AQRP Monthly Technical Report

PROJECT TITLE	A synthesis study of the role of mesoscale and synoptic-scale wind on the concentrations of ozone and its precursors in Houston	**PROJECT #**	18-010
PROJECT PARTICIPANTS	Qi Ying, John Nielsen-Gammon	**DATE SUBMITTED**	4/8/2019
REPORTING PERIOD	**From:** 3/1/2019 **To:** 3/31/2019	**REPORT #**	6

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

Task 1: Synthesis of mesoscale wind structures in the synoptic-scale context
Dr. Nielsen-Gammon's group worked on updating and streamlining our software for decoding profiler data, interpolating missing data in space and time, and objectively diagnosing instances of wind rotation. We anticipate fully processing the profiler data and completing identification of suitable days for simulation during April.

Task 3: Analysis of the interaction of mesoscale winds and ozone formation during key episodes
Analyzed vertical distribution of aged and fresh ozone at Galveston and Aldine and the region contributions at the two locations.

Preliminary Analysis
Figure 1 shows that the vertical distributions of ozone at Galveston and Aldine have distinctive patterns. At Galveston on high surface ozone days (August 30-31, and September 4-5), high ozone is limited below 500 m due to shallower boundary layer. From September 1-3, high ozone concentrations occur at higher elevations between 500-1000 m, and some downward transport can be observed in the afternoons. At Aldine, ozone concentrations always peak near the surface and high ozone concentrations extends to 1500 m or more above surface in the afternoon. Figure 2 shows that aged ozone (> 8 hours) at Galveston can be significant contributor to total ozone at both surface and higher elevations. On August 30 and 31, higher aged ozone occurred at higher elevations about 250-500 m above surface with concentrations exceed 30 ppb. In the afternoon and evening hours of September 4, high concentration of aged ozone occurred throughout the boundary layer and lasted for more than 12 hours. Fractional contributions of aged ozone to total ozone exceeds 50% on these hours. Figure 3 shows that at Aldine, aged ozone is limited at higher evaluations near the top of the boundary layer. Concentrations of aged ozone near the surface is low, with contributions to total ozone less than 10% in most times.

