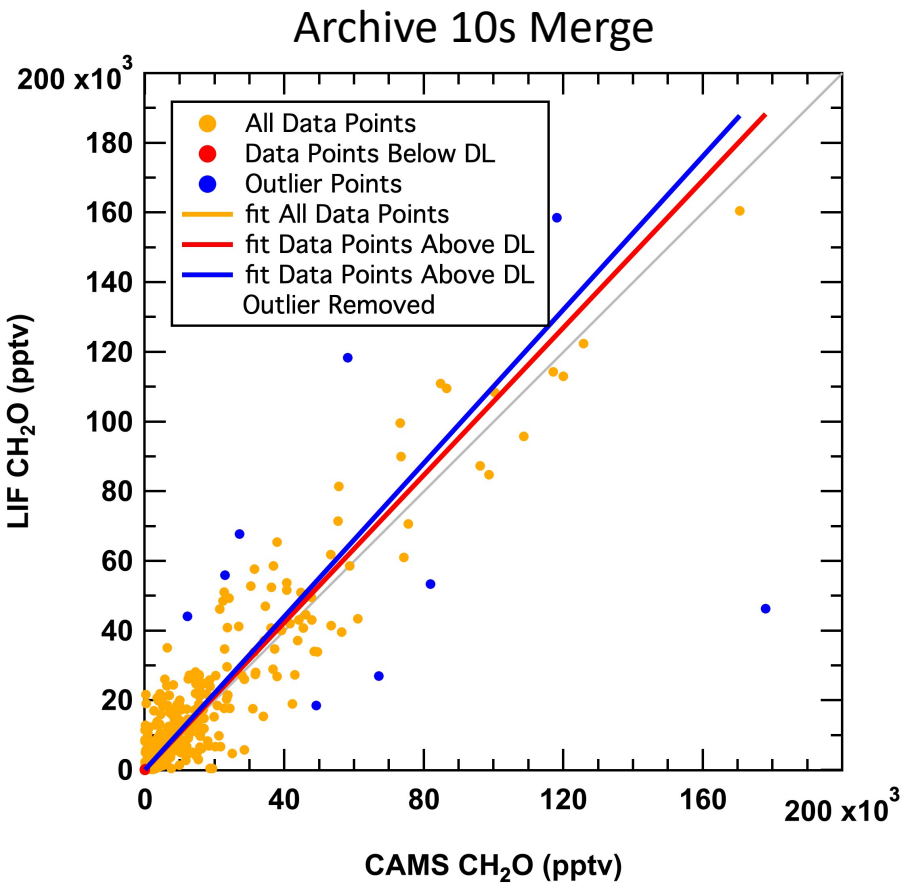
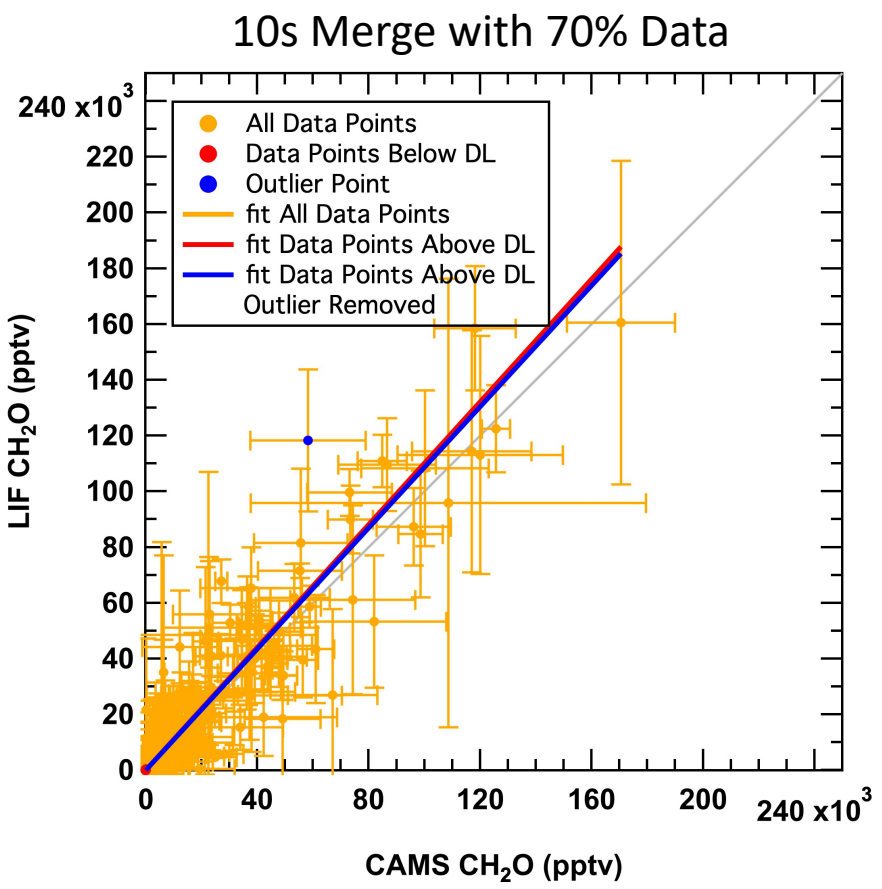
Formaldehyde – NASA Goddard ISAF vs CU-INSTAAR CAMS





