



Factors controlling air quality in the Kathmandu Valley, Nepal

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The urban agglomeration of Kathmandu, Nepal (population >2.5 million), sits in a deep bowl-shaped valley, half-way between the Ganges Plains and the Tibetan Plateau. Kathmandu is the largest and the most polluted city in the Himalaya. The air pollution problem in the Kathmandu Valley has been a visible concern for its citizens and policy makers since decades, but has seen very little scientific research compared to other similar cities around the world. In 2004-2005 we conducted the largest field study in Kathmandu to date, collecting high frequency measurements of pollutants and meteorology in and around the valley over an entire nine month dry season. This was followed by pollution transport simulations using the meso-scale model MM5, and more recently the newer model WRF.

We have been able to explain the mechanisms responsible for the daily accumulation of pollutants within and their ventilation out of the valley. The observed early morning and early evening peaks in pollution within the valley are caused by a complex interplay between temporally varying emissions and ventilation patterns. Pollutants emitted within most of the valley are only transported out during limited hours each afternoon, while at night katabatic winds converging over the city push underneath layers of polluted air and lift them up; these re-circulate back to the ground in the morning. Addressing the Kathmandu Valley's local air pollution problem requires careful attention to the timing of emissions within the valley, restricting polluting activities to time periods when air parcels have a short life time within the valley. It also requires paying attention to composition of air flowing into the valley: our measurements upwind and on mountain tops near the Kathmandu Valley found surprisingly polluted conditions ("background" CO concentrations of 500 ppb), attributed to upwind emissions in rural

Nepal and the Ganges Valley beyond.