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Analysis of past earthquakes along the North Anatolian Fault in the Marmara Region (Turkey): Implications for the spatial distribution for surface ruptures in the last 1000 years

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The North Anatolian Fault (NAF), one of the major continental strike-slip faults of the World, extends for about 1500 km between the Karlıova triple junction to the east and the North Aegean Trough to the west. This tectonic structure showed a remarkable seismic activity between 1939 and 1999, when the westward migrating earthquake sequence created surface ruptures of more than 1000 km, leaving unbroken only the Yedisu Segment to the east, and the Marmara Segment to the west. The rich historical records include many past earthquakes that destroyed ancient settlements along the NAF. However, there are ambiguities for the spatial distribution of the surface ruptures of these palaeoevents, especially in the Marmara Region, where the fault bifurcates into two branches, the more active northern and the less active southern strands.

In order to understand the spatial distribution of these historical earthquakes, we revised the available palaeoseismological studies, including trenches for the inland, and results of core analyses for the offshore segments, in the framework of the EU project “MARsite: New directions in seismic hazard assessment through focused Earth observation in the Marmara Supersite”. First, we compiled a dataset of more than 50 trench and 20 coring sites, which are mostly located along the northern strand of the NAF. Then, all faults are simplified to show only the major geometric elements such as their generalized strikes and lengths. The integration of these temporal and spatial data enabled us to model the relationship between the individual palaeoseismic studies. Our preliminary results show that the migrating earthquake sequence is not characteristic only for the 20th century, but it also occurred in the past. Moreover, limited number of studies, revealing the co-seismic slip of palaeoevents, suggest ‘non-characteristic behaviour’ of NAF, especially at structurally complex segments.