IMPROVING LOCAL WIND SIMULATIONS WITH *Code_Saturne* USING DATA ASSIMILATION

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Local scale atmospheric simulations are necessary to address various issues related to micro-meteorology such as dispersion of pollutants or wind potential estimate. However, local wind fields in wind farms, around industrial sites, and in urban neighbourhoods may be difficult to simulate with CFD models. In fact, these complex wind fields are particularly sensitive to geometrical features (topography, buildings, etc.) and to model inputs, especially the boundary conditions. These boundary conditions are generally provided by larger-scale models or measurements, which may lack accuracy.

Using data assimilation (DA), a few measurements inside the domain could add information to the imprecise boundary conditions and thus greatly enhance the precision of the atmospheric simulations. Data assimilation techniques developed so far in meteorology are generally applied to larger scale simulations that are mainly driven by initial conditions (IC). Local scale simulations are largely determined by the boundary conditions (BC) and new DA techniques are necessary.

Two data assimilation techniques (the iterative ensemble Kalman smoother and the back and forth nudging algorithm) have been adapted to local scale simulations by taking boundary conditions into account instead of initial conditions for which they are usually applied. Their performances have been evaluated at small scales with the CFD model *Code_Saturne* over a 2D realistic topography (XZ plane). The iterative ensemble Kalman smoother (IEnKS) is here presented in greater detail, and compared to the reference method 3D-Var using twin experiments. The IEnKS is thus proved to correct the boundary conditions and substantially reduce the total error, even with sparse observations.

KEYWORDS: Data assimilation, local scale simulations, wind potential estimate, atmospheric dispersion, boundary conditions, *Code_Saturne*, 3D-Var, iterative ensemble Kalman smoother.