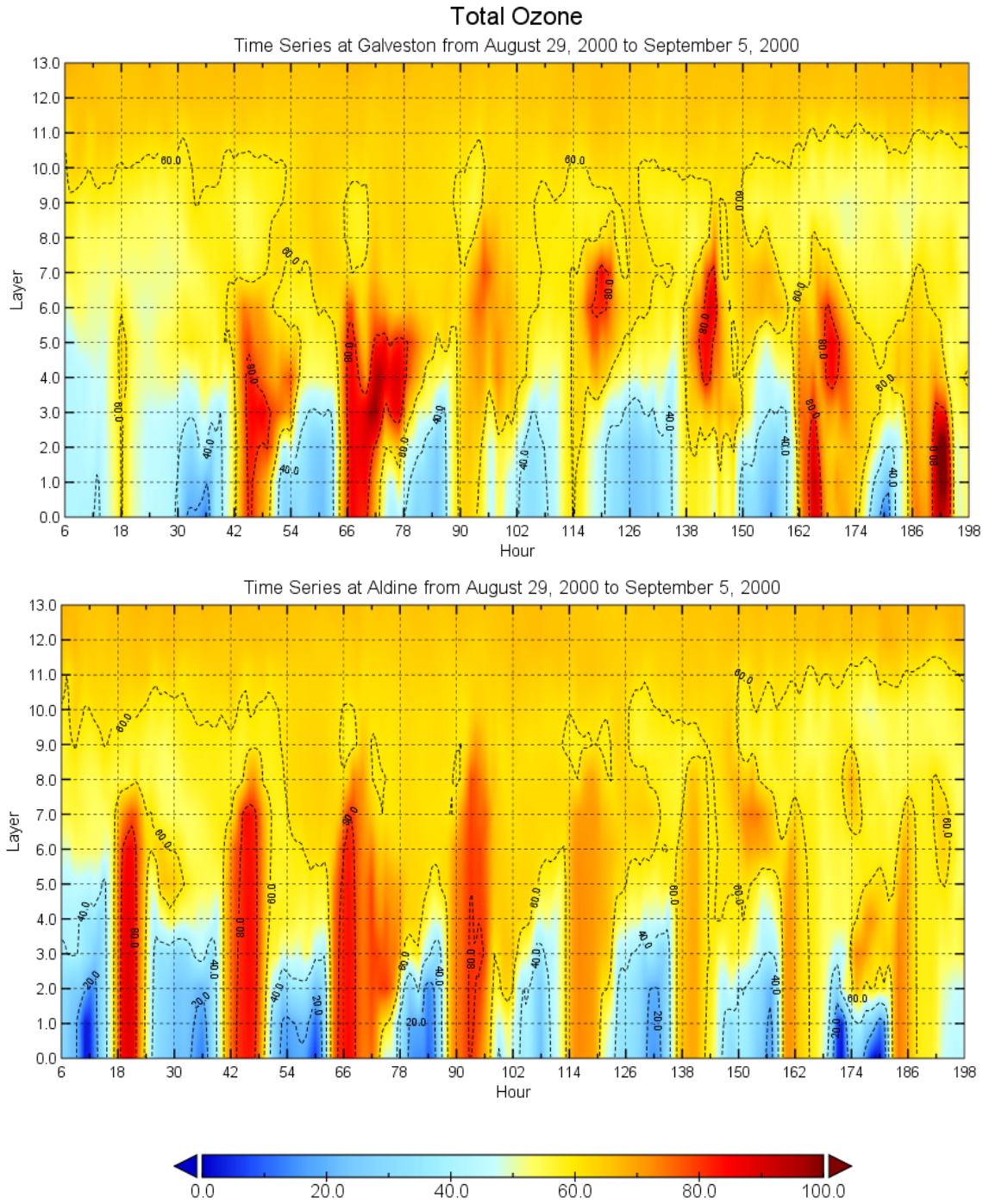

Figure 1 Time series of vertical distribution of ozone at Galveston (top) and Aldine (bottom) from August 29, 2000 to September 5, 2000. Hour 6 is the 0000 hours local time on August 29, 2000. The mid-layer evaluations for each layer from the lowest are 22, 68, 135, 275, 460, 700, 1090, 1640, 2280, 3140, 4330, 6180, 9550, and 16200 m,

