AQRP Monthly Technical Report

PROJECT TITLE	Analysis of Airborne Formaldehyde Data Over Houston Texas Acquired During the 2013 DISCOVER-AQ and SEAC^{4}RS Campaigns	**PROJECT #**	14-002
PROJECT PARTICIPANTS	Alan Fried, Christopher P. Loughner, and Ken Pickering	**DATE SUBMITTED**	8/7/2015
REPORTING PERIOD	**From:** July 1, 2015 **To:** July 31, 2015	**REPORT #**	10

A Financial Status Report (FSR) and Invoice will be submitted separately from each of the Project Participants reflecting charges for this Reporting Period. I understand that the FSR and Invoice are due to the AQRP by the 15th of the month following the reporting period shown above.

Detailed Accomplishments by Task

During the July reporting period we focused our efforts: 1) employing the CMAQ model in the Process Analysis mode to determine CH_2O source attribution over the entire Houston-Galveston-Brazoria Metropolitan Area, initially for the month of September in 2013; and 2) continuing with our identification of additional P3 time periods when sampling large petrochemical flaring events. This report will present the results for item (1).

Preliminary Analysis

In previous reports we presented our 1-km CMAQ-Measurement comparisons for formaldehyde (CH_2O), highlighting the good daily agreement on average. Excluding Sept. 25, the average-median and average-average (CMAQ-Measurement) bias in the boundary layer are -309 ± 322 pptv, and -470 ± 306 pptv, respectively. Thus, the CMAQ model can be employed with some degree of confidence in the Process Analysis mode to accurately assess CH_2O source attribution. Figure 1 below shows the 4 and 1-km domains used in our calculations, however, only the 1-km domain calculations are used in our source attribution assessments. As can be seen, this domain focuses on the Houston-Galveston-Brazoria Metropolitan Area.

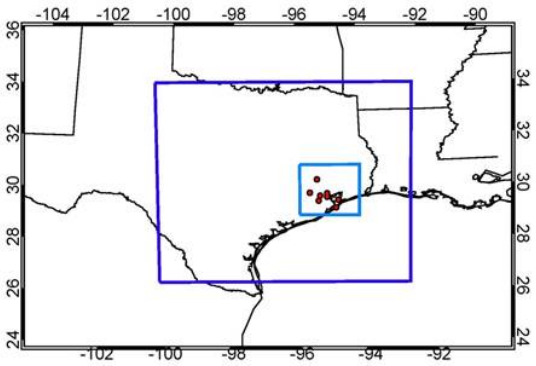

Figure 1: 4 and 1-km domains employed in the CMAQ model

Figure 2 shows the results of our daily average calculations for the entire month of September in 2013 averaged over the entire 1 km domain. As can be seen, CH_2O from secondary production sources (Production – Destruction) is approximately a factor of 5 times higher than direct emission sources in the planetary boundary layer (PBL) over the entire month of September and approximately a factor of 7 to 8 times the direct emission source for the atmosphere over the Houston-Galveston-Brazoria Metropolitan Area up to 5-km altitude. These results are in agreement with our qualitative assessment presented in last month's report based upon our fast CH_2O-O_3-NO_x/NO_y correlations.

