



Abstract

Real time monitoring systems around seismogenic zone are very important for early detection of earthquake and seismic hazard and seismic risk assessments. Furthermore, these systems are also indispensable to understand crustal activities and phenomena as precursor. In Jordan, The Dead Sea Transform (DST) system is responsible for earthquake activities in the region. Two seismic networks were installed in Jordan by Jordan Seismological Observatory (JSO). These networks are running telemetry stations and strong motion stations. These networks include one station which belongs to the CTBTO International Monitoring Stations and two stations which belongs to GEOFON Global Seismic Network. Jordan seismic networks and advanced seismic hazard applications are explained.

Regional Tectonic and seismotectonic Settings

The DST was formed in the Cenozoic by the break up between Arabian and African plates. It links the Taurus-Zagros zone of plate convergence to the sea-floor spreading in the Red Sea (Girdler, 1985; Quennell, 1984). It is along this transform and its associated fault zones that stress-strain accumulation brought about by the deep acting geodynamics processes is causing lithospheric deformations thus resulting in geological structures as well as the shallow seismicity of this region. The DST including the Levant Fracture Zone is the major active tectonic and morphotectonic features of the region (including the Gulf of Aqaba, the Wadi Araba, the Dead Sea, the Jordan Valley, the Yammouneh fault and the Ghab basin). It was generated in the Middle of the Cenozoic era by the breakup between the Arabian and African plates. It extends for about 1000 to 1100 km (see Fig. 1), as a part of the great East African-Syrian rift system which extends for about 6000 km (Quennell, 1958, 1984; Freund et al., 1970) and the volcanisms and uplift, as well as N-S and NW-SE transgression cycles of the Tethys are the major factors that characterized the region.

Seismograph Stations in Jordan

In 1983, the Jordan Seismological Observatory (JSO) of Natural Resources Authority (NRA) of Jordan started a national program through which eight telemetry seismic stations were installed in northern-central Jordan. Nowadays, the Jordan Seismic Network (JSN) of the JSO consists of 18 short-period and broadband stations connected to the Jordan Seismological Observatory (JSO) via GPRS and Vsat transmission signals. The data acquisition system are using Seiscomp3 and Reftek software. Seiscomp3 and Seisan are used for data analyzing and locating of local, regional and distant earthquakes. Different types of seismometers are installed in the seismograph stations. These includes: High performance, low noise, compact, broadband seismometers STS-2 BB, Guralp and Reftek. Data obtained from these stations will allow the JSO to improve the location and characterization of the earthquakes in and around Jordan. Fig. (2) shows the distribution of the the seismograph stations in Jordan. The distribution is concentrated near the main of the DST.

