

Interactive comment on “A comparison of PM_{2.5}-bound polycyclic aromatic hydrocarbons in summer Beijing (China) and Delhi (India)” by Atallah Elzein et al.

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We thank the reviewer for commenting this paper and we hope our responses below will better clarify the importance of this manuscript, not only to the scientific community but also to policy makers and local governments. We are sorry that the reviewer didn't find the paper exciting, but rigorous analysis of data and factual interpretation can be high value for species where literature observations are relatively sparse.

This manuscript fits well within one of the science focus of ACP (aerosols, field measurements and chemical composition), and also submitted as part of the wider investigation on Beijing air quality (Special Issue: In-depth study of air pollution sources and

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processes within Beijing and its surrounding region (APHH-Beijing) (ACP/AMT inter-journal SI)). To the best of our knowledge, there is no published work in ACP showing the day/night variation of PAHs in Delhi. A direct comparison using the same methods and techniques for PAHs in Beijing and Delhi is also absent from the literature. In this work, we have collected, extracted and analysed particle samples using the same analytical method, which provides a sensitive comparison of PAHs and of emission control policies between two megacities, Beijing and Delhi. This study shows that the adverse health effects from inhalation exposure to PAHs in Delhi is 2.2 times higher than in Beijing, assessed using the same LECR method. Returning to the question of what causes PAHs to exhibit the diurnal and nocturnal variation, and the new findings from high-time resolution samples. As discussed in section 3.2, seasonal variation plays an important role on ambient concentrations of PAHs. However, the variation between day and night depends on many factors including natural impacts and circumference of the sampling location. In both cities, Beijing and Delhi, the concentration of total PAHs in the first 3 h filter (08:30–11:30) of the day appear to be higher than the rest of the day, suggesting a potential relation with the early morning rush hour time and vehicle emissions. Despite the higher boundary layer height during the day in Delhi, PAHs concentration in the first 3 h filter support their direct emissions from local sources especially petrol vehicles.

The difference in PAHs variation between day and night in Beijing is not significant and emission sources were mostly related to petrol combustion emissions and local emission sources rather than contribution from long range transport. However, in Delhi, PAHs variation between day and night was significant. It could be affected by multiple factors including the spatial variation, the input from multiple local sources, the surroundings of the sampling site, and the meteorological conditions in the north of Delhi. The higher total PAHs concentration at night in Delhi could also be related to emissions from biomass burning, waste burning, solid fuel cooking and heavy duty diesels entering the city at night-time. To the best of our knowledge, this is the first time that there has been an attribution of the higher concentration of PAHs at night time to natural

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influences such as the lower atmospheric mixing heights as shown in Fig. 4. Another important factor that can negatively impact PAHs concentration in daytime is the higher concentration of ozone and on filter oxidation, discussed in section 2.4, 3.2 and 3.3.

So, the new findings are not just about the high-time resolution samples, but also include the important role of natural impacts on PAHs variation such as the boundary layer height at night-time in Delhi. Moreover, the contribution from long range transport in Delhi need more investigation using correlation studies between different types of pollutants. The new findings identified the major sectors that could be subject to mitigation measures and may improve air quality in both cities. The high-time resolution samples clearly provide a better assessment of PAH concentrations and can reflect direct source emission signals as modified by meteorology during the daytime and night-time. We note that the reviewer did not include any citations to literature reporting equivalent findings and so we contend that whilst of course previous measurement of PAH have been made in both cities, this paper adds new insight into controlling processes and sources.

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