# STUDY OF MICRO CLIMATE FOR NEW BELGIAN POLAR BASE

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In 2004 the Belgian government commissioned the design and construction of a new research base in Antarctica. The micro climate of this station requires a careful analysis with respect to wind comfort, wind loading, snow erosion and snow deposition. The goal of the present research project was to perform RANS simulations with the commercial solver FLUENT which complement the extensive wind tunnel test program performed at the VKI.

Simulations of the flow over the topology (a hill of 16m height), were performed to determine the mean velocity field and in particular the speed-up of the flow along the hill.
Model-scale simulations, which reproduced the wind tunnel test conditions, were compared to the available test data and showed a 15% difference in the speed-up ratio on the hill top at 2m above the ground.
From full-scale simulations, with boundary conditions representing the ABL flow as dose as possible, the velocity ratio between the two automatic weather stations positioned on the ridge was extracted. The resulting value was within 5% of the field measurements.
The inlet velocity profile was found to considerably affect the profiles throughout the domain, but the influence on the speed-up factor was less than 20%.

Simulations of the flow around the building integrated on the ridge were performed to obtain the pressure distribution and the corresponding wind loading.
The CFD results for the pressure coefficient differed less than 0.2 (25% of the stagnation pressure) from the wind tunnel tests in 75% of the points where pressure tap measurements were performed. The discrepancy in the resulting drag coefficient varied between 5% and 20% over prediction. The discrepancy in the lift coefficient varied from a 36% under prediction to a 43% over prediction. This scatter is the result of an uncertainty in the wind tunnel pressure measurements on the lower surface, which changed considerably with a variation in the height and inclination of the building.
Based on these results, it was concluded that the CFD simulations provide a sufficiently accurate result for the pressure distribution and the corresponding loading on the building. The determination of the design wind loading for the final building can consequently be determined from CFD simulations, combined with an appropriate safety factor.

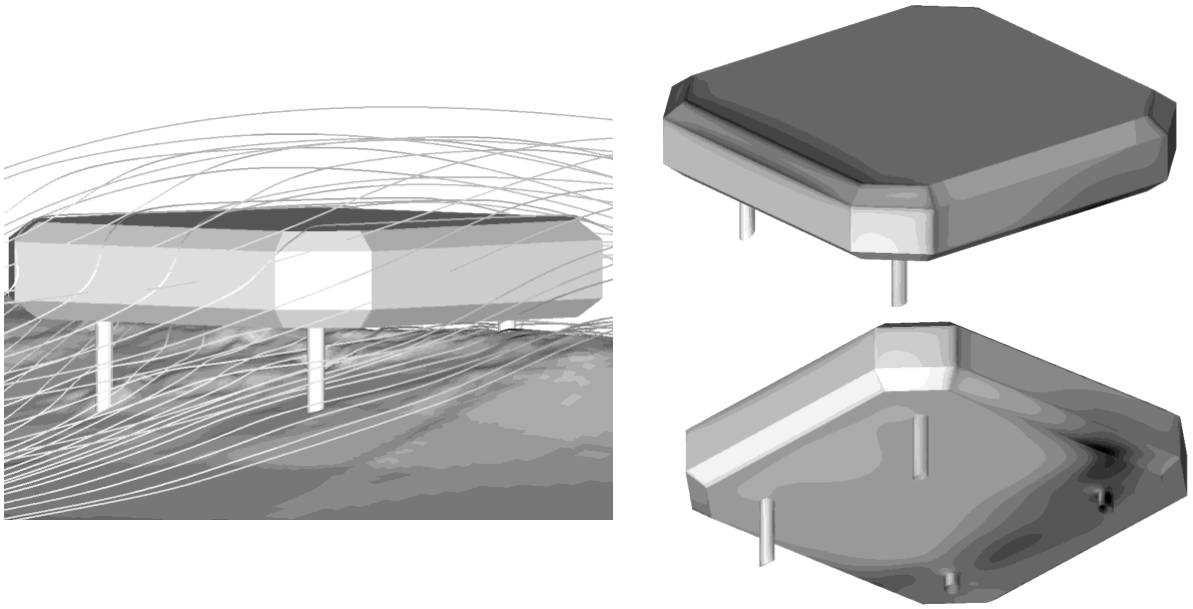

*Figure 1: Flow Pattern around Building and Pressure Coefficient Contours on Building Surface*