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Sequential ozone assimilation on a chemistry-transport model, CHIMERE, at a regional scale

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This paper evaluates the performance of a sequential data assimilation system applied to the regional chemistry-transport model CHIMERE, combined with the hourly ozone surface observations in the greater Paris. Our objective is to obtain a more reliable pollutant concentration field, taking into account the model and the observations. We used for this purpose the Ensemble Kalman Filter (EnKF) algorithm. While the EnKF algorithm has been applied mostly for solving large-scale assimilation problems in the atmospheric field, our study case focuses on a regional scale.

Our first implementation of the assimilation system explores the effect of adding pseudo-random fields with prescribed characteristics (mean and variance) to the ozone concentrations, using the Fast Fourier Transform. In this way it is possible to take into account the inaccuracies of the deterministic model. The initial ensemble was generated from a free-run model state, to which we added smooth pseudo-random fields. For each ensemble member, the new ozone concentration was obtained by adding some smooth fields to the original one, all other variables in the state model (i.e. concentrations in 43 species) remaining those provided by the original model. The test period is the last decade of July 1999.

Our results show, at a regional scale, a consistent improvement of the model output, reducing significantly the differences between the model simulations and the ozone concentrations measured at ground level.