Offshore microseismic monitoring with very sparse networks: An application to the Castor (Spain) Seismic Sequence

Analyzing offshore seismic sequences is challenging for the lack of optimal seismic monitoring networks. These conditions limit the application of standard data analysis procedures, leading to low accuracy results that may affect monitoring and early identification of the source of seismicity, particularly when potentially related to offshore industrial operations. Here we apply a recently developed location procedure for offshore seismic sequences capable of achieving high location accuracy with suboptimal monitoring conditions. We focus on the analysis of the Magnitude 4.2 earthquake sequence in the offshore of Valencia Gulf (Spain) occurred in September 2013. The earthquake sequence lasted for about one month and consisted of about 1000 seismic events. Due to the sparsity of the local seismic network, composed of only two stations within 15 km from the epicentral area of the seismicity, the use of standard location methods did not allow to identify the structure associated with the seismic sequence. In this study, we locate the seismic sequence with more advanced location techniques allowing us to achieve a higher location accuracy, even when dealing with suboptimal monitoring conditions. We analyze this dataset using waveform-based location techniques and a recently developed location technique based on Distance Geometry Solvers (DGS). This last approach uses inter-event distances between earthquake pairs estimated at one or two seismic stations to get high-resolution locations of seismicity clusters. The application of such techniques led to different improvements in locating the seismic sequence, which is more clustered and clearly shows trends compatible with the geological setting of the area. Although, this approach has been already successfully applied the 2019 Mw 6.9 Ridgecrest (California, US) Earthquake sequence this work clearly shows how the application of advanced methos for seismicity characterization lead to enhanced results even when dealing with extremely sparse seismic networks.