

Aerosol and CO emissions during *meji* burning

Biomass burning produces emission of a whole variety of trace gases¹, which is a matter of concern due to its effects on atmospheric chemistry and the climate system. We report emission attributes of *meji*² burning, a festive biomass burning ritual, in Assam and the neighbouring states of northeast India.

Bhogali Bihu, the harvest festival of the people of Assam, is celebrated during mid-January each year with an overnight feast on the eve, *Uruga*, and lighting of the *meji* at the dawn of *Bihu*. Assam has a population of 26.66 million spread over an area of 78438 sq. km and has 16,312 villages housing over 87% of the state's population³. As such, there is no estimate of the number of *mejis* burnt each year; however, the number will be on a much higher side than the number of villages. This would account for numerous tonnes of biomass being burnt at a time.

We monitored carbon monoxide (CO) and aerosols of aerodynamic diameter < 2.5 μm ($\text{PM}_{2.5}$) simultaneously during the festival at Tezpur University campus – a receptor site, which is surrounded by villages. Tezpur is centrally located in Assam, geographically positioned at 26°37'N and 92°50'E. There were no *mejis* within 3 km radius of the monitoring site. CO and $\text{PM}_{2.5}$ were continuously measured by TSI Q-Trak Indoor Air Quality Monitor (Model: 8554) and TSI Dust Trak Aerosol Monitor (Model:

8520) respectively, for five days (from 12 to 16 January 2009) at a height of 15 m with half hourly average logging interval.

The CO and $\text{PM}_{2.5}$ concentration ranges were found to be 75–169 and 39–100 $\mu\text{g m}^{-3}$ respectively during the monitoring campaign and the maximum concentrations were recorded during the morning hours on the day of *Bihu*. The average concentration of CO and $\text{PM}_{2.5}$ during the period was found to be $104 \pm 19 \mu\text{g m}^{-3}$ ($n = 124$) and $54 \pm 10 \mu\text{g m}^{-3}$ respectively. The correlation of CO and $\text{PM}_{2.5}$ (Figure 1) suggests that $\text{PM}_{2.5}$ could primarily originate from a combustion source as in the case of CO, which in the present context is *meji* burning.

Carbon monoxide and $\text{PM}_{2.5}$ are both important species in the atmosphere. CO plays an essential role in the oxidative behaviour of the earth's atmosphere and can, therefore, bring about changes in the concentration of trace gases affecting atmospheric chemistry, for e.g., tropospheric ozone build up climate system and the stratospheric ozone. Aerosols in the atmosphere, on the other hand, take part in both positive and negative radiative forcing contributing to both global warming and global cooling. Khalil and Rasmussen⁴ hypothesized in the mid-1990s that the lowering trend of global CO is the reflection of reduction in tropi-

cal biomass burning. However, festive biomass burning can only increase with time because the volume of biomass burnt is a function of population and population, in this part of the world, is constantly on the rise.

Ramanathan *et al.*⁵ projected that for the next few decades, regional aerosol effects will continue to play a major role in affecting the radiation balance of the earth, as long as such strong sources of air pollution remain. They further recommended a reliable global inventory of aerosol emission rates, lifetime and concentration. Festive biomass burning episodes, like *meji* burning of northeast India, must not be left unnoticed. Therefore, an inventory of number, volume of biomass, and volume and characteristics of the emissions from *meji* burning during each celebration every year is a vital task for climate scientists of the region.

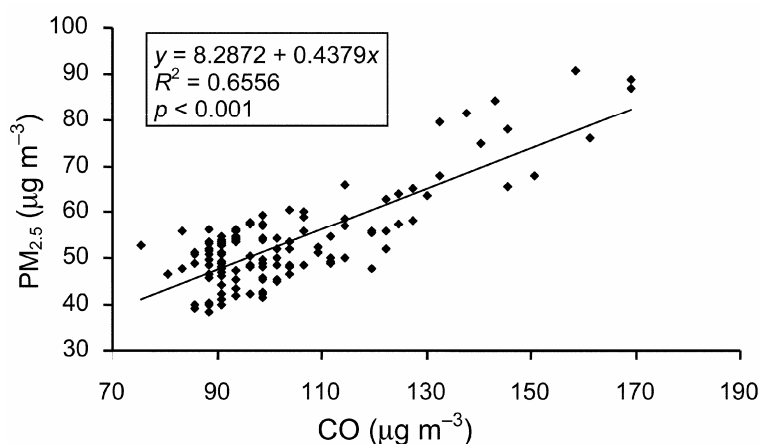


Figure 1. Correlation of CO and $\text{PM}_{2.5}$.

1. Crutzen, P. J., Heidt, L. E., Krasnec, J. P., Pollok, W. H. and Seiler, W., *Nature*, 1979, **282**, 253–256.
2. The *meji* is a structure built of bamboo, leaves, straw and stubble of paddy held tier above tier with bamboo poles giving a lofty temple shaped structure of 5 to ~25 feet in the open fields. It is lit in every Assamese village after community gathering and feasting. It is also observed in open spaces in cities and towns. This can also be seen in the neighbouring states where people of Assamese origin settled, as the northeastern states were one single province – Assam, till they divided as separate states of the Indian Union in 1972.
3. Census Report, Government of India, 2001.
4. Khalil, M. A. K. and Rasmussen, R. A., *Nature*, 1994, **370**, 639–641.
5. Ramanathan, V., Crutzen, P. J., Kiehl, J. T. and Rosenfeld, D., *Science*, 2001, **294**, 2119–2124.

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