Geophysical Research Abstracts
Vol. 13, EGU2011-11151, 2011
EGU General Assembly 2011

Tracking of Urban Aerosols Using a Scanning Mie Lidar

Tingyao He (1), Fei Gao (1), Samo Stanič (1), Klemen Bergant (1,2), Darko Veberič (1), Xiaoquan Song (3), and Aleš Dolžan (4)

(1) University of Nova Gorica, Center for Atmospheric Research, Slovenia (tingyao.he@ung.si), (2) Environmental Agency of the Republic of Slovenia, Ljubljana, Slovenia, (3) Ocean University of China, Qingdao, China, (4) Optotek d.o.o., Ljubljana, Slovenia

Increase of aerosol concentration in urban areas caused by human activities has a significant impact on the status of the environment and quality of life in general. In the cities the presence of aerosols can cause reduced visibility and increase the rates of the atmospheric opto-chemical reactions. Scanning aerosol lidars offer the ability to monitor air pollution, plume dispersion, visibility and to track plumes of potentially hazardous aerosols.

A preliminary study of aerosol monitoring in urban areas was performed over the neighbouring towns of Nova Gorica in Slovenia and Gorizia in Italy using a scanning Mie lidar operating in infrared range (1064nm). The lidar system was developed within our laboratory and can perform hemispherical scans of the atmosphere with high spatial resolution (3.75m). A measuring campaign was done on 24 and 25 May 2010 from 8AM to 7PM to investigate the two-dimensional spatial and temporal distribution of urban aerosols. Two different scanning paterns were used. In a Range Height Indicator (RHI) scan, the elevation angle was increased in 1° steps covering a range of 45° from the horizontal while keeping the azimuth angle constant, and in Plane Position Indicator (PPI) scan, where the elevation angle was set to zero, the azimuth angle was changed in 2° steps covering a range of 62°. Each scan took 8 minutes to complete.

As a result of the study we estimated the detectable lidar range for the device and obtained two-dimensional distributions of increased aerosol loading, which can be used to investigate flow dynamics and locate aerosol sources. We obtained the temporal variation of the spatially averaged aerosol concentration throughout the day. Its most prominent feature was a local peak in aerosol concentration which appeared around noon. The concentration briefly decreased in the early afternoon and increased again to reach its daily peak around 5PM. Based on the aerosol extinction coefficients retrieved by analytical inversion of lidar return signal (Klett method), we found that the atmosphere was not horizontaly homogeneous. Noticeable spatially localized temporal variations of the lidar return signal were also observed, such as the presence of point sources of particulate matter at a horizontal distance of about 2km from the lidar site which was later confirmed in the field.

As the tracking of aerosol features allows us to identify aerosol sources and thus control the emission of pollutants, our future plans are to establish an automated environmental monitoring system that provide spatial distribution of aerosol loading in various environmental settings and to develop data analysis software capable of animated temporal presentations of the plume trajectories.