
From the blast marks on the seabed to sea surface circle observations generated by counter-mining of explosive devices

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Résumé

The French project POSA studies the seismic risks generated by blasting of bombs and mines from World War II . This project is based on seismometers and acoustical measurements during blasting actions to study earthquakes created by devices whose weight, and location, are well known. These measurements are then compared to numerical simulations of seismo-acoustic wave propagation (Favretto-Cristini, 2019) based on the most faithful 3D representation of the seabed sediments and underlying rocks. This project first focused on the 3D environment representation based on specific surveys and then on two blasting experiments which consists in exploding bombs from 10 to 680 kg eq. TNT in two different environmental places.

During the two experiments the first visual observation is the the presence of a large circle in the instant of the explosion, then the arrival of the bubble on the surface. The explosion is more or less well heard in the air according to the depth, the listening distance and of the load; it is very well perceived under water. The microseism developped is very clear on board even at several ki-meters and it is perfectly recorded on the seismometers placed on the coast near the explosion and on the seismometers of the earthquake monitoring network (RESIF) up to several hundred kilometers when loads exceed a certain threshold. Following the last experiment that took place at Rade d'Hyères in December 2018 , many articles were initiated on the propagation in the water and the modeling of these phenomena. The purpose of this presentation is to analyze the visual traces of the explosion that are fleeting on the sea surface and which seem perennial on the seabed.

During the experiment videos and photos show the surface inprint of each explosions. The bigger difference is between explosions realized near the surface versus them realized on the seabed. For these one the analysis of the dimensions of the circle and of the arrival of the bubble at the surface is done to look at a relation between the charge and the surface concerned. The study of these elements is done to look at a relation between the quantity of explosives and the dimension of the disk at the sea surface.

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On seabed of this region, marks with diameters are from 11 to 134 meters are present. They have been observed in this region from 10 to 250m depth with a maximum of occurrences around 40 meters. The most surprising thing is that there are no depressions in these circles, they are detected on Multi Beam Echo Sounders by there have a strong reflectivity. Part of the 661 circles observed in the Grande Rade of Toulon could come from counter-mining activities, but most of them seems to come from the bombings of the Second World War (Garlan et al, 2018). A hydrographic survey on the area of the last POSA experiment must be done in the future next months to look at the relation between the dimension of these imprint and the load of the explosives. We hope to obtain a relation between the load of explosives and the dimension of the circles of the sea surface and of the seabed.

Mots-Clés: underwater explosion, acoustic, shock wave, sea bed