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Tomographic LP-DOAS measurements of 2D trace gas distributions above the city of Heidelberg, Germany

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LP-DOAS (Long Path-Differential Optical Absorption Spectroscopy) is a well known remote sensing technique for measuring the average concentration of tropospheric trace gases along extended light paths in the open atmosphere. It could already be shown, that tomographic LP-DOAS measurements using several intersecting light paths, give the possibility to retrieve 2D and 3D trace gas distributions with the use of inversion techniques. So far this technique is still in the stage of big developments in the measurement technique and as well in the tomographic reconstruction. Here we present new results from a campaign in Heidelberg, Germany. A measurement set-up encompassing a total of 18 horizontal partly intersecting light paths was realised with three “Multibeam” LP-DOAS instruments. Each of these instruments allows the measurement along 4 light paths simultaneously and more over using scanning techniques, whereby the required time resolution can be achieved. The investigated area of about 4 * 4 km^2 above the city centre covers different urban areas with different emission sources. In the wavelength range from 285nm to 365nm the average concentrations of the trace gases NO2, SO2, O3, HCHO and HONO along each light path could be retrieved with a temporal resolution below 15 minutes. These gases play a major role in the chemistry of the polluted atmosphere, e.g. photo smog. With enhanced measurements and data analysis the evaluated mean concentrations could be improved in accuracy by more than a factor of 2. Therefore it was not only possible for NO2 and SO2 to derive two-dimensional trace gases distributions above the city, but also for the other investigated trace gases. Emission sources varying strongly in space and time can be distinguished and identified mainly as traffic emissions (NO2) and domestic heating (SO2). Coherences between the different trace gases are very good

visible and give the possibility to study the chemical processes as well as transport. New studies were performed to simplify the instrumentations for tomographic LP-DOAS measurements. With this we think that this technique can become important in the near future, for many types of tropospheric trace gas measurements.