# Storage of $CO_2$ at low temperature as liquid or solid gas hydrate in deep-sea sediments - Application in the French and Spanish Exclusive Economic Zones in North-East Atlantic

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The storage of $CO_2$ in deep saline aquifers at high temperature (in the supercritical state) is presently the most studied storage option, both onshore and offshore. However, the trapping of $CO_2$ in deep-sea sediments at low temperature (either in the liquid state or as gas hydrates) is a "deep offshore option" that has yet to be fully explored. In this option, the state of stored $CO_2$ (liquid or solid gas hydrate) depends strongly on the local geothermal gradient (based on the available Ocean Drilling Program data) as well as the quality of the injected $CO_2$ stream (e.g. presence of nitrogen or methane as impurities during the capture process).

In the present study, we firstly improve the modelling results in the French Exclusive Economic Zone (EEZ) (1) and then extend the study to the Spanish EEZ. This improvement relies first on the high resolution of the EMODnet bathymetry (2), with a gridsize of 1/8 * 1/8 mn (circa 230 m) which encompasses the European abyssal plain and continental rise. It relies also on a new set of three safety criteria similar to the previous study (1). The Negative Buoyancy Zone (NBZ), the Gas Hydrate Formation Zone (GHFZ), the theoretical storage volume were calculated using different numerical tools (GERG-2008, TREND, CSMGem, GMT) in order to estimate the $CO_2$ storage capacity (either as liquid or solid gas hydrate). The $CO_2$ storage capacities in the French and Spanish EEZ have been then compared in the case with impurities. This study allowed us to identify key input data which need to be better estimated in order to further improve these modeling results (e.g. sediment permeability/thickness).

The implications of this research are potentially important for the long-term $CO_2$ storage deployment strategy in Western Europe.

References
1. http://doi.org/10.1016/j.ijggc.2015.01.018
2. http://www.emodnet-bathymetry.eu