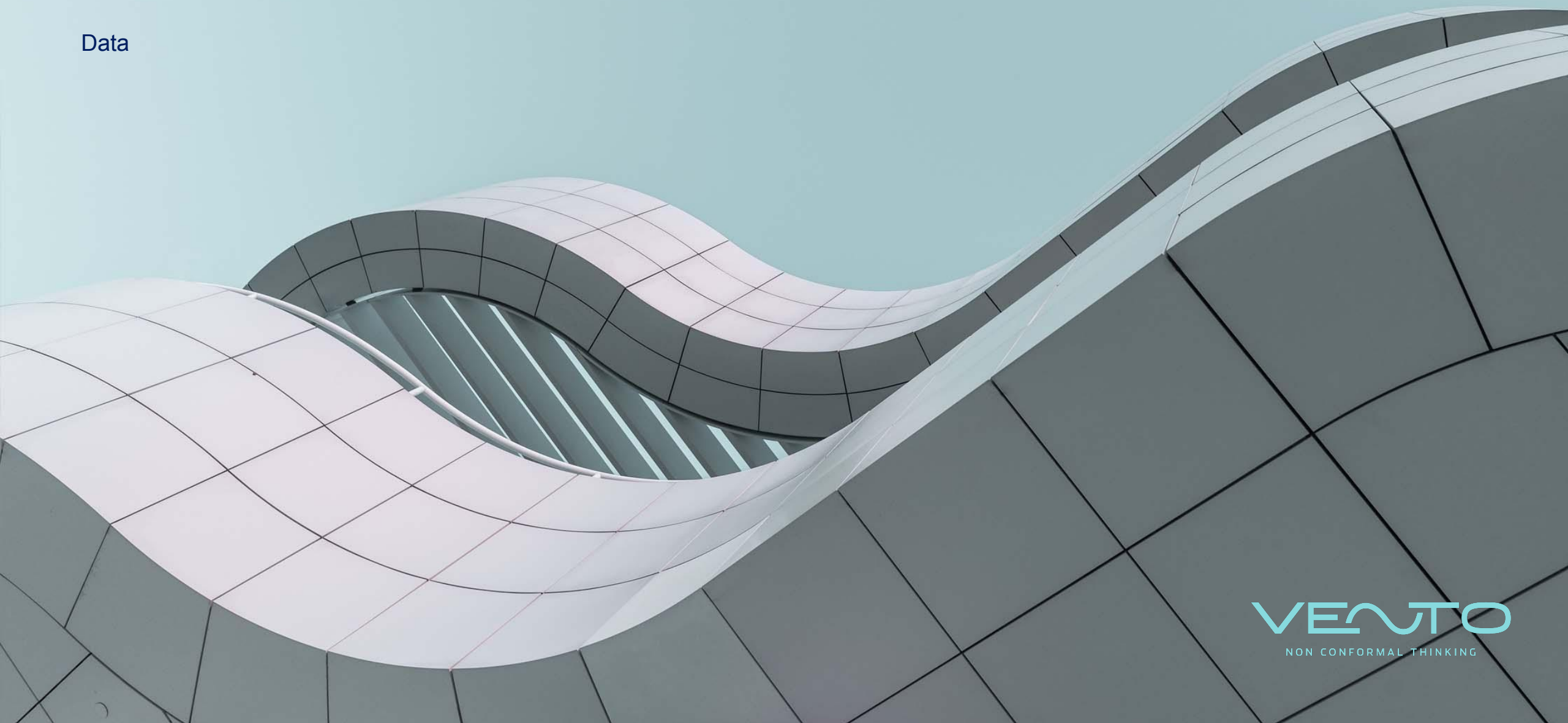# VENTO

NON CONFORMAL THINKING

Innovative CFD for the built environment
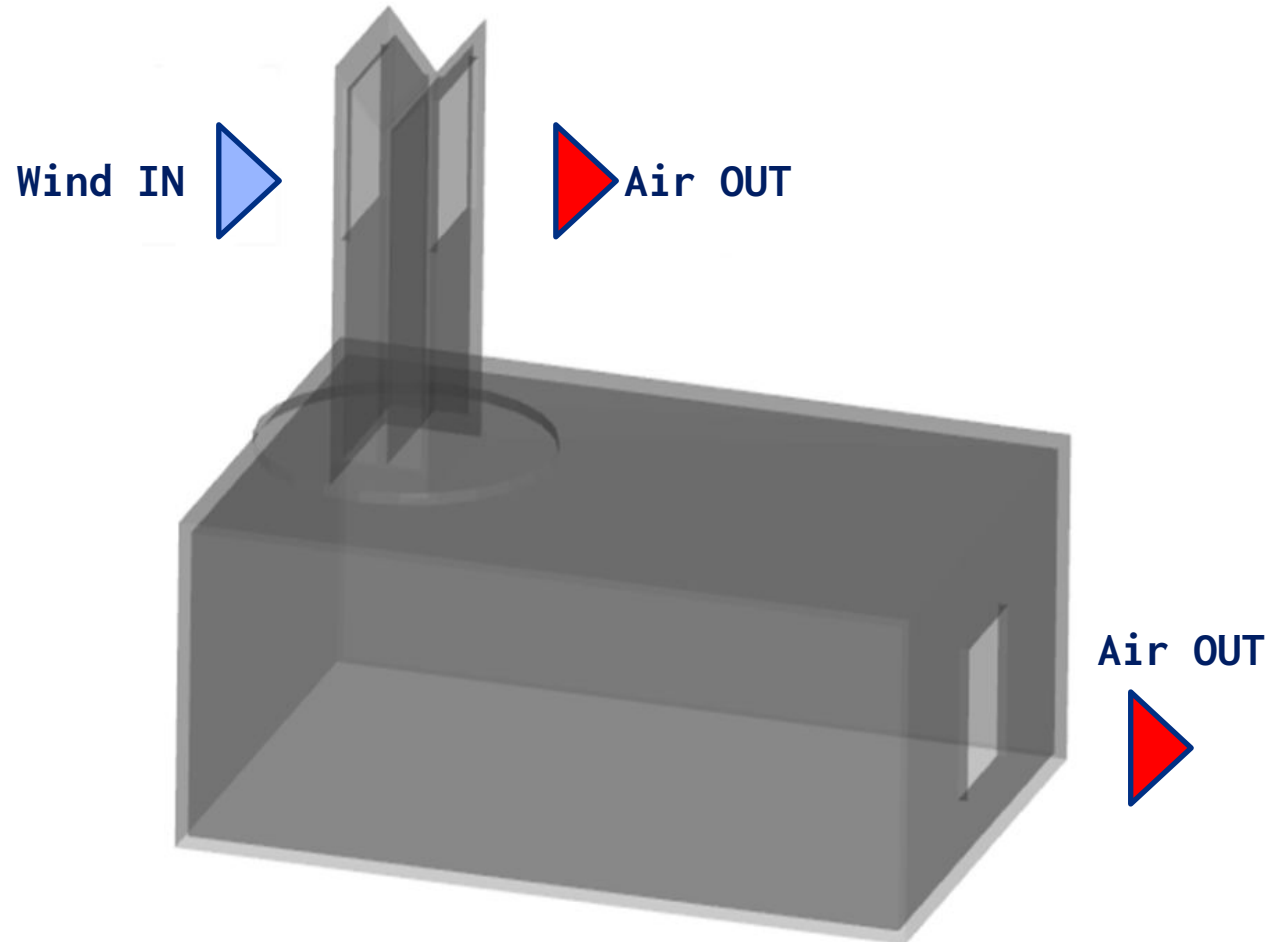
Validation | The Windcatcher

Data

The Windcatcher

The Windcatcher is a traditional Persian architectural element that **uses the wind to create natural ventilation inside buildings**.

These architectural elements date back to 4,000 years B.C.

The Windcatcher

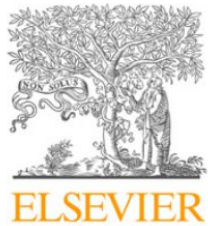**Wind IN** ▶   ◀ **Air OUT**

Air OUT ◀

A two-sided windcatcher **catches the wind by the windward opening** and **forces the air to circulate** inside the building.

