

Response to Reviews

We thank both reviewers for their constructive comments to improve the manuscript. Their comments are reproduced below with our responses in blue. The corresponding changes in the manuscript are highlighted in blue.

Reviewer 2

This manuscript examines whether interannual variability in summertime monthly ozone concentrations in Houston can be explained by the strength and location of the Bermuda High. Through multiple linear regression analysis, the authors show that a remarkable degree of ozone variability can be explained by the intensity and longitudinal extent of the Bermuda High. These features of the large scale circulation patterns can explain even more of the interannual variability than local temperatures or winds. It is useful that the authors briefly touch on the influence of BH metrics on ozone in other Gulf Coast cities, to show the extent to which the conclusions for Houston might apply elsewhere. The methods of the paper are sound and its findings are well explained. The manuscript merits publication in ACP after addressing the minor comments noted below.

1. The paper focuses on June, July and August, noting in Lines 100-101 that this is when the Bermuda High is closer to North America and more influential on circulation patterns over Houston. However, as shown in Figure 5, Houston ozone exhibits a bimodal seasonality, with some of the highest ozone and exceedance rates occurring in the spring and early fall rather than in JJA. If the meteorological features identified here are unable to predict peak ozone outside of JJA, this should be noted as a limitation of the study.

We have stated this limitation. Line 268-271: "We note here that HGB ozone exhibits a bimodal seasonality (c.f. Figure 5), with 41% of exceedance days occurring in JJA, and the rest in the spring and early fall. The meteorological features identified here are not expected to predict peak ozone outside of JJA, which is a limitation of the study."

2. The ozone standard is now 70 ppb, though the paper uses the earlier 75 ppb standard as the exceedance threshold.

We have changed the threshold to 70 ppb and re-calculated the exceedance days. See the revised Figure 5.

3. It should be clarified in Lines 92-93 how the Bermuda High influences nocturnal low level jets.

Clarification has been added. Line 93-94: "...due to the superposition of the sea breeze cycle on a strong synoptic-scale southerly flow."

4. Meteorological data is taken from a 2.5 x 2.5 degree reanalysis, but the longitude

of the Bermuda High is reported with 0.1 degree precision. Clarify how BH-Lon was computed from the data.

BH-Lon is calculated as the longitude of the cross-point of the 1560 geopotential meter (gpm) isoline and the 850hPa wind ridgeline (defined below). The location of the 1560-gpm isoline is linearly interpolated to 0.1 degree precision within the 2.5 x 2.5 degree grid which contains this isoline. We have clarified this in the text (line 163-165).

5. Line 159: Clarify what is meant by the 850hPa wind ridgeline.

The ridgeline refers to the roughly zonal line that separates the easterly trade winds in the south from the westerly winds in the north at 850hPa. Mathematically it can be written as $u=0$ and $\frac{\partial u}{\partial y} \geq 0$, where u is the zonal wind component and y is meridional coordinate. We have clarified it in the text (line 160-163).

6. The authors choose to de-trend the Bermuda High longitude data, though the reasons behind the trend remain unclear (lines 176-184). It would be helpful to note how the results would have been affected if BH-Lon had not been de-trended.

We have clarified in the text that the main reason to de-trend the BH-Lon data is to be consistent with the treatment of ozone data in the MLR model (line 190-191). We have verified that the results are not affected if BH-Lon is not de-trended or de-trended with a different method. See the detailed explanation of this point in our response to the 1st reviewer and the added Table S2 and S3 in the supplementary material and related discussion in the text (line 283-292).

7. It is unclear how Figure 6a illustrates the claim in lines 247-249.

We've removed the reference of Figure 6a here and corrected the r values.

8. Where was the correlation observed in Zhu and Liang (lines 312-314)

It was over the southern Great Plains (including Houston). We've clarified this point. See line 336.

9. In Figure 3, I don't see the black dashed line, and the units of the "5" arrow should be clarified.

For clarity we now use the white dashed line to indicate the BH-Lon. The arrow indicates wind speed (m/s) and unit has been added.

Minor technical corrections:

Line 63: replace "the high pressures" with "high pressure";

Corrected.

Line 160: replace "the US" with "Houston";

Corrected.

Line 343: replace "the former month" with "2001" for clarity.

Corrected.