



Tsunami risk assessment in the Southeast of the Mediterranean Sea

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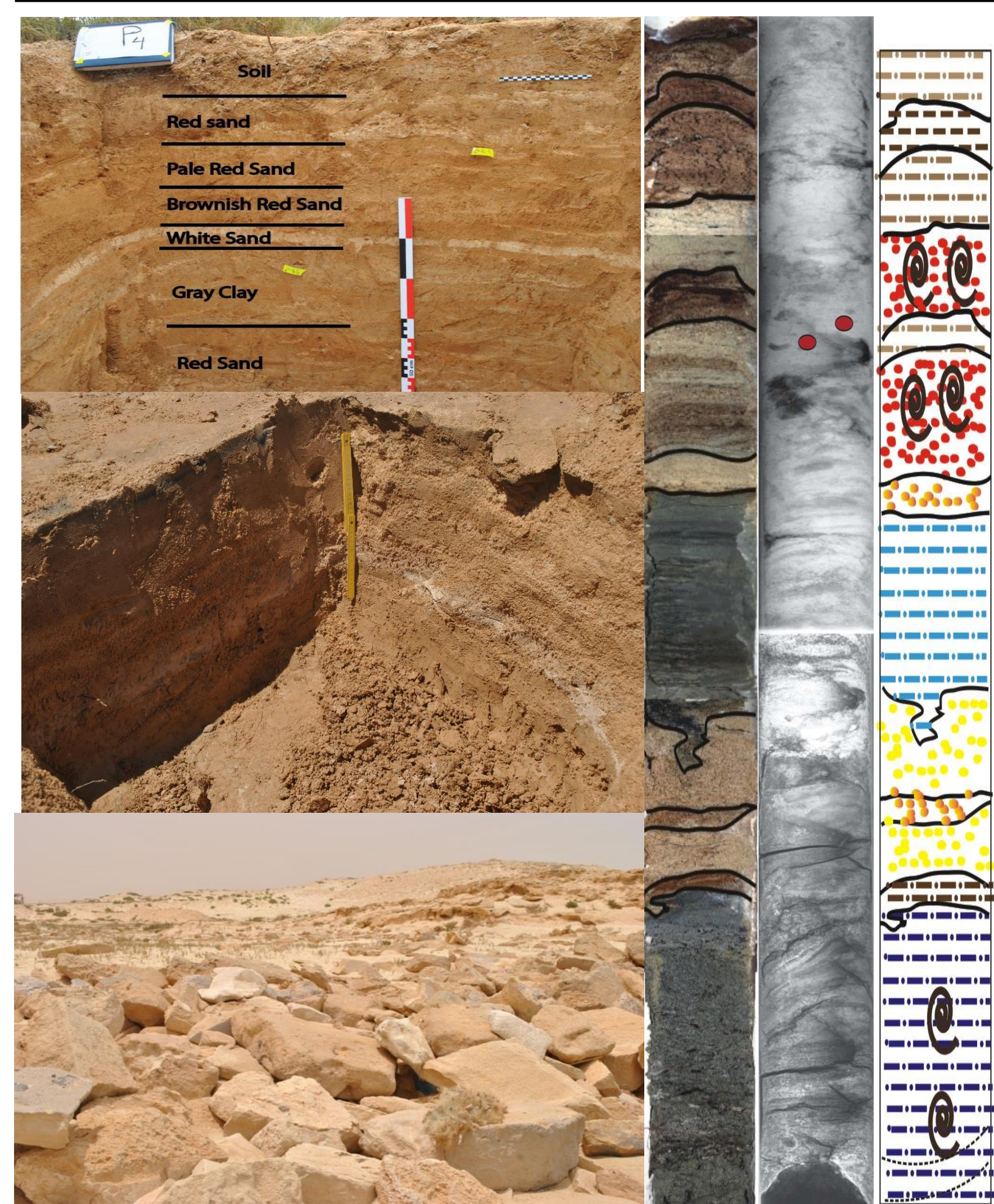


