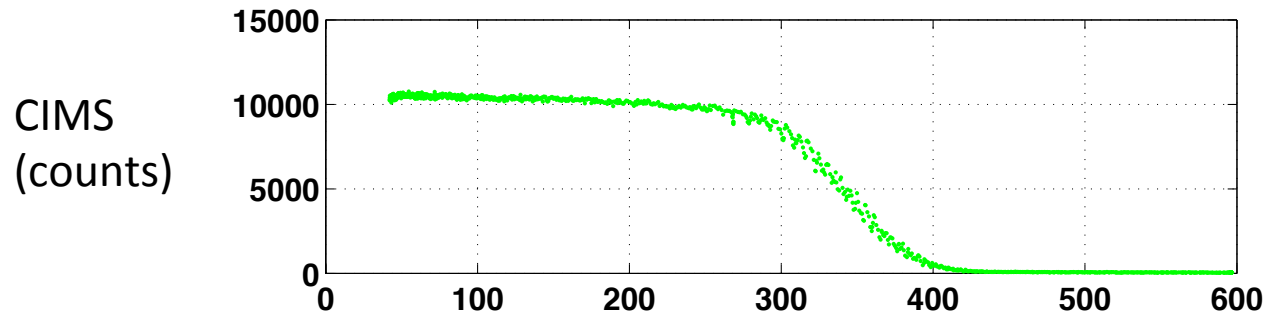
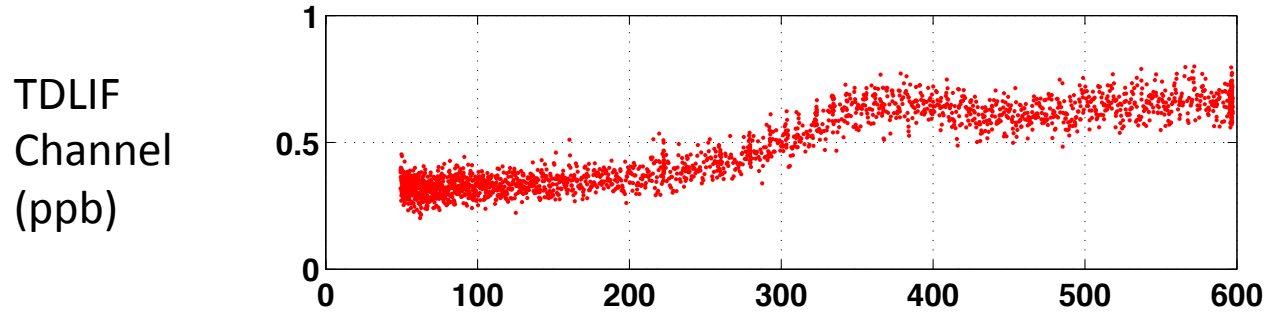
350°C Channel



