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Turbulence-induced secondary motion in a buoyancy-driven flow in a circular pipe JACQUES MAGANUDET, YANNICK HALLEZ, IMFT/Cnrs — We analyze the results of a direct numerical simulation of the turbulent buoyancy-driven flow that sets in after two miscible fluids of slightly different densities have been initially superimposed in an unstable configuration in an inclined circular pipe closed at both ends. In the central region located midway between the endwalls, where the turbulent flow is fully developed, the resulting mean flow is found to exhibit nonzero secondary velocity components in the tube cross section, resulting in a four-cell pattern in the tube cross-section. We analyze the generating mechanism of this secondary flow which turns out to be due to the combined effect of the lateral wall and the shear-induced anisotropy between the transverse components of the turbulent velocity fluctuations. Although of small magnitude compared to the main flow, this secondary mean motion is found to be of primary importance in the mixing process between the light and heavy streams.

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