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Could a 1755-like tsunami reach the French Atlantic coastline? Constraints from 20th century observations and numerical modeling.

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The tsunami generated by the 1st November 1755 (Mw ∼8.5) earthquake off Portugal affected mainly the coasts of the Iberian Peninsula and Northwest Morocco, and was observed in some places on the North Atlantic coasts, towards the West Indies, but also towards Ireland and the Great Britain, in Cornwall. However, no evidence of observation were found along French Atlantic coastline so far. In a first step, to determine whether there could be effects due to tsunamis on the French coastline, we conducted a study to search for actual tsunamis signals in all historical tide gauge stations of the French Atlantic coast available during the 20th century, specifically for the 1969 and 1975 tsunamis that were well observed in Portugal. Because many recordings are available from the French Hydrographic Service in La Rochelle (west French Atlantic coastline), we focus our study on this harbor. The analysis of these historical tide gauge data shows no evidence for tsunamis in La Rochelle, neither in 1969 or in 1975. Then, to confirm this lack of tsunami, we simulate the tsunamis from the 1969 and 1975 sources, using non linear shallow water equations and a series of imbricated bathymetric grids focusing to the French coastline, and then towards the harbor of La Rochelle: the modeling results confirm unnoticeable amplitudes. In the following step, tsunamis from three different scenarios for the 1755 earthquake have been similarly modeled to estimate the impact of such a tsunami on the French Atlantic coast, with a focus on La Rochelle harbor. The results show that, while the harbor is well protected (amplitudes computed on a synthetic tide gage in the harbor do not exceed 20 to 30 cm crest-to-trough) several areas may have undergone a more important, yet moderate impact, from 0.5 to 1 m, especially in the western part of the island of Ré and the northern coast of the island of Oléron. This may have caused possible local inundations in lowland areas, all the more since the tide was high at the arrival time. A study of the effect of the tide is conducted using different levels (high tide and low tide) during a spring tide configuration. To determine the potential difference due to the tide, showing an enhancement of the tsunami impact towards the western coast of the island of Ré. In this area frequently struck by severe Atlantic storms, our results may also encourage historical or in situ investigations to have a better idea of the actual impact of the 1755 tsunami.