AQRP Monthly Technical Report

PROJECT TITLE	Impact of large-scale circulation patterns on surface ozone concentrations in Houston-Galveston-Brazoria (HGB)	**PROJECT #**	14-010
PROJECT PARTICIPANTS	Texas A&M University at Galveston	**DATE SUBMITTED**	4/8/2014
REPORTING PERIOD	**From:** March 1, 2015 **To:** March 31, 2015	**REPORT #**	3

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 *(Include all Task actions conducted during the reporting month.)*

Task 1: We analyzed the influence of the Bermuda High (BH) on surface ozone concentrations over HGB on the seasonal and monthly time scale (Figure 1-2 and Figure 4) and the interannual variations of monthly mean ozone and the west edge longitude of BH (BH-Lon) (Figure 3).

Task 2: Not started.

Task 3: The set up of GEOS-Chem on the supercomputer of TAMU (ada) was finished.

Preliminary Analysis

The seasonal variations of BH-Lon and surface ozone concentrations are shown in Figure 1. Results show that the trough of ozone in July is accompanied by the lowest BH-Lon of the year, which means the most westward extension of the BH in July. The westward extension of BH, thus lower BH-Lon in numerical sense, is accompanied with stronger inflow of maritime air into HGB and that's why BH-Lon can explain the seasonal variations of ozone over HGB. In some years (e.g. 2005), the 1560-gpm isoline does not exist over the Bermuda region in May. Considering the instability of the BH in May, we only calculate BH-Lon from Jun to Sep in the monthly timescale analysis.

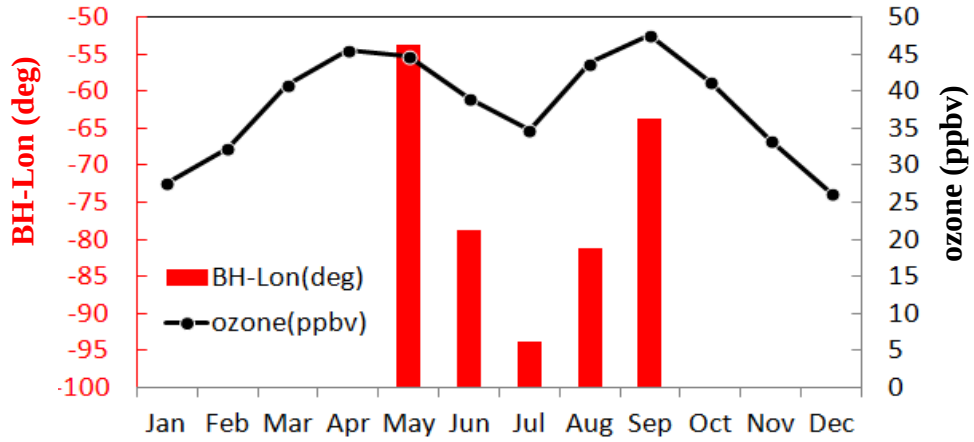
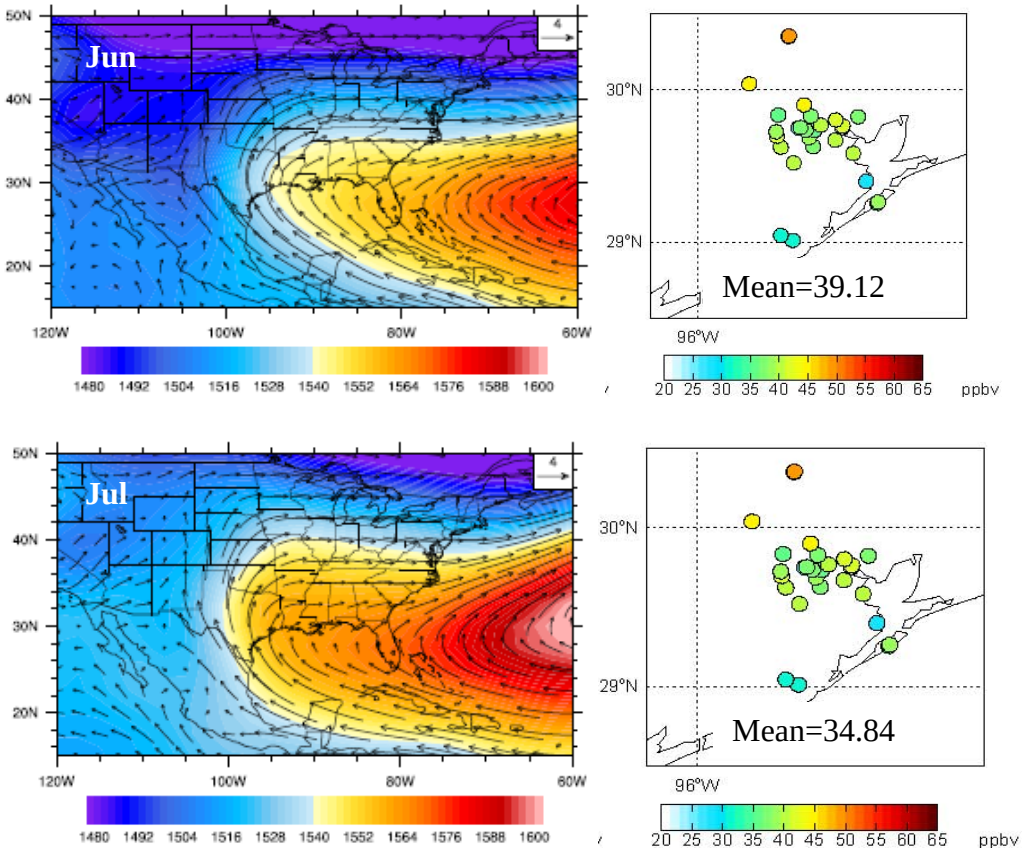


