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Linear theory for the circulation in a wide strait : application to the Sicily Strait

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The strait of Sicily connects the Eastern and Western Mediterranean Basins. The flow in the strait is driven by direct forcing such as wind and by horizontal density gradient between the two basins. The respective role of these forcings and the surface current variability in the strait are still open questions. Here, we only consider the remote thermohaline forcing and by means of a linear model with simplified geometry, we demonstrate how a permanent circulation can be established in the strait. In this model, the sill of the strait enables the separation of the inflow into two cross-strait branches and two along-strait branches and therefore plays a fundamental role. The analytical solution shows that the transports are controled by the ratio between the layer thickness in each part of the domain. A fully non-linear multilayer shallow water model in the same configuration, based on the MICOM code, is used to successfully validate these results. Both models are shown to provide an adequate framework for the analysis of the seasonal and interannual variability of the circulation in the Sicily Strait and adjacent basins.