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**The flow in an underfloor plenum. A comparison of experiment and simulation.** JONG KEUN YU, PAUL LINDEN, UCSD — In underfloor air distribution (UFAD) systems cool air is introduced through diffusers placed in a raised floor. Air is delivered to the diffusers after circulating in the plenum. The heat transfer across the floor heats the air in the plenum, which results in temperature variations at the diffusers. Consequently, there can be thermal discomfort of occupants and loss of energy efficiency of the system. The flows in an underfloor plenum with multi-supply air inlets are investigated by means of laboratory experiments using particle image velocimetry (PIV) and by numerical simulations (FLUENT 6.22, FLUENT Inc.). The inhibition of vertical motions induced by the small aspect ratio of vertical length scale to horizontal length scale of the plenum, implies that two-dimensional flow dynamics characterize the flow. The experimental and numerical results strongly support the relevance of these two-dimensional flow dynamics. Self-organization processes are observed which lead to the formation of long-lived coherent flow structures, resulting from inverse energy cascade in the two-dimensional turbulent flow due to the absence of vortex stretching and twisting. Furthermore, we analyze thermal performances of the inlet configurations by three dimensional numerical simulations.

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