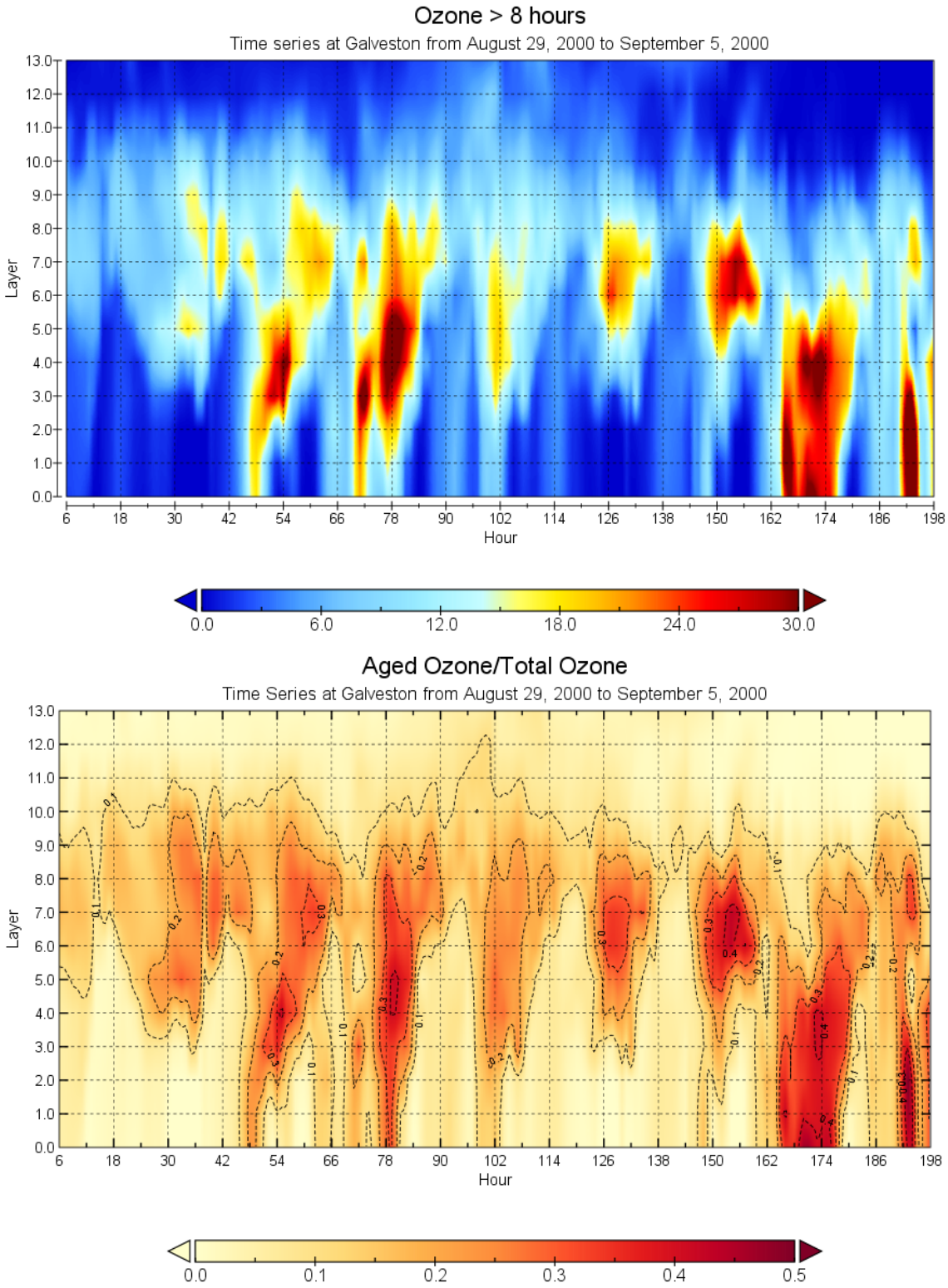

Figure 2 Time series of vertical distribution of aged ozone concentrations (top) and aged ozone fraction (bottom) at Galveston from August 29, 2000 to September 5, 2000. Hour 6 is the 0000 hours local time on August 29, 2000.