All Data Points
(41013 pts)
y = a + bx
a = 125.2 ± 6.6
b = 1.057 ± 0.002
R^2 = 0.864

Data Points > DL
(39636 pts)
y = a + bx
a = 124.5 ± 6.9
b = 1.057 ± 0.002
R^2 = 0.863

Data Points > DL
Outliers Removed
(39627 pts)
y = a + bx
a = -67.2 ± 5.7
b = 1.101 ± 0.002
R^2 = 0.904

All Data Points
(33677 pts)
y = a + bx
a = 70.0 ± 6.3
b = 1.100 ± 0.002
R^2 = 0.906

Data Points > DL
(32662 pts)
y = a + bx
a = 67.3 ± 6.5
b = 1.100 ± 0.002
R^2 = 0.906

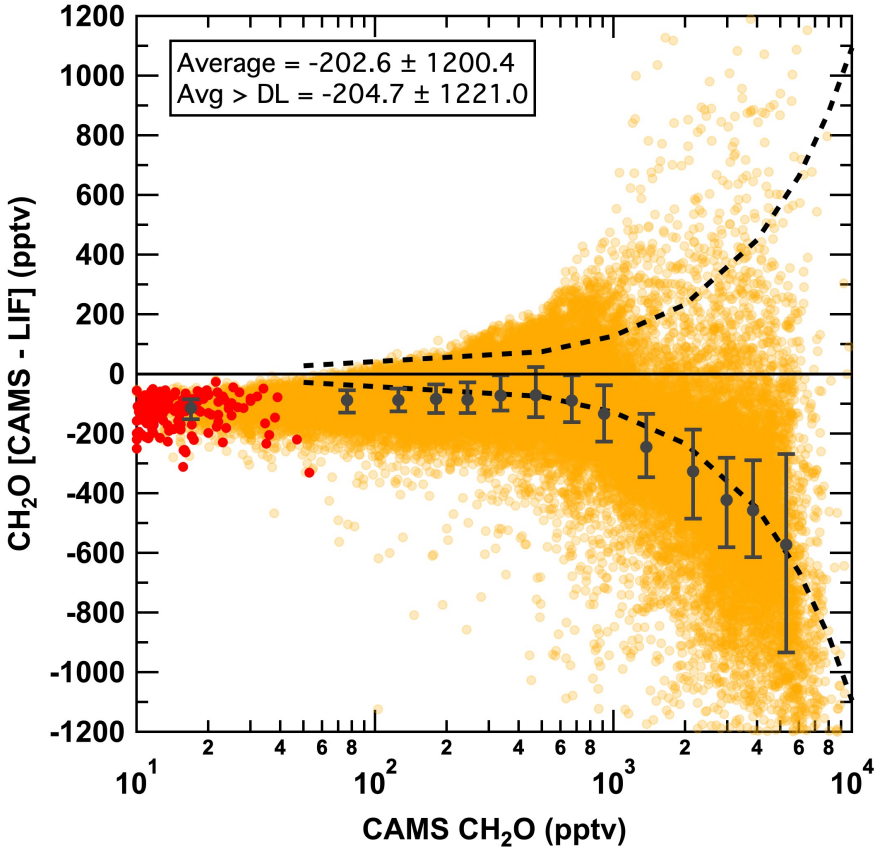
Data Points > DL
Outliers Removed
(32661 pts)
y = a + bx
a = 86.8 ± 6.2
b = 1.085 ± 0.002
R^2 = 0.911

