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Tidal Exchange through a Strait: A Numerical Experiment Using a Simple Model Basin

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ABSTRACT

In order to investigate the mechanism of tidal exchange through a strait, we numerically track the Lagrangian movement of water particles over a full cycle of the M_2 tide. As a result, it is found that the spatially rapid changes of the amplitude and the phase lag of the M_2 current in the vicinity of the strait cause the exchange of an extremely large amount of water through the strait. The tidally-induced residual circulation in the vicinity of the strait also plays an important role in the water exchange. The calculated exchange ratio over one tidal cycle is $\sim 87\%$, i.e., the greater part of the outer water entering into the inner basin through the strait stays in the inner basin while an equal amount of basin water is drawn out after a cycle of the M_2 tide. This fact also suggests that the major part of the water exchange through a strait is generated, not by turbulent diffusion, but by the dynamic process of the tidal current.

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