

Atmospheric Boundary Layer simulations with a LES model nested in a regional atmospheric simulation.

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Abstract:

This proposal aims to improve the ability of the `caffa3d`-CFD model by incorporating realistic climate information from a mesoscale meteorological model (WRF). An unidirectional strategy was implemented for the nesting of the models. Once generated the tool will be used to evaluate the flow over a simple geometry in an easy access region selected for which promising results were obtained.

Keywords: WRF, CFD, Nesting.

1 Introduction

Numerical simulations carried out with models that solve relatively large-scale turbulent vortices (Large Eddies Simulation models, LES) can be very appropriate to study atmospheric processes near the ground, specifically in the atmospheric boundary layer. On the other hand, these processes are also determined by movements of the atmosphere of relatively larger scales than the domains of the LES models can resolve, particularly by the mesoscale and the synoptic scale [1]. The boundary and initial conditions of these simulations allow incorporating this information. The prescription of idealized wind or temperature conditions allows valuable studies for many purposes. In any case, realistically prescribing atmospheric circulation variables larger than the LES domain significantly enhances the usefulness of the LES models. In this sense, short-term regional numerical forecast information can be prescribed, as well as interpolation to regular field data grids by assimilating them to short-term numerical forecasts. This paper describes a method for prescribing initial and boundary conditions to a in-house CFD model `caffa3d`. MBR [2] from the regional WRF model, which may or may not include assimilation of field data.

2 Experimental Setup

In this work an unidirectional strategy was implemented for the nesting of the models. The information generated by the WRF is provided to the `caffa3d` model as boundary and initial conditions. Three nested domains of successive higher resolution and smaller size (D1, D2 and D3) were used in CFD simulations. A horizontal mesh was used for each domain with square section cells vertically expanded. In order to increase topography in D2 and D3 data of ASTER Global Digital Elevation Model (GDEM) from NASA was added.

