STUDY OF TURBULENT TRANSPORT OF A PASSIVE SCALAR APPLYING LARGE EDDY SIMULATION

Anna Mueller, Poland
Supervisors: J.-M. Buchlin, C. Benocci, R. Giammanco, P. Rambaud

The advection of any substance by a turbulent flow is important in many natural and engineering settings. In this study we concentrate on the case where the advected substance has no coupling effect on the flow; therefore we consider it a 'passive scalar'.

The practical relevance of understanding the statistics of scalar field fluctuations is obvious if on considers, for example, the probability of the pollutant concentration exceeding some tolerance level as it spreads from the source.

The purpose of this project has been to extend the capabilities of the existing inhouse Large Eddy Simulation code, **MiOma**, in order to add the passive scalar transport equation to the solver. The turbulent transport has been studied on a case of Turbulent Periodic Plane Channel at equilibrium.

MiOma is a natively parallel Large Eddy Simulation solver developed at VKI by R. Giammanco during his doctoral work. It is written in ANSI C and makes use of the PETSc MPI layer for parallel execution. It is a framework containing auxiliary tools for data postprocessing and visualisation, documented with Doxygen and containing 80.000 lines of code.

The new subgrid scale modeling for viscosity was introduced - WALE. Afterwards it was adapted to handle the scalar diffusivity. The newly implemented WALE model is validated both for velocity and scalar fields, comparing with the DNS data of Kim \& Moin for $Re_t = 180$, $Pr = 0.71$.

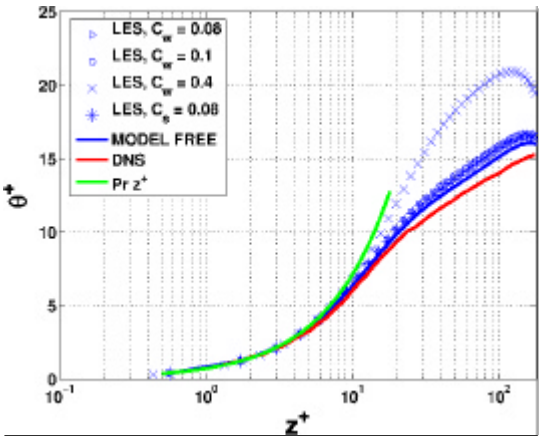

Figure 1: Profile of scalar concentration, model dependence

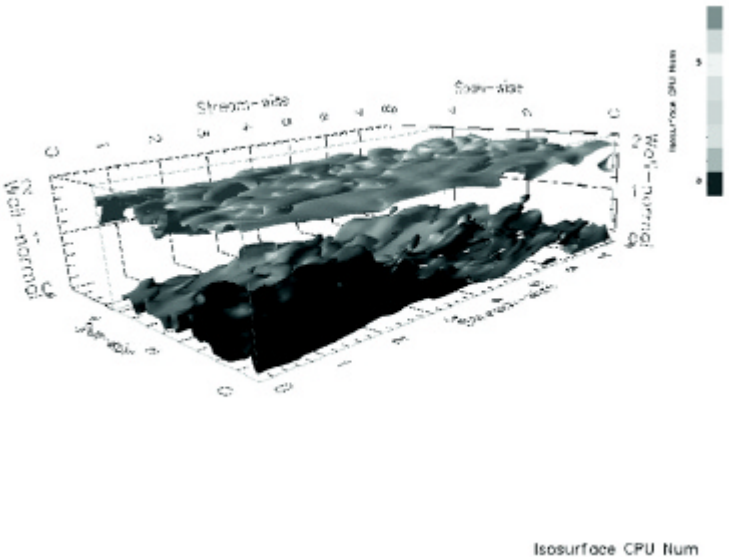

Figure 2: Isosurface of scalar concentration coloured with processor number