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Preliminary Results of the first European Source Apportionment intercomparison for Receptor and Chemical Transport Models

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Source Apportionment (SA) is the identification of ambient air pollution sources and the quantification of their contribution to pollution levels. This task can be accomplished using different approaches: chemical transport models and receptor models.

Receptor models are derived from measurements and therefore are considered as a reference for primary sources urban background levels. Chemical transport model have better estimation of the secondary pollutants (inorganic) and are capable to provide gridded results with high time resolution.

Assessing the performance of SA model results is essential to guarantee reliable information on source contributions to be used for the reporting to the Commission and in the development of pollution abatement strategies.

This is the first intercomparison ever designed to test both receptor oriented models (or receptor models) and chemical transport models (or source oriented models) using a comprehensive method based on model quality indicators and pre-established criteria. The target pollutant of this exercise, organised in the frame of FAIRMODE WG 3, is PM10.

Both receptor models and chemical transport models present good performances when evaluated against their respective references. Both types of models demonstrate quite satisfactory capabilities to estimate the yearly source contributions while the estimation of the source contributions at the daily level (time series) is more critical. Chemical transport models showed a tendency to underestimate the contribution of some single sources when compared to receptor models.

For receptor models the most critical source category is industry. This is probably due to the variety of single sources with different characteristics that belong to this category. Dust is the most problematic source for Chemical Transport Models, likely due to the poor information about this kind of source in the emission inventories, particularly concerning road dust re-suspension, and consequently the little detail about the chemical components of this source used in the models.

The sensitivity tests show that chemical transport models show better performances when displaying a detailed set of sources (14) than when using a simplified one (only 8). It was also observed that an enhanced vertical profiling can improve the estimation of specific sources, such as industry, under complex meteorological conditions and that an insufficient spatial resolution in urban areas can impact on the capabilities of models to estimate the contribution of diffuse primary sources (e.g. traffic).

Both families of models identify traffic and biomass burning as the first and second most contributing categories, respectively, to elemental carbon.

The results of this study demonstrate that the source apportionment assessment methodology developed by the JRC is applicable to any kind of SA model. The same methodology is implemented in the on-line DeltaSA tool to support source apportionment model evaluation (http://source-apportionment.jrc.ec.europa.eu/).