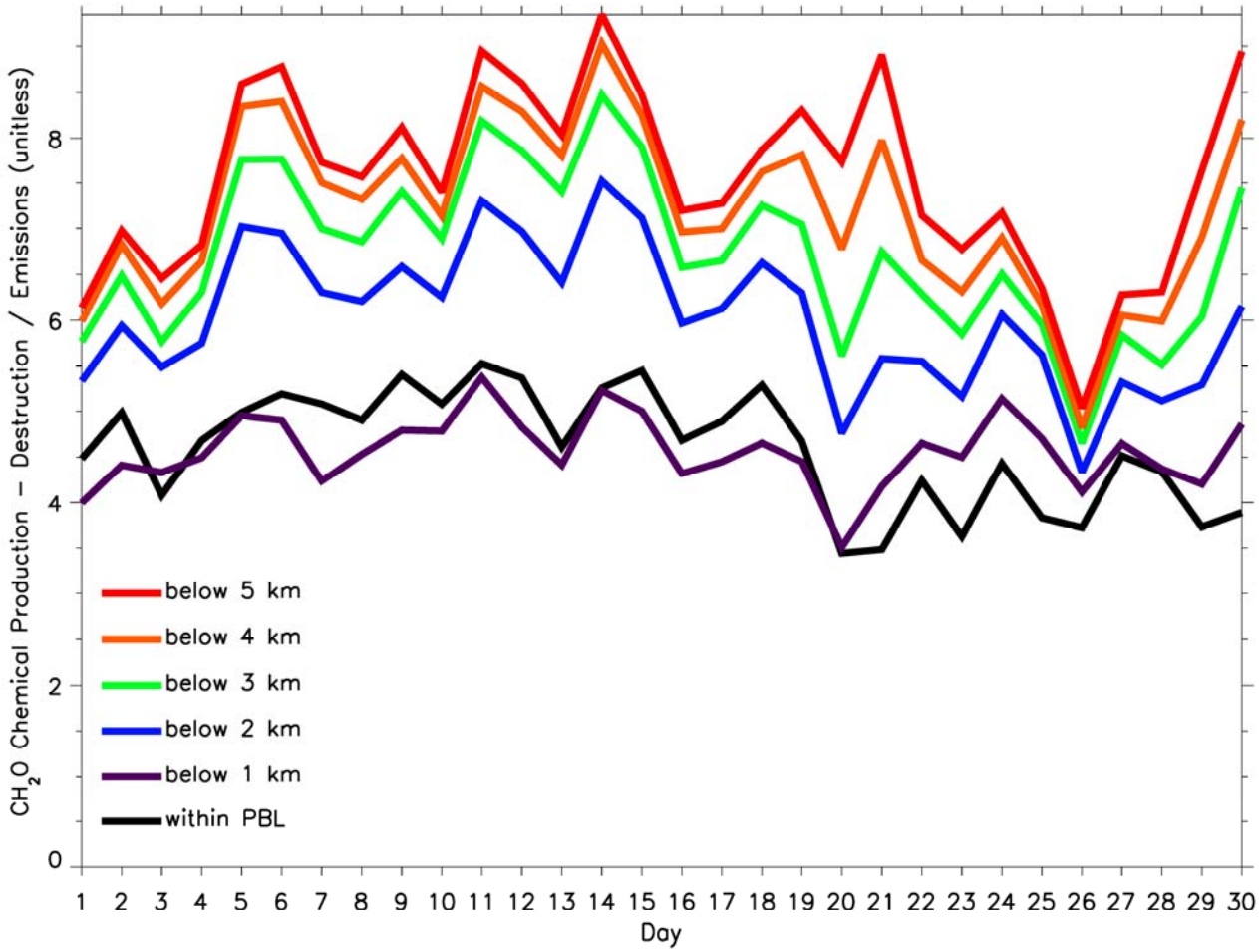

Figure 2: 1-km CMAQ model ratios of CH_2O from secondary production sources (production-destruction) relative to direct emission sources for the entire month of September in 2013 over the Houston-Galveston-Brazoria Metropolitan Area.

Figure 3 below further shows this breakdown as a function of hour for the entire month of September 2013. Over the 7 am – 7 pm daylight hours, the average ratio yields a value of ~ 8/1 within the PBL. This yields a secondary CH_2O contribution of ~ 89% over the daylight hours and this agrees well with the determination from Parrish et al. (ACP, **12,** 3273-3288, 2012) of ~ 95% based upon OH reactions of ethene and propene to produce CH_2O during daylight hours. It should be mentioned that our results are based upon present emission inventories for ethene and propene that have not been updated to include possible over-assisted flaring emissions that has been discussed in previous monthly reports.

