

## One-year measurements of aerosol vertical profiles in Gual Pahari, India

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Keywords: lidar, lidar ratio, extinction, remote sensing, air pollution.

The effects of atmospheric aerosols and their interactions with clouds have the largest uncertainty in climate forcing estimates (e.g. Ramanathan *et al.*, 2001; Lohmann & Feichter, 2005). Particles affect and change various climatically important factors, like the cloud reflectivity and lifetime. The influence of particles on radiative balance is depending on their properties and vertical profiles.

In Southern Asia only few measurements of aerosol vertical profiles have been carried out, and mostly during short campaigns. Though, these countries have an important role in the battle against pollution and climate change. The largest and most persistent of pollution-caused hazes, the “brown cloud”, covers an area of 10 million km<sup>2</sup> over the Southern Asia and concerns more than 50 % of the world’s population. This particulate air pollution is assumed to originate from fossil fuel and biomass burning. The polluted air is likely to have significant harmful effects on human health and regional climate over Southern Asia (e.g. Pandey *et al.*, 2005; Lau & Kim, 2006; Ramanathan *et al.*, 2007). It is suggested that the atmospheric brown cloud in Asia contributes to the regional lower-tropospheric warming as much as the recent increase of the anthropogenic greenhouse gases (Ramanathan *et al.*, 2007).

We have established a one year campaign of lidar measurements to measure aerosol vertical profiles in Gual Pahari (28°26’N, 77°09’E, 243 m a.s.l.), India. The station is surrounded by agricultural farm fields and forests, about 30 km south of Delhi. The lidar measurements were conducted from March 2008 to March 2009. The measurements belong to the frame of the EUCAARI (European Integrated project on Aerosol Cloud Climate and Air Quality interactions) project.

The instrument used, is a seven-channel Raman-lidar called “POLLY XT–PortabLe Lidar sYstem eXTended” (Althausen *et al.*, 2008). The output of the instrument includes vertical profiles of the particle backscattering coefficient at three wavelengths (355, 532 & 1064 nm) and of the particle extinction coefficient at two wavelengths (355 & 532 nm). The vertically integrated extinction coefficient gives the AOD (Aerosol Optical Depth). Also such size/composition-dependent, intensive particle quantities as the Ångström exponents of the

backscatter and the extinction coefficients, the lidar ratio and depolarisation can be determined. With this optical data it is possible to get information about the particle size distribution and chemical composition with an inversion. The height and the evolution of the boundary layer and night-time residual layer can be defined together with the height and thickness of different cloud and aerosol layers. The depolarisation channel (355 nm) of the lidar enables us to estimate the ratio of ice crystals and water droplets in clouds. The vertical resolution of the system is 30 meters. Depending on the cloudiness the whole troposphere can be monitored (up to few tens of kilometres).

Preliminary results reveal up to 5 km thick aerosol layers, with AODs well above one. The lidar-based AOD values were in line with the values obtained from MODIS (The Moderate Resolution Imaging Spectroradiometer) satellite instrument. Often multi-layer aerosol structure is observed and with backward trajectories the sources areas of various layers can be defined. Furthermore, statistics of the boundary layer evolution will be defined and the measurements will be compared with ground-based measurements at the site. A detailed comparison with AOD obtained from lidar and MODIS will be done. The typical backscattering and extinction profiles for the different seasons will be provided. Attempts to characterize the share of biomass burning aerosol and dust will be done.

This work was supported by the EUCAARI project.

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