Abstract

Along with history, the southern-eastern Mediterranean coasts have experienced several historical tsunamis triggered by the earthquake from both far and near field sources (e.g., Hellenic, Cyprian arcs). The most hazardous tsunami events were 365 AD in Crete with Mw8.5, 1222 in Cyprus with Mw 7 - 7.5 and 1303 in Rhodes Island with Mw8.0. The tsunamis caused widespread destruction and victims along the coastal cities as evidenced by available historical reports, geomorphology and paleo-tsunami investigations accomplished recently. On the other side potential mechanisms to generate tsunami would be a local underwater landslide, mass movement due to Volcanic eruptions and local earthquakes. These potential sources pose a higher risk due to short travel times for tsunami waves that limits the alarming time. Furthermore, a case study for tsunami impact was applied in details in the city of Alexandria. By combining hazard and vulnerability levels for residential buildings, a qualitative risk assessment has been performed. The urge for the implementation of early warning system for the coast of eastern Mediterranean is becoming an essential and urgent need.

Table 1 :Historical tsunami affected the northern Egyptian coast

Dates	Epicentre	Mag.	Reference
~1600 B.C.	Santorini	-	Cita et al. (1996)
21 July 365	W. Crete	8.3 – 8.5	Stiros and Drakos, (2006);
18 January 746	DSF	7.5	Ambraseys, (2009)
881 - 882	Palestine	?	Galanopoulos A., (1957)
4 January 1033	Jordan Valley	7.4	Ambraseys, (2009)
18 January 1068	N. Lebanon	6.9	Ambraseys, (2009), Soloviev et al.(2000)
8 August 1303	Rhodos	8	Abu al-Fida (1329), Ambraseys (2009)
24 June 1870	Hellenic Arc	7.2	Ben-Menahem (1979) ; Soloviev et al. (2000)



Three high-energy sedimentary layers deposited along the Egyptian coastline at Kefr Saber and Alamein) were identified by Salama et al. 2018. The radiocarbon age dating for the samples collected from these layers show ages correlate with three tsunamigenic earthquakes of the Hellenic subduction: 1) The 21 July 365 (Mw 8.3), 2) the 8 August 1303 (Mw 7.8–8), and 3) the 24 June 1870 (Mw 7 - 7.5). The size of past tsunamis can be manifested by the thickness of the deposited catastrophic sedimentary units in trenches of K.Saber and core units of the El Alamein site.