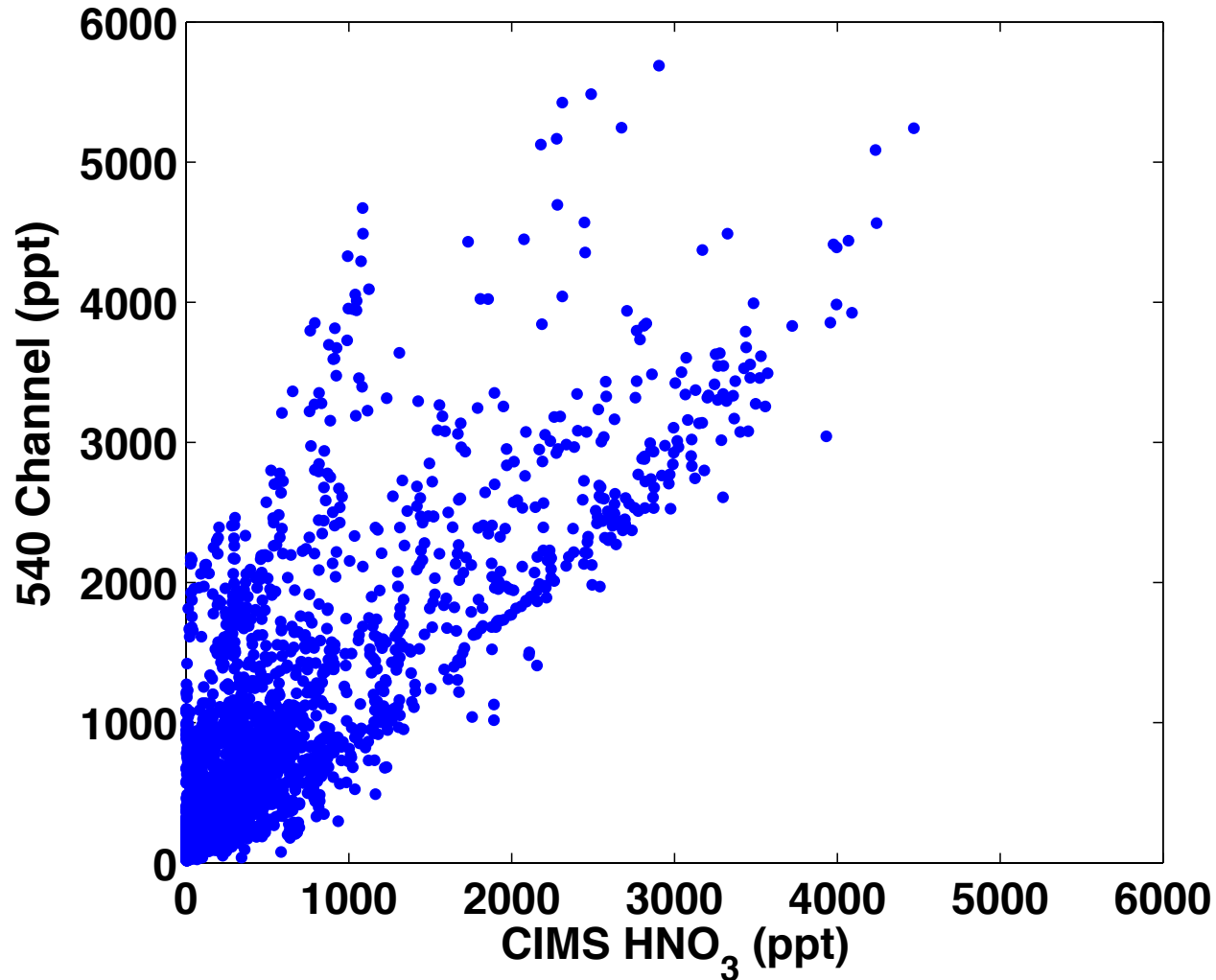
350°C Channel

- Possible reasons for discrepancy
 - Cl + NO₂ recombination after oven
 - Fast enough, but Cl is used up by other species
 - Surface reactions?
 - Temperature too low to capture all ClNO₂

