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Seismicity and Seismic Hazard along the Western part of the Eurasia–Nubia plate boundary

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The seismic phenomenon is the most damaging natural hazard known in the Mediterranean area. The western part of the Eurasia–Nubia plate boundary extends from the Azores to the Mediterranean region. The oceanic part of the plate boundary is well delimited from the Azores Islands, along the Azores-Gibraltar fault to approximately 12°W (west of the Strait of Gibraltar). From 12°W to 3.5°E, including the Iberia–Nubia region and extending to the western part of Algeria, the boundary is more diffuse and forms a wider area of deformation. The boundary between the Iberia and Nubia plates is the most complex part of the margin. This region corresponds to the transition from an oceanic boundary to a continental boundary, where Iberia and Nubia collide. Although most earthquakes along this plate boundary are shallow and generally have magnitudes less than 5.5, there have been several high-magnitude events. Many devastating earthquakes, some of them tsunami-triggering, inflicted heavy loss and considerable economic damage to the region.
From 1920 to present, three earthquakes with magnitudes of about 8.0 (Mw 8.2, 25 November 1941; Ms 8.0, 25 February 1969; and Mw 7.9, 26 May 1975) occurred in the oceanic region, and four earthquakes with magnitudes of about 7.0 (Mw 7.1, 8 May 1939, Santa Maria Island and Mw 7.1, January 1980, Terceira and Graciosa Islands, both in the Azores; Ms 7.1, 20 May 1931, Azores-Gibraltar fracture zone; and Mw 7.3, 10 October 1980, El Asnam, Algeria) occurred along the western part of the Eurasia–Nubia plate boundary. In general, large earthquakes (M $\geq$7) occur within the oceanic region, with the exception of the El Asnam (Algeria) earthquakes. Some of these events caused extensive damage.
The 1755 Lisbon earthquake ($\sim$Mw 9) on the Portugal Atlantic margin, about 200 km W–SW of Cape St. Vincent, was followed by a tsunami and fires that caused the near-total destruction of Lisbon and adjacent areas. Estimates of the death toll in Lisbon alone ($\sim$70,000) make it one of the deadliest earthquakes in history. Measured in lives lost, the 1926, 1980 and 1998 Azores earthquakes (Portugal), the 1954 and 1980 El Asnam earthquakes (North Algeria), the 1994 and 2004 Alhoceima earthquakes (North Morocco), and the 2003 Boumerdes earthquakes (North Algeria) were the worst earthquakes in the past 120 years in the study area. Hence, this region has experienced many large and damaging earthquakes. The city of Cairo (Egypt) was struck in October 1992 by an Mw 5.8 magnitude earthquake, which caused large damage. In 1935, the Syrte region in Libya experienced an M6.9 earthquake with severe damage. Generally, North Africa has experienced moderate earthquakes. However, the region remains vulnerable due to the shallow seismicity, the poor mechanical properties of its soil and local site conditions, and the consequent strength of the ground shaking. Knowing the behaviour of a seismogenic area, particularly the fault zone, will lead us to better assess the hazard and risk in and around large urban areas.
In order to mitigate the destructive impact of the earthquakes, the regional seismic hazard in North Africa is assessed using different approaches (ex. deterministic and probabilistic) using historical and instrumental seismicity, earthquake sources, seismotectonic zonation, structural models and attenuation laws. As a result, reliable seismic hazard maps are produced in terms of maximum displacement and in terms of maximum intensity map.

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