NUMERICAL SIMULATIONS OF ATMOSPHERIC POLLUTANT DISPERSION: EFFECTS OF METEOROLOGY AND TOPOGRAPHICAL MODELS

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With the different environment protocols and different worldwide agreements of pollutant limitation and control, the prediction of air quality became crucial. Moreover, when facing a major problem of accidental pollutant release the delicate decision taking would benefit of fast and reliable prediction of atmospheric pollutant dispersion.

The most common methodology to approach the problem is the use of a meteorological mesoscale codes (such as RAMS, MM5, WRF, TVM) to provide the input data required by a dispersion model (FLEXPART, HYPACT, MELPUFF).

On the other hand, Computational Fluid Dynamics (CFD) solvers have became powerful tools for study turbulent flows over complex geometries. It is largely thought today, that a proper coupling of a meteorological mesoscale code with a CFD solver using the LES approach will provide a multiscale system able to produce a reliable history of the 3D map field over any terrain.

At present, an open source code, known as WRF, has been selected and compiled on the VKI cluster. WRF provides the weather prediction to the user on a limited area of several thousand kilometres which correspond to the mesoscale weather forecasting. The next step of this research will consist of a proper coupling between WRF and a LES solver that will predict the turbulent pollutant dispersion at a finer spatial and temporal scale taking into account typical complex terrain that are encountered in the atmospheric boundary layer (ABL).

Based on a successful comparison, the LES flow fields will be used to carry on parametrical studies on various pollutant releases associated to different stability conditions of the atmosphere. The dispersion data will be gathered and analysed. A simplify model based on data reduction will be proposed to allow fast decision taking in case of the release of pollutant in an industrial urban area.



Figure 1. x-component of velocity during the Hurricane Katrina (28th August 2005) at 2Km height