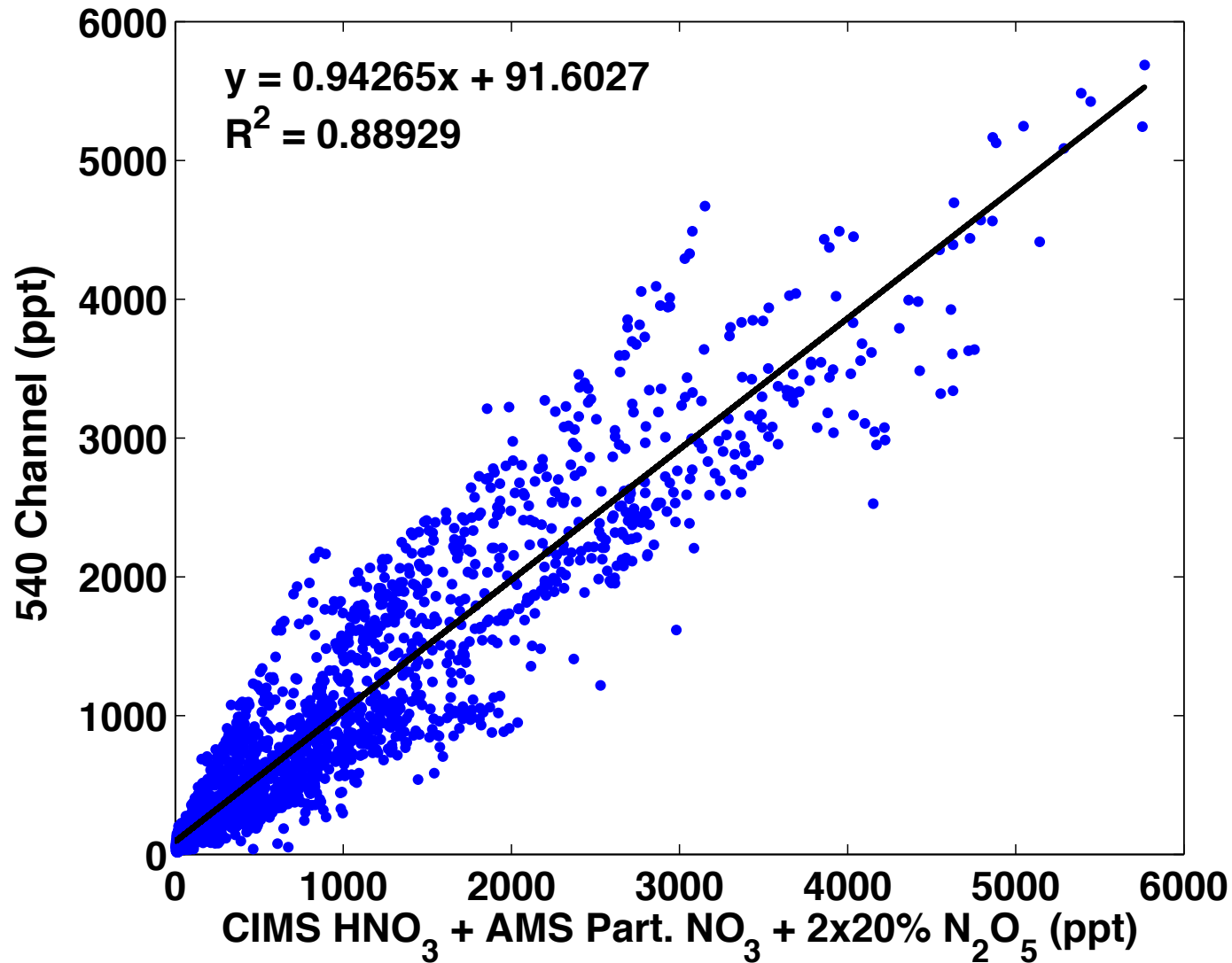
Temperature Scan



540°C Channel vs. CIMS 1

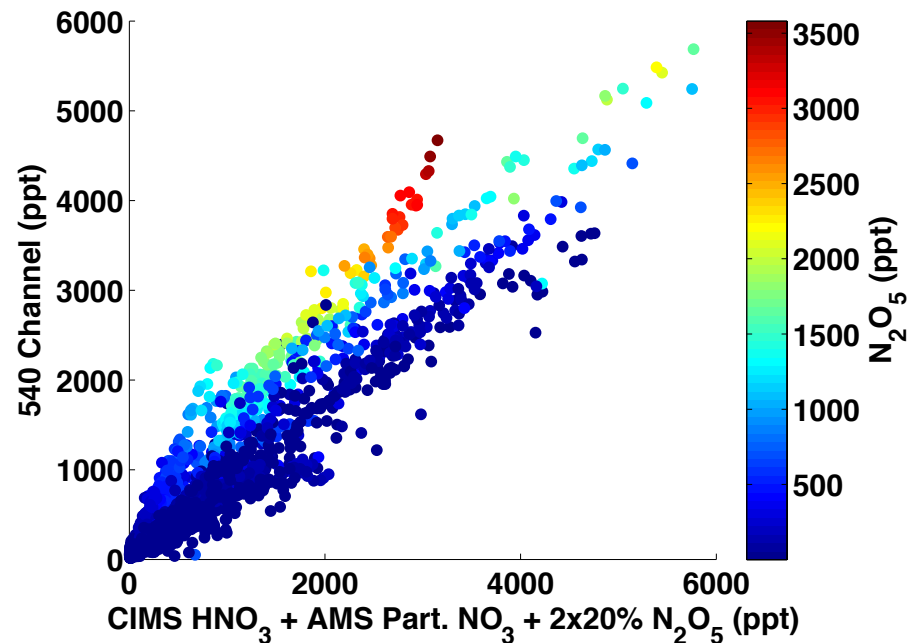


540°C Channel vs. CIMS 1

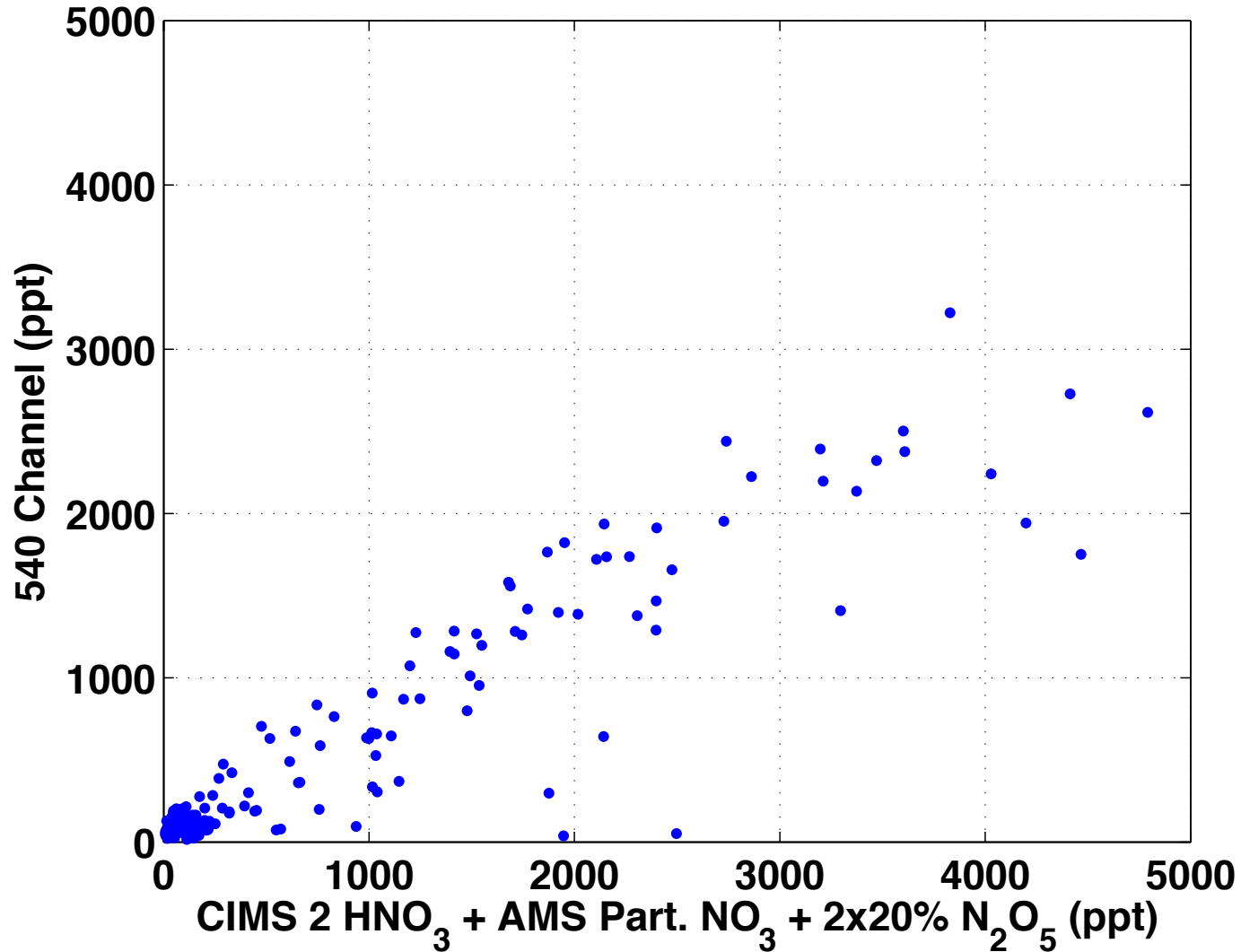


540°C Channel vs. CIMS 1

- Comparison with CIMS 1 in Berkeley showed we weren't seeing $2xN_2O_5$ in 540 channel
- Could be different in ambient air vs dry calibration
- HNO_3 comparison still has N_2O_5 correlation- subtracting all N_2O_5 reduces scatter significantly more



