Airflow and heat flux through the vertical opening of buoyancy-induced naturally-ventilated enclosures

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Characteristics of the mean and turbulent airflow and heat flux through the vertical opening of a buoyancy-induced naturally ventilated full-scale enclosure with upper and lower vents on one of the sidewalls were studied experimentally. The effect of the interaction between the mixing and the displacement ventilation modes on the airflow through the upper vent is explored. Measurements include vertical profiles of mean and turbulent air velocity and temperature through the upper opening using a three dimensional sonic anemometer. The airflow appears to be inclined to the horizontal plane due to the effect of buoyancy. The level of the neutral plane at the upper vent, defined here as the plane separating between inflow and outflow, can be identified by the vertical profiles of both mean flow and turbulence intensity, with good agreement between the two approaches. The contribution of the turbulent to the total (mean and turbulent) heat flux through the vent decreases as ventilation transforms from the mixing to the displacement mode.