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Large-scale flows in free and mixed convection¹ JORGE BAILON-CUBA, MOHAMMAD EMRAN, JOERG SCHUMACHER, Technische Universitaet Ilmenau — Convective turbulence in closed volumes is associated with large-scale circulations of the flow (LSC). They depend sensitively on the geometry and the physical parameters, such as Rayleigh and Prandtl numbers. Here, we consider two systems: free convection in cylindrical cells and mixed convection in a complex rectangular setting with local heat sources. The LSC and the amount of heat transferred is determined by the so-called proper orthogonal decomposition (POD) of the turbulent fields. We apply the so-called snapshot method to extract the modes from DNS data. The most energetic POD modes give us insight into the dynamic dominance of coherent flow and temperature patterns, and how well the original inhomogeneous flow can be modeled with a reduced number of modes in a low-dimensional model. For example, in case of the cylindrical cell the primary POD mode transfers about one half of the total amount of heat through the vessel. For the mixed convection case, the influence of the geometry and the inflow conditions on these LSC structures is also addressed.

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Jorge Bailon-Cuba Technische Universitaet Ilmenau

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