

# ***Interactive comment on “Polycyclic aromatic hydrocarbons (PAHs) in aerosols over the central Himalayas along two south-north transects” by Peng Fei Chen et al.***

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In addition to the comments made by referees, please address the following comments and suggestions:

1. The review of prior studies of PAH in the Himalayas on page 4 line 15-16 is very terse and has overlooked several relevant publications that provide insight to PAH sources and seasonal variation in the Himalaya:

Chen, P. F., S. C. Kang, C. L. Li, M. Rupakheti, F. P. Yan, Q. L. Li, Z. M. Ji, Q. G. Zhang, W. Luo and M. Sillanpaa, 2015. Characteristics and sources of polycyclic aromatic hydrocarbons in atmospheric aerosols in the Kathmandu Valley, Nepal. Science of the

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Total Environment 538, 86-92.

Kim, B. M., J. S. Park, S. W. Kim, H. Kim, H. Jeon, C. Cho, J. H. Kim, S. Hong, M. Rupakheti, A. K. Panday, R. J. Park, J. Hong and S. C. Yoon, 2015. Source apportionment of PM10 mass and particulate carbon in the Kathmandu Valley, Nepal. Atmospheric Environment 123, 190-199.

Stone, E. A., J. J. Schauer, B. B. Pradhan, P. M. Dangol, G. Habib, C. Venkataraman and V. Ramanathan, 2010. Characterization of emissions from South Asian biofuels and application to source apportionment of carbonaceous aerosol in the Himalayas. Journal of Geophysical Research-Atmospheres 115.

2. In light of the abovementioned source apportionment studies – there is evidence for multiple sources of PAH (e.g. coal, biomass, and fossil fuel use) in the Himalayas. The limitations of using PAH isomer ratios for source identification in the presence of multiple sources should be discussed.

3. Isomer ratios of PAH have also been utilized as a measure of atmospheric aging, particular photochemical degradation (see Bi et al. 2003). Use of the appropriate isomer ratios to track aging may be useful in establishing quantitative support to evaluate local versus long range transport of PAH.

Bi, X. H., G. Y. Sheng, P. Peng, Y. J. Chen, Z. Q. Zhang and J. M. Fu, 2003. Distribution of particulate- and vapor-phase n-alkanes and polycyclic aromatic hydrocarbons in urban atmosphere of Guangzhou, China. Atmospheric Environment 37 (2), 289-298.

4. I concur with referees concerns with the validity of dry deposition flux estimation. A “rough estimation” using an assumed, untested, and unexplained deposition velocity is not valid. The only conclusion drawn is that flux trends follow concentration, which is obvious from Equation 1 when assuming a fixed deposition velocity. The resulting data are not used “assess the atmospheric environment and its impacts on the Himalayan ecosystem” as noted on page 14 lines 14-15. Consequently, section 3.4 should be

removed from the manuscript.

5. In the abstract, a number of improvements are needed: a) clarify the importance of studying PAH in the Himalays (“understanding. . . remains limited” is too vague); b) the names of the sites (with their altitudes) should be listed following “Himalayas:” at line 5; c) define  $x$  and  $y$  in the equations at lines 12-13.

6. In the introduction (page 3 line 15) clarify what “atmospheric mechanisms” specifically need to be understood and why.

7. The motivation to study PAH should be justified and clarified in the introduction. PAH generally have low acute toxicity to humans, and their most significant endpoint is cancer.

8. The “sum of PAH” noted on page 3 line 22 is not operationally defined by the method of analysis; indicate the number of PAH and number of rings considered in this summation to provide context for these numbers.

9. Likewise, the phrase “total PAH” must not be used in describing the measurements from this study, as not all PAH isomers were quantified. Instead “measured PAH” should be used throughout, e.g. in the caption for Table SI-1.

10. The following clarifications to the methods are needed: a) why is hexamethylbenzene used as an internal standard? A number of PAH internal standards are reported in the SI; what is the relationship to this compound? b) do ambient measurements correspond to local / ambient temperature and pressure, or standard conditions?; c) GC film thickness is needed on page 7 line 12; d) number of field and laboratory blanks analyzed; e) detection of analytes (other than naphthalene) in field blanks; f) treatment of field blanks, e.g. field blank subtraction; g) number of spike samples; h) preparation of spike samples; i) a section describing statistical analysis software and methods (e.g. ANOVA).

11. The statement about “similar altitudinal distributions” on page 11, line 4 needs clar-

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ification. Does this refer to similar logarithmic distributions in prior studies? References are needed.

12. A value and corresponding reference is needed on page 16 line 1 for the value for wheat burning.

13. In SI-1, revise to read “70 eV” and “-20 C until injection.”

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