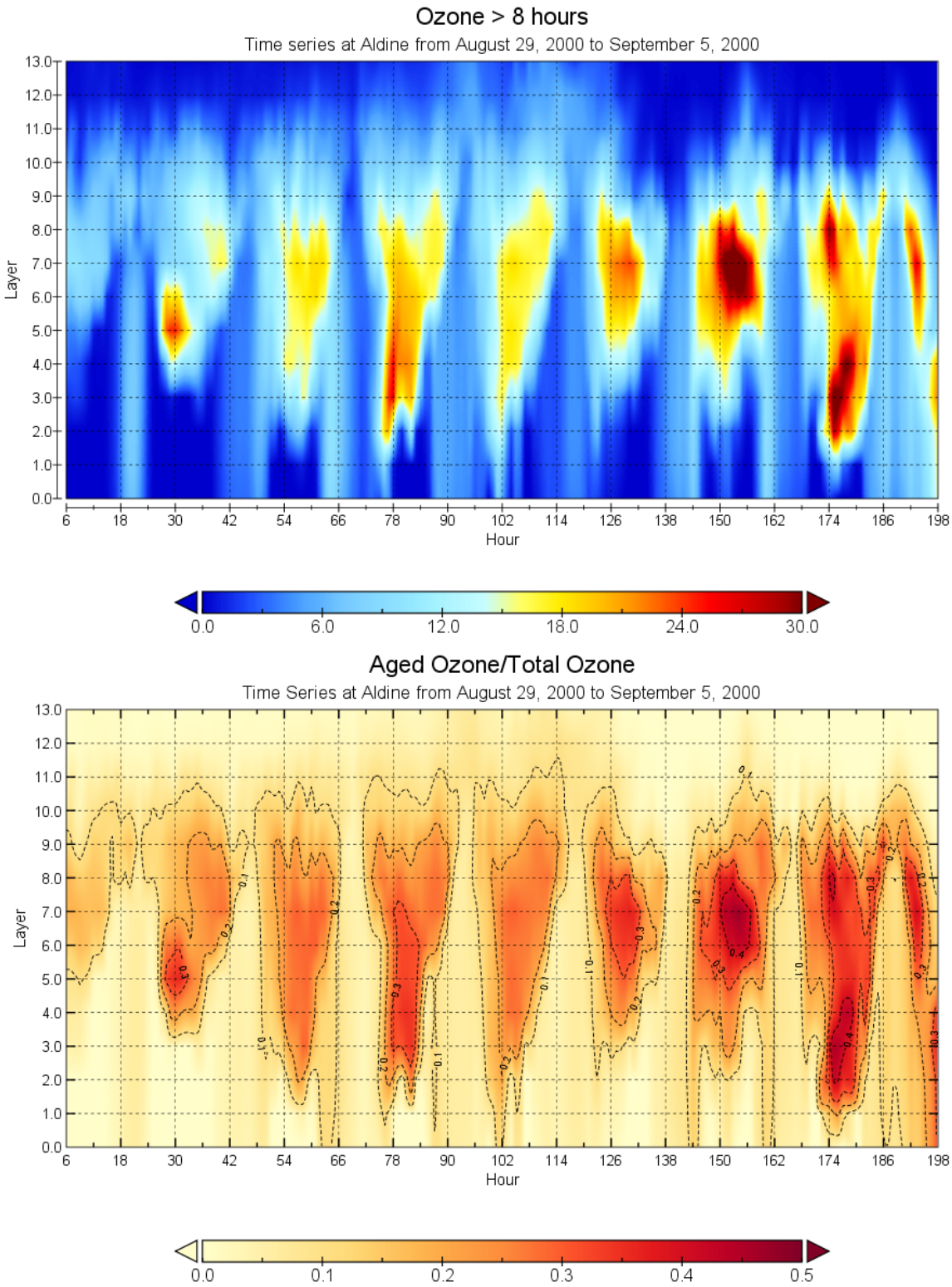

Figure 3 Time series of vertical distribution of aged ozone concentrations and aged ozone fractions at Aldine from August 29, 2000 to September 5, 2000. Hour 6 is the 0000 hours local time on August 29, 2000.

