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## Fireworks Induced Particle Pollution: A Spatio-temporal Analysis

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### Abstract

Diwali-specific firework induced particle pollution was measured in terms of aerosol mass loading, type, optical properties and vertical distribution. Entire nation exhibited an increase in particulate concentrations specifically in Indo-Gangetic Plain (IGP). Aerosol surface mass loading at middle IGP revealed an increase of 56-121% during festival days in comparison to their background concentrations. Space-borne measurements (Aqua and Terra-MODIS) typically identified IGP with moderate to high AOD (0.3–0.8) during pre-festive days which transmutes to very high AOD (0.4-1.8) during Diwali-day with accumulation of aerosol fine mode fractions (0.3-1.0). Most of the aerosol surface monitoring stations exhibited increase in PM<sub>2.5</sub> especially on Diwali-day while PM<sub>10</sub> exhibited increase on subsequent days. Elemental compositions strongly support K, Ba, Sr, Cd, S and P to be considered as firework tracers. The upper and middle IGP revealed dominance of absorbing aerosols (OMI-AI: 0.80-1.40) while CALIPSO altitude-orbit-cross-section profiles established the presence of polluted dust which eventually modified with association of smoke and polluted continental during extreme fireworks. Diwali-specific these observations have implications on associating fireworks induced particle pollution and human health while inclusion of these observations should improve regional air quality model.

**Capsule:** Polluted and dust aerosols in the entire Indo-Gangetic Plain modified through Diwali-specific firework emissions with association of smoke and polluted continental aerosol.

**Keywords:** Aerosol; CALIPSO; Fireworks; Indo-Gangetic Plain; MODIS-AOD; OMI.

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