The air then **exits the building from the leeward opening** of the windcatcher and also from other openings in the building.
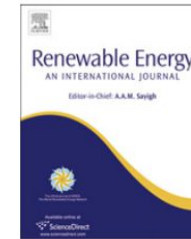
VENTO
NON CONFORMAL THINKING
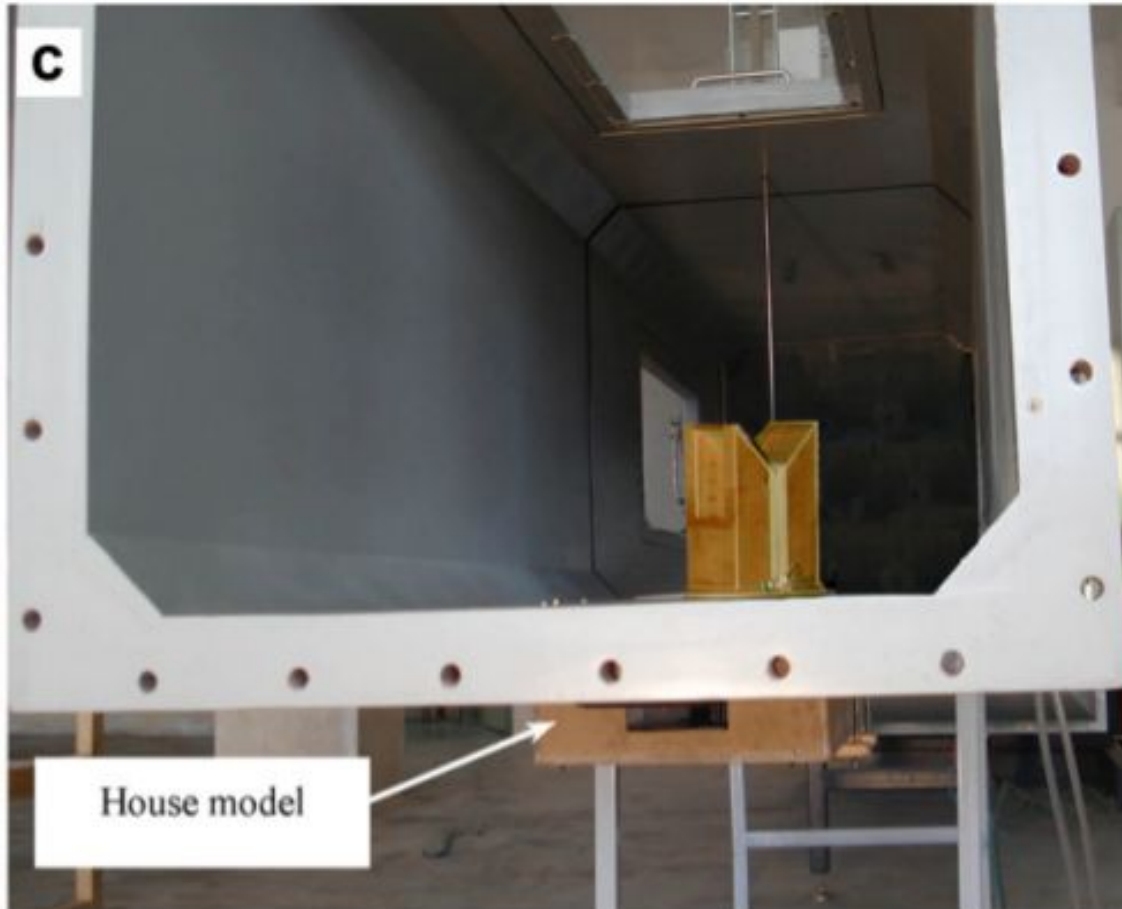
Reference (CFD and Wind Tunnel data)

Two-sided wind catcher performance evaluation using experimental, numerical and analytical modeling

