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Quantifying estuarine exchange flows in a thermohaline framework

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The quantification of estuarine exchange flows in terms of bulk values for volume transport and salinity has been done for over a century. Yet, just in recent years scientists were able to relate these bulk values to the mixing inside the estuary. For a long-term averaged estuary, the simplest approximation states that the integrated mixing inside the estuary is the product of inflowing salinity, outflowing salinity and river discharge.

The computation of the bulk values is done in an isohaline framework, which for estuaries is suitable as the density is approximately only controlled by the salinity. For estuaries where the contribution of temperature to the density is not negligible, an isothermal framework should be included.

In this study we do exactly this and we extend the isohaline framework to a thermohaline framework which includes potential temperature. With this framework we can decompose the exchange flow into a T-S diagram and compute robust bulk values of the exchange flow. The additional information about pot. temperature enhances the information about water masses of the exchange flow.

To show the strength of this method, we elaborate on the exchange flow of the Persian Gulf, a large inverse estuary with a distinct seasonal cycle. This seasonal cycle is reflected in the properties of the exchange flow which is discussed with focus on the composition of the outflowing water.

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