Title:	Quantifying the contribution of long-range transport to particulate matter (PM) mass loadings at a suburban site in the north-western Indo-Gangetic Plain (NW-IGP)
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Abstract:	Many sites in the densely populated Indo-Gangetic Plain (IGP) frequently exceed the national ambient air quality standard (NAAQS) of 100 µg m-3 for 24 h average PM10 and 60 µg m-3 for 24 h average PM2.5 mass loadings, exposing residents to hazardous levels of particulate matter (PM) throughout the year. We quantify the contribution of long-range transport to elevated PM levels and the number of exceedance events through a back-trajectory climatology analysis of air masses arriving at the IISER Mohali Atmospheric Chemistry facility (30.667° N, 76.729° E; 310 m a.m.s.l.) for the period August 2011-June 2013. Air masses arriving at the receptor site were classified into six clusters, which represent synoptic-scale air-mass transport patterns. Long-range transport from the west leads to significant enhancements in the average fine- and coarse-mode PM mass loadings during all seasons. The contribution of long-range transport from the west and south-west (source regions: Arabia, Thar Desert, Middle East and Afghanistan) to coarse-mode PM varied between 9 and 57 % of the total PM10-2.5 mass. Local pollution episodes (wind speed < 1 m s-1) contributed to enhanced PM2.5 mass loadings during both the winter and summer seasons and to enhanced coarse-mode PM only during the winter season. South-easterly air masses (source region: eastern IGP) were associated with significantly lower fine- and coarse-mode PM mass loadings during all seasons. The fraction of days in each season during which the PM mass loadings exceeded the national ambient air quality standard was controlled by long-range transport to a much lesser degree. For the local cluster, which represents regional air masses (source region: NW-IGP), the fraction of days during which the national ambient air quality standard (NAAQS) of 60 µg m-3 for 24 h average PM2.5 was exceeded varied between 36 % of the days associated with this synoptic-scale transport during the monsoon, and 95 % during post-monsoon and winter seasons; the fraction of days during which the NAAQS of 100 µg m-3 for the 24 h average PM10 was exceeded, varied between 48 % during the monsoon and 98 % during the post-monsoon season. Long-range transport was responsible for both, bringing air masses with a significantly lower fraction of exceedance days from the eastern IGP and air masses with a moderate increase in the fraction of exceedance days from the west (source regions: Arabia, Thar Desert, Middle East and Afghanistan). In order to bring PM mass loadings into compliance with the NAAQS and to reduce the number of exceedance days, mitigation of regional combustion sources in the NW-IGP needs to be given highest priority.

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