H. Montazeri*, F. Montazeri, R. Azizian, S. Mostafavi

Department of Mechanical Engineering, School of Engineering, Yazd University, Yazd, Iran
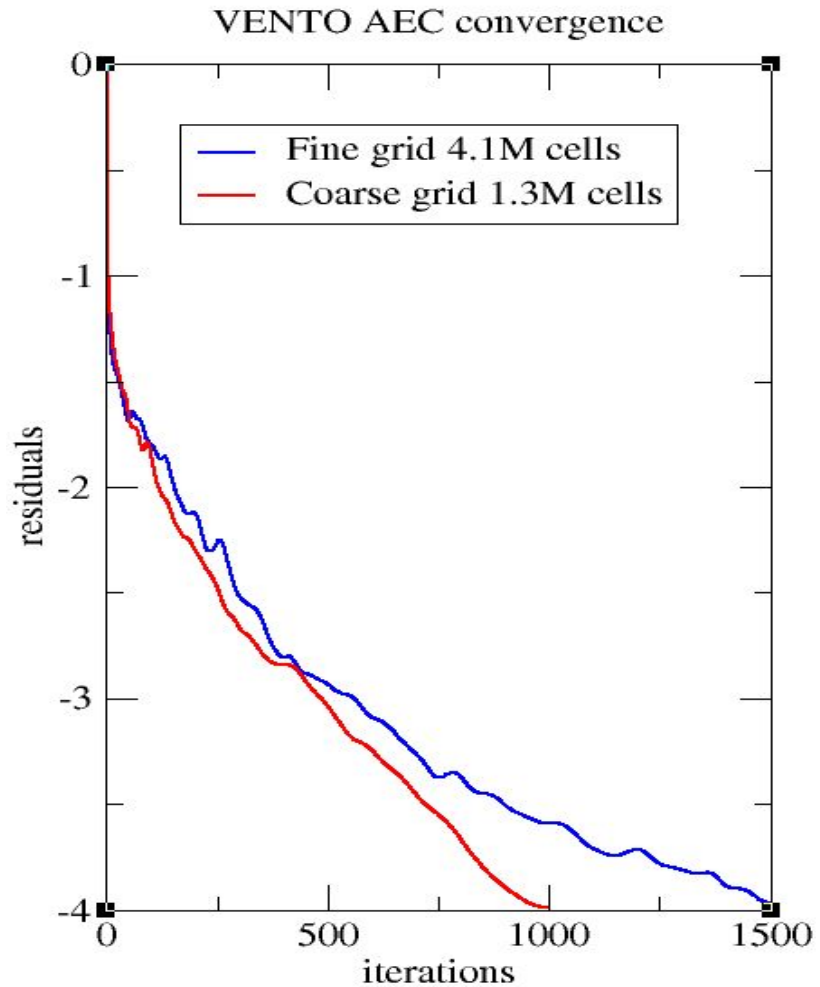
Conditions

The **two-sided windcatcher** is placed **in the wind tunnel** test section.

The **underlying portion** of the building is **not in the wind tunnel**.

The model scale is **1:40.**

VENTO CFD simulation

VENTO AEC convergence

— Fine grid 4.1M cells
— Coarse grid 1.3M cells

The analysis was carried out on **2 grids** of **4.1M** cells and **1.3M** cells.

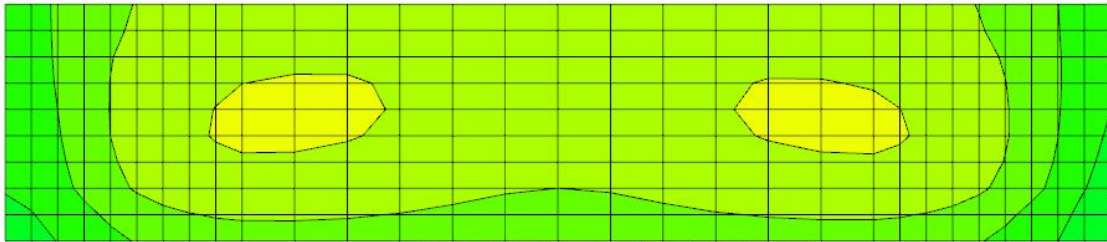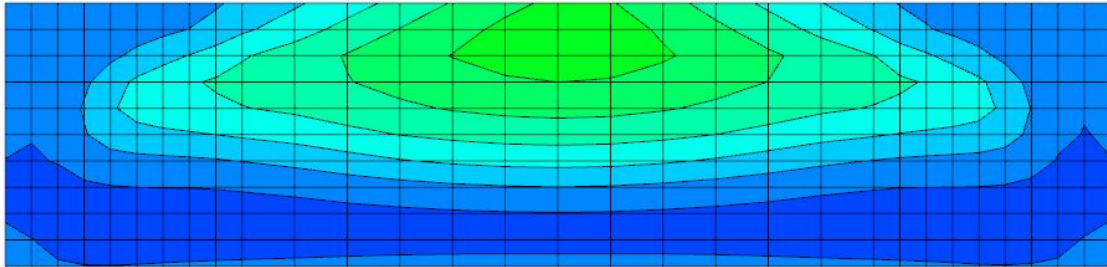|	Setup (*)	Simulation (&)
Grid 1	10'	86'
Grid 2	3'	400'

