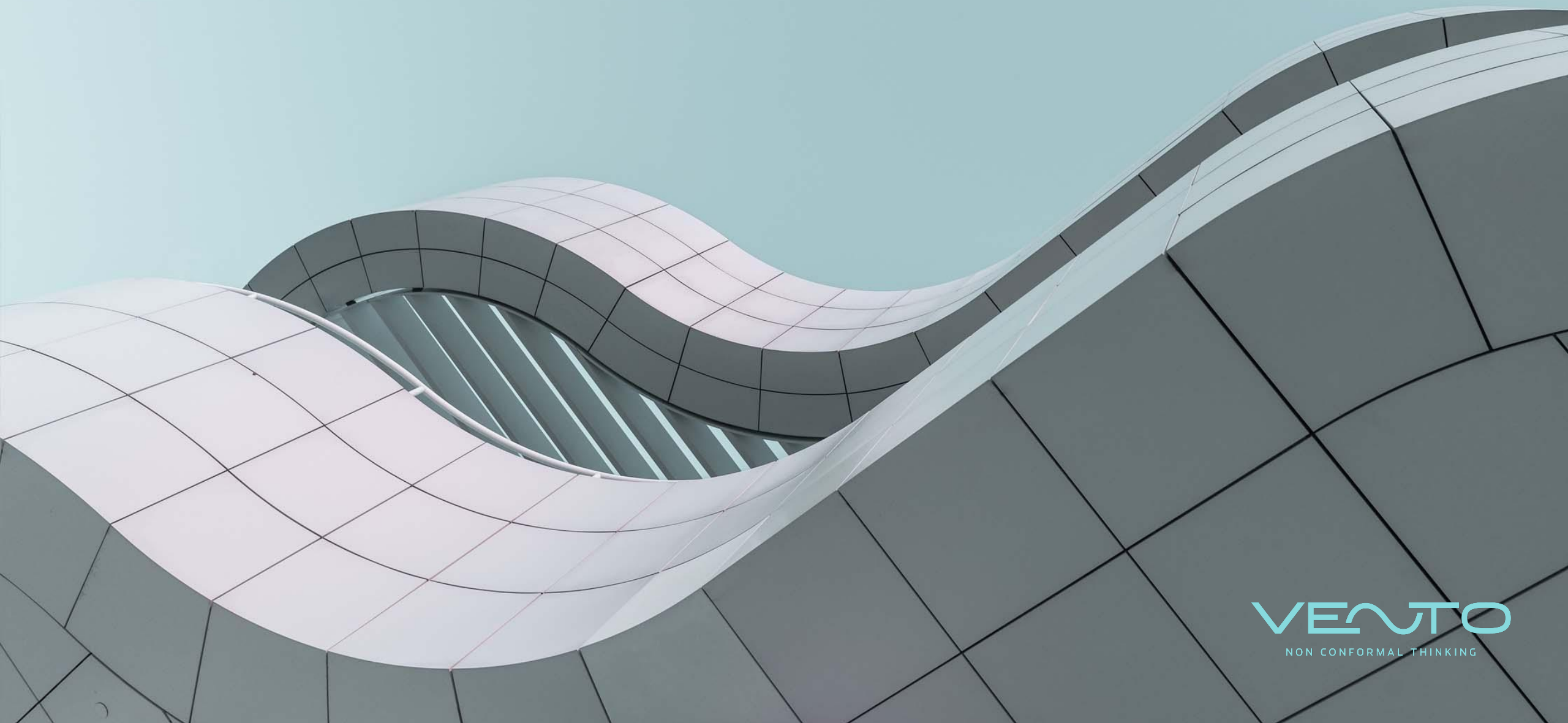


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Validation | Surface pressure coefficients on a Low-Rise Building with Eaves



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Database of Isolated Low-Rise Building With Eaves:
A collection of data on aerodynamic pressures acting on low-rising building with eaves.