Figure 1. Seasonal variations (1998-2013 mean) of BH-Lon and surface ozone concentrations over HGB.

The long-term mean (1998-2013) surface ozone concentrations over HGB for the month Jun to Sep are shown in the left panels of Figure 2. From June to July, the onset of the BH leads to the change of BH-Lon from 78.75ºW to 93.75ºW, which corresponds to a decrease of the HGB-mean ozone from 39.12 ppbv to 34.84 ppbv. From July to September, however, the retreat of the BH is accompanied by the increase of surface ozone concentration over HGB from 34.84 ppbv to 47.51 ppbv.



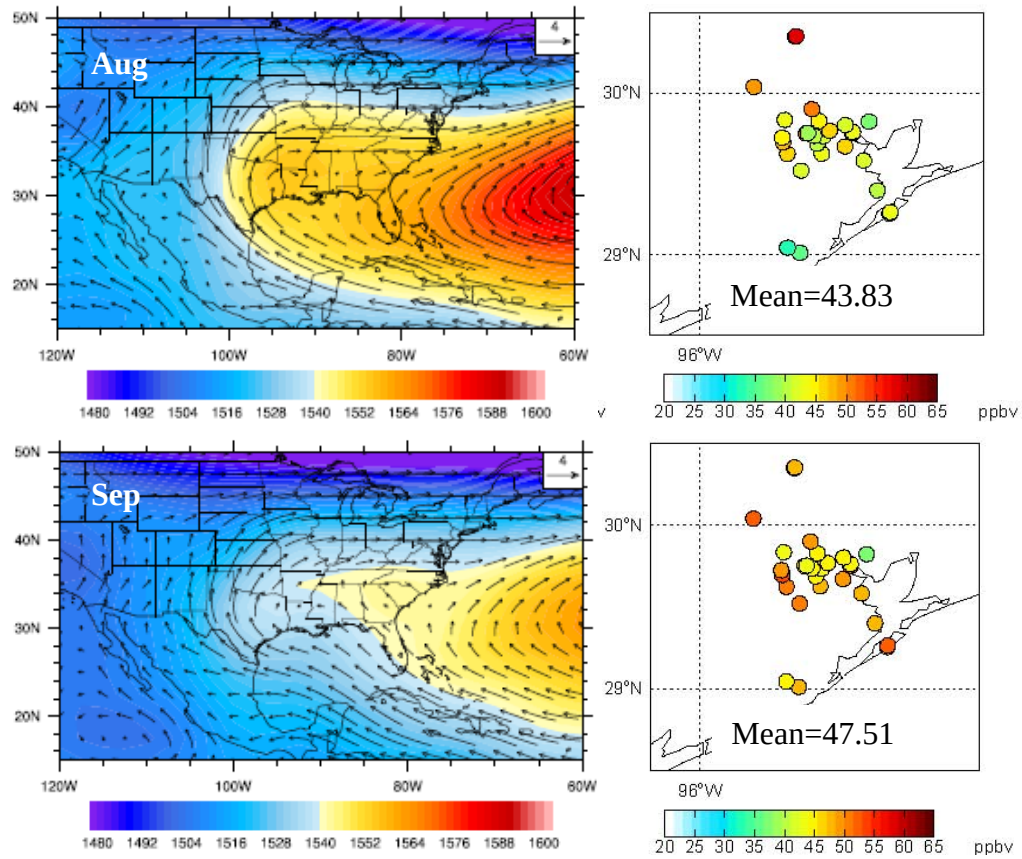
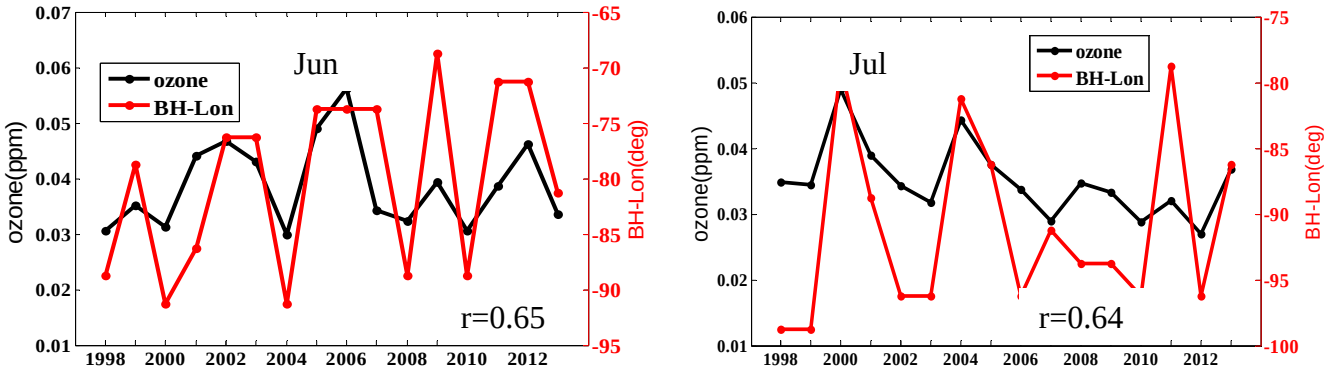


Figure 2. Spatial distributions of 850hPa geopotential height (gpm), wind field (m/s) and surface ozone concentration over HGB in June, July, August and September. Data shown are multi-year mean (1998-2013).