Difference dependence on CH_2O value

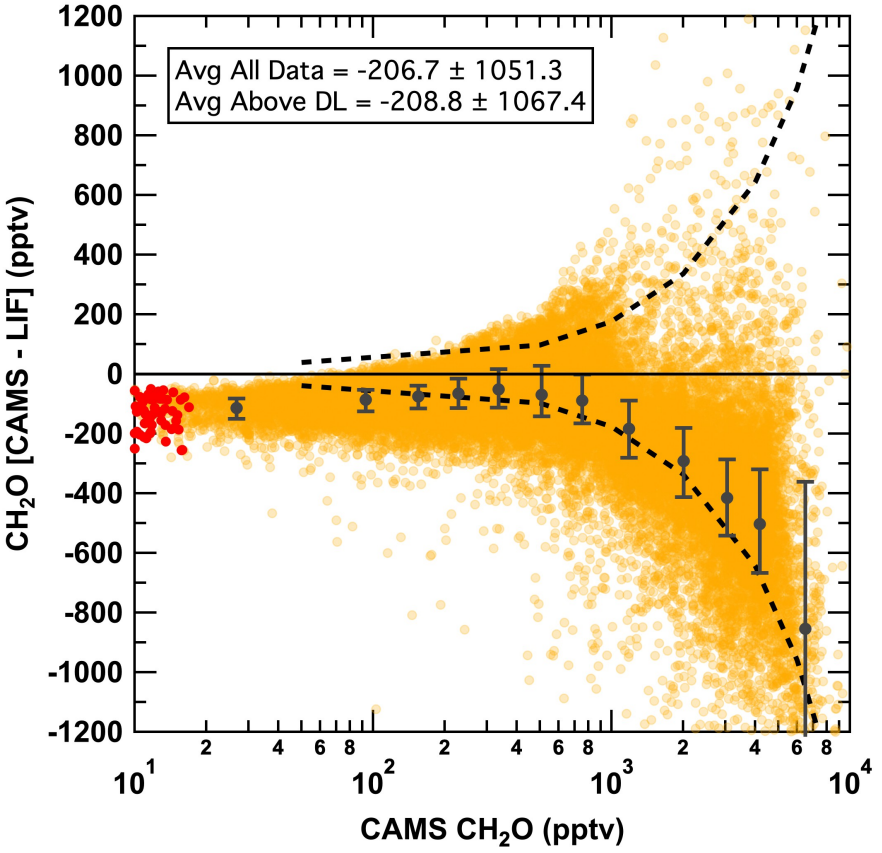
Uncertainty envelopes based on 10s combined data uncertainty

(CU-INSTAAR CAMS calculated from data file, NASA Goddard ISAF = ± (10 pptv + (10 pptv + 10%))

Archive 10s Merge



10s Merge with 70% Data



(All Data Points, Data Points < DL)

