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Simulation of an irregular free surface with a displacement finite difference scheme

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In this paper, we present a method to simulate wave propagation in medium with irregular free surface using finite differences (FD). The technique develops the free surface condition through an explicit scheme in displacement. In our technique a matrix with the form of the model to study is defined, and then the points where the free surface is localized are catalogued. Then displacements in the interior points of material are computed and subsequently the displacements at the points of free surface, applying the boundary conditions to the stress-tensor components by means of an explicit finite difference scheme. In this method a fictitious line above the free surface is used to compute the displacement at the free surface. We present some results of the application of this technique to simulate the seismic response of a canyon and a mountain using an explosive source and a vertical force, respectively. We compared the results with the synthetics calculated by the Indirect Boundary Element Method (IBEM).