Secretariat · Inquiry TPU Aerodynamic Database

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COE Program TPU Wind Effects on Buildings and Urban Environment

The 21st Century COE program
Wind Effects on Buildings and Urban Environment

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Aerodynamic Database of gable-roof low-rise Buildings with varied eaves

• Introduction [click → PDF](#)

An aerodynamic database has been constructed by the Tokyo Polytechnic University as one part of the Wind Effects on Buildings and Urban Environment, the 21st Century Center of Excellence Program, 2003–2007, funded by the Ministry of Education, Culture, Sports, Science and Technology, Japan. Present work is the isolated low-rise building with varied eaves part of the aerodynamic database. Wind loads on low-rise buildings in codes and standards are mainly based on wind tunnel test results on simple models without eaves. Actually, low-rise buildings usually have various kinds of eaves for the sake of usage, which may have some effects on the wind flow around buildings.
To study the effects of varied eaves on wind loads on gable-roofed low-rise buildings, a series of wind pressure measurement wind tunnel test were taken for gabled-roof buildings with slope of 26.7° with 3 kinds of eaves (Type A, B, C), eave height of models varied in 60, 120, 180cm.
12 test cases are included in the following database, from which the local wind pressures, area averaged wind pressure coefficients and wind pressure coefficient time series on roof or wall surfaces and some more detail information can be queried.

Isolated Low-Rise Building with Eaves

Contours of local wind pressure coefficients were measured for all the surfaces of a low-rise building with gable eaves and side eaves (Type C). The test model case used has:

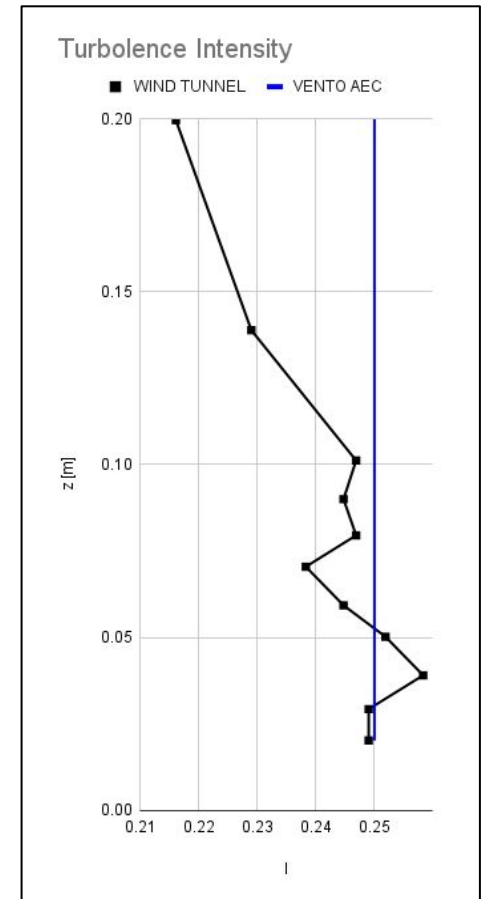
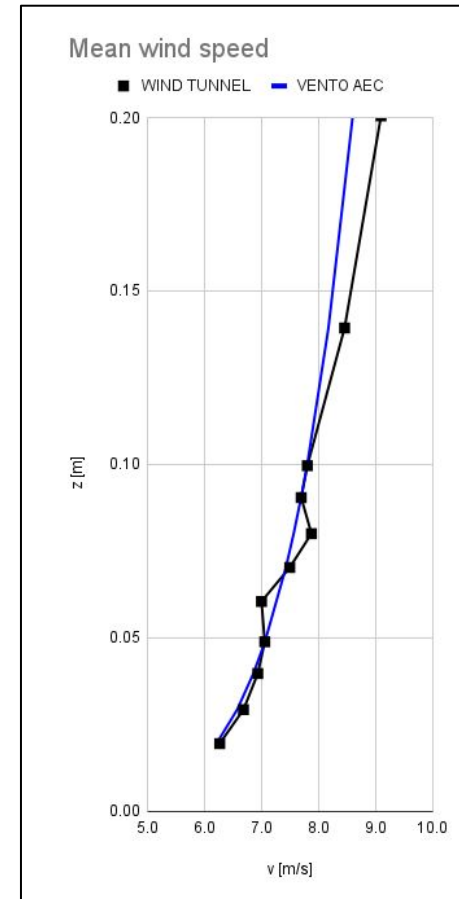
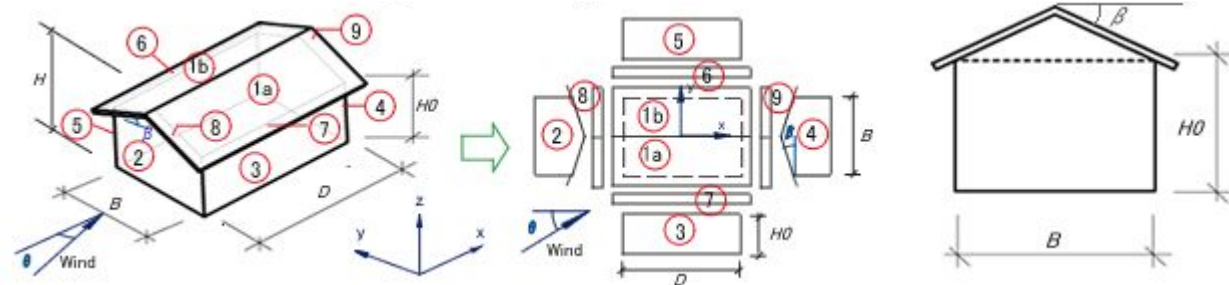
Breadth/Depth/H0=(160/240/120)mm and $\beta=26.7^\circ$