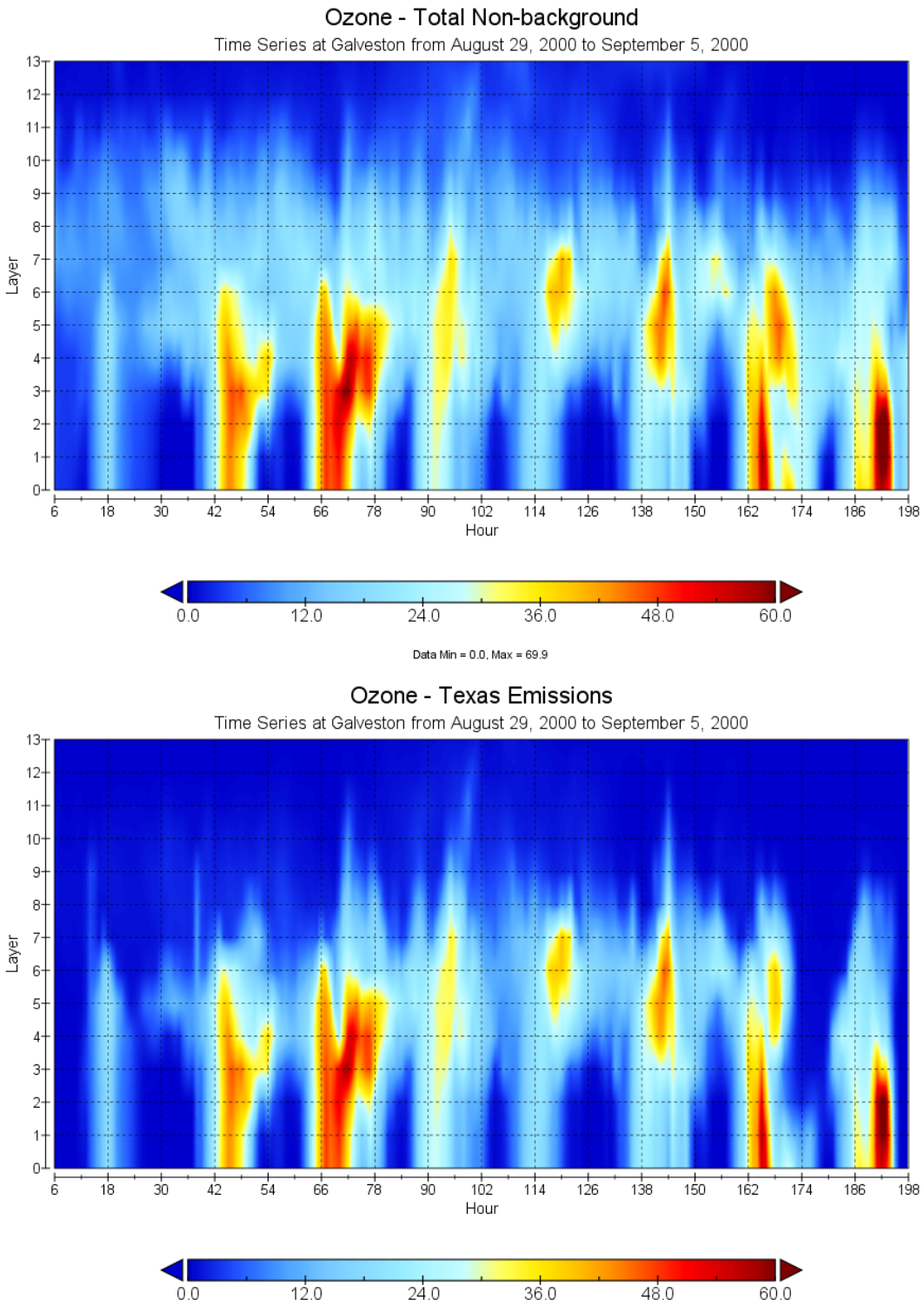

Figure 4 Time series of vertical distribution of total non-background ozone and ozone at Galveston due to Texas emissions from August 29, 2000 to September 5, 2000. Hour 6 is the 0000 hours local time on August 29, 2000.

Contributions of regional emissions to ozone at Galveston is shown in Figure 3 and Figure 4. Throughout the entire boundary layer, most of the ozone at Galveston is due to Texas emissions. All other regions have small contributions to non-background ozone. Ozone from emissions in Louisiana and Mississippi contribute to 10-20 ppb of ozone on the night of September 4 and early morning hours of September 5. This long range transport of ozone appears to occur within 0-500 m above surface.