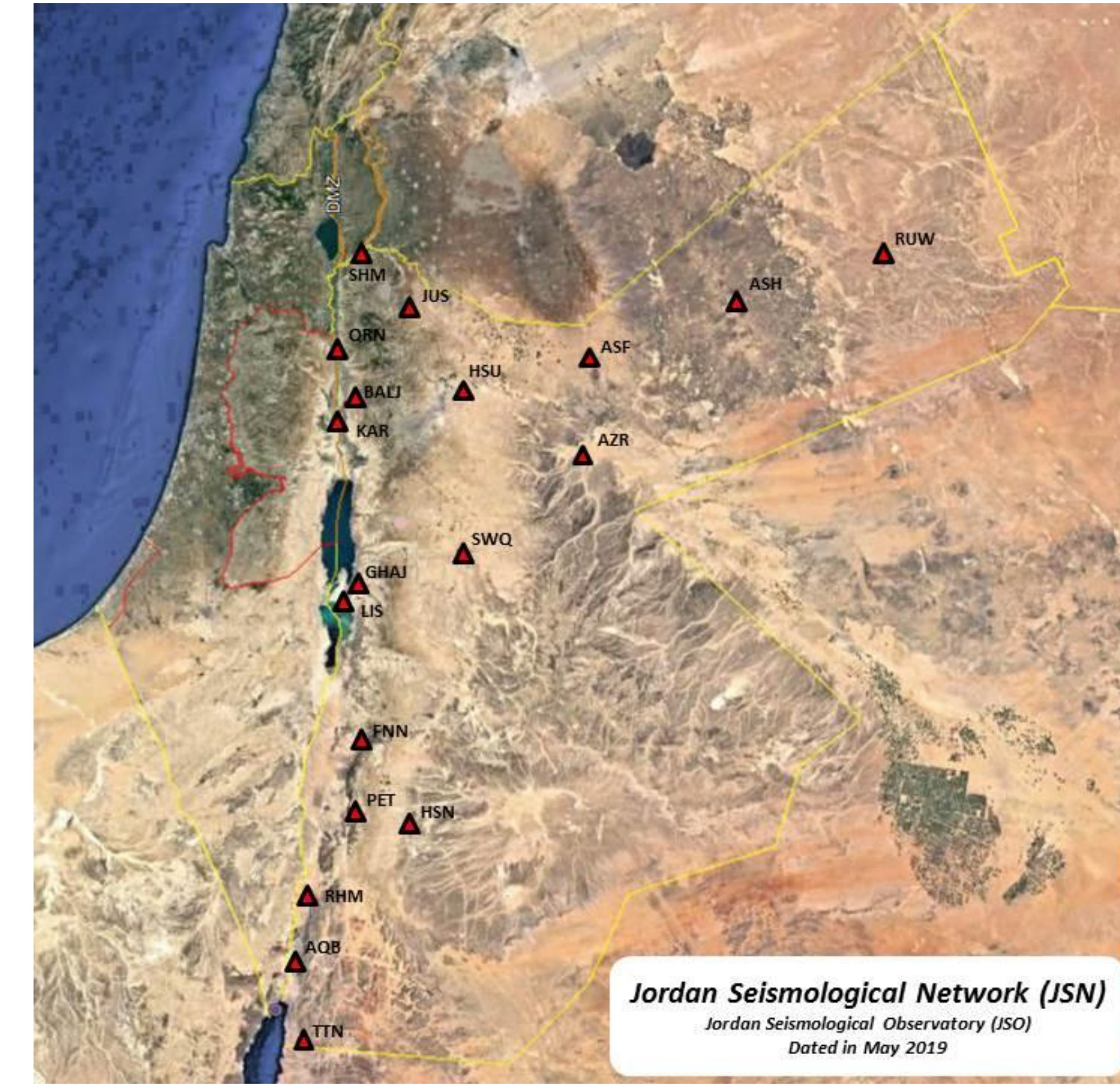


Fig. (2): Distribution of the seismograph stations of the JSO in Jordan.