Two wind directions are considered: $\theta=0^\circ$ and 68° .

Velocity and turbulence density (intensity) profiles as a function of height are provided. In Vento AEC, a Power law inlet wind profile was assigned, while the inlet turbulence intensity was set constant to 25%.

The simulation was performed using the k-epsilon (RANS) turbulence model.

Note: Some information from the TPU aerodynamic database is not entirely clear, for instance the reference speed for non-dimensionalization and the scales used to report the pressure coefficients (C_p). For this reason, specific choices were made in the conducted simulations.

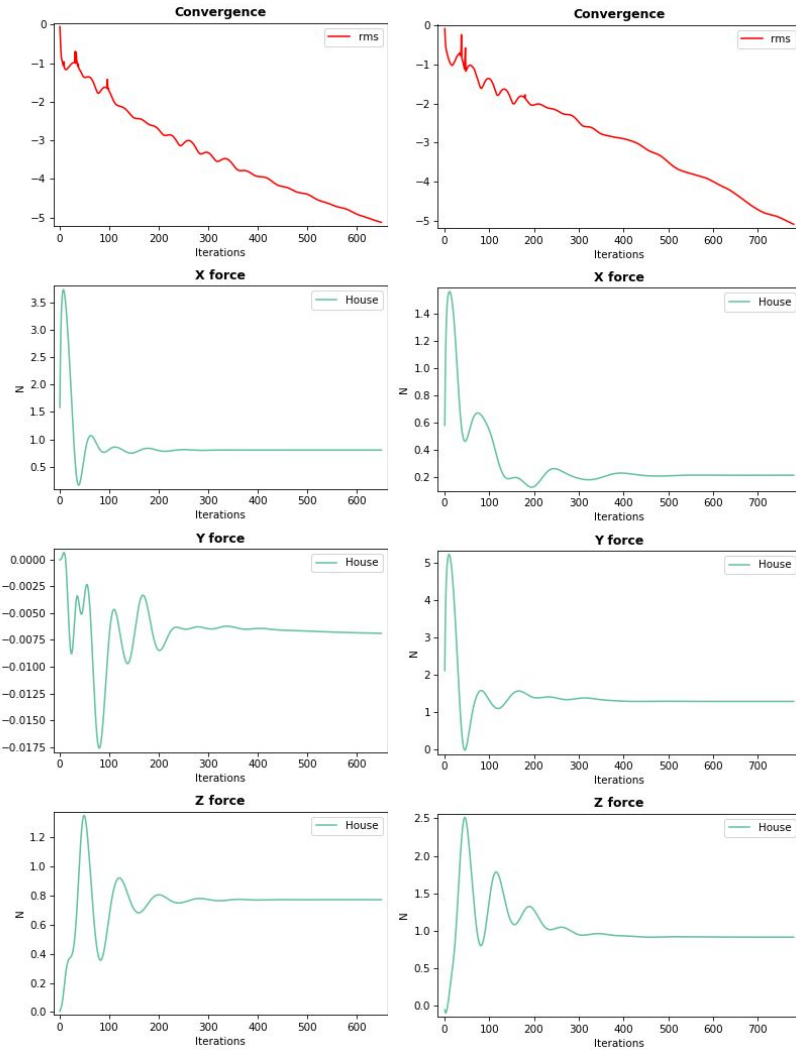


Isolated Low-Rise Building with Eaves

VENTO AEC CFD simulation

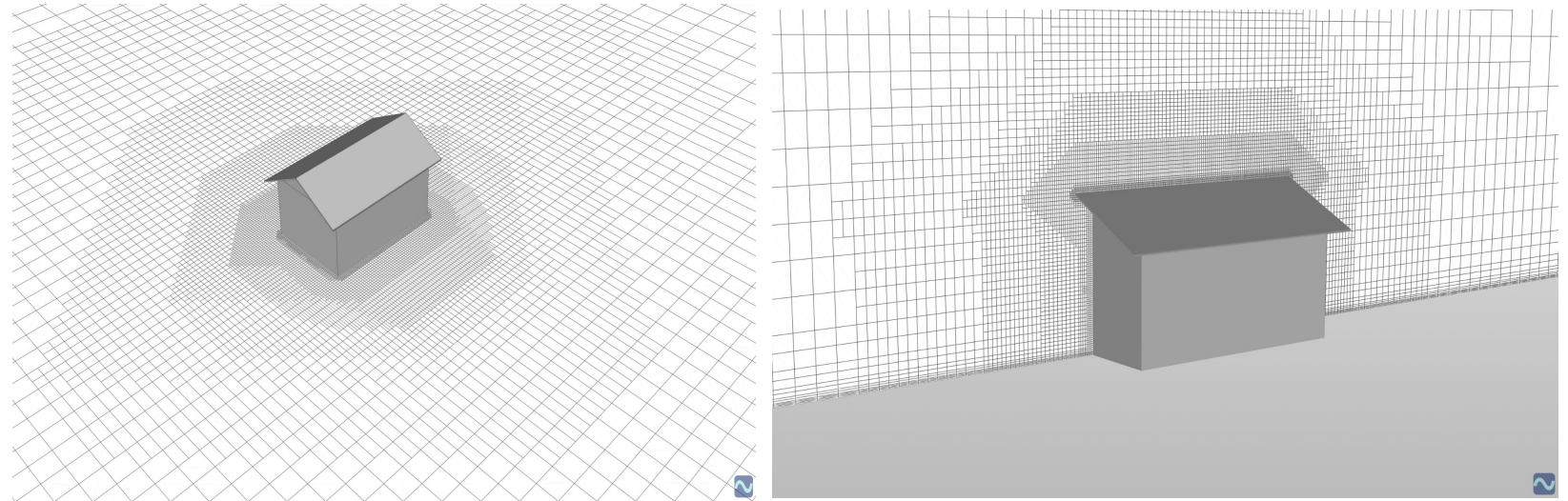
Wind direction $\theta=0^\circ$

Wind direction $\theta=68^\circ$



VENTO AEC: 800 K cells, K & Epsilon turbulence model.

The convergence level -5 was reached in less than 30 min on a 4-cores desktop with CFL=50. Forces were stable after 15 min.

