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Experimental Investigation of Large-Scale Flow Structures in Turbulent Mixed Convection[1] MAX KOERNER, CHRISTIAN RESAGK, Institute of Thermodynamics and Fluid Mechanics, Tech Univ Ilmenau, ANDRE THESS, Institute of Engineering Thermodynamics, German Aerospace Center — We report on experimental investigations of the temporal and spatial behavior of large-scale flow structures (LSC) in turbulent mixed convection. Using a reduced scale model room with a passenger cabin based geometry allows a global view on the LSCs, which are mainly responsible for thermal comfort and air quality within rooms. Moreover, the usage of pressurized working gases like air or sulfur hexafluoride (SF6) enables experimental investigations within broad ranges of the Reynolds number Re and Rayleigh number Ra. Thus, it is also possible to achieve realistic values of the dimensionless numbers allowing direct conclusions to be drawn about the LSCs in rooms similar to passenger cabins. The LSCs are determined by measurements of the 2D velocity field using a 2D2C particle image velocimetry system. In order to characterize three-dimensionally evolved flow structures, the measurement plane can be moved throughout the depth of the model room. We found very complex LSCs ranging from two-dimensional to three-dimensional structures and from one-roll systems over simple two-roll ones to chaotic behavior of the flow. The formation the LSCs has a strong dependency on the relation between Re and Ra and they often show distinct coherent oscillations.

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