Ocean Science Discussions

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Comment on os-2021-30

Anonymous Referee #3

Referee comment on "Flow separation, dipole formation, and water exchange through tidal straits" by Ole Anders Nøst and Eli Børve, Ocean Sci. Discuss., https://doi.org/10.5194/os-2021-30-RC3, 2021

The manuscript describes the generation, dynamics, and transport properties of a pair vortices through tidal straits, which is a key mechanisms in water exchanges. A set of 164 simulations with varying strait width, length, and tidal amplitude is investigated. Along with comments already posted by the two referees, a few more suggestions are provided below.

The paper is within the scope of Ocean Science.

The manuscript is well written and the physical mechanisms at play are extensively described. However, it somehow lacks of conciseness, and the reader can get lost in long descriptions that could be replaced, or complemented by illustrative sketches (or simulation outputs) for the sake of clarity. An example is the description of the origin of the asymmetry leading to net exchange (l18-30).

Introduction:

The authors quote a few experimental studies. Recent work by Albagnac et al (i.e. A three-dimensional experimental investigation of the
structure of the spanwise vortex generated by a shallow vortex dipole. (2014) Environmental Fluid Mechanics, vol. 14 (n° 5). pp. 957-970. ISSN 1567-7419, and later articles) provide quantitative description of the 3D dynamics of vortex dipoles, including in stratified environment.

Sec 3: an illustration of the effect of tidal amplitude would have been interesting.

Fig 13: S1 and S2 are not described in in the caption.

l412: phenomena - > phenomenon.

Conclusion: Multitidal forcings are often present at straits, an interesting perspective would be to investigate their effect on the overall dynamics and the impact on water exchanges.

As suggested by the authors, comparisons with realistic configurations would be of interest to evaluate the parameters controlling the dipole dynamics. A relevant configuration could be the one of the Gibraltar strait, where the variety of finescale structures and the water exchange through the strait are actively studied combining LES simulations and sea campaigns (Numerical modelling of hydraulic control, solitary waves and primary instabilities in the Strait of Gibraltar, Hilt et al. Ocean Modelling, 2020).