CZ.1.05/1.1.00/02.0060: Numerical and experimental models of atmospheric boundary layer turbulent characteristics interacting with building structures

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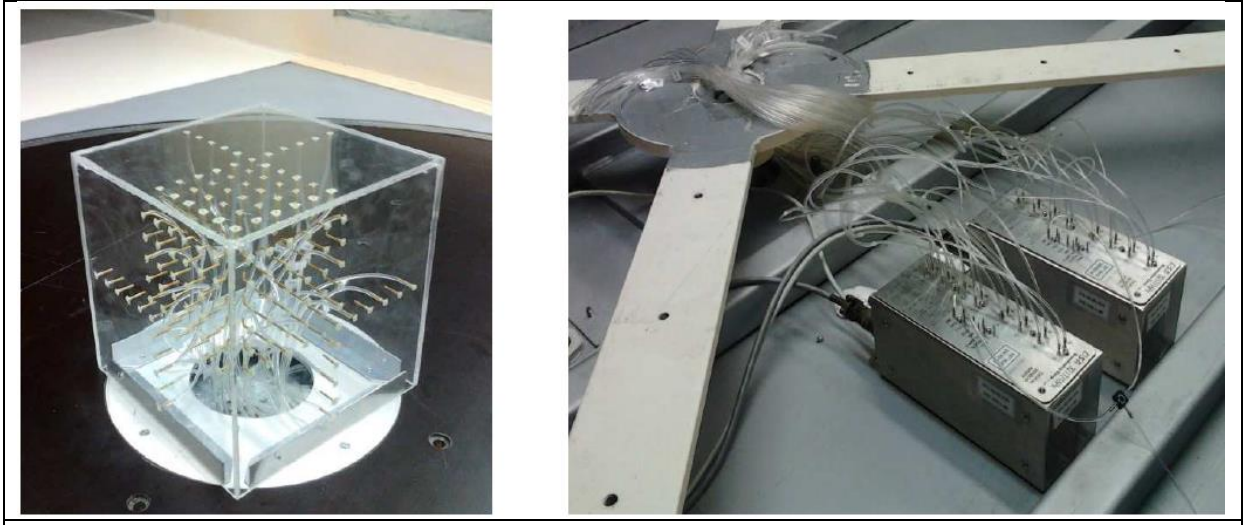
Modelling a flow around low objects of non-aerodynamic shapes brings many problems and this applies to both numerical and physical simulations. The aim of the research was to compare results of the physical and numerical modelling of an air-flow around an object of the shape of a cube with an edge of 0.24 m. It represents the famous experimental benchmark -"Silsoe" cube - with a scale of 1:25 that has gradually become a standardized experimental element in the field of building aerodynamics. The reason for this choice is the possibility of using informative data from measurement in the tunnel to assess the final results of both approaches.

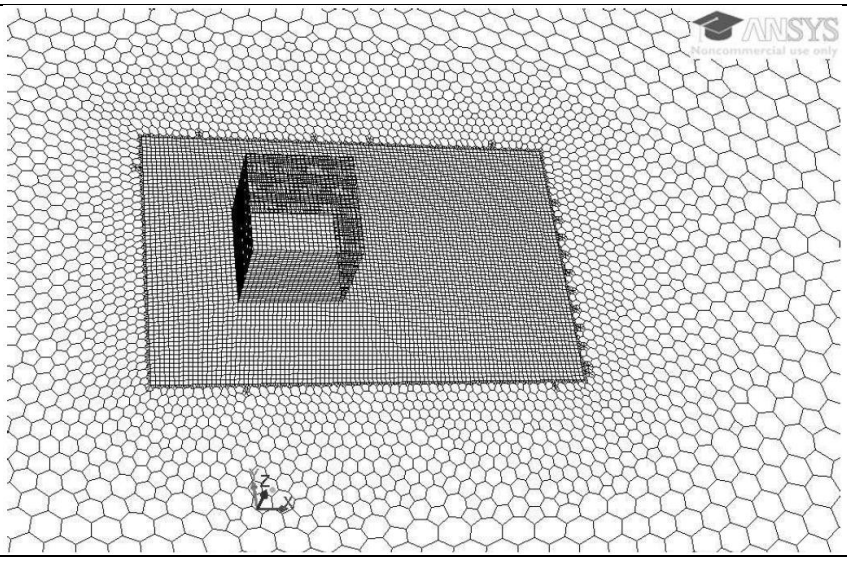


The model in the measuring section and a detail of the measuring pressure scanner below the testing section

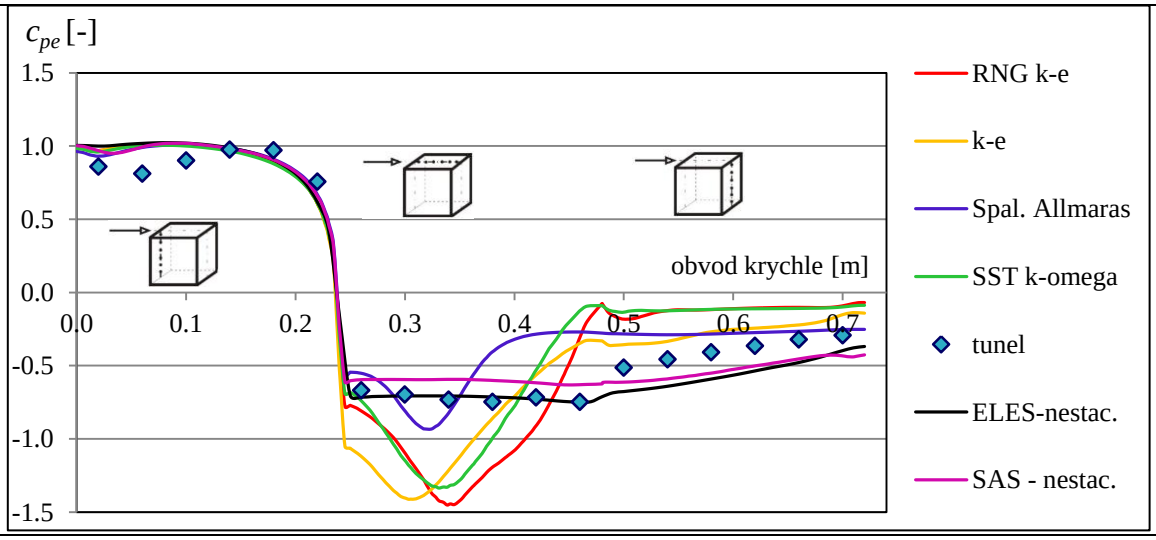
A smooth flow field with a constant vertical velocity profile of 13.5 m/s and a turbulence intensity of approx. 1 % was modelled within a physical experiment in the CET wind laboratory. The object of evaluation is the pressure load of the model due to the effects of a flow field. The external pressure coefficient *Cpe* has been measured, calculated, and evaluated in two sections perpendicular to each other and in a horizontal section.

The non-stationary calculations using the ELES and SAS models achieved satisfactory results. Moreover, the ELES model gave the results on the front, the upper and the both sides almost identical to those measured in the wind tunnel. The results on the leeward side differ slightly. The SAS model correctly copies the shape of the load curve along all three monitored perimeters of the cube being flowed around. A small displacement could be avoided by using a new denser grid and a longer simulated time of a flow, which will be the object of further examinations.

The results of the numerical simulations using the ELES and SAS models for non-stationary problems showed a very satisfactory similarity with the experiment, which is promising for the further modelling with the atmospheric turbulence.



Combined grid for the ELES model



Results and comparison of wind pressure coefficients by alternative methods