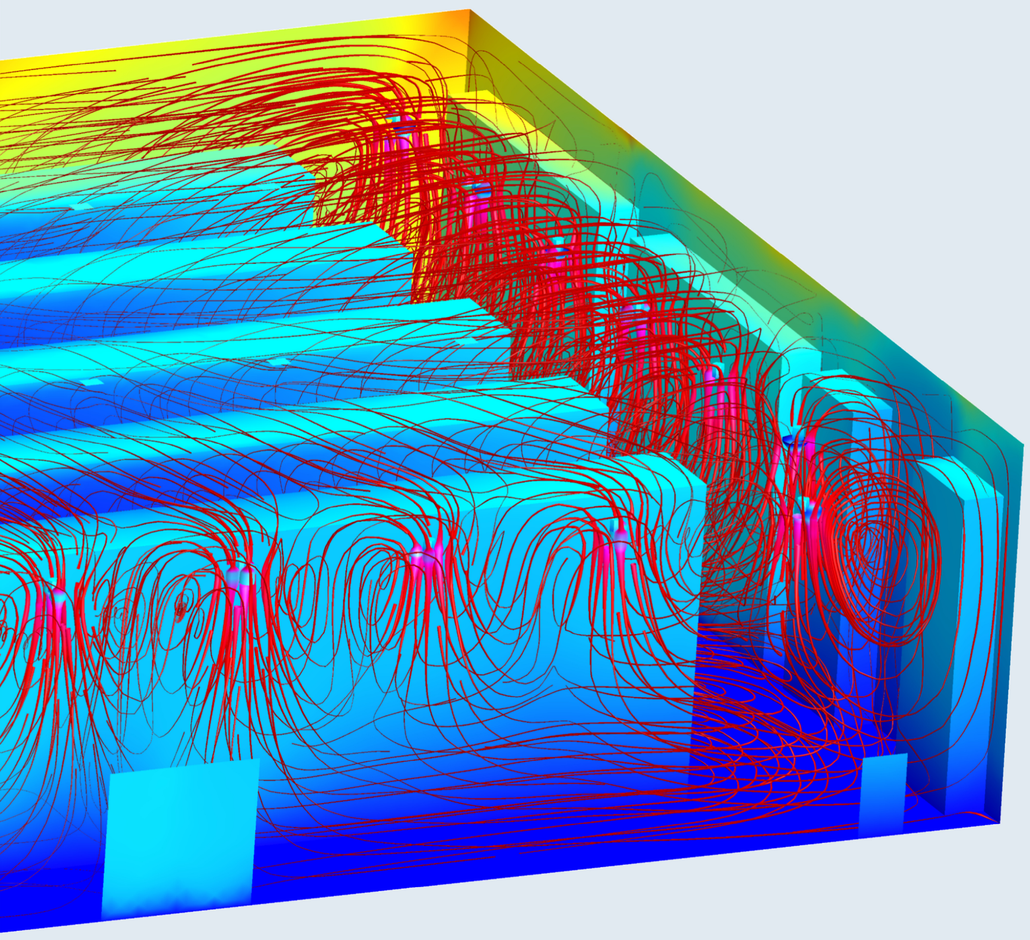

Indoor Thermal Analysis of a Storehouse

Exploiting numerical simulation to identify a suitable ventilation and thermal lay-out for a warehouse in a hot climate

R. Sinatra, S. Cagliari, A. Barbagallo, G. Petrone

BE CAE & Test S.r.l., Catania, Italy

COMSOL Certified Consultant

Abstract

Preserving **goodness of items** stored inside a **warehouse** implies to control the **internal temperature distribution.** A correct **ventilation system is essential** to this goal.

The aim of this study is tos to evaluate the airflow thermal distribution inside a warehouse of 12 600 m^3 in volume located in Mediterranean area, considering hot summer climate conditions. Several lay-outs are investigated.

