FINITE VOLUME MODELLING OF WATER QUALITY CHANGES IN SHALLOW-WATER BODIES

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Evaluating the transport of constituents in shallow-water bodies is important in order to properly quantify the short- and long-term impact of human activities on the environment and to verify the management strategies employed to improve the water quality.

The Finite Volume Method can be adopted in real-world cases because of its flexibility, robustness, local conservativity properties and the possibility to adopt, without special treatment, unstructured meshes, suitable for natural geometries: widely used are the triangular meshes, due to their easiness of implementation. Unfortunately, while the accuracy in the calculation of advective fluxes is scarcely sensible to the mesh shape, the accuracy and stability of numerical treatments for viscous fluxes is strongly dependent on the shape of the unstructured mesh implemented (Petrovskaya, 2001).

In this paper, an application of the Finite Volume Method is shown, aiming at the numerical solution of the Shallow-water equations, together with the Advection-dispersion equation: this set of equations is extensively used to simulate the effects of physical forcing on shallow-water bodies, together with the transport of a conservative solute transport in the water body. The mesh adopted is the *median-dual* of a Delaunay triangulation (see Figure 1), in order to approximate the viscous fluxes accurately and with stability, while preserving the adaptability to complicate domains. In order to calculate the viscous fluxes, the positive, linear preserving scheme of Barth (1995) is extended to the case of non-homogeneous, non-isotropic diffusivity. Advective fluxes are calculated by means of a simplified version of the HLLC approximate Riemann solver.

A special treatment for the source terms and the advective fluxes in Shallow-water Equations is used, in order to guarantee the accuracy and stability of the numerical solution, especially in long-time computations, while the conservativity of the scheme is preserved (Cozzolino, 2005).

A number of numerical experiments are reported (Figure 2), showing the promising capabilities of the model to solve real-world problems with complicate topographies.

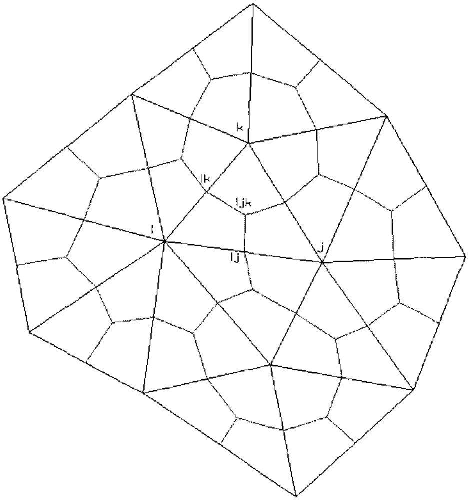

Fig. 1 Delaunay triangulation with median-dual mesh.

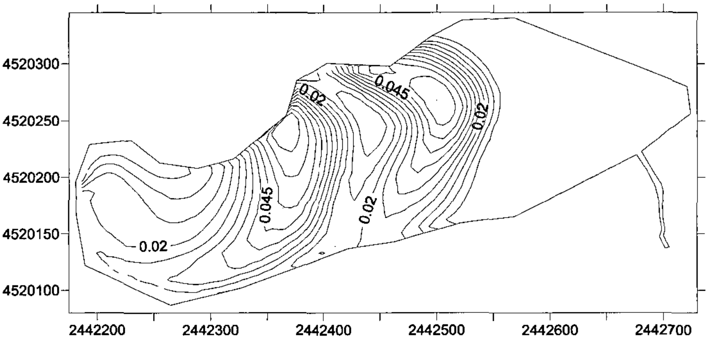

Fig. 2 Lago Lucrino test-case: concentration field after 24 hours.

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