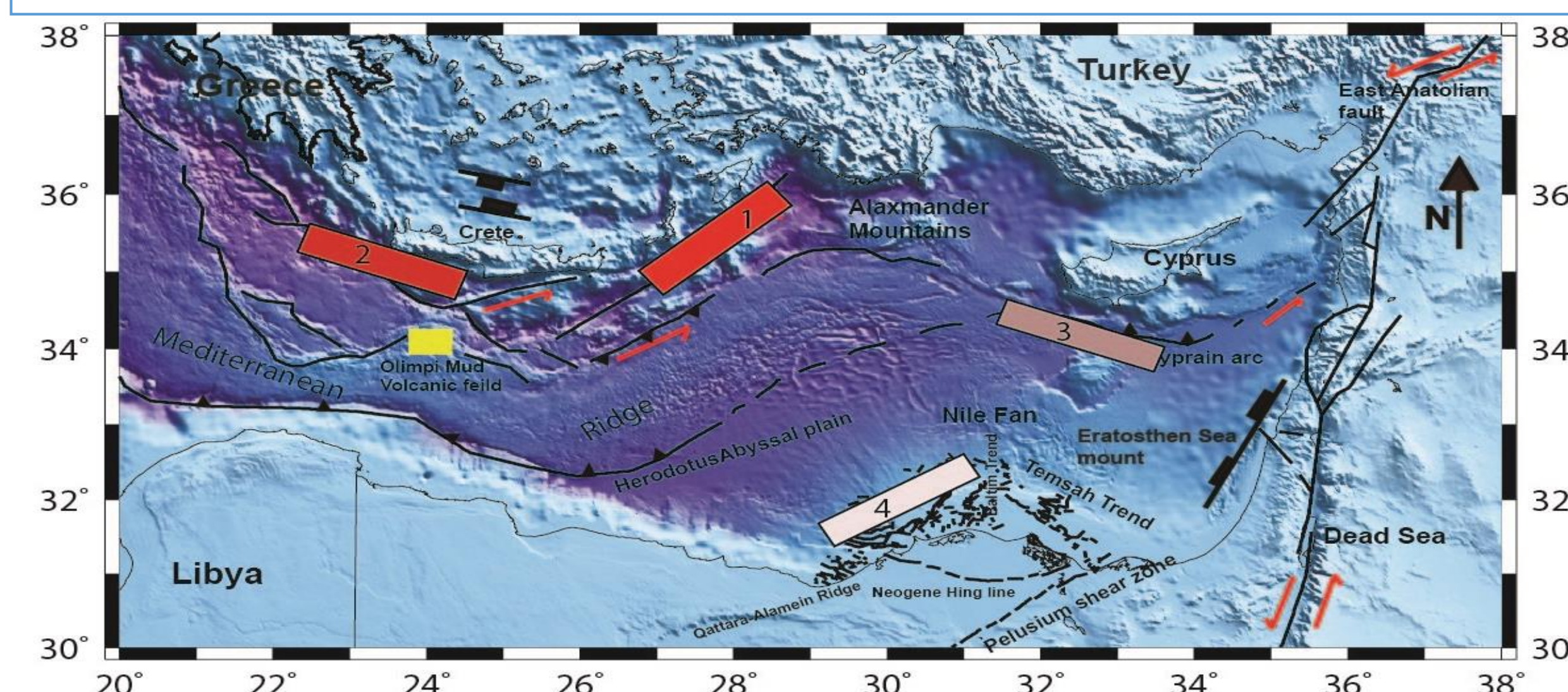


Figure 2: Possible tsunamigenic sources for N. Egypt

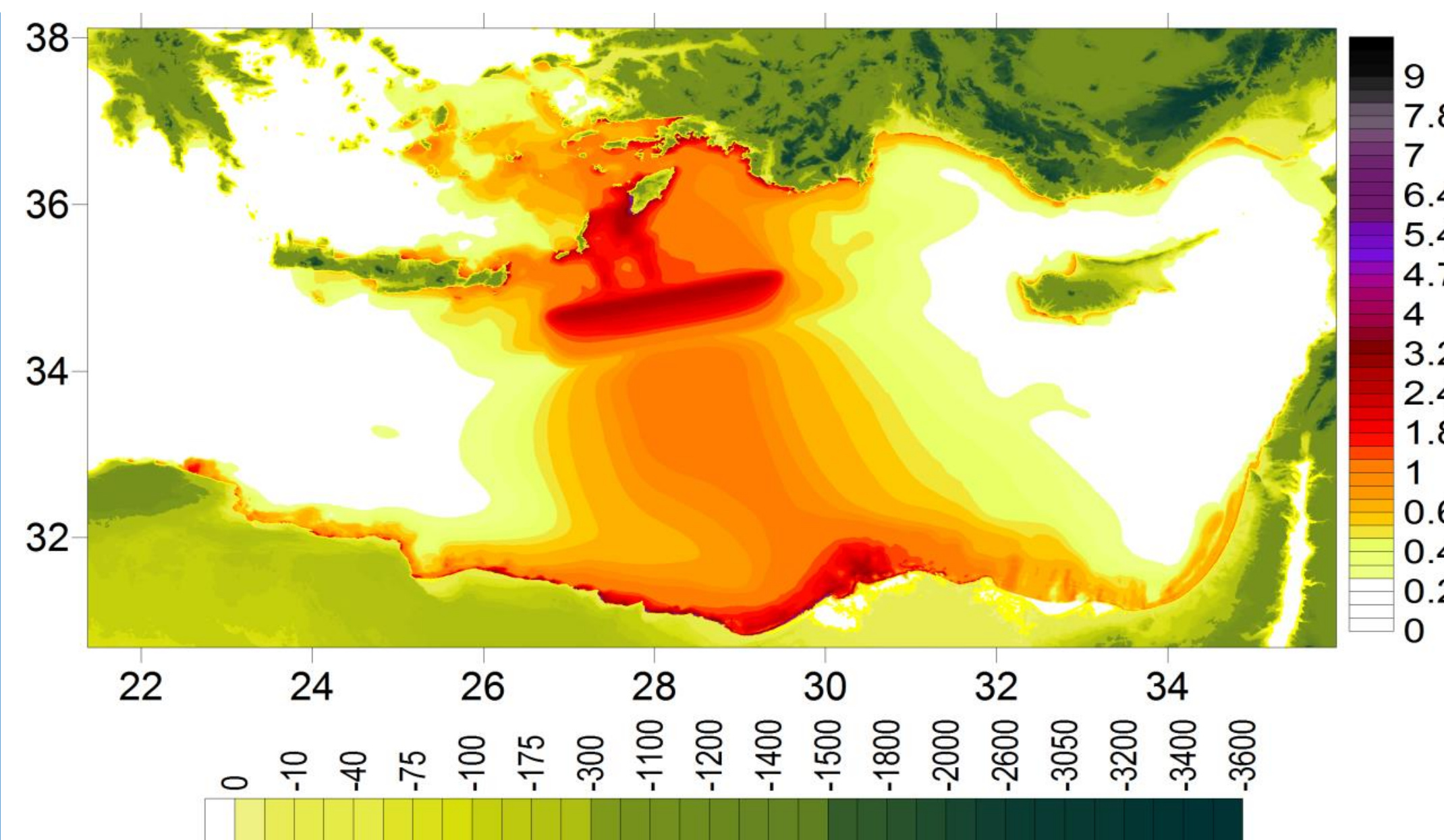


Figure 3: The maximum positive wave amplitudes for EHA.

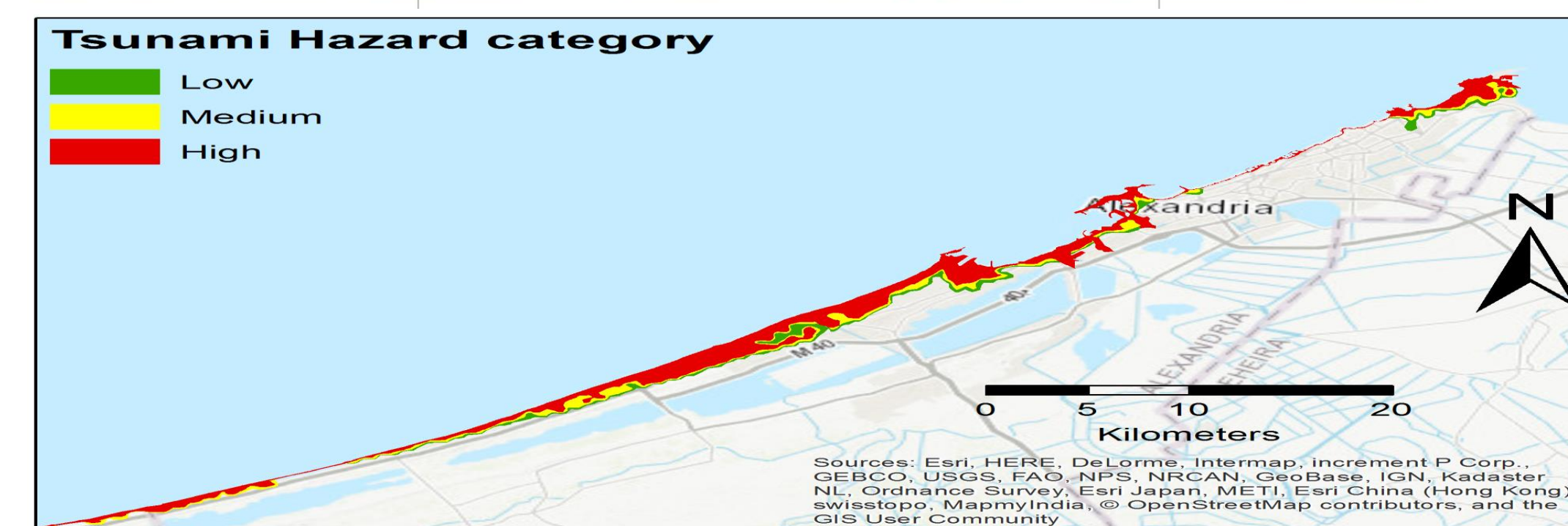
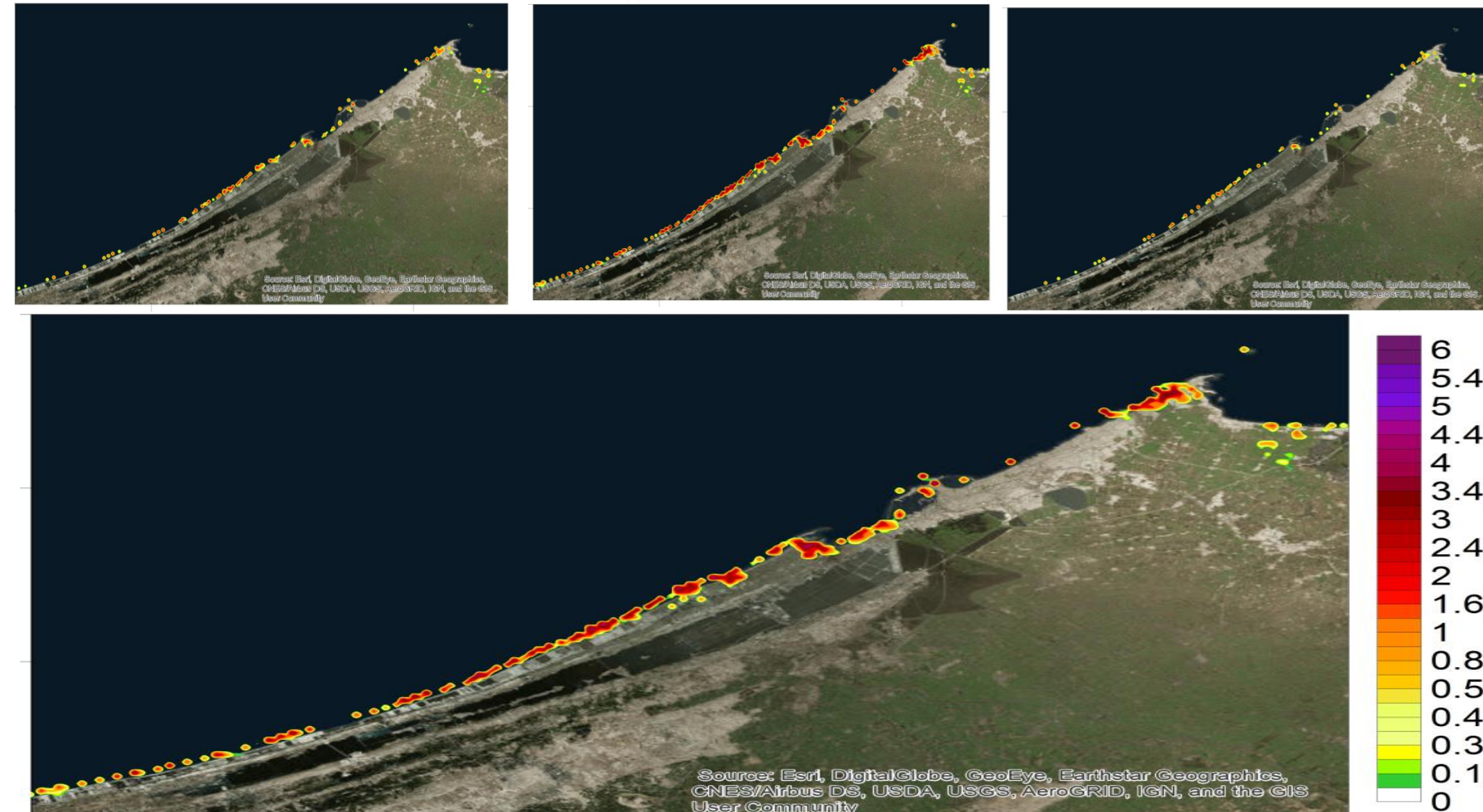
