



## **The 2013 seismic sequence close to gas injection platform of the Castor project, offshore Spain**

Simone Cesca (1,2), Francesco Grigoli (2), Sebastian Heimann (1), Alvaro Gonzalez (3), Elisa Buforn (4,5), Samira Maghsoudi (2), Estefania Blanch (6), and Torsten Dahm (1)

(1) GFZ German Research Centre for Geosciences, Potsdam, Germany (simone.cesca@gfz-potsdam.de), (2) University of Potsdam, Potsdam, Germany (simone.cesca@gfz-potsdam.de), (3) University of Zaragoza, Zaragoza, Spain, (4) University Complutense Madrid, Madrid, Spain, (5) IGEO, UCM-CSIC, Madrid, Spain, (6) Ebro Observatory, Roquetes, Tarragona, Spain

A spatially localized seismic sequence has originated few tens of kilometres offshore the Mediterranean coast of Spain, starting on September 5, 2013, and lasting at least until October 2013. The sequence culminated in a maximal moment magnitude  $M_w$  4.3 earthquake, on October 1, 2013. The epicentral region is located near the offshore platform of the Castor project, where gas is conducted through a pipeline from mainland and where it was recently injected in a depleted oil reservoir, at about 2 km depth. We analyse the temporal evolution of the seismic sequence and use full waveform techniques to derive absolute and relative locations, estimate depths and focal mechanisms for the largest events in the sequence (with magnitude  $m_bLg$  larger than 3), and compare them to a previous event (April 8, 2012,  $m_bLg$  3.3) taking place in the same region prior to the gas injection. Moment tensor inversion results show that the overall seismicity in this sequence is characterized by oblique mechanisms with a normal fault component, with a  $30^\circ$  low-dip angle plane oriented NNE-SSW and a sub-vertical plane oriented NW-SE. The combined analysis of hypocentral location and focal mechanisms could indicate that the seismic sequence corresponds to rupture processes along sub-horizontal shallow surfaces, which could have been triggered by the gas injection in the reservoir. An alternative scenario includes the iterated triggering of a system of steep faults oriented NW-SE, which were identified by prior marine seismic investigations. The most relevant seismogenic feature in the area is the Fosa de Amposta fault system, which includes different strands mapped at different distances to the coast, with a general NE-SW orientation, roughly parallel to the coastline. No significant known historical seismicity has involved this fault in the past. Our both scenarios exclude its activation, as its known orientation is inconsistent with focal mechanism results.