FreeVol++ 2D, solve finite volume method with FreeFem++

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FreeVol++ is a code to solve numerically finite volume method on an unstructured grid using FreeFem++ [1] software. We will describe in this talk, the way to build several fluxes used in the finite volume method and apply this technique first on the advection 2D equation then on the Shallow Water 2D system :

$$\partial_t \mathbf{U} + \mathbf{div}([F(\mathbf{U}), G(\mathbf{U})]) = S(\mathbf{U}), \tag{1}$$

where

$$\mathbf{U} = \begin{pmatrix} H \\ Hu \\ Hv \end{pmatrix}, F(\mathbf{U}) = \begin{pmatrix} Hu \\ Hu^2 + \dfrac{g}{2}H^2 \\ Huv \end{pmatrix}, G(\mathbf{U}) = \begin{pmatrix} Hv \\ Huv \\ Hv^2 + \dfrac{g}{2}H^2 \end{pmatrix}, S(\mathbf{U}) = \begin{pmatrix} 0 \\ -gH\partial_x z_b \\ -gH\partial_y z_b \end{pmatrix}. \tag{2}$$

Here u and v are the scalar components in the horizontal x, y directions of the depth-averaged velocity, $z_b(x, y)$ is the bathymetry function, η is the local water depth, $H = \eta - z_b$ is the total water depth and $g > 0$ denotes the gravity constant.
We also will detail a new mesh adaptation technique defined in [2] with its parallel version.

Références

[1] Frédéric Hecht, Olivier Pironneau, Antoine Le Hyaric and Kohji Ohtsuka. Freefem++ Manual, 2012.

[2] Georges Sadaka. Generation and propagation of a *Tsunami* wave, to appear 2018.

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