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Establishing the origin of particulate matter in the Netherlands using LOTOS-EUROS

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To be able to develop effective mitigation strategies to reduce concentrations of both PM2.5 and PM10, the origin of particulate matter needs to be established. For the LOTOS-EUROS chemistry transport model a new module was developed that tracks the origin of primary as well as secondary aerosol components in each process. The source apportionment module was validated with dedicated simulations and functions correctly. It enables to quantify the source contributions of a large set of source at a computational effort of about 20% compared to performing a scenario based assessment for each source. Moreover, the module provides the source attribution under the same chemical regime which is not the situation when a source apportionment is based on scenarios.
The new model was used to establish the source attribution of PM10 and PM2.5 in the Netherlands at a SNAP 1 level, distinguishing between national and foreign sources, for the period 2007-2009. Based on modelled PM, 70-80% of PM10 and 80-95% of PM2.5 in the Netherlands is estimated to be man-made. About 1/3 of anthropogenic PM10 is of Dutch origin and 2/3 originates in foreign countries. For PM2.5, a Dutch share of 30% was found. These figures change with location, with higher foreign shares along the eastern border and higher domestic contributions in the densely populated western part of the country. During peak episodes, natural sources are less important than under normal conditions, whereas especially road transport and agriculture become more important. Model results are also compared to experimental tracer and PMF data. Note, that the model underestimates the total PM10 mass concentration, which is largely explained by the absence of condensable organic material in this version of the model. By using the source apportionment module, new valuable information about particulate matter origin across the Netherlands was obtained.