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## Absorbing layers for shallow water models

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Open boundaries are often seen as a major source of uncertainty or even error in numerical model simulations. One of the main difficulties is that the boundary conditions must allow the outward propagation of the signal out of the computational domain without creating unphysical reflections. In this presentation, the use of absorbing/sponge layers as boundary conditions is examined in the context of the shallow water equations.

The *Flow Relaxation Scheme* (FRS) amounts to the introduction of a linear damping term in an absorbing layer bordering the computational domain. This approach is particularly appealing since its numerical implementation is really straightforward. The FRS technique has received new attention with the introduction of *Perfectly Matched Layers* (PML), first in the context of electromagnetism, then in computational fluid dynamics and, quite recently, in numerical oceanography. Upon introducing extra evolution equations, PMLs enable a clean treatment of waves propagating at any incidence with respect to the boundary.

In both the FRS and PML approaches, an absorption coefficient is introduced that varies from zero inside the model domain to a maximum value at the outer boundary of the absorbing layer, controlling the gradual damping of outgoing waves. Using some simplified model set-up, we show that the performances of these boundary schemes depend critically on the spatial variations of the absorption coefficient and on the spatial resolution within the absorbing/sponge layer. Using the tools of numerical optimization together with some quasi-analytical developments, a nearly optimum law is derived. In a second step, the different types of absorbing layers are compared with each other through the two-dimensional problem of the collapse of a Gaussian-shaped mound of water and its advection by a mean current using the linear and the non-linear shallow water equations.