MODELING THE CONTRIBUTION OF WILDFIRE EMISSIONS TO AIR POLLUTION IN KATHMANDU VALLEY

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Problem

The mid-western part of Nepal is at high risk from forest fires. The fire counts (see figure below) show, on average, 2000 occurrence of fire events every year in Nepal [1].

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WRF-Chem modeling system can be used to assess the impact of such wildfires on the air quality and health of people [2]. The fire emissions are available due to the use of remote sensing and GIS [3]. But this impact assessment is difficult due to three aspects in Nepal:

RESULTSContribution of wildfire to:
CO PM_{10} $PM_{2.5}$ 4OD (550 nm)00<

AOD (550 nm) from WRF-Chem Fire Simulation (KTM Domain)

- 1. Complex terrain of Nepal
- 2. Availability of emission data
- 3. Ground-based monitoring data





Method



VALIDATION





CONTRIBUTIONS

Till now, the distribution of wildfire in Nepal has been studied but the effect of the wildfire emissions on the air quality and human health has not been quantified. This research has tried to quantify the contribution of wildfire emissions to the air quality in the Kathmandu Valley. A high-resolution modeling system has been used to simulate the different scenarios of wildfire emissions. The

FUTURE WORK

- 1. Improving the emission data.
- 2. Increasing the model resolution.
- 3. Validation of WRF-Chem with pollution data of Kathmandu Valley.
- 4. Long-term simulations with nested do-

separate domains with resolution 48 km (ASIA Domain) and 6 km (KTM Domain).

Boundary conditions: NCEP Final analysis (FNL); Microphysics: Purdue Lin scheme; Cumulus: New Kain-Fritsch; Longwave radiation: RRTM; Shortwave radiation: Dudhia shortwave scheme; Surface: MYJ; Planetary Boundary Layer: YSU.

Anthropogenic emissions: EDGAR HTAP v2; Chemical initial and boundary conditions: MOZART-4; The biogenic emissions: MEGAN; Fire emissions: FINN v 1.5. In chemistry parametrization, MOZART chemistry with GOCART aerosol was used.

The MODIS Terra and MERRA-2 AOD: from NASA LAADS Web.

main contributions are:

- WRF-Chem modeling system at highresolution that can be used for overall assessment of air quality.
- 2. Quantification of the effect of wildfire emissions on air quality.
- 3. Validation of WRF-Chem with data from remote sensing.
- 4. Importance of local wildfire emissions.

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References

[1] Parajuli, A. *et al.* Spatial and temporal distribution of forest fires in Nepal. In *XIV World Forestry Congress* (Durban, South Africa, 2015).

[2] Crippa, P. *et al.* Population exposure to hazardous air quality due to the 2015 fires in equatorial Asia. *Scientific Reports* **6**, 37074 (2016).

[3] Matin, M. A. *et al.* Understanding forest fire patterns and risk in Nepal using remote sensing, geographic information system and historical fire data. *International Journal of Wildland Fire* **26**, 276–286 (2017).