We thank the reviewers for their constructive comments. Specific responses to each of the comments are provided below (reviews' comments in black, our responses in blue, and the manuscript text follows in italics with changes in bold).

Anonymous Referee #1:

BrC has raised attention over the past decade because of its important contribution to light absorption and climate forcing. The authors aimed to unravel the complex links between SOA light absorption and chemical composition. To achieve this goal, biogenic VOCs (isoprene, alpha-pinene) and anthropogenic VOCs (TMB, toluene) were exposed to varying NOx levels in a chamber. The results show BrC formed from anthropogenic VOCs; specifically, the toluene SOA has the highest absorption under high-NOx level and 30-80% RH conditions. They found a nearly 50% underestimate of the MAC values based on a partitioning model, which is usually the case for current climate models. They also discussed the effect of RH and aging on the optical properties of aromatic BrC. In the end, the authors calculated the imaginary refractive indices and compared them with previous literature values. Overall, the experiments are described well and the results provide new insights into the BrC light absorption. I favor its publication in ACP with the following minor revisions.

-in section 3.3, why is there no absorption enhancement when RH was increased from 30% to 80%?

That is a good question that we are unfortunately unable to definitively answer. In the second paragraph of section 3.3 (lines 297-317), we discuss possible reasons for this observation, though we can only present hypotheses that need further testing. We hypothesize that observations are related to particle-phase reactions because it is difficult to identify any gas-phase reactions involving water vapor that produce BrC chromophores. We assume that the modest to high RH serves as an on/off "trigger" in the production of light-absorbing compounds. We presume that water is not directly involved in these reactions so that additional condensed phase water provided by increasing RH from 30% to 80% does not further enhance reaction rates. Further investigations, including molecular analysis on SOA products formed under various RH conditions, would help answer this specific question.

-fig 1, the alpha-pinene SOA has a higher absorption than the isoprene SOA over the 300-350 nm wavelength range. It might be appropriate to comment on this. It will also be useful to list the MAC values in the supplement.

The text in lines 182-183 has been edited as:

Compared to isoprene SOA, *SOA formed from photochemical oxidation of α-pinene* ~~***also***~~ *showed* ***slightly higher absorption in the 300-350 nm wavelength range, though the absolute MAC values are still small****.*

The MAC values of isoprene, α-pinene, TMB and toluene SOA formed under NO_x-free and high-NO_x conditions at 30% RH, i.e., data shown in Figure 1, are now listed in Table S1 in supplemental materials. A description has been added into Figure 1 caption:

Figure 1. MAC values for SOA formed under NOx-free and high-NOx conditions, from isoprene, α-pinene, TMB, and toluene. Note the 10× difference in scale between the terpene and aromatic precursors. ***The MAC values shown in this figure are tabulated in the supplementary material (Table S1).***

-fig 6, it's interesting that the authors observed a decline in the MAC values within 10 hours. I wonder whether the authors tried the 80% condition. And I suggest listing the change in MAC values over time in the supplement.

We did conduct toluene SOA aging experiments at 80% RH though these experiments were conducted with a different experimental protocol. To be specific, UV lights were turned off after several hours of aging to distinguish between the effects of photolysis and hydrolysis. Results were shown in Figure 7. It is clear that the MAC values started to decrease in the first several hours, consistent with what we observed for the 30% RH condition shown in Figure 6.

In response to this comment and a similar comment from Reviewer 1, we added spectra showing the spectral changes as a function of time in Figure S4. We also added a table showing the MAC values in the 300-700 nm spectral range over time as Table S3.

-please add a column in table 1 to label the high-NOx, low-NOx and NOx-free levels.

We have added this column to Table 1.

-line 178, delete (Lin et al., 2014b). Citation already given in line 176, be careful about repeating the citation, line 194, 220, 240, 242: : :: : :

Repeating citations have been deleted.

-line 242 and line 412, there is some ambiguity. Is biomass burning anthropogenic or non-anthropogenic? In line 242 the authors see it as anthropogenic, in line 412, however, it is treated as non-anthropogenic.

The discussion at line 242 was mainly focused on the impacts of biogenic VOCs, specifically isoprene. To avoid confusion, lines 243-246 have been edited as:

Hecobian et al. (2010) measured the light absorption of water-soluble organic carbon (WSOC) in Atlanta in different seasons and found that the winter WSOC has a ~3 times higher MAC than *summer, due to* ***~~biomass burning influence in winter~~ a higher fraction of organic aerosols formed from biogenic VOCs in summer*** *(Hecobian et al., 2010).*

-line 273 to line 275: I would suggest rephrasing the sentence.

The sentence is rephrased as:

A third possibility is that organic peroxides and alcohols, which were shown to be the dominant component of isoprene SOA (Krechmer et al., 2015), may react with toluene SOA components to produce oligomers capable of absorbing in the UV/VIS that are not present in the single-precursor SOA particles.