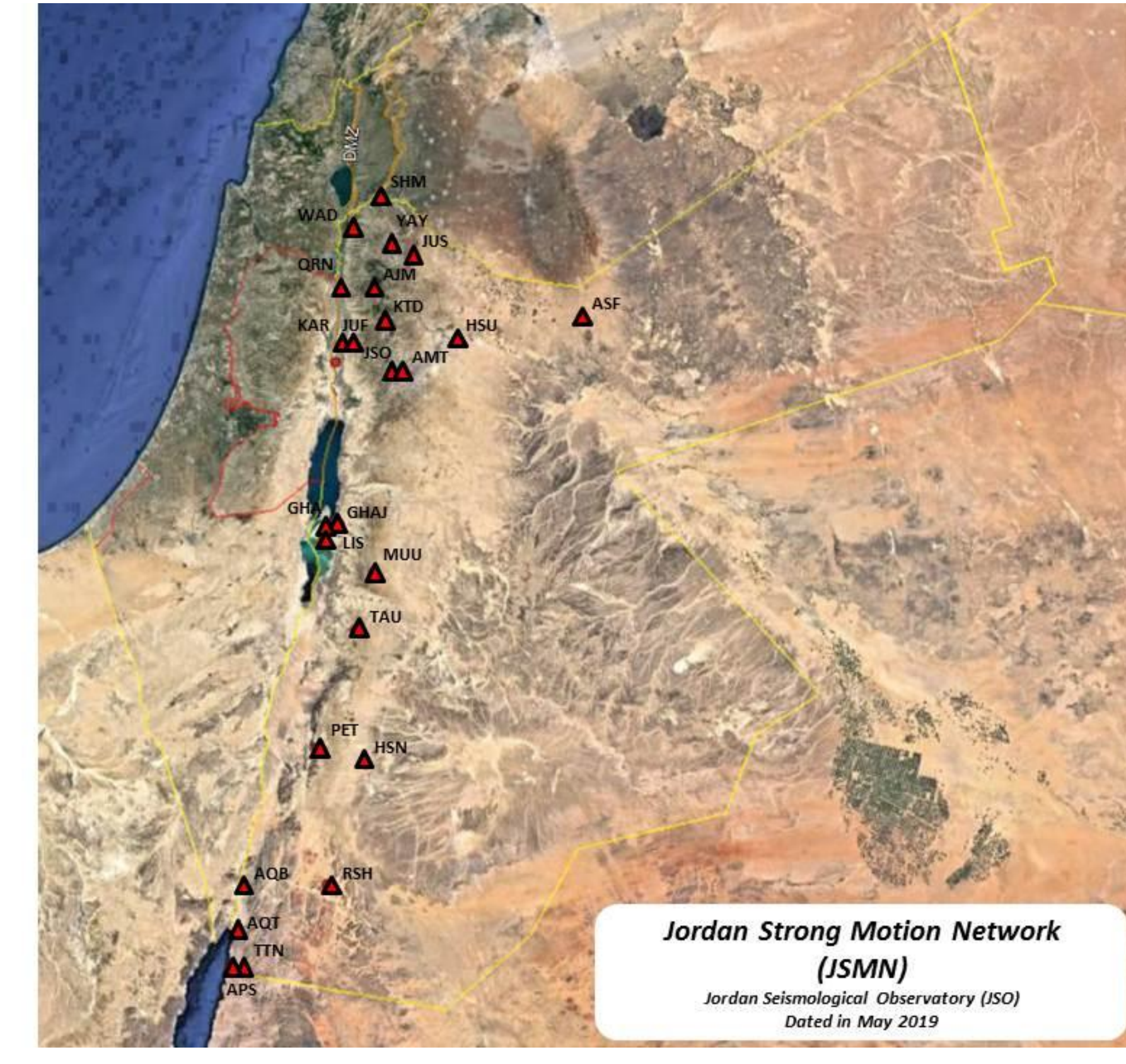


Fig. (3): Distribution of the accelerograph stations of the JSO in Jordan.

Accelerograph Stations in Jordan

Earthquake strong ground motion observation in Jordan began in May 1990 when the JSO operated the Kinematics PDR-1 accelerograph stations. In the second stage, JSO operated the Kinematics SSA-2 and Etna accelerograph stations. Etna2 instruments were installed in 2018. Despite the slow increase in the number of accelerographs in Jordan, useful accelerograms were obtained. Fortunately, recent intensive installation of digital accelerographs instruments took place in different localities of Jordan. Where nowadays the Jordan Strong Motion Network (JSMN) consists of 26 digital accelerograph stations (see Fig. 3).

Seismic Hazard Assessment

Seismic hazard assessment for the Greater Amman Municipality, Aqaba City, Irbid City and Petra zone were conducted to stand the expected risks and losses studies due to proposed earthquake scenarios. Accordingly, these studies were an attempt to evaluate the geographical distribution of potential human and material losses due to proposed earthquake scenarios. The results of the seismic hazard studies showed that the DST fault system is recognized as the main seismic source within the region. Although, revision of historical and recent instrumental earthquake catalogue (see Fig. 4) indicated sixteen different earthquake area zones, three earthquake scenarios were proposed: The Dead Sea Basin (scenario I), the Jordan Valley (scenario II) and the Wadi Araba (scenario III). These scenarios were suggested based on active seismicity and the deaggregation of PSH analysis of the studied areas.

