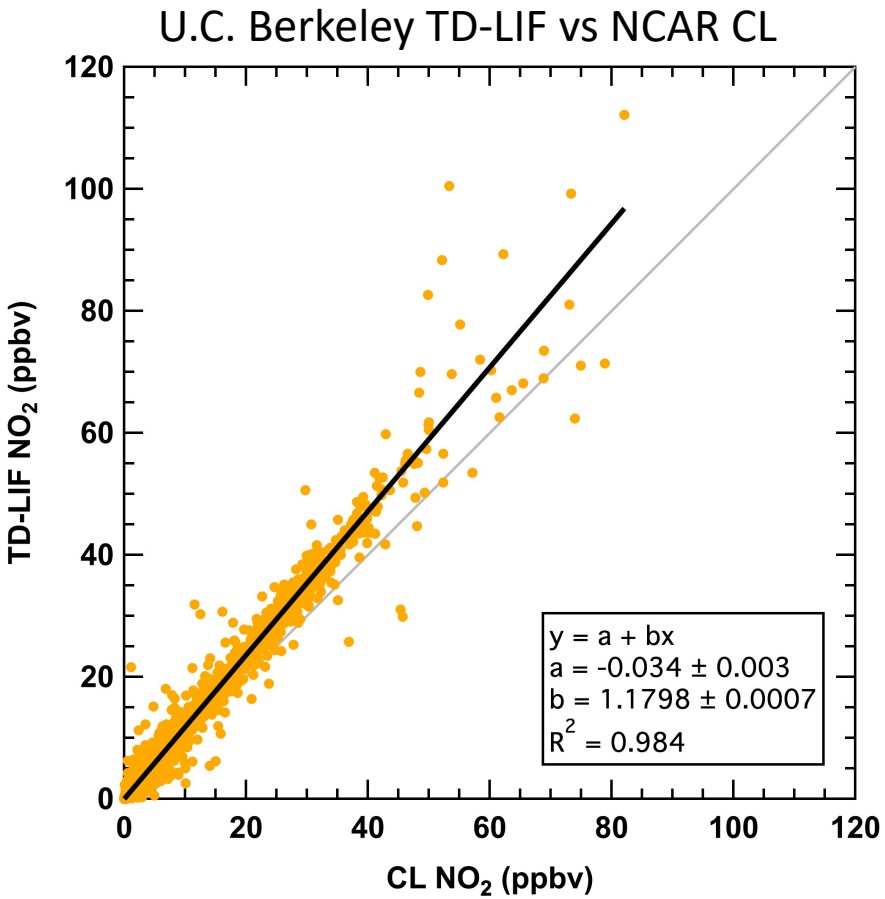
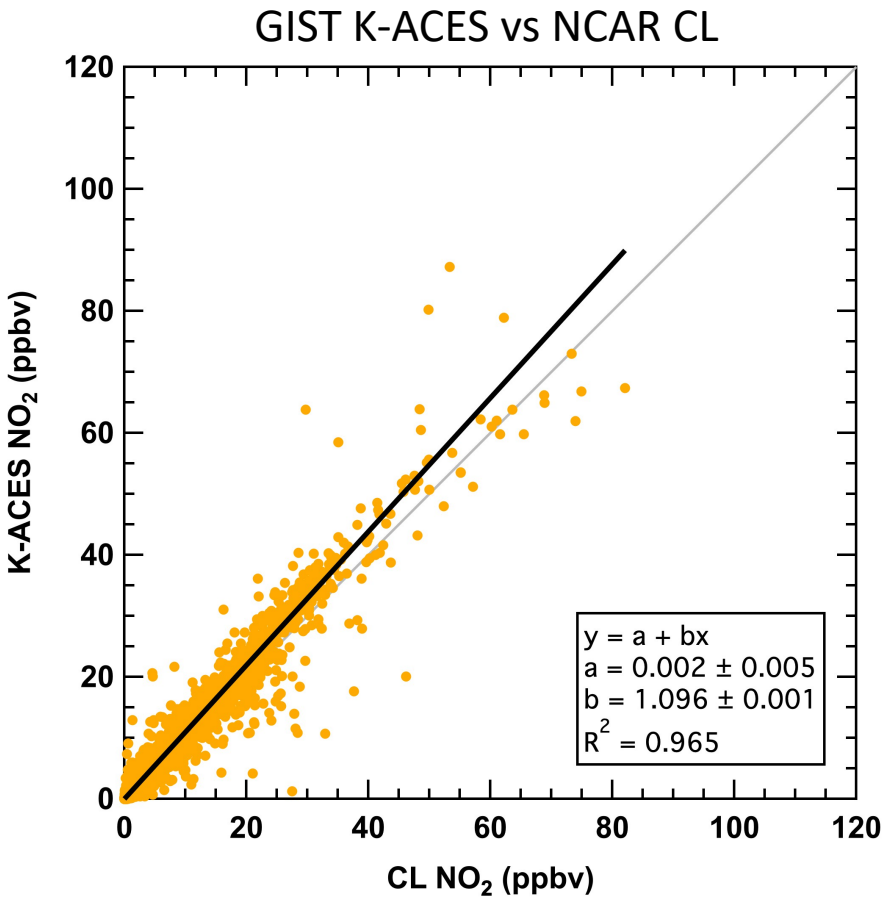
NO_2 - U.C. Berkeley TD-LIF vs NCAR CL

