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Air pollution monitoring and mesoscale model validation with DOAS: Overview of a multi-year experience

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Effective air quality management of urban and regional air basins requires spatially representative continuous measurements of ambient air pollutants, particularly for regulatory purposes. Measurements alone however do not provide enough information to fully understand the mechanisms that control pollution in a given air basin. This goal can be achieved through simulation with properly validated models, which also allow devising cost-effective air pollution abatement strategies. Simulation models require measurements of compatible spatial and temporal resolution for their validation. Measurement techniques based on open-path absorption, such as DOAS (Differential Optical Absorption Spectroscopy), meet the resolution requirements of mesoscale (regional) Eulerian models by providing concentrations averaged over atmospheric paths ranging from some hundred meters to some kilometers.

This poster summarizes the results of 5 years of research at EPFL/LPAS on DOAS and its application for mesoscale model validation. We introduce the concept of Allan variance for the analysis of the dependence of precision and detection limit on integration time. We also discuss the effect of atmospheric transmission and integration time on collected light intensity and its impact on measurement precision on the basis of field data. Measurements of BTEX, O_3, SO_2, CH_2O, and NO_2 in various European and South American locations are presented. The study of photochemical air pollution in the Grenoble region (GRENOPHOT 1999) exemplifies the application of DOAS mea-

surements for the validation of grid model calculations, particularly of formaldehyde. The representativeness of DOAS measurements is also discussed, particularly on the basis of measurements carried out over a crowded urban zone in a high altitude plateau in Colombia.

Keywords: air pollution monitoring, DOAS, precision, detection limit, monocyclic aromatic hydrocarbons, ozone, sulfur dioxide, formaldehyde, nitrogen dioxide, mesoscale, photochemical grid model, model validation, Andes