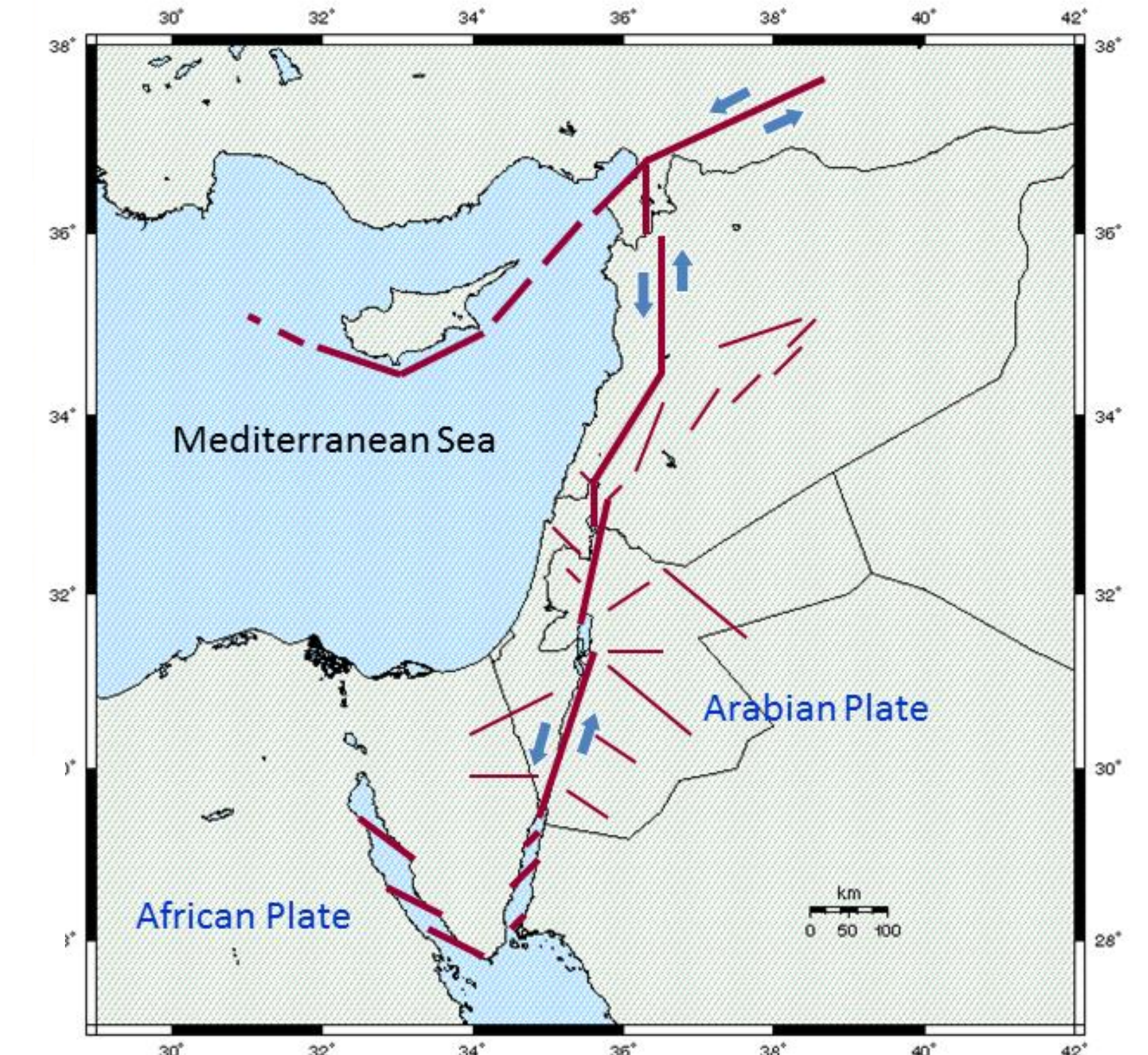


Fig. (1): Regional tectonics of the DST region and around.

