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Title:	Gridded 1 km × 1 km emission inventory for paddy stubble burning emissions over north-west India constrained by measured emission factors of 77 VOCs and district-wise crop yield data
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Abstract:	Every year in the post-monsoon season, ~1.7 billion tons of paddy stubble is burnt openly in the Indo-Gangetic Plain (IGP) producing persistent smog and air quality deterioration that affects the entire IGP. Information concerning the identity, amounts and spatial distribution of volatile organic compounds (VOCs) which drive ozone and aerosol formation is still largely unknown as existing global emission inventories have poor VOC speciation and rely on limited satellite overpasses for mapping burnt areas. Here, emission factors (EFs) of 77 VOCs were measured from paddy fire smoke and combined with 1 km × 1 km stubble burning activity constrained by annual crop production yields and detected fires to compile a new gridded emission inventory for 2017. Our results reveal a large source of acetaldehyde (37.5 ± 9.6 Ggy−1), 2-furaldehyde (37.1 ± 12.5 Ggy−1), acetone (34.7 ± 13.6 Ggy−1), benzene (9.9 ± 2.8 Ggy−1) and isocyanic acid (0.4 ± 0.2 Ggy−1) that are not accounted for by existing emission inventories (GFED, GFAS, FINv2.1). During October–November, these emissions (346 ± 65 Ggy−1 NMVOC; 38 ± 8 Ggy−1 NOx; 16 ± 4 Ggy−1 NH3; 129 ± 9 Ggy−1 PM2.5; 22,125 ± 3674 Ggy−1 GHG CO2 equivalents) are more than 20 times larger than corresponding emissions from traffic and municipal waste burning over north-west India. Mitigation of this source alone can therefore yield massive air-quality climate co-benefits for more than 500 million people.
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