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APPLICATION OF GENETIC ALGORITHMS FOR THE CALIBRATION OF AN AIR QUALITY MODEL AND ITS VALIDATION USING POLLUTANT MEASURES FROM THE SURROUNDINGS OF AN ELECTRIC POWER PLANT

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This work presents the calibration and validation of an air quality finite element model applied to emissions from a thermal power plant located in Gran Canaria. The calibration is performed using genetic algorithms. To calibrate and validate the model, the authors use empirical measures of pollutants concentrations from 4 stations located nearby the power plant; an hourly record per station during 3 days is available. Measures from 3 stations will be used to calibrate, while validation will use measures from the remaining station.

The air quality model involves the generation of an adaptive tetrahedral mesh, the computation of an ambient wind field, the inclusion of the plume rise effect in the wind field, and the simulation of transport and reaction of pollutants, as described in [1]. The wind field has been computed following the method described in [2] using results from the HARMONIE meso-scale model. The model's parameters are the wind field, the diffusion and the chemical reactions among pollutants. The diffusion parameter is the most uncertain, therefore it will be estimated.

To calibrate the model the diffusion parameter is estimated using a genetic algorithm. The fitting function to be minimised is the root mean square error (RMSE) of the pollutant concentrations given by the model with respect to the empirical measures.

Once the model is calibrated, the validation is performed by comparing the resulting concentrations and the empirical measures not used in the calibration.

The successful validation proves the utility of the proposed model.

References:

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[2] Oliver A, Rodríguez E, Escobar JM, Montero G, Hortal M, Calvo J, Cascón JM, Montenegro R, (2014) Wind Forecasting Based on the HARMONIE Model and Adaptive Finite Elements. Pure Appl. Geophys.