

SEASONAL GRIDDED (~10x10)km EMISSION INVENTORY OF CROP RESIDUE BURNING IN INDIA (2018)



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Introduction:

Crop stubble burning is a global phenomenon which has a significant contribution in climate change, environment and human health. India being an agrarian country where large quantity of agricultural waste is an imperative source of hazardous air pollutants, manifesting peculiar negative effects on climate. This present work is first of its kind to develop such a high-resolution gridded (~10x10) km seasonal national emission inventory of major pollutants from crop-residue burning in 2018. Present work claims to be the most comprehensive and more reliable because it involves ~0.62 million village/district-level micro-level activity data followed by ~585 Million Tons (MT) crop-residue data of 8 different crop species i.e. rice, wheat, maize, mustard, groundnut, sugarcane, coarse cereals and cotton, along with their seasonality data.

Data & Methodology:

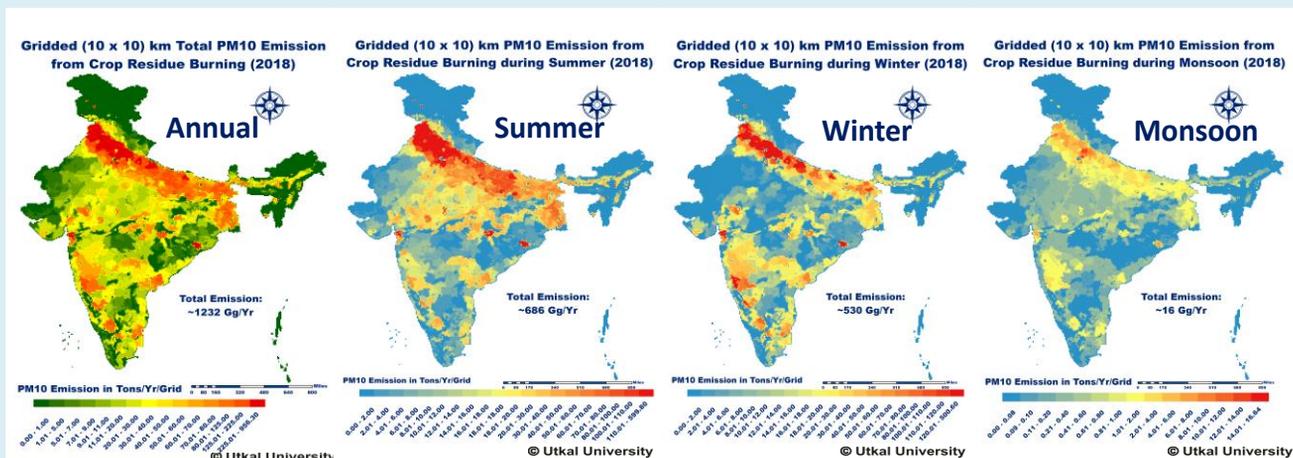
Emission from crop residue burning is calculated using the following equation:-

$$(\text{Emission})_i = \sum C_i (P \times R \times D \times F \times EF)$$

Where:- i = Crop variety; P = Crop production; R = Residue to crop product ratio; D = Dry matter fraction; F = Fraction burnt; EF = Emission factors for air pollutants.

| CROP VARIETY | PRODUCTION (MT) | RESIDUE GENERATED (MT) | RESIDUE BURNT (MT) |
|----------------|-----------------|------------------------|--------------------|
| RICE | 112.91 | 145.65 | 49.09 |
| WHEAT | 99.70 | 139.58 | 34.89 |
| MAIZE | 28.72 | 37.91 | 9.48 |
| MUSTARD | 8.32 | 19.97 | 2.00 |
| GROUNDNUT | 9.18 | 14.69 | 1.47 |
| SUGARCANE | 411.00 | 144.67 | 36.17 |
| COARSE CEREALS | 46.99 | 67.90 | 16.97 |
| COTTON | 6.29 | 15.10 | 1.51 |

Result:



| POLLUTANTS | PM _{2.5} | PM ₁₀ | CO ₂ | CO | NO _x | SO ₂ | CH ₄ | VOC | BC | OC |
|---------------------|-------------------|------------------|-----------------|----------|-----------------|-----------------|-----------------|---------|--------|--------|
| TOTAL EMISSION (Gg) | 990.68 | 1231.26 | 262051.06 | 11208.18 | 484.55 | 144.66 | 785.56 | 1282.95 | 123.33 | 410.99 |

Conclusion: The first ever high resolution gridded seasonal emission inventory of crop residue burning is developed using micro-level crop activity data for base year 2018. As shown in the maps, the Indo-Gangetic Plain experience high PM₁₀ load in all the seasons. The summer season depicts the highest emission i.e. ~686 Gg/yr during the month of Mar-Jun (i.e. Summer), followed by 530 Gg/yr during Sept-Feb (i.e. Winter) and lastly 16 Gg/yr Jun-Sept (i.e. Monsoon). The developed new emission data is part of SaBe National Emission Inventory for India (SNEII v1.0) dataset for climate/chemistry modelling study.