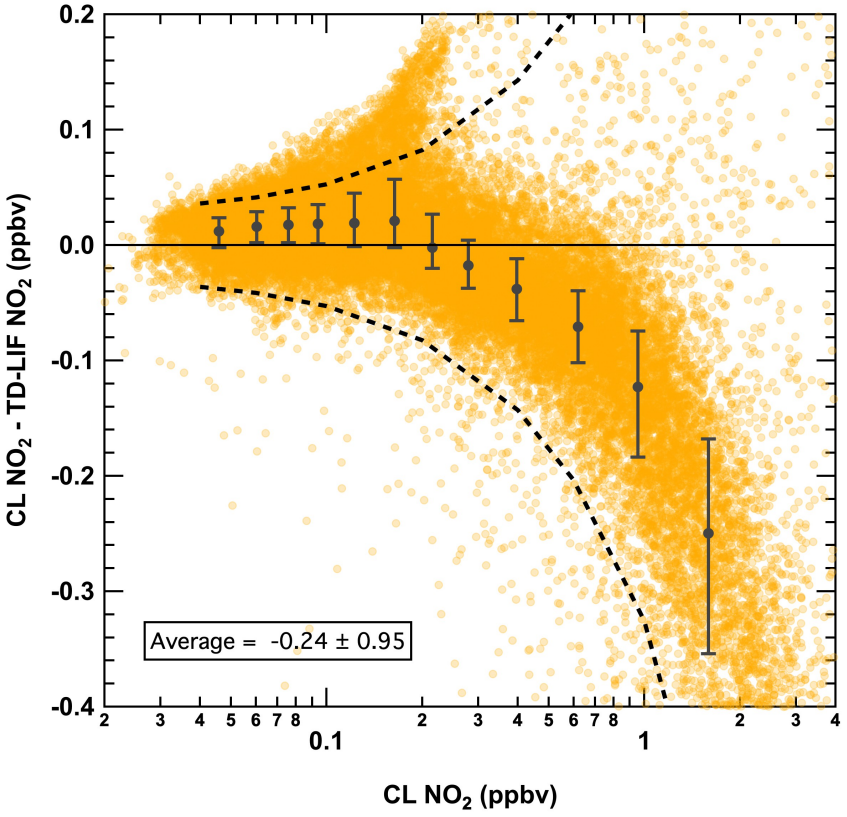




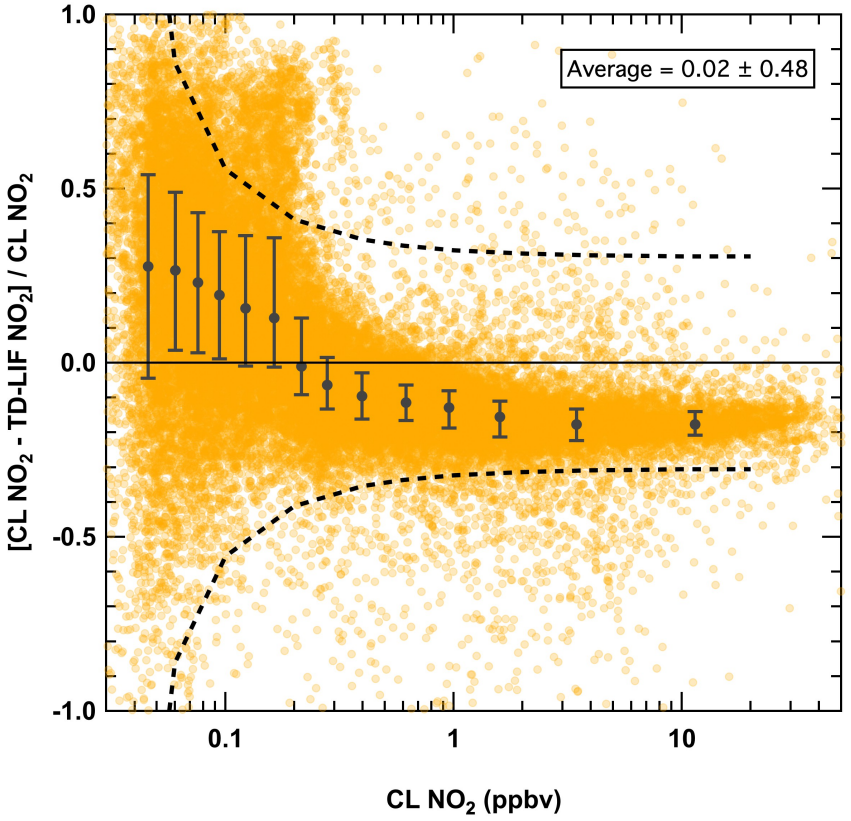
Difference dependence on NO_2 - U.C. Berkeley TD-LIF vs NCAR CL

