INVESTIGATION OF ATMOSPHERIC BOUNDARY LAYER APPLYING LARGE EDDY SIMULATION

Giorgio Crasto, Italy
Supervisors: C. Benocci & P. Rambaud

The CFD investigation of the Atmospheric Boundary Layer (ABL) is gaining importance for engineering applications like wind power generation, dispersion of pollutants and other.

RANS approach often doesn't provide a satisfactory solution of flows bounding complex terrains or architectural structures, Large Eddy Simulation (LES) result more promising.

The present project was aimed to analyse the ABL with the LES option of the code Fluent.

Since the wall-functions for rough walls are not available in the LES option of Fluent while they can be applied for the Detached Eddy Simulation (DES), a hybrid method RANS/LES, the latter has been firstly chosen to perform the studies.

The DES simulations on flat terrains showed an overshoot of the velocity in the surface layer. The wall-shear stress resulted underestimated compared to the one predicted by the similarity theory.

The not satisfactory results obtained with the DES led to implement a new UDF (User Defined Function) to define a Smagorinsky model coupled with wall-functions for rough surfaces.
The simulations done with the LES-UDF resulted better than the DES.

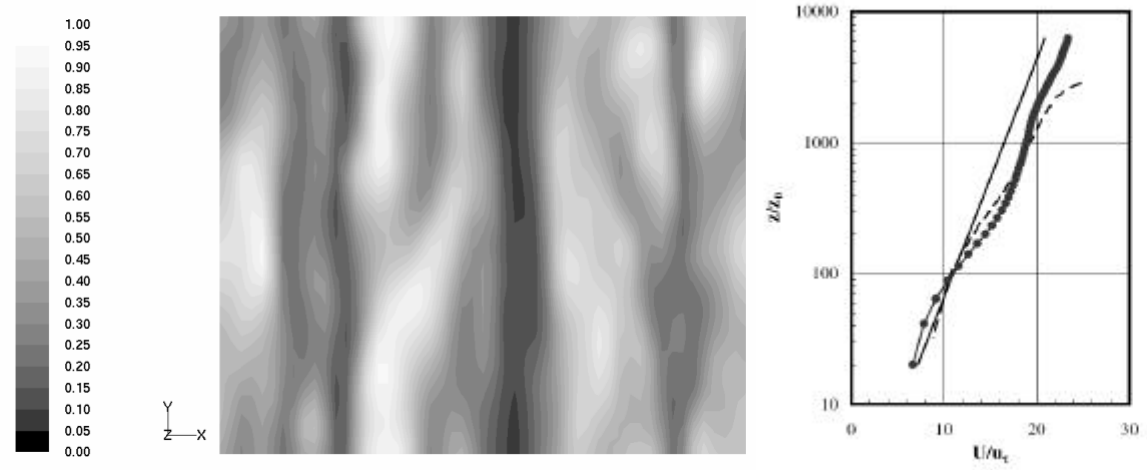

Figure 1: map of wall-shear stress (left), [Pa], traces of super-streaks; (right) normalized velocity profile, solid line LES-UDF, dashed line baseline Sullivan's model (1994).