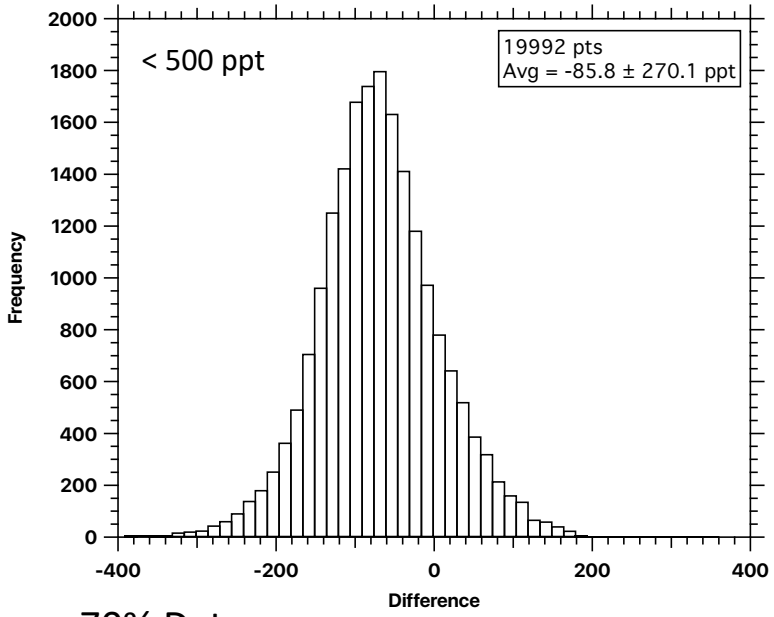
75th Percentile

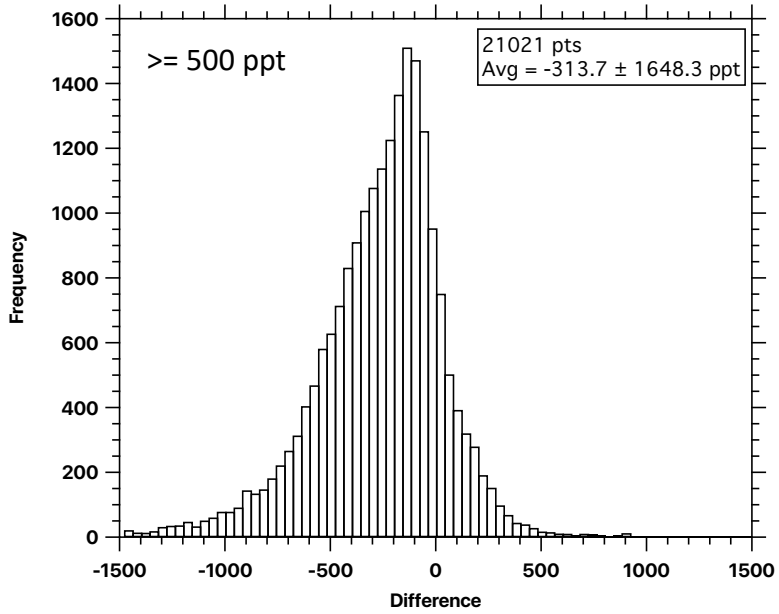
Median

25th Percentile

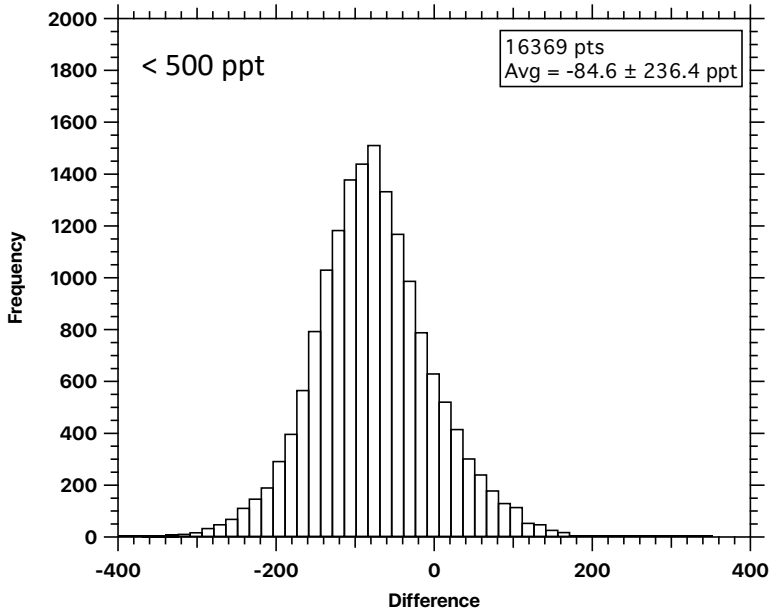
Frequency distribution

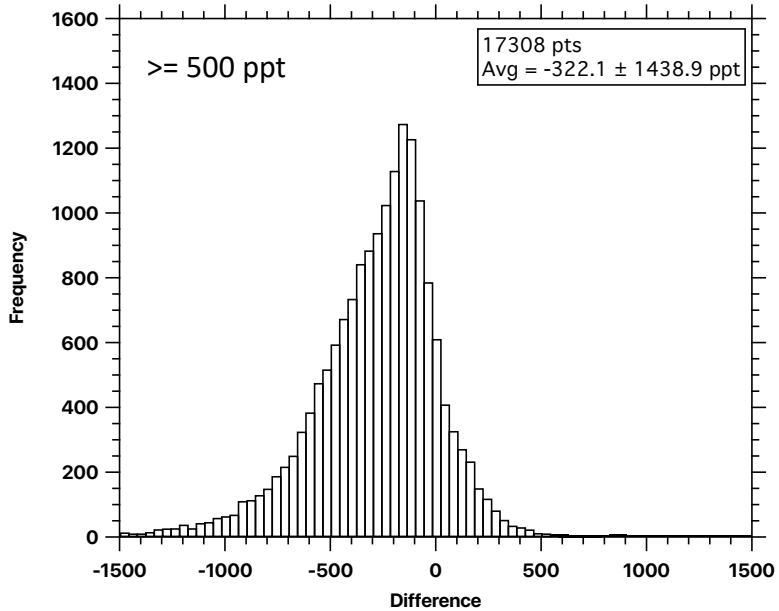
10s Archive Merge



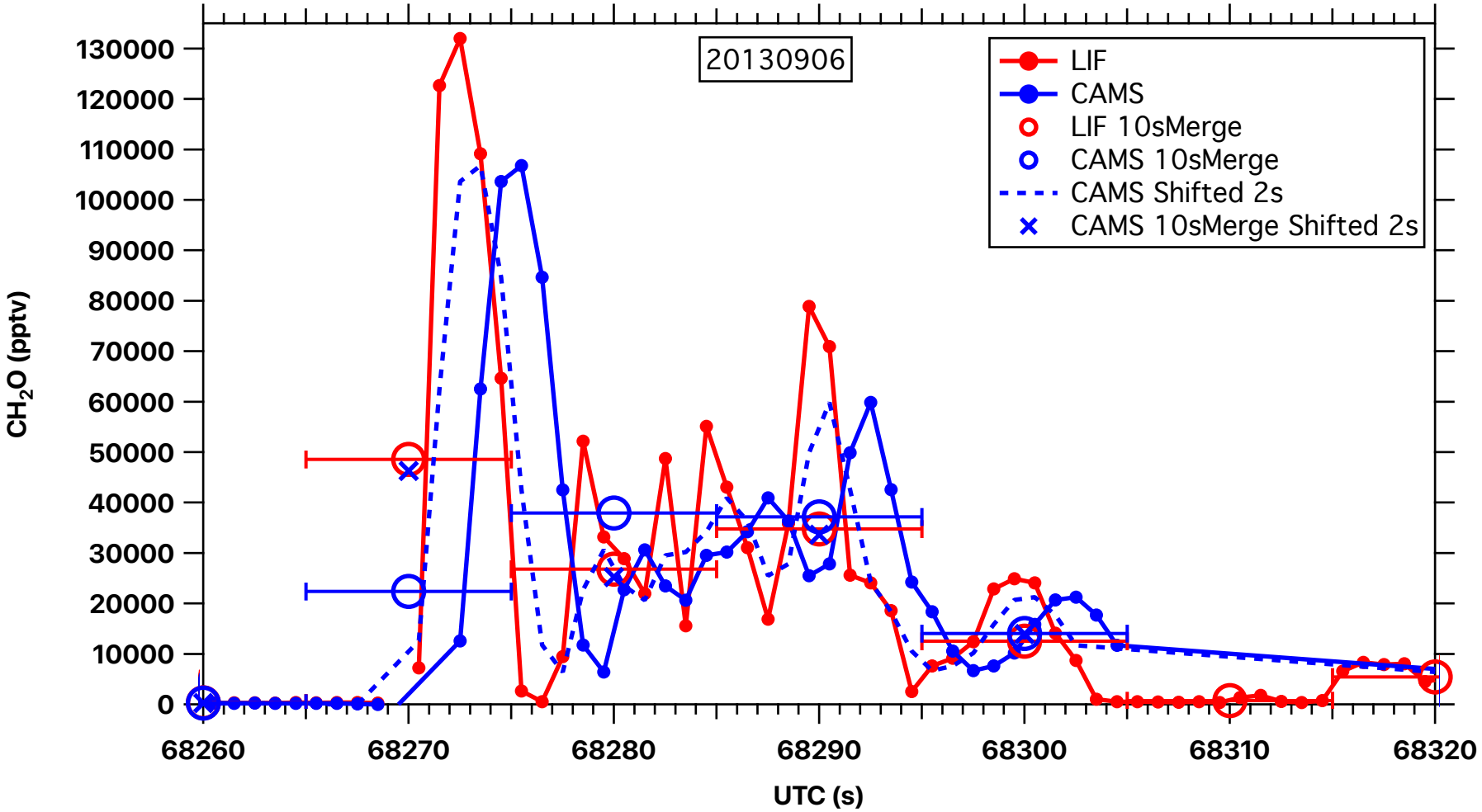


10s Merge 70% Data



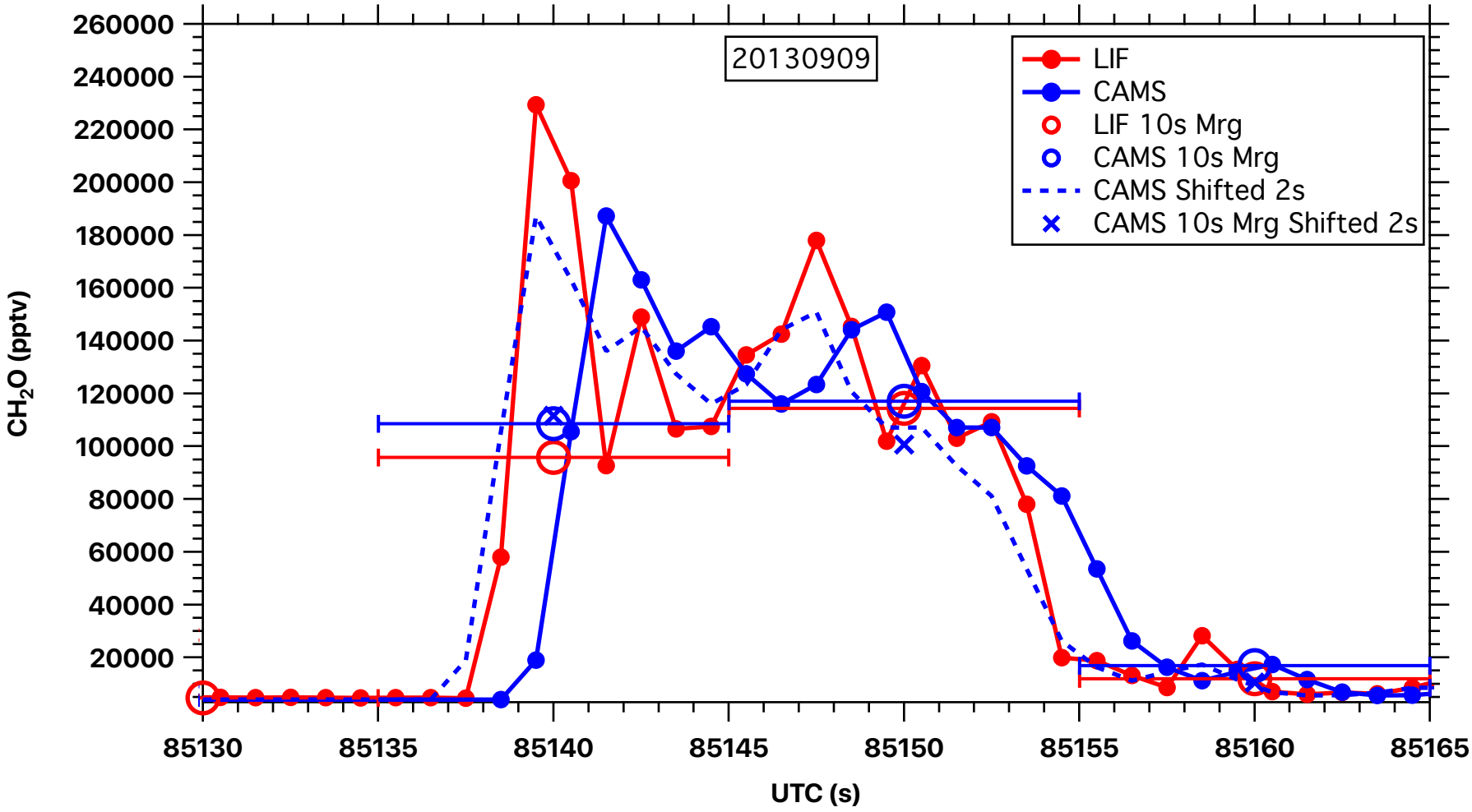


Time Shift Analysis – 09/06/13



- Shifting CAMS data -2 seconds yields better agreement for 2 out of 5 points.

Time Shift Analysis - 09/09/13



- Shifting CAMS data -2 seconds does not significantly improve agreement.

Data:

- 10 second merge: SEAC4RS-mrg10-dc8_merge_20130806_R5_thru20130923.ict