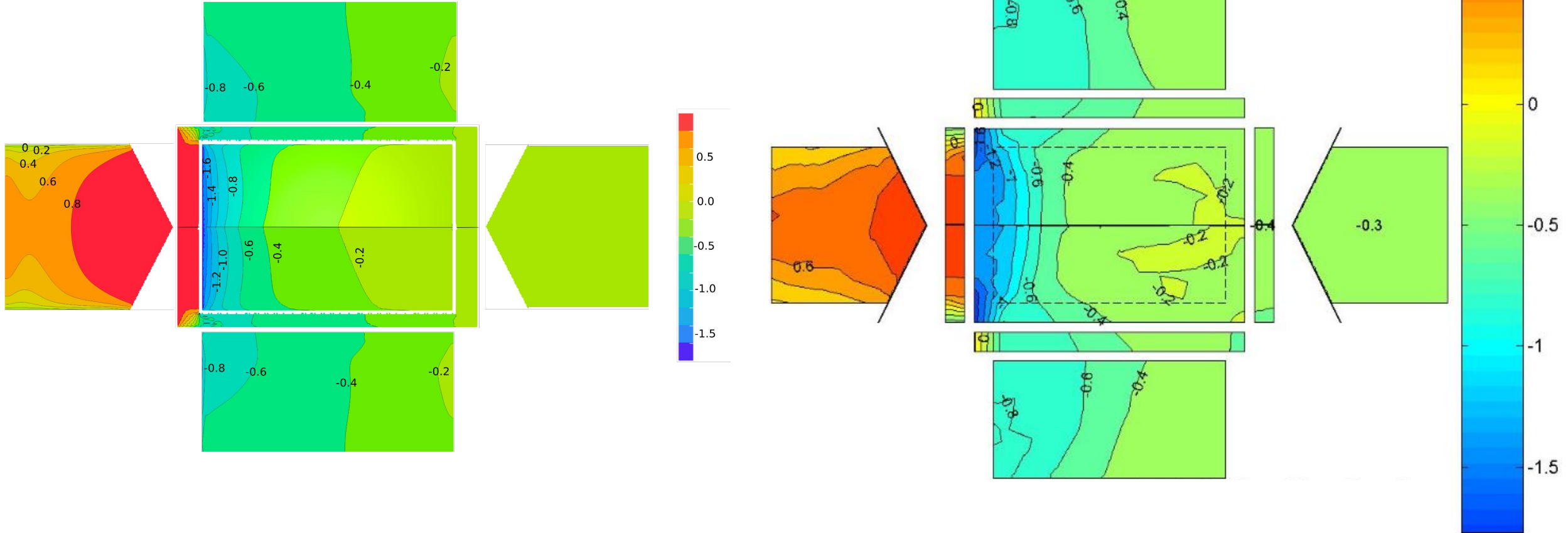


Isolated Low-Rise Building with Eaves

VENTO AEC results vs reference

Contours of local wind pressure coefficient referred to the mean values.

Wind direction $\theta=0^\circ$.



