Project TANDEM (Tsunamis in the Atlantic and the English ChaNnel: Definition of the Effects through numerical Modeling) (2014-2017): main results and perspectives

Hélène Hébert and the TANDEM team

CEA, DAM, DIF, Arpajon, France (helene.hebert@cea.fr)

The TANDEM project (Tsunamis in the Atlantic and the English ChaNnel: Definition of the Effects through numerical Modeling) has been funded (2014-2017) in France to provide a better appraisal of coastal effects due to tsunami waves on the French coastlines, with a special focus on the Atlantic and Channel coastlines, where civil nuclear facilities have been operating since about 30 years. Launched after the 2011 tsunami, it first aimed at drawing lessons from the 2011 catastrophic tsunami, and, together with a Japanese research partner (Meteorological Research Institute, MRI), at adapting and validating numerical methods of tsunami hazard assessment, using the database of the 2011 tsunami. The validated methods have been applied to estimate the tsunami hazard for the French Atlantic and Channel coastlines.

The project TANDEM follows the recommendations of International Atomic Energy Agency (IAEA) to analyse the tsunami exposure of the nuclear facilities, as well as the recommendations of the French Nuclear Safety Authority (Autorité de Sûreté Nucléaire, ASN) in the aftermath of the 2011 catastrophe, which required the licensee of nuclear facilities to conduct complementary safety assessments (CSA), also including "the robustness beyond their design basis".

TANDEM aims at defining the tsunami effects expected for the French Atlantic and Channel coastlines, basically from numerical modeling methods. A series of 19 test cases has been defined to benchmark numerical methods accounting for the various steps of a tsunami from generation to impact, thus down to the interaction with coastal structures (3D approaches).

Then the methods have been tested to characterize and quantify the associated uncertainties (in the source, the propagation, and the coastal impact), and have been used to compare models to the large observational dataset gathered in 2011, specifically for coastal sites such as in Kamaishi.

Finally the numerical models have been applied to the French coastlines to provide hazard estimations for various sites and scenarios. Using high resolution bathymetric and topographic data in the frame of Litto3D (a French project whose main objective is to build a seamless integrated topographic and bathymetric coastal Digital Terrain Model), TANDEM partners investigated possible worst case scenarios, through a detailed seismotectonic zonation and analysis of the slope stability off the coastlines (for the Celtic and Armorican margins, Bay of Biscay. Far field scenarios have also been used (Canaries, Lesser Antilles) to complete worst case sources. The results indicate, for return periods of a few centuries, a moderate possible tsunami impact for the Atlantic coastline, and a low impact for the English Channel, while the expected tsunami heights can exceed a few meters for extreme catastrophic sources with return periods above several thousands of years.