- 1 second CAMS: SEAC4RS-CH2O_DC8_########_R0.ict (######## = daily files from 20130806 – 20130923).
- 1 second ISAF: SEAC4RS-ISAF-H2CO_DC8_########_R1.ict (######## = daily files from 20130806 – 20130923).

Correlation:

- 10s merge with 70% data are calculated using 1s PI data files. Each 10s interval must contain at least 70% of data for analysis.
- 10s archive merge outliers removed iteratively when Cook's Distance > 1 (https://en.wikipedia.org/wiki/Cook%27s_distance).
- Outlier removed from 70% data 10s merge based on largest Cook's Distance.
- 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).

- CAMS 1s uncertainty: reported in data file; 10s uncertainty: calculated from 1s LOD quadrature average and SMU 10s average.
- ISAF 1s uncertainty: $\pm$ [30 pptv + (10 pptv +10%)]; 10s uncertainty: $\pm$ [9.5 pptv + (10 pptv + 10%)].

Difference dependence on CH_2O value:

- Absolute difference calculated by CAMS – ISAF.
- Median, 25th, and 75th percentiles based on 3000 data point bins after data is sorted by CAMS values.
- Uncertainty envelopes based on 10s data uncertainty.

Frequency Distributions:

- NOAA CAMS data divided into 2 regions (< 500 ppt, >= 500 ppt).
- Frequency distribution bin width [< 500 ppt] = 15; Frequency distribution bin width [>= 500 ppt] = 40

Time Shift Impact: Bins containing at least 70% of data

- Assume 10s merge will largely mitigate minor time shift impact.
- Case studies show 6 out of 8 data points across the 2 analyses do not significantly improve agreement when 1s data is shifted, i.e., the 10s merge lessens the time shift influence.

Summary: Archived 10s merge

Data Range	# Points	# Pts within Combined Unc.	# Pts within 2*Combined Unc.
All	32634	12490 (30%)	27536 (67%)
< 500 ppt	19992	4421 (22%)	9619 (48%)
>= 500 ppt	21021	1519 (7%)	3101 (15%)

Summary: 10s merge with 70% data

Data Range	# Points	# Pts within Combined Unc.	# Pts within 2*Combined Unc.
All	33677	5655 (17%)	11205 (33%)
< 500 ppt	16396	10710 (65%)	13409 (82%)
>= 500 ppt	17281	2520 (15%)	4764 (28%)