

# ***Interactive comment on “Seasonal and Spatial Changes in Trace Gases over Megacities from AURA TES Observations” by Karen E. Cady-Pereira et al.***

**Anonymous Referee #1**

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This manuscript provided an interesting study about long-term observations of trace gases from TES over two megacities. TES observations, as well as satellite products and global model results, are capable to capture the seasonal signal, identify a pollution episode, and confirm the impacts from biomass burning on local air quality. The topic is applicable for Atmospheric Chemistry and Physics. The text is concisely written and well documented. Generally, the study about the Mexico City is very comprehensive including satellite observations, surface measurements, and model simulations. However, the case about Lagos lacks validation of satellite observations and model results due missing of in-situ measurements. The Mexico City and Lagos are substantially different in the chemistry and environment. For instance, Lagos has lots of emissions

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from oil and natural gas industry, so it could be of problem to use the similar approach to analyze results from these two cities. Discussion about the uncertainty in the Lagos study is suggested. Minor revisions as indicated in the comments and remarks below are needed before consideration of publication in ACP.

#### Detailed Remarks/Suggestions for Revision

Page 4 Line 22: Please define SOs as 'Special Observations (SOs)' here.

Page 5 Line 13: So these levels 'sometimes' could not coincide with the lowest 3 levels? What are the uncertainty introduced here when NH<sub>3</sub>, HCOOH and CH<sub>3</sub>OH are calculated based on inconsistent levels of TES products? Can the authors use fixed 3 lowest layers to calculate the values and then compare the results?

Page 8 Line 24 to 34: It is a little bit hard to tell the differences based on the solid line separated by dotted lines. Can the revised manuscript include some values such as 'it contains elevated O<sub>3</sub> (xxx ppbv), CH<sub>3</sub>OH (xxx ppbv) ...'. Or compile all the satellite measurements (TES, AIRS, and MODIS) in a table?

Page 12 Line 5: The authors emphasize the importance of biomass burning to the local air quality in MCMA and Lagos, what are the possible uncertainties when using GEOS-Chem 2012 simulations driven by the seasonal biomass burning emissions from GFED4? For instance, do 2013-2015 have typical biomass burning scenario as described in GFED4? Further explanation or discussion is suggested.

Page 22: In Figure 1, it is hard to tell the MCMA from the background map. Can the authors use a contour line to highlight the metropolitan area?

Page 29: Same as above, please highlight the Lagos metropolitan area using a circle.

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