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Atmospheric Chemistry and Physics Discussions

# *Interactive comment on* "Atmospheric pollutant outflow from southern Asia: a review" *by* M. G. Lawrence and J. Lelieveld

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Overall: This is an impressive and thorough review of the status of our understanding of the problem. The start with the perspective provided by the INDOEX experiment during late 1990s and then bring in field campaigns and modeling studies conducted post-INDOEX. The review covers the chemistry, transport and climate implications of the brown clouds. The literature coverage is also extensive. The paper is also written very well and was a good reading in spite of the length of the paper and the in-excusably small font and even smaller figures and Tables. My major comments are the following:

1. One of the important deductions in the paper is that top-down estimates of emission are3 much larger than the bottom-up emissions. This difference is particu-



larly large for BC , for which, according to the authors: the top-down will yield 2 to 3 GT/ yr while the emission inventories suggest 0.5 T/Yr. This is a fundamentally important result for the current debate on BC radiative forcing, where estimates based on observed aerosol optical depths and BC yield a global radiative forcing of 0.9 Wm-2 (Ram and Carmichael, Nature_Geosic, 2008), while IPCC models which use emission inventories estimate it to be 0.3 Wm-2 (IPCC-AR4). The authors have buried it deep in the text; it should be highlighted in the conclusions as a separate item and briefly mentioned in the Abstract.

2. Pollution in-flows in the Himalayan-Tibetan region: The authors touch on this important topic. ABC and other projects are showing large concentrations on BC in the elevated Himalayas and Tibetan region. This poses threat to the glacier retreat. It will be insightful if the authors can show schematics for the monsoon and the dry season, various pathways of pollution into the Tibetan-Himalayas region.

3. One of the major accomplishments of INDOEX was to observe and quantify the aerosol indirect forcing (e.g Heymsfield paper; and composite figure shown in Ramanathan et al, Science 2001). The authors should touch on this fundamental topic.

Editorial and technical Comments:

1. The font size of the text should be enlarged (to at least 12 font) and Tables also should have larger font.

2. Introduction starts with INDOEX. It will help the reader to have following statements as guide to the reader: The INDOEX had two major objectives: to understand the anthropogenic aerosols and their impacts on radiative forcing and regional climate; to understand the ozone and other oxidant chemistry due to

pollution. The overall results on the aerosol part as well as the field component of INDOEX are summarized in Ramanathan et al (2001; JGR) and the chemistry components are summarized in Lelieveld et al (2001). The major papers from the field campaigns are published in two special volumes of J Gephsy Res.

Let me again repeat that this is an excellent review and will serve as a surrogate text book for the future.

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