Results mainly show that thermal stratification with respect to the storehouse heigh can occur in absence of forced ventilation. In this condition, the insulation envelope makes thermal conditions worse. The free-cooling ventilation by means of jet-funs located close to the roof determinates a significant air mixing and temperature mitigation. Free-cooling appears more efficient during the morning time.

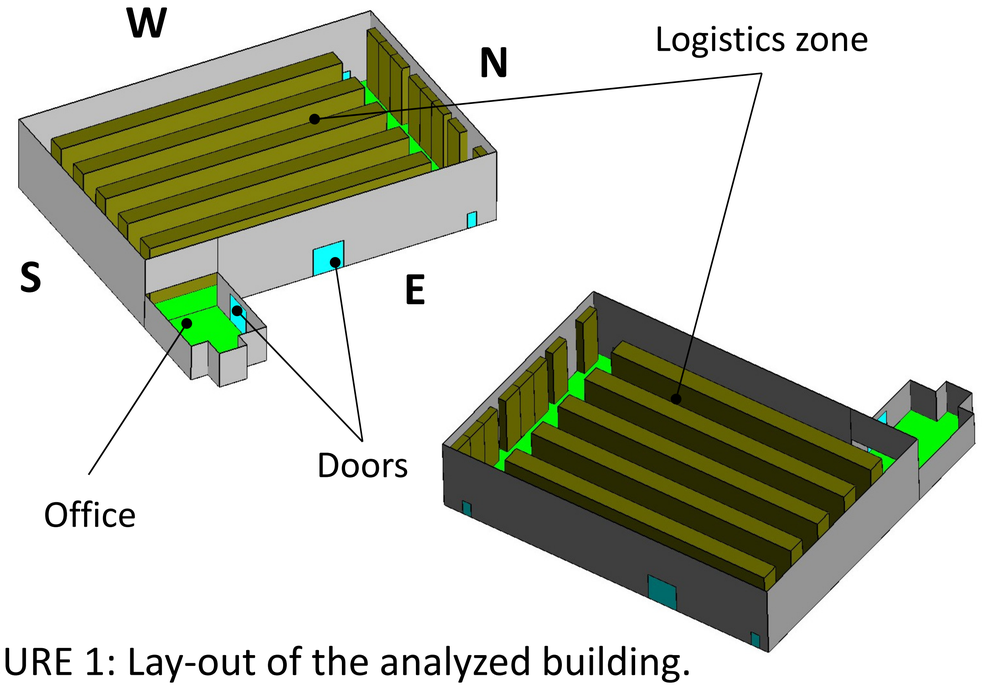

FIGURE 1: Lay-out of the analyzed building.

Methods

Coupled Navier-Stokes and energy equations solved considering or not considering an indoor ventilation system. The influence of a building insulating envelope is investigated. Several environmental external conditions are considered referring to meteorological data of a hot summer day in a Mediterranean area.

Natural and forced airflow are solved for 3 configurations:

1 - <NAT-CONFIG> buoyancy-driven flow;

2 - <NAT-INS-CONFIG> buoyancy-driven flow and envelope insulation;

3 - <VENT-CONFIG> forced ventilation (free-cooling jet-funs).