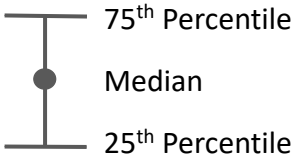
Uncertainty envelopes based on 10s data uncertainty (NCAR = ± (15.8 pptv + 30%), TD-LIF = ± (22.1 pptv + 5%)

Absolute Difference

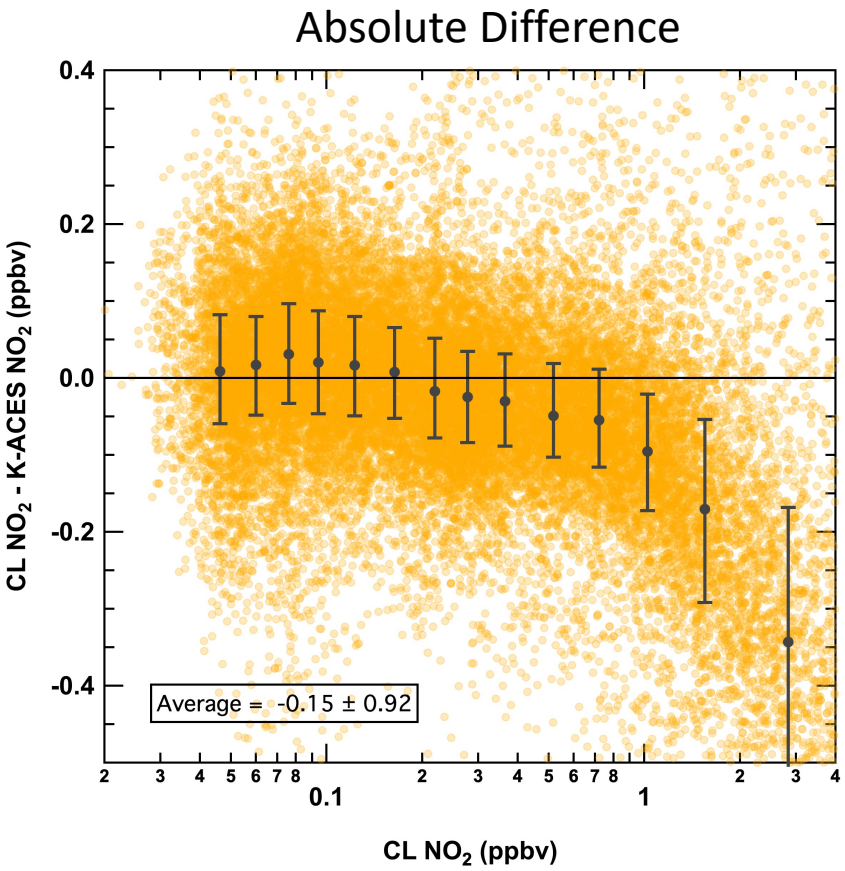


