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Lock exchange for evaluating ocean models ?

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Generally speaking, test cases offer a simplified framework for understanding of numerical ingredients of an OGCM. However, even simple test cases can present difficulties. As a very newcomer to the ocean modelling community, I compared NEMO (GFD) and FreshKiss2d (CFD) in the lock exchange experiment framework against experimental results using Benjamin 1968, Ilicak 2014 and Adduce 2012.

NEMO and FreshKiss2d obviously present differences as both software target distinct objectives (implicit regularization at centimetric resolutions). Then, how to quantify these differences ? What is the proper metric to quantify the numerical method quality ? Can we set a validity range using analytical solution and experimental results ? The front speed is widely used but it is not relevant for this goal and computing the potential energy in an experimental context is not straight forward. Another problem is that I did hydrostatic simulations while laboratory experiment are non-hydrostatic. Is it sufficient to play with parameterization to ensure results consistency ? How to transfer results obtained in a laboratory tank to NEMO's applications ? Eventually, the lock exchange experiment non linearities bring out the difficulty to quantify tracer spurious mixing. Indeed, even from a theoretical point of view, without any source of dissipation, it is not clear whether the interface between light and dense fluids should be continuous or not. Then, how to evaluate the effect of the momentum irregularities on the mixing in a numerical context ?

As a conclusion, my experience with the lock exchange test case has risen more unanswered questions than provided results. Still, as the organisers call for sharing experience about test cases, it may be relevant to open such a discussion.

Do you need an official invitation letter?

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