(*) time from STL import to CFD-ready status
(&) simulation time on a 4-core desktop

VENTO CFD simulation

Coarse grid

Fine grid
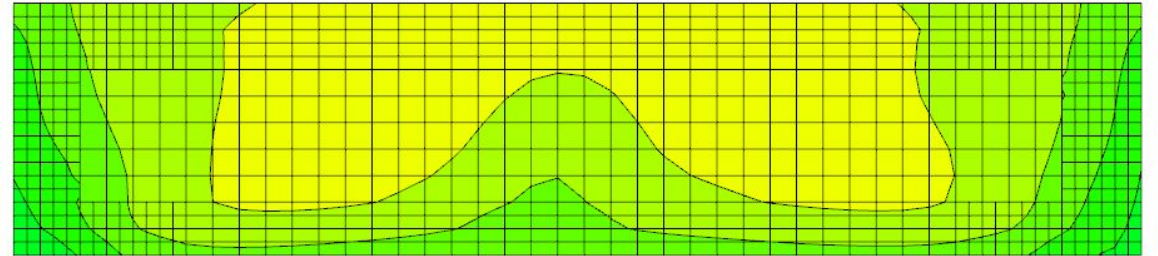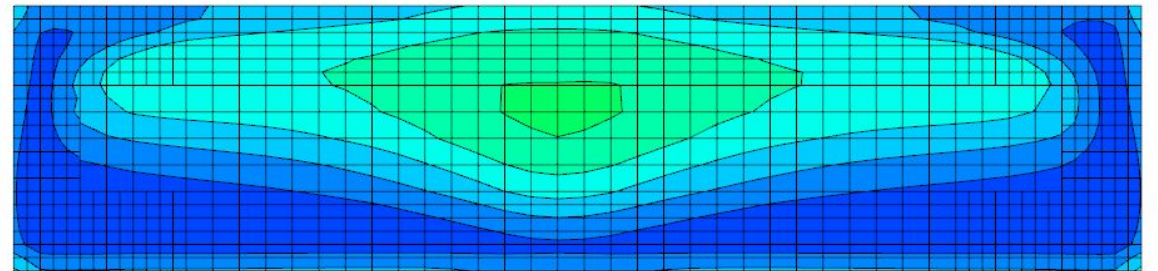
Color maps of the vertical velocity on a horizontal section of the windcatcher at mid height.
Above: the windward side. Below: the leeward side.

