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Numerical modeling of seismo-acoustic wave propagation in the Grande Rade of Toulon

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Explosive devices from World War II are discovered every week on the French coasts. In a short time after their discovery, they must be destroyed by the French Navy Mine Warfare Office. If the risks are well known by mine warfare experts, the consequences of counter-mining on the marine environment are much more complex to evaluate and expertise is then required. Depending on the environment geology, the explosive charges and their localization, the seismic waves generated by the explosion may cause damage to infrastructures located on the coast, and under specific conditions, small submarine landslides. The POSA project, led by Shom, and which includes LMA, Géoazur and LPG Nantes, focuses on the Mediterranean coast and proposes to address the upstream hazard management issue of such counter-mining operations in the marine field. The goal is to identify these risks for specific configurations and to develop a decision support tool for their control. The originality of the POSA project lies in the coupling between acoustic data measured on the seabed and coastal zone and seismic data recorded on the coast, together with sedimentary measurements.

First, from topographical and sedimentary measurements performed in the Grande Rade of Toulon, physical and geometrical characteristics of the marine environment have been carefully selected in order to be input data for numerical simulations. Then, numerical simulations of wave propagation, from the source to several stations deployed on the Saint-Mandrier peninsula and on the coast of Toulon, have been carried out using a spectral-element method. Influence of the thin sedimentary layers and of the water layers on the simulated signals has been studied according to the source characteristics. Finally, the numerical results have been compared with the real signals recorded by the seismic stations during a counter-mining campaign that took place in November 2016.