ANALYSIS OF INTERACTION BETWEEN BUOYANCY AND WIND FORCES FOR SINGLE-SIDED NATURAL VENTILATION IN A BUILDING

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ABSTRACT

In this study, we performed numerical simulations of three-dimensional turbulent flows over an isolated building with an opening by using a CFD model in order to investigate the combined effect of wind and buoyancy on windward single-sided ventilation. Both positive and negative temperature differences were considered, and the Archimedes number (Ar) was introduced as an index for evaluating the interaction between buoyancy and wind effects. The interaction between the two forces under a positive temperature difference was found to be destructive, with combined effect either decreasing or increasing the volume flow rate depending on the Archimedes numbers. The wind effect was found to be dominant for $Ar^{0.5} < 0.45$, with the buoyancy effect beginning to increase at $Ar^{0.5} = 0.2$, and tending to be dominant for $Ar^{0.5} > 0.45$. The two effects were found to be fairly comparable at $Ar^{0.5} = 0.45$. Conversely, the interaction between the buoyancy and wind effects under a negative temperature difference was found to be always constructive, with the combined effect reinforcing the ventilation for all Archimedes numbers. More detailed results will be shown in the final poster presentation.

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