Results

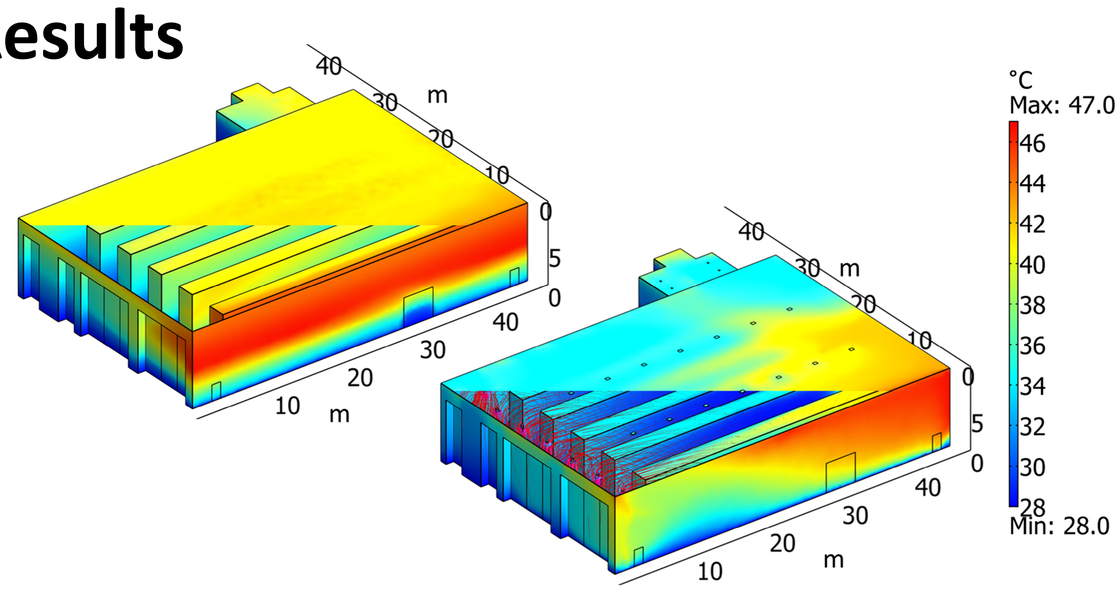

FIGURE 2: Thermal maps for <NAT-CONFIG> @10:00 a.m. (left) and <VENT-CONFIG> @10:00 a.m. (right).

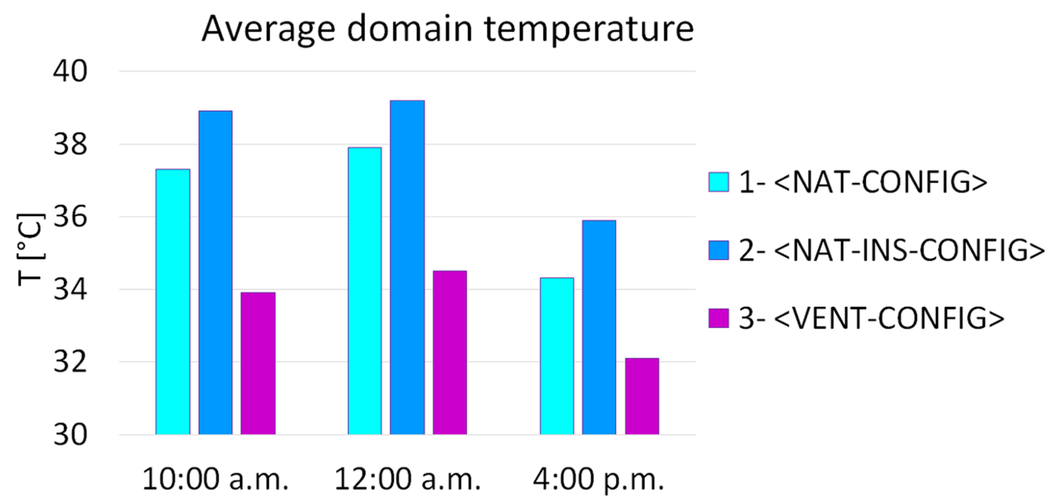

FIGURE 3: Average indoor air temperature computed at 10:00 a.m., 12:00 a.m. and 4:00 p.m. for the studied configurations.

REFERENCES

1. Standard UNI 10349
2. COMSOL 6.1, Heat Transfer Module User's Guide

http://www.be-caetest.it/

BE CAE & Test

info@be-caetest.it

+39 095 216 6426

ITALY
- *Viale Africa, 170 - 95129 Catania (CT)*
- *Via Toscana, 104 - 41053 Maranello (MO)*

SPAIN
- *Calle Impresores, 20 - 28660 Boadilla del Monte (Madrid)*

Excerpt from the Proceedings of the COMSOL Conference 2023 Munich