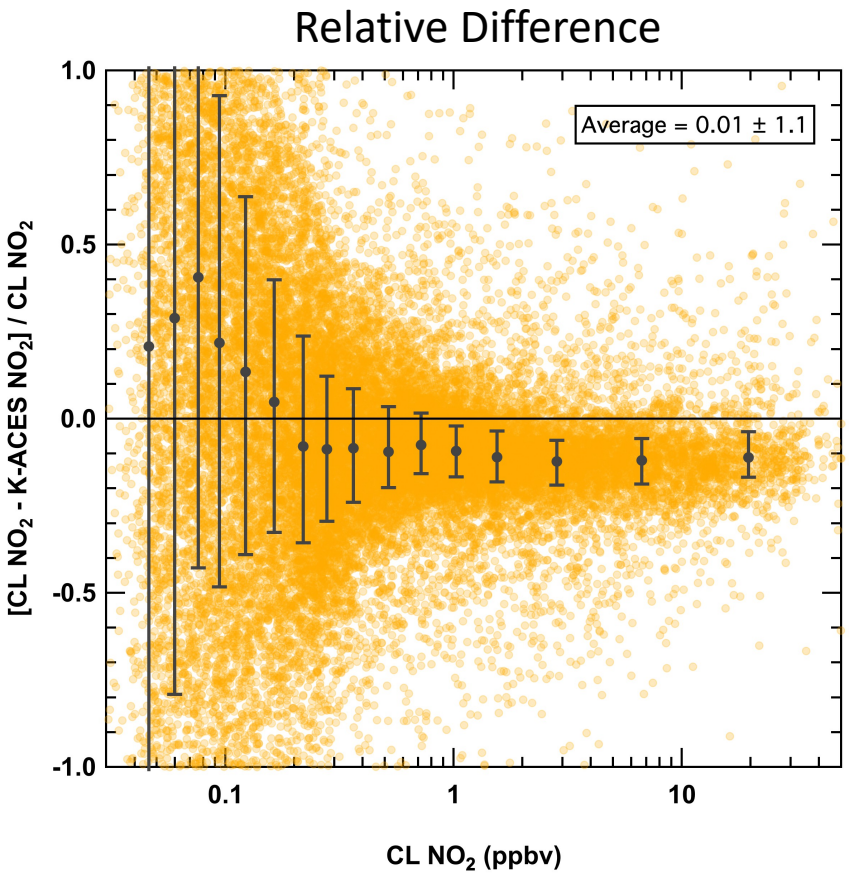
Relative Difference

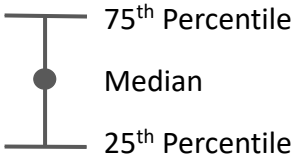




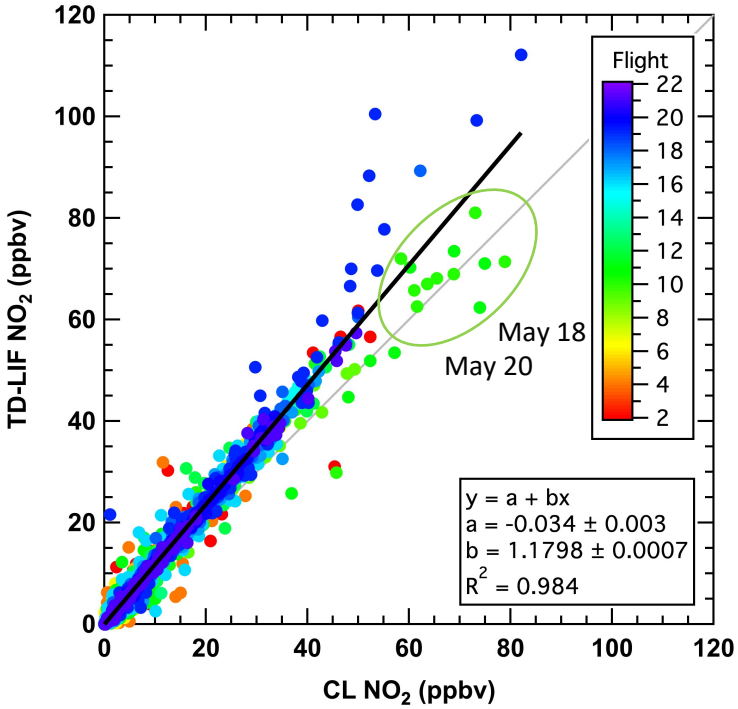
Difference dependence on NO_2 - GIST K-ACES vs NCAR CL