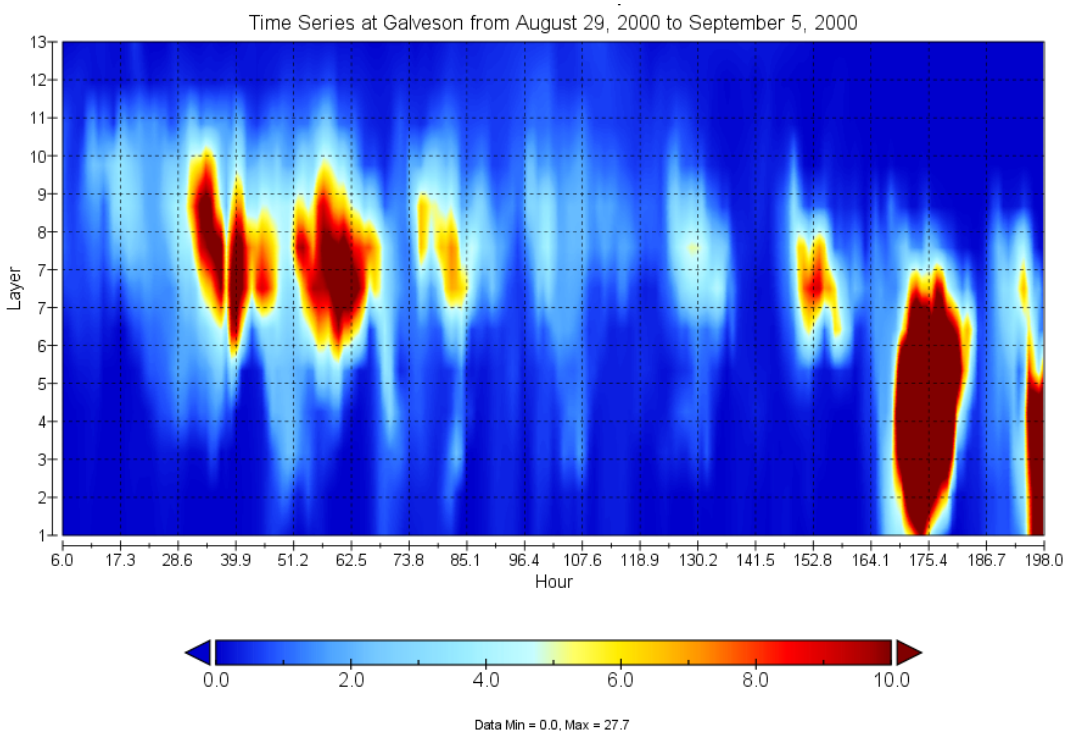

Figure 5 Time series of vertical distribution of ozone at Galveston due to Louisiana and Mississippi emissions from August 29, 2000 to September 5, 2000. Hour 6 is the 0000 hours local time on August 29, 2000.

Data Collected

No additional data were collected during this period.

Identify Problems or Issues Encountered and Proposed Solutions or Adjustments
None to report.

Goals and Anticipated Issues for the Succeeding Reporting Period

We plan to continue analyzing the age and source region contributions to NOx, VOC and relative atmospheric oxidation products (such as PANs) during this period. Meteorological patterns will be further analyzed to corroborate to air quality modeling results and to explain the model predictions. We will also report modeling preparation for other ozone episode as such periods are identified. Since we showed that ozone is mostly due to Texas emissions, we also will perform

additional simulations to track emissions from different regions within Texas and evaluate the regional transport under different synoptic-scale wind conditions.

Detailed Analysis of the Progress of the Task Order to Date

Task 2 (source and age resolved model development) has been completed. Task 1 is currently on-going with all necessary data retrieved. Task 3 is on-going for the year 2000 with good results. We believe that sufficient progress has been made in order to complete the project in time.

Do you have any publications related to this project currently under development? If so, please provide a working title, and the journals you plan to submit to.

_X__Yes ___No

We are working on a manuscript with a preliminary title "Improve the computation efficiency of source-oriented chemical mechanisms for the source apportionment of secondary gaseous and particulate pollutants", which we plan to submit to Atmospheric Environment.

Do you have any publications related to this project currently under review by a journal? If so, what is the working title and the journal name? Have you sent a copy of the article to your AQRP Project Manager and your TCEQ Liaison?

___Yes __X_No

Do you have any bibliographic publications related to this project that have been published? If so, please list the reference information. List all items for the lifetime of the project.

___Yes _X__No

Do you have any presentations related to this project currently under development? If so, please provide working title, and the conference you plan to present it (this does not include presentations for the AQRP Workshop).
___Yes _X__No

Do you have any presentations related to this project that have been published? If so, please list reference information. List all items for the lifetime of the project.

___Yes _X__No

Submitted to AQRP by Qi Ying, on April 8, 2018.

Principal Investigator