European Intercomparison for Receptor Models Using a Synthetic Database

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Establishing to what extent a methodology for identifying pollution sources is appropriate for a specific purpose and expressing the reliability of the results quantitatively is complex.

In order to assess model performances and estimate their uncertainties, intercomparison exercises (IE) have been conducted within the framework of the JRC Initiative on Harmonization of Source Apportionment with Receptor Models (RM).

The present IE involved 20 expert groups from Europe and 2 from South America and was performed using a synthetic database (DB) developed on purpose.

The test DB consisted of 364 $PM_{2.5}$ daily samples including total mass and 38 inorganic and organic species deriving from a simulation of the CAMx PSAT tool for the calendar year 2005 and extracted for a cell corresponding to the city of Milan.

A total of 26 solutions obtained using the following model versions were reported for evaluation: EPA PMF 3.0 (12), EPA PMF 4.1 (1), EPA PMF 5.0 (1), PMF2 (3), EPA CMB 8.2 (4), CMB ROBOTIC (1), FA MLR (1), COPREM (1) and ME-2 (1).

Participants provided the number and label of the identified sources, their contribution estimation (SCE) and uncertainty. In addition, the source/factor chemical profiles, the contribution of the sources to each species and the contribution of each source/factor in each sample were also reported.

Source/factors identified by participants were classified into 9 different source categories: biomass burning, traffic exhaust, road dust, sulphates, nitrates, crustal material, industry and secondary. An 85% of participants reported a number of source/factors close to the "true" number of sources in the synthetic database (±2).

The inclusion of every source/factor into a category was checked by comparing its chemical profile and time trend with all the other members of the same category and with the reference source. The SCEs of the different solutions were compared with the reference source contributions in the synthetic database using the z-score and z'-score indicators (ISO 5725-5) according to the methodology described by Karagulian & Belis, (2012).

More than 80% of the 200 assessed source/factor contribution estimations met the acceptability criterion when compared to the source contributions used in the creation of the synthetic database. Even though, these results are about 10% lower than those obtained in a previous intercomparison using real-world data, a quite satisfactory ability of RM to retrieve the "true" source contributions comes out from this IE.

Karagulian, F., and Belis, C. A., 2012. Enhancing Source Apportionment with Receptor Models to Foster the Air Quality Directive Implementation. International Journal of Environmental Pollution 50, 190-199.