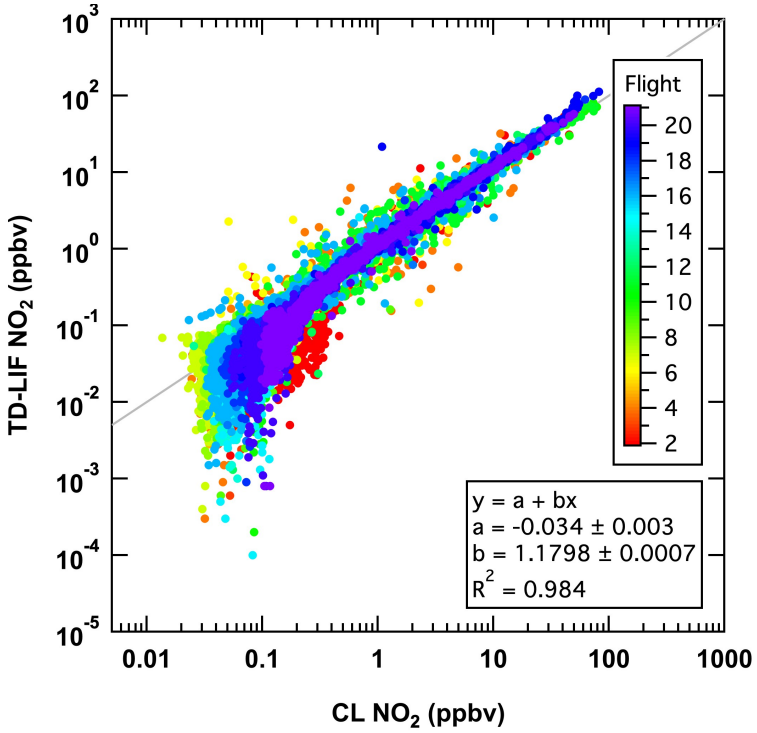


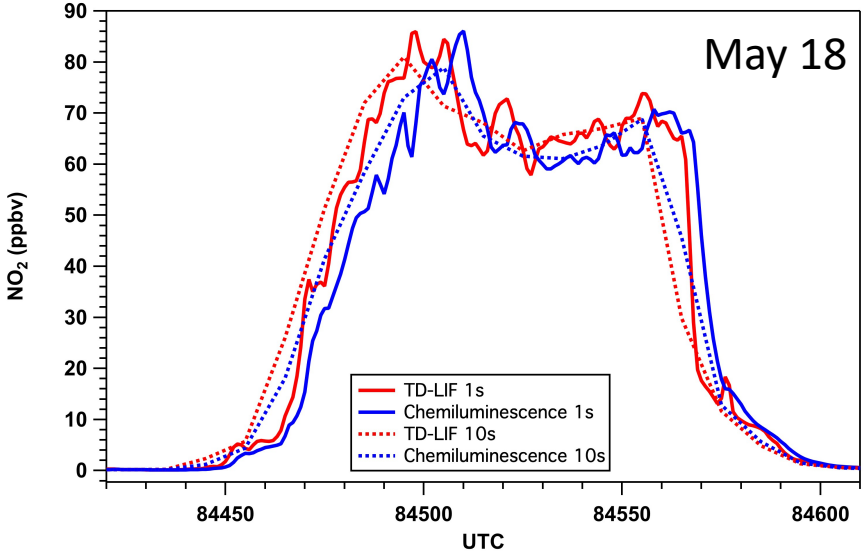


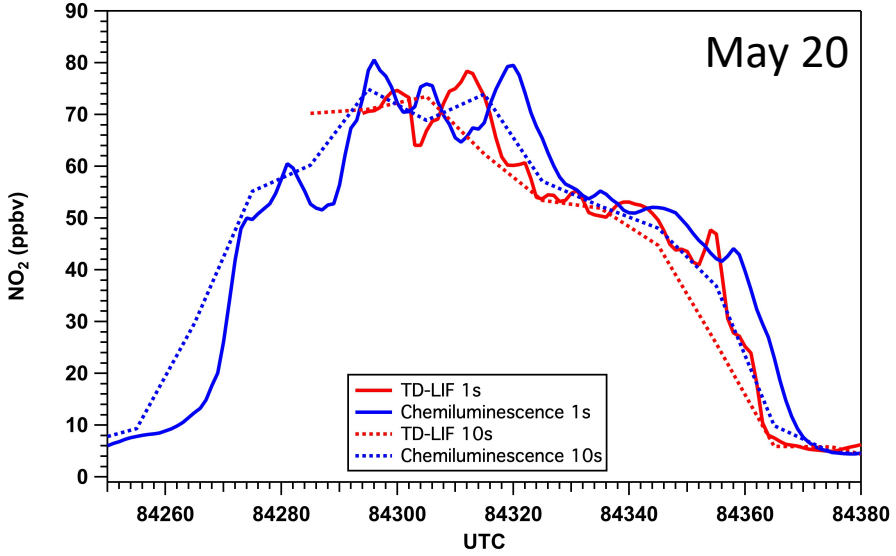


NO_2

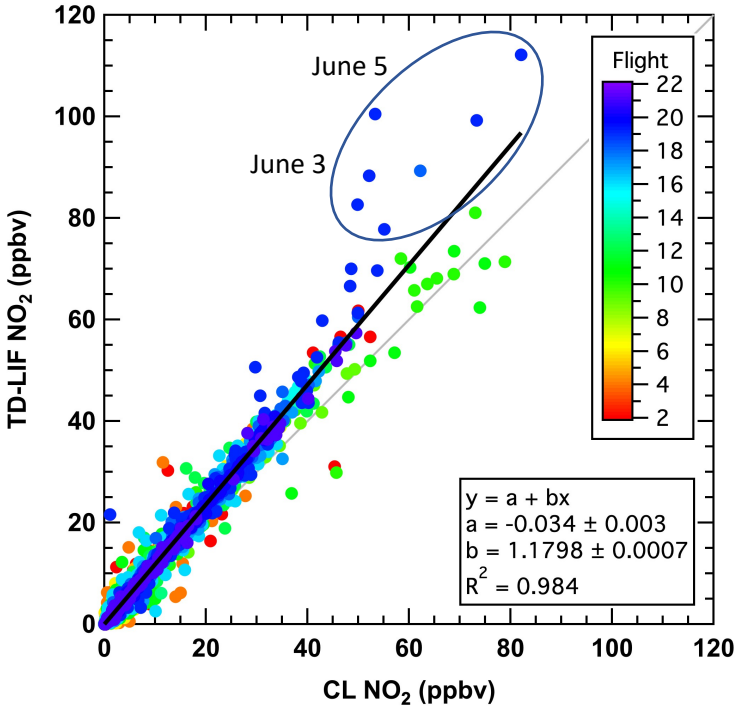

TD-LIF NO2 (ppbv)
CL NO2 (ppbv)
Flight
May 18
May 20
y = a + bx
a = -0.034 ± 0.003
b = 1.1798 ± 0.0007
R2 = 0.984