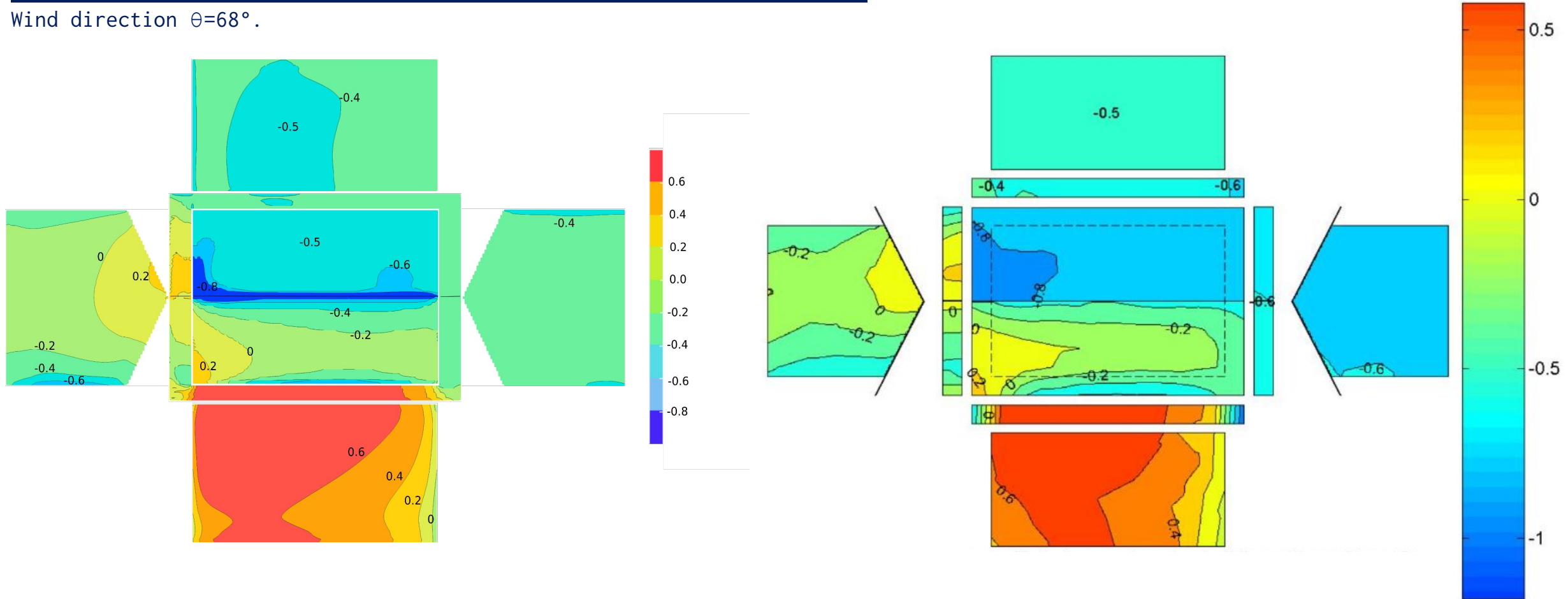
Pressure coefficient is calculated considering the wind pressure of the approaching wind velocity at the average roof height ($0.5\rho V_H^2$, V_H mean longitudinal wind speed at the reference height H , ρ the air density). The scales used for the comparison differ slightly in color shade.

Isolated Low-Rise Building with Eaves

VENTO AEC results vs reference

Contours of local wind pressure coefficient referred to the mean values.

Wind direction $\theta=68^\circ$.

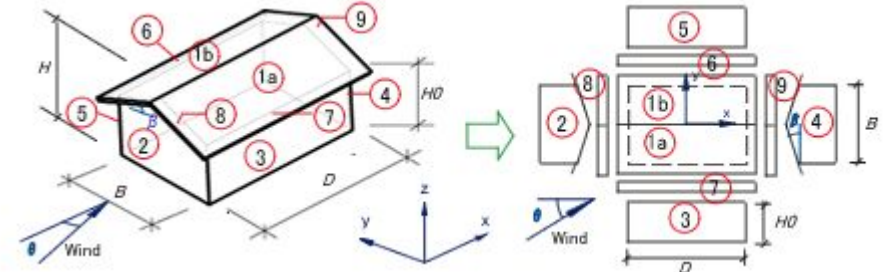


Pressure coefficient is calculated considering the wind pressure of the approaching wind velocity at the average roof height ($0.5\rho V_H^2$, V_H mean longitudinal wind speed at the reference height H , ρ the air density). The scales used for the comparison differ slightly in color shade.

