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EFFECTS OF HUMIDITY ON NATURAL CONVECTION IN A DIFFERENTIALLY HEATED CUBIC CAVITY

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In order to study the natural convection of humid air in building-integrated photovoltaic (BIPV) systems for facades and roofs configurations, a computational model of coupled radiation and natural convective flow was developed. It was validated on the flow in a differentially heated cubic cavity containing humid air was developed and validated. The effects of varying the humidity on natural convection were studied for a steady flow at Rayleigh number of 10^6. The radiation calculation used the discrete ordinates method (DOM) with spectral line-based weighted sum of grey gases (SLW) method to model participating medium. The large eddy simulation was adopted on a fine grid to capture the flow features whilst radiation calculations were carried out on a coarse grid. The model was implemented in a finite-volume based in-house code. The results were validated against reference data in low temperature gradient conditions. It was shown that the inclusion of a participating medium contributed to the decrease of thermal stratification. At higher humidity levels, flow activity increased near the boundaries and the low-velocity circulation was isolated at the cavity center.