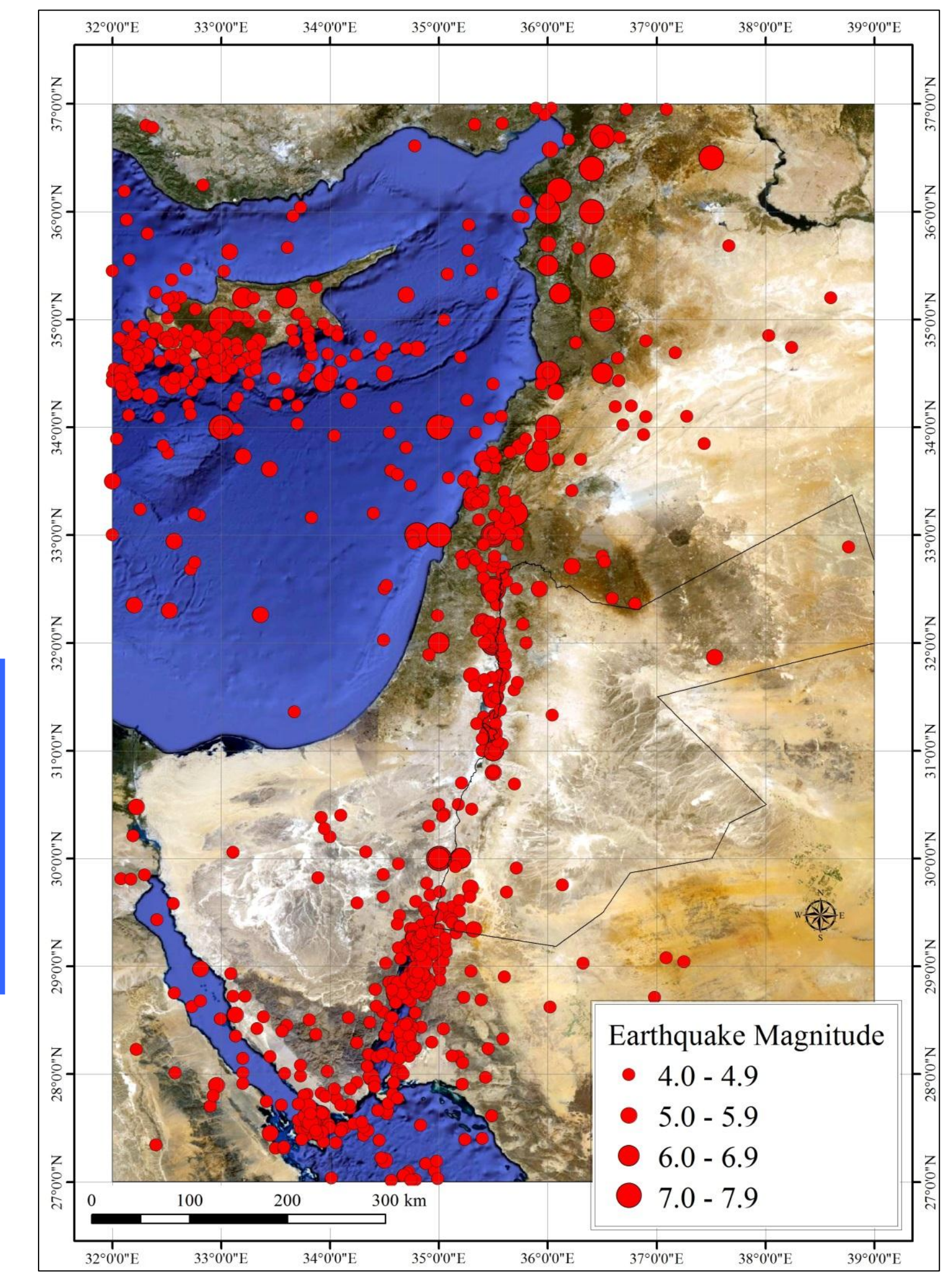


Fig. (4): Earthquake epicenters of the Instrumental and historical seismicity from 31 A.D. to 2016)