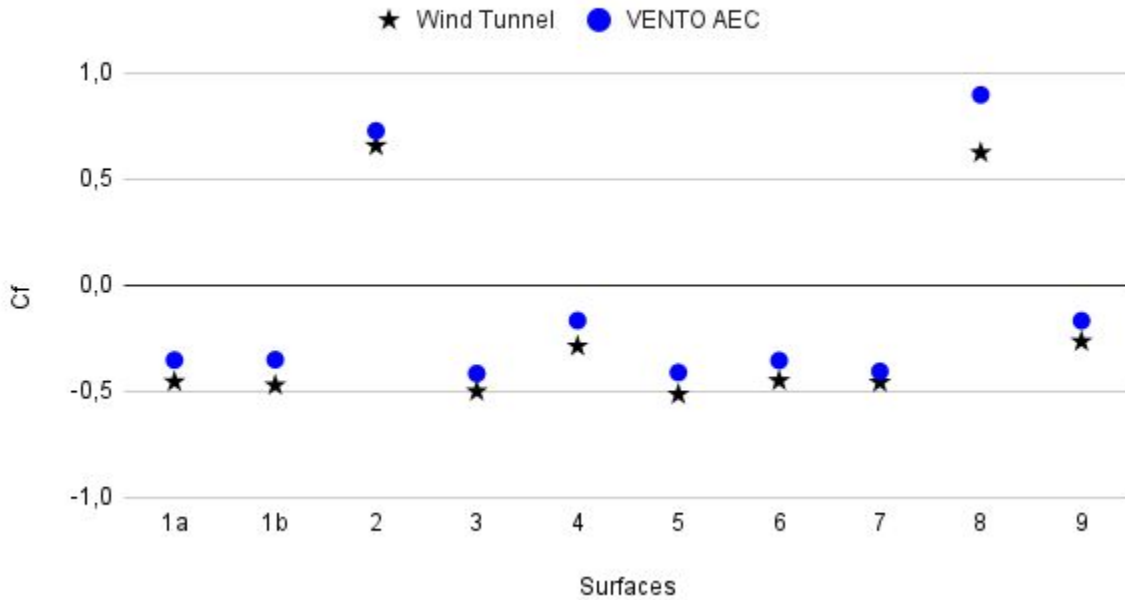
Isolated Low-Rise Building with Eaves

VENTO AEC results vs reference

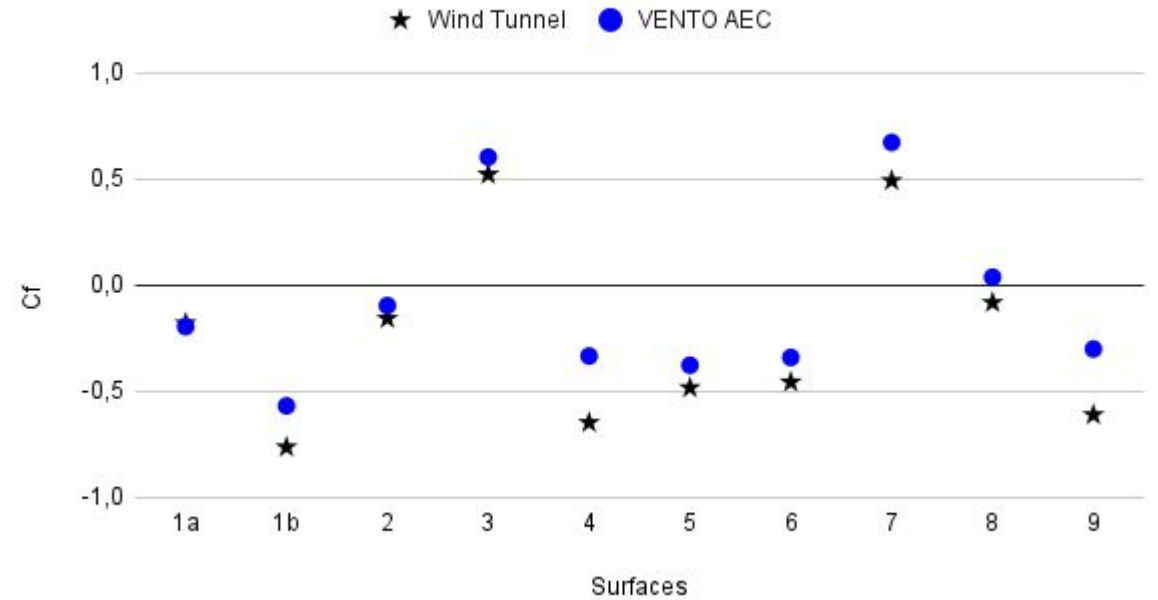
Area averaged wind pressure coefficients



Wind direction $\theta=0^\circ$



Wind direction $\theta=68^\circ$



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