Micro-seismicity of the Northern Sea of Galilee - Before and During the July-August 2018 Seismic Swarm

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This study presents observations and analysis from a high-sampling-rate micro-seismic network, located at the north of the Sea of Galilee, Israel. Stations’ locations were chosen following the seismic swarm at the North of the Sea of Galilee, in October 2013, aiming to perceive a better understanding of the seismicity and structure of this area, in light of that anomaly seismic swarm, and of the seismic activity along the Dead Sea Fault. The micro-seismic network was active between May 2016 to August 2018, with six stations altogether, in distances of 3-5km around the northern Sea of Galilee. Each of the micro-seismic stations had two collocated sensors: 1) GS-1 Geospace, 1 Hz vertical seismometers, sampled at 500 samples per second, and 2) 3-channel Episensor embedded in a Rock+ Kinematics datalogger, sampled at 200 samples per second. Towards the dismantling of the network, another swarm, stronger in magnitude, and longer in duration, has occurred in July-August 2018, roughly at the same location. Meanwhile, a significant upgrade of the Israel Seismic Network (ISN) was taking place, also densifying the number of stations around the Sea of Galilee.

The seismic processing presented here has many steps of verification, at all levels: detection, association, and location. Processing begins with the local high-sampling-rate micro-seismic stations, tuning the most appropriate micro-seismic detectors, and association, location and magnitude parameters. Then this new generated micro-seismic catalogue is used to reveal lower magnitude events within the ISN stations, followed by relocation and re-magnitude estimations, done to those events that have additional information from the ISN stations. Running this process for increasing time-windows, it is demonstrated how the use of micro-seismic instrumentation can increase the seismic catalogue by an order of magnitude, providing higher resolution of the seismicity, both in space and time.

These efforts, of increasing the seismic catalogue, and improving their locations, are utilised for two main goals: a) obtaining a clearer picture of the seismicity and structure in the area before and during the seismic swarm of July-August 2018, b) Zooming into the interesting micro-seismic activity just before the initiation of the swarm.