Figure 3 displays the interannual variations of the monthly mean surface ozone over HGB and BH-Lon for June, July, August and September. The correlations between ozone and BH-Lon in June and July are better than those in August and September, since the BH is relatively stronger in June and July. For August and September, we plan to combine BH-Lon with other indices (such as the large-scale circulation patterns over the continent) to explain the interannual variations of surface ozone over HGB.



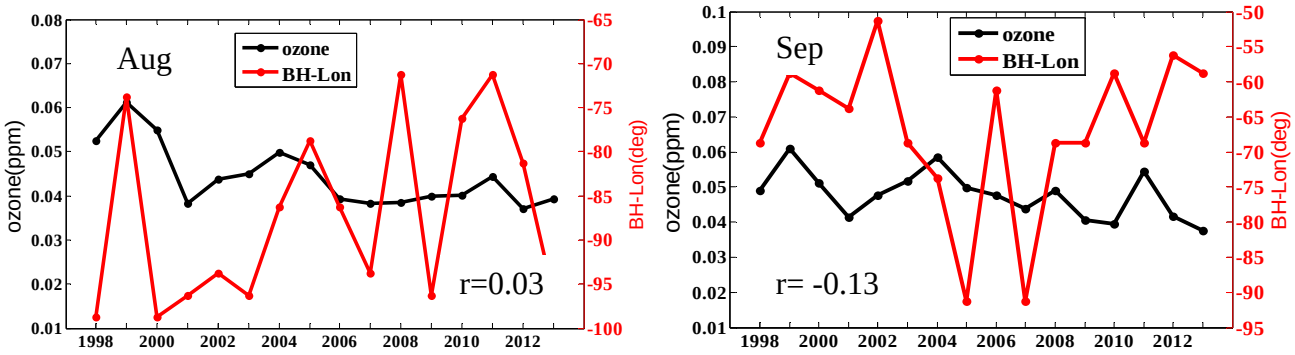


Figure 3. The interannual variations of the monthly mean surface ozone and BH-Lon for June, July, August and September.

