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Uncertainty calculation in the RIO air quality interpolation model and aggregation to yearly average and exceedance probability taking into account the temporal auto-correlation.

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RIO is an operational air quality interpolation model developed by VITO and IRCEL-CELINE and produces hourly maps for different pollutant concentrations such as O_3, PM_{10} and NO_2 measured in Belgium [1]. The RIO methodology consists of residual interpolation by Ordinary Kriging of the residuals of the measured concentrations and pre-determined trend functions which express the relation between land cover information derived from the CORINE dataset and measured time-averaged concentrations [2]. RIO is an important tool for the Flemish administration and is among others used to report, as is required by each member state, on the air quality status in Flanders to the European Union. We feel that a good estimate of the uncertainty of the yearly average concentration maps and the probability of norm-exceedance are both as important as the values themselves.

In this contribution we will discuss the uncertainties specific to the RIO methodology, where we have both contributions from the Ordinary Kriging technique as well as the trend functions. Especially the parameterisation of the uncertainty w.r.t. the trend functions will be the key indicator for the degree of confidence the model puts into using land cover information for spatial interpolation of pollutant concentrations. Next, we will propose a method which enables us to calculate the uncertainty on the yearly average concentrations as well as the number of exceedance days, taking into account the temporal auto-correlation of the concentration fields. It is clear that the autocorrelation will have a strong impact on the uncertainty estimation [3] of yearly averages. The method we propose is based on a Monte Carlo technique that generates an ensemble of interpolation maps with the correct temporal auto-correlation structure. From a generated ensemble, the calculation of norm-exceedance probability at each interpolation location becomes quite straightforward. A comparison with the ad-hoc method proposed in [3], where the uncertainty on the number of exceedance days was calculated from the range in number of exceedance days obtained when adding and subtracting the uncertainty on the yearly average concentrations on a daily basis, learns that the Monte Carlo method yields slightly higher uncertainties on the number of exceedance days. In general both methods however deliver reasonably similar uncertainty estimates.

We will present uncertainty maps for the PM_{10}, NO_2 and O_3 yearly average concentrations in 2008 derived over the Belgian territory as well as the exceedance probability of the PM_{10} norm of 50 μg/m3.

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References

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