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# Experimental studies of rotating exchange flow through simple and divided straits

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Ocean basins are connected by straits and passages, allowing important heat and salt exchanges which in turn influence the global thermohaline circulation and climate. Such exchanges can be modelled in an idealised way by considering a density-driven two-layer flow. The particular foci of this study are the effects of rotation and topographic divides within the strait. We use a laboratory model of a lock-exchange between two reservoirs of different density through a flat-bottom channel with a horizontal narrows and a removable island located within the strait. Experiments were undertaken on two different platforms: a $1m$ diameter turntable and the $14m$ diameter turntable at Coriolis/LEGI (Grenoble, France). This allowed us to obtain for the first time detailed measurements of the velocity fields in these flows. The influence of rotation is studied by varying the Rossby number, $R_0$, defined as the ratio of the baroclinic Rossby radius to the overall channel width at the narrows. In addition, a two-layer version of the Miami Isopycnic Coordinate Model (MICOM) is used to study the cases with low Rossby number. Results from experiments by Dalziel (1988) are also included for comparison. Time-mean exchange fluxes for any $R_0$ are in close agreement with the inviscid zero potential vorticity theory of Dalziel (1990) and Whitehead et al. (1974); however, for $R_0 < 1$ the flows are qualitatively very different from the theoretical predictions and in particular are found to be unsteady. The qualitative features of the flow are also influenced by frictional effects and initial conditions. The presence of an island in the strait changes the qualitative features of the flow, but the exchange flux is the same as that in a strait without an island in almost all our experiments.