Figure 4 shows the longer-term time series of monthly HGB-mean ozone and BH-Lon from June 1998 to September 2013. The data shown in Figure 4 are deseasonalized and detrended. The detrended and deseasonalized mean surface ozone concentration over HGB and BH-Lon show a significant correlation of 0.35, indicating that a higher ozone concentration is companied with a weaker westward extension of BH which is consistent with the argument of BH variability determining the strength of maritime air inflow into HGB. August 1999, July 2000, July 2004 and August 2011 are the months with extremely high ozone and BH-Lon. We performed some preliminary analysis about the anomalous meteorological conditions of August 2011 (not shown here). We found that the higher numerical value of BH-Lon of that month (i.e., BH locating more eastward from HGB) caused weaker prevailing southeasterly winds in the lower atmosphere, which suppressed the inflow of clean marine air. Also, temperature of that month was higher and the total cloud cover was lower, both of which are favorable for the formation of ozone.

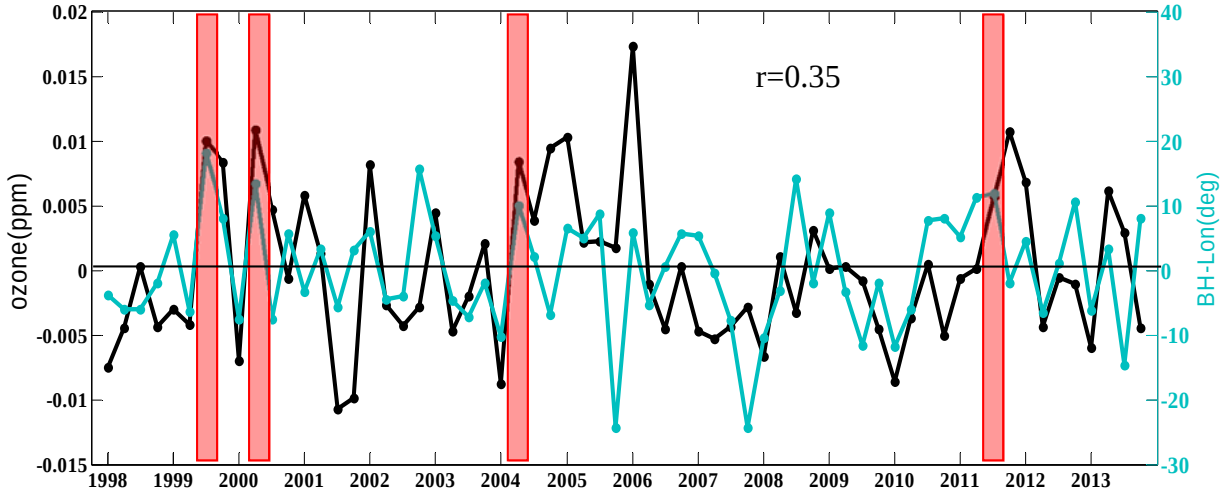


Figure 4. Time series of the detrended and deseasonalized ozone and BH-Lon from Jun 1998 to Sep 2013. (Red highlights indicate the months with extremely high (> 0.8 std) ozone and BH-Lon)

Data Collected

Collection of data used to run GEOS-Chem is finished.

Identify Problems or Issues Encountered and Proposed Solutions or Adjustments
None this period.

Goals and Anticipated Issues for the Succeeding Reporting Period
We will try other metrics of MDA8 O_3 over HGB and other indices beyond BH-Lon to capture the variations of ozone in August and September.
We will start the simulations of surface ozone using GEOS-Chem.

Detailed Analysis of the Progress of the Task Order to Date*(Discuss the Task Order schedule, progress being made toward goals of the Work Plan, explanation for any delays in completing tasks and/or project goals. Provide justification for any milestones completed more than one (1) month later than projected.)*
Progress on the project is ongoing.

Submitted to AQRP by:

Principal Investigator: Yuxuan Wang