VENTO CFD simulation
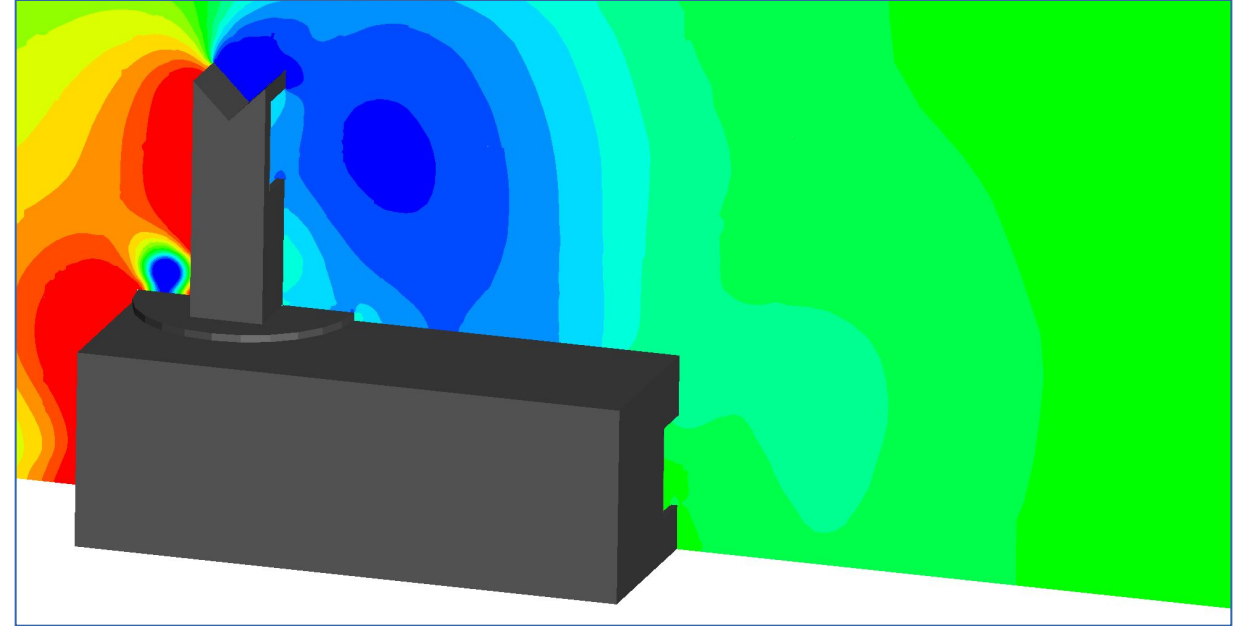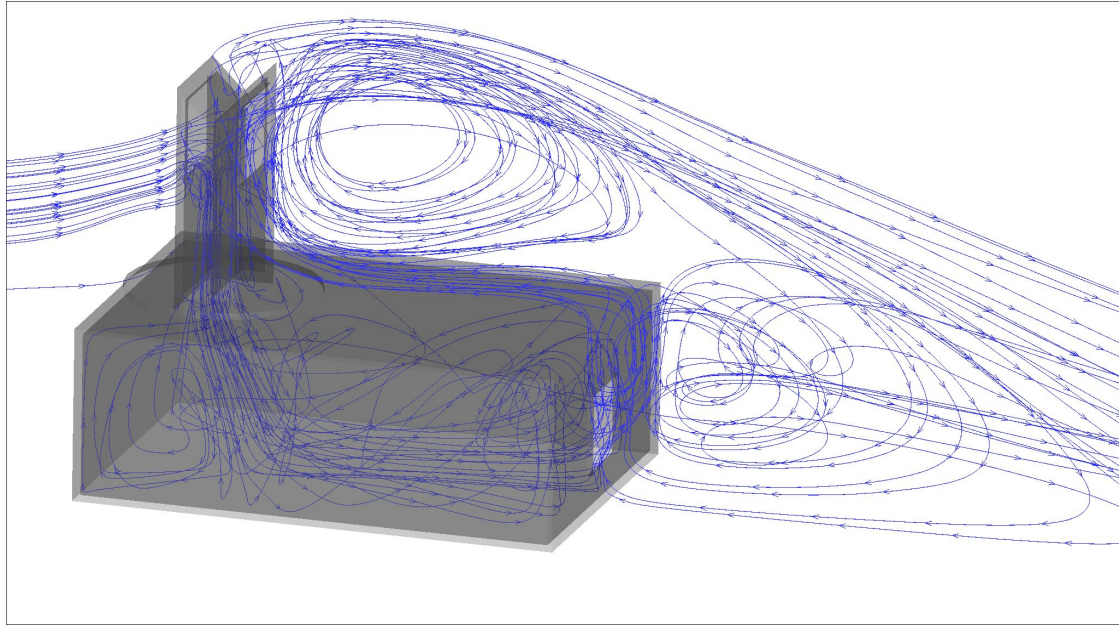
Left: streamlines and flow structure.
Right: color map of the pressure on the symmetry plane.

VENTO CFD simulation

The table shows the % of the wind mass flow rate entering the windward side opening, which then exits from the leeward side opening.

The rest of the mass flow rate exits from the underlying building opening.

Experiments (Reference)	48%
CFD results (Reference – various models)	46% - 49% - 52%
VENTO	45% (grid 1) – 52% (grid 2)

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