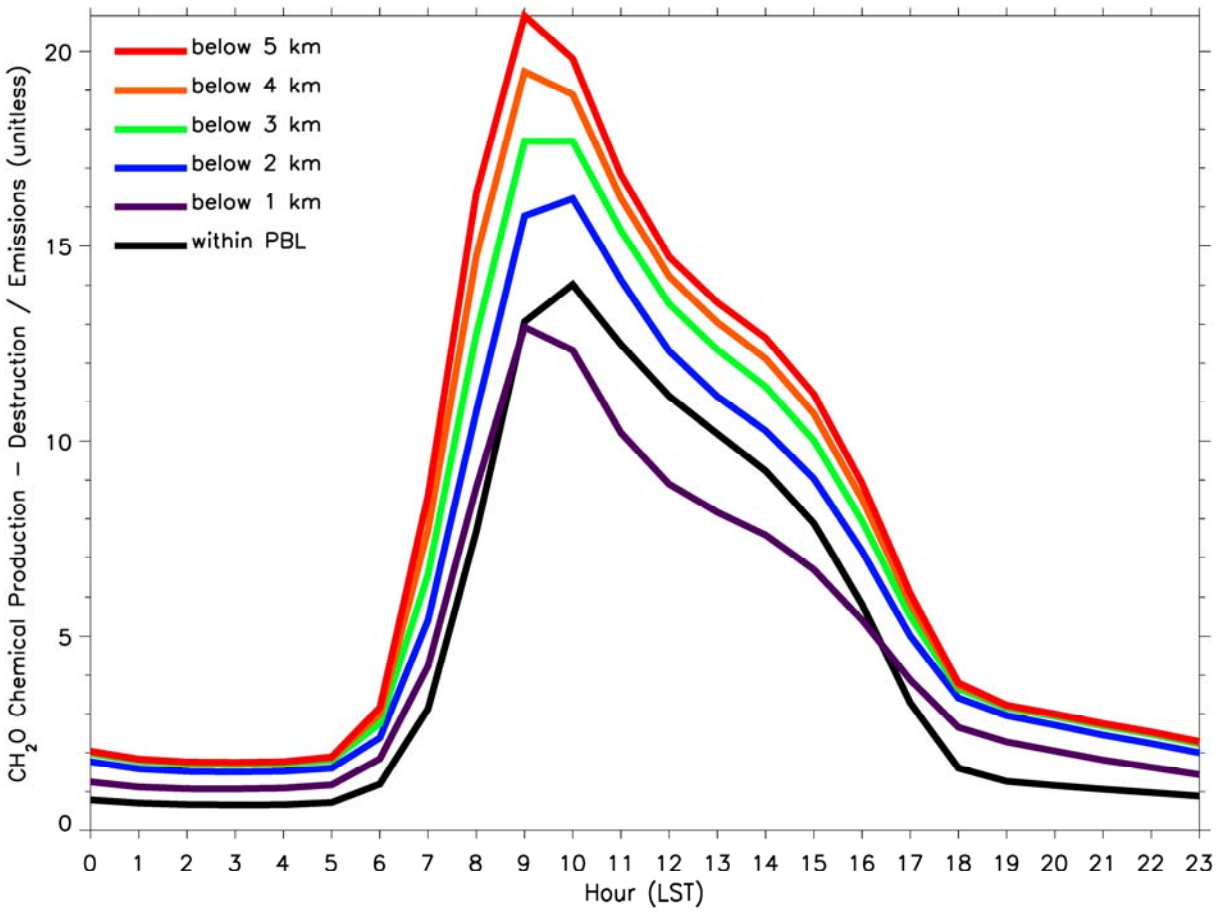

Figure 3: CMAQ model results from Fig. 2 broken out by hour of day for the entire month of September 2013.

Data Collected

None.

Identify Problems or Issues Encountered and Proposed Solutions or Adjustments

No problems encountered.

Goals and Anticipated Issues for the Succeeding Reporting Period

Re-run CMAQ simulations with process analysis mode for source attribution employing modified emissions from petrochemical-flaring events.

Detailed Analysis of the Progress of the Task Order to Date

We don't anticipate delays in the completion of this project.

Submitted to AQRP by: Alan Fried
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