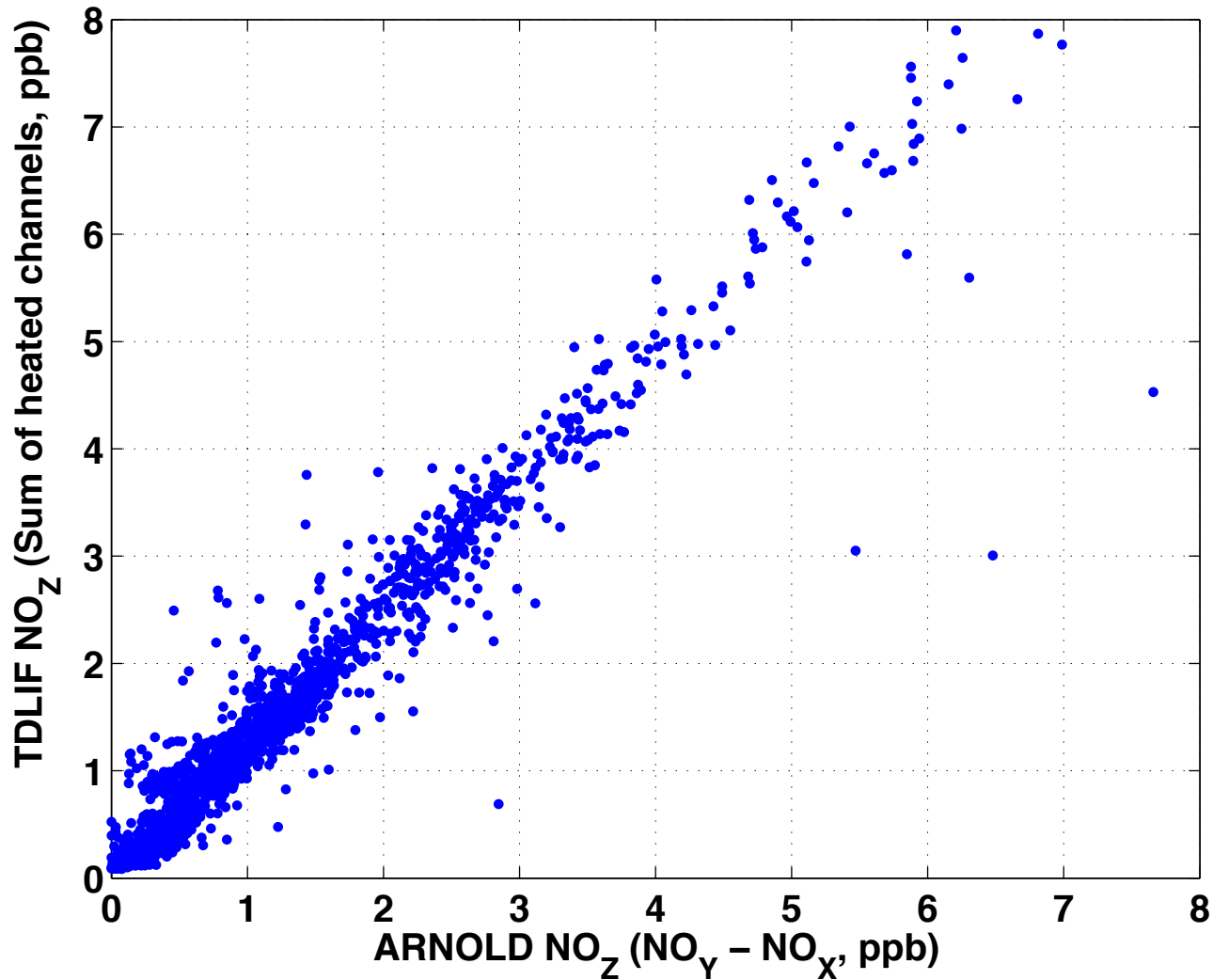
540°C Channel vs. CIMS 2



Other 540 Channel Considerations

- How much N_2O_5 are we seeing?
- Are we seeing any ClNO_2 in this channel?
- Water dependence?
- Effect of different inlets (heated or not, etc)

NO_z Comparison



Conclusions

- Despite challenges in interpreting each channel, our overall NO_y/NO_z compares well
- Need to solidify understanding of N_2O_5 and ClNO_2 signal
- How much N_2O_5 are we seeing in the 540°C channel?
- Issues we see with our inlet could be relevant to other inlets