

Title: Aerosol chemistry, transport and climatic implications during extreme biomass burning emissions over Indo-Gangetic Plain
MS No.: acp-2018-446

Authors sincerely appreciate the careful reviews and suggestions provided by the reviewer and thank the reviewer and the Editor for their time to evaluate the manuscript. Authors have made appropriate changes to the manuscript in response to the comments that have considerably improved the manuscript. In authors' response, authors have responded point-by-point to comments (reviewer comments in *blue*, authors' responses in *black*), and have included the revisions in the text with and without tracked-changes.

Authors' Responses to Referee # 1

Singh et al. analyse the effects of biomass burning on aerosol distribution, chemistry, and radiative forcing over the Indo-Gangetic Plain combining in situ and satellite-based observations and radiative transfer calculations. Manuscript can be considered for publication in ACP however several comments should be addressed.

1. Page 1, l.36: "weighted of air trajectories" to "weighted air trajectories"
Modified in the revised text.
2. Page 1, l.41: "must need to be studied" to "are needed"
The sentence has been modified (page 1, l.39-41).
3. Page 1, l.42: "in much finer scale to improve parameterization of aerosol/-climate model across the region."
This is not clear. Rewrite or remove.
Authors emphasized that such detailed characterization of aerosol chemistry over IGP will be useful for reducing uncertainties in regional aerosol-climate model. However, as suggested, authors have modified the text (page 1, l.39-41).
4. Page 4, l.10: wunderground.com data is validated with regional weather monitoring station data! Why is that needed, and how good the validation results turned out to be?
To understand the implications of meteorology on particulate mass, daily mean of meteorological variables was required. The regional weather monitoring station, as maintained by India Meteorological Department (IMD), is although located close to the particulate sampling station however, only reports daily maximum (at 1730 h) and daily minimum (at 0830 h). To be accurate, authors have considered daily means from wunderground.com (WU), which reports weather data collected directly from automated weather stations operating at airports (here in Babatpur, Varanasi). The aerial distance of Varanasi airport to particulate monitoring station is 23 km. We therefore, compared daily maximum and minimum (as reported by IMD) against WU reported observations and found no significant difference. Likewise, WU reported daily maximum (R^2 : 0.955) and minimum temperature (R^2 : 0.964) was found well validated against IMD reported observations.
5. Page 4, l.13: What is meant by simulated meteorological observations?
This was in context of ABL height (at 0.5°) which was retrieved from NCEP's Global Data Assimilation System (GDAS). The GDAS is the system used by the NCEP Global Forecast System (GFS) model to place observations from individual station into a gridded model. GDAS adds meteorological observations like surface observations, balloon data, wind profiler data, aircraft reports etc. from a station to simulate a gridded, 3-D, model space available at various resolutions.
6. Page 4, l.14: "measure" to "analyze" in context of NCEP data.

Modified in the revised text (Page 4, l.14).

7. Page 8, l.12: “OPAC derived outputs were tuned in respect to measured relative humidity”. This is not clear. OPAC outputs are for different humidity ranges. How could output be tuned further! clarify / rewrite.
Authors admit the error and deleted the text from the revised manuscript (Page 8, l.14). Authors wish to mention that the OPAC derived outputs (AOD and SSA) are reconstructed in a way so the modelled (OPAC output) and observed/satellite derived values matches within $\pm 5\%$ deviation. Average relative humidity for dominating period (RH: 70%) and for non-dominating period (RH: 80%) was however, considered separately as the prevailing RH only to simulate OPAC model.
8. Page 8, l.15-16: “as an input” to “as inputs”
Modified in the revised text.
9. Fig. 8: Top row, Y scale should have been 0-10 km or so, there is not much data seen above that altitude.
Figure 8 has been modified accordingly.
10. Section 3.3.: key sources of BC aerosols over the stations and nearby should be discussed based on literature (Kumar et al., JGR, 2015)
Thanks for the suggestion. Authors have addressed the point that diurnal variation in BC was in fact not driven by anthropogenic emissions rather by the changes in the regional meteorology, especially ABL. Authors have included additional discussion on BC sources in the revised text based on Kumar et al. 2015b (Page 11-12, l.29-4).
11. Page 13, l.23: “has” to “have”
Modified in the revised text.