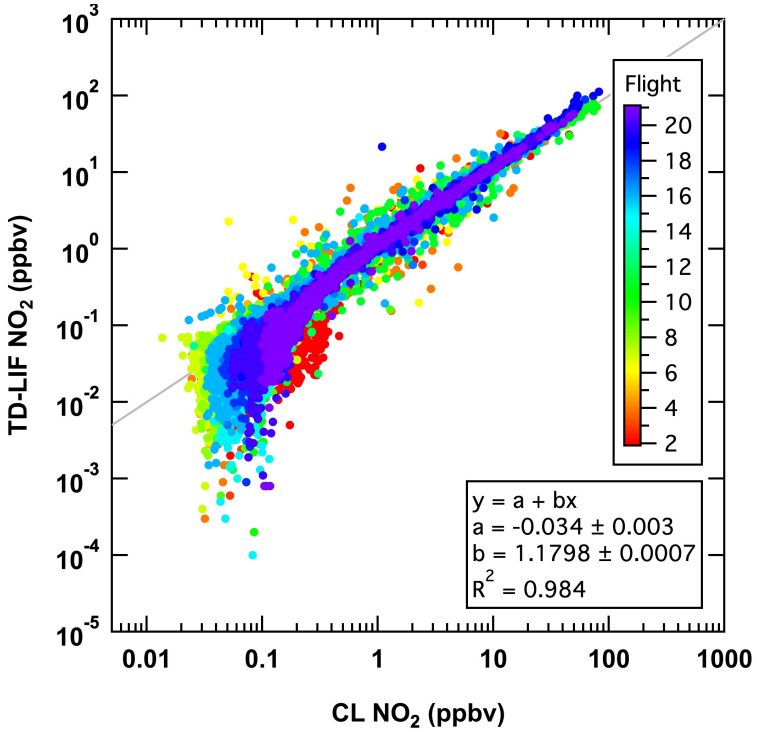

TD-LIF NO2 (ppbv)
CL NO2 (ppbv)
Flight
y = a + bx
a = -0.034 ± 0.003
b = 1.1798 ± 0.0007
R2 = 0.984

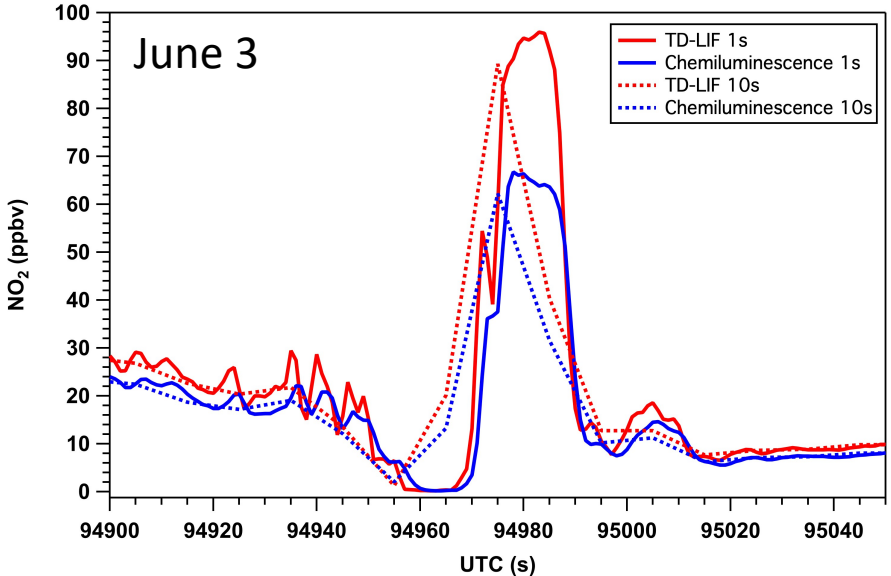

May 18
NO2 (ppbv)
UTC
TD-LIF 1s
Chemiluminescence 1s
TD-LIF 10s
Chemiluminescence 10s

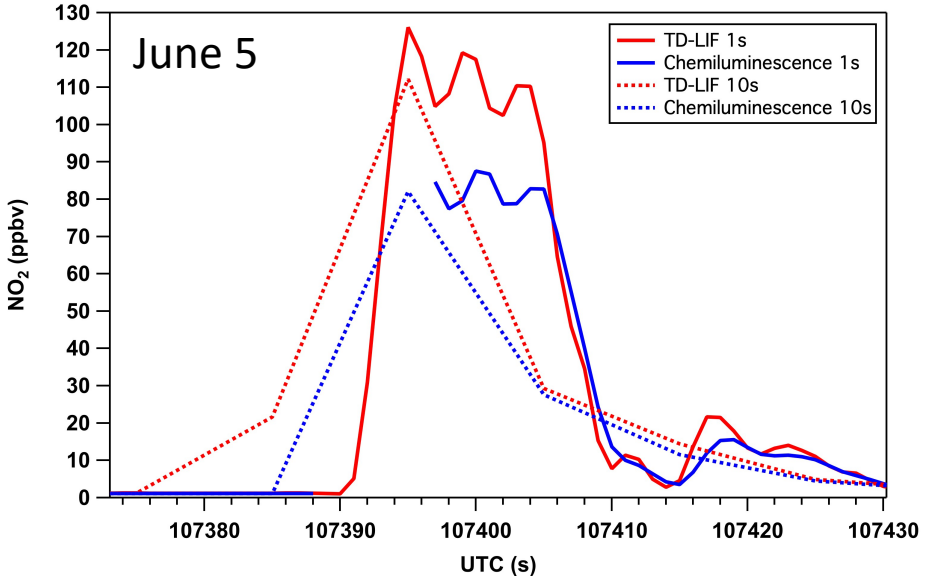

May 20
NO2 (ppbv)
UTC
TD-LIF 1s
Chemiluminescence 1s
TD-LIF 10s
Chemiluminescence 10s

NO_2

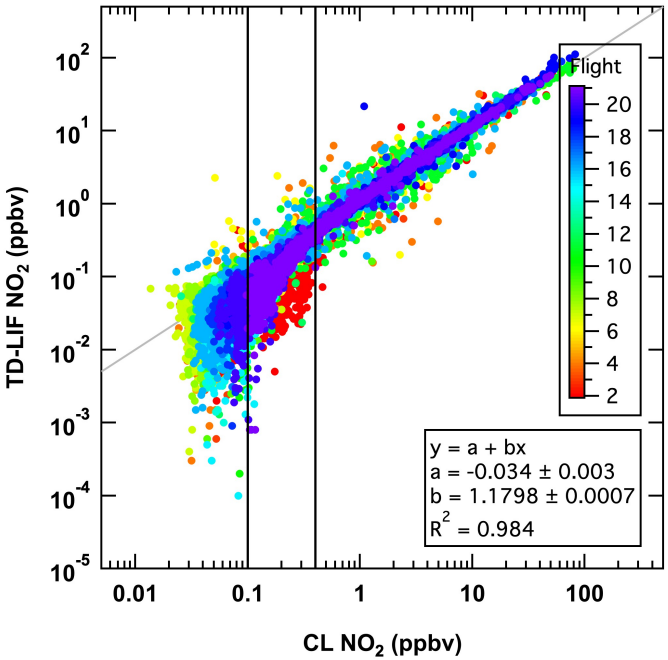

June 5
June 3
Flight
22
20
18
16
14
12
10
8
6
4
2
y = a + bx
a = -0.034 ± 0.003
b = 1.1798 ± 0.0007
R2 = 0.984
TD-LIF NO2 (ppbv)
CL NO2 (ppbv)
0
20
40
60
80
100
120

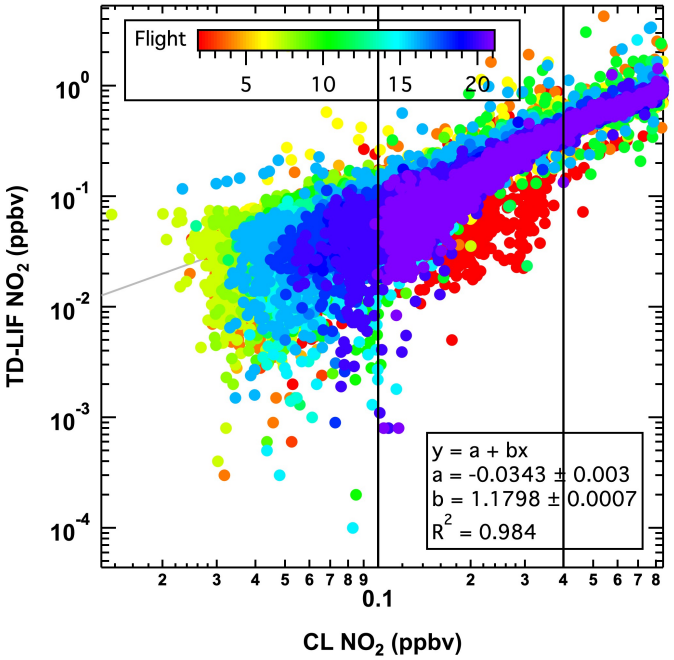

Flight
20
18
16
14
12
10
8
6
4
2
y = a + bx
a = -0.034 ± 0.003
b = 1.1798 ± 0.0007
R2 = 0.984
TD-LIF NO2 (ppbv)
CL NO2 (ppbv)
10-5
10-4
10-3
10-2
10-1
100
101
102
103
0.01
0.1
1
10
100
1000


June 3
TD-LIF 1s
Chemiluminescence 1s
TD-LIF 10s
Chemiluminescence 10s
NO2 (ppbv)
UTC (s)
0
10
20
30
40
50
60
70
80
90
100
94900
94920
94940
94960
94980
95000
95020
95040

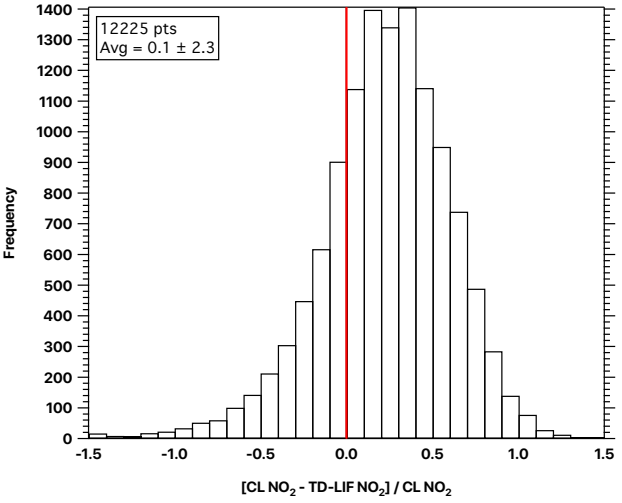

June 5
TD-LIF 1s
Chemiluminescence 1s
TD-LIF 10s
Chemiluminescence 10s
NO2 (ppbv)
UTC (s)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
107380
107390
107400
107410
107420
107430

Frequency distribution based on NCAR CL data value

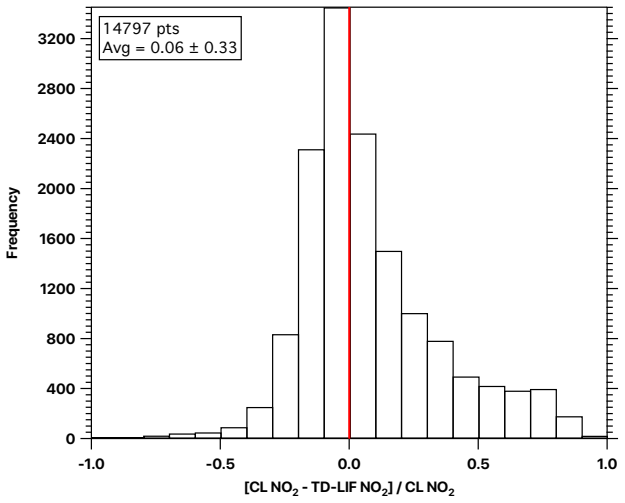




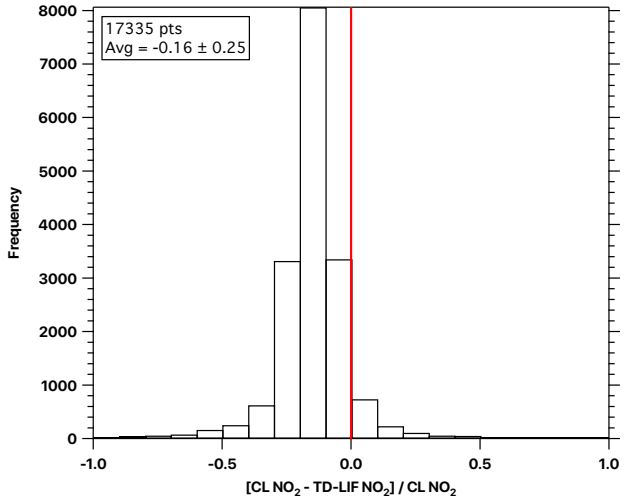
CL Data < 0.1 ppbv



0.1 < CL Data < 0.4 ppbv



CL Data > 0.4 ppbv



Summary: CL vs TD-LIF

Data Range	# Points	# Pts within Combined Unc.	# Pts within 2*Combined Unc.
All	41576	37460 (90%)	41075 (99%)
CL < 0.1 ppbv	11286	10104 (89%)	11253 (99%)
CL [0.1,0.4) ppbv	14260	12426 (87%)	14043 (98%)
CL > 0.4 ppbv	16030	14930 (93%)	15779 (98%)

Data:

- 10 Second Merge: korusaq-mrg10-dc8_merge_20160426_R6_thru20160618.ict (only data from flights 20160501-20160609 used in analysis – non-transit flights).

Correlation:

- Fit lines are derived from orthogonal distance regressions.
- R^2 values are calculated independently, not from orthogonal distance regression.

Uncertainty propagation (Uncertainties provided by PIs).

- TD-LIF 1s uncertainty: +/- (70 pptv + 5%); 10s uncertainty: +/- (22.1 pptv + 5%), calculated using using quadrature average.
- NCAR 1s uncertainty: +/- (50 pptv + 30%); 10s uncertainty: +/- (15.8 pptv + 30%).

Difference dependence on NO_2 value:

- U.C. Berkeley TD-LIF vs NCAR CL
  - Absolute difference calculated by (CL - TD-LIF).
  - Relative difference calculated by (CL – TD-LIF)/CL.
  - Median, 25^{th}, and 75^{th} percentiles based on 3000 data point after data is sorted by NCAR values.
  - Uncertainty envelopes based on 10s data uncertainty.
- GIST K-ACES vs NCAR CL
  - Absolute difference calculated by (CL – K-ACES).
  - Relative difference calculated by (CL – K-ACES)/CL.
  - Median, 25^{th}, and 75^{th} percentiles based on 2000 data point after data is sorted by NCAR values.

Frequency Distributions:

- NCAR data divided into 3 regions (< 0.1 ppbv, 0.1-0.4 ppbv, and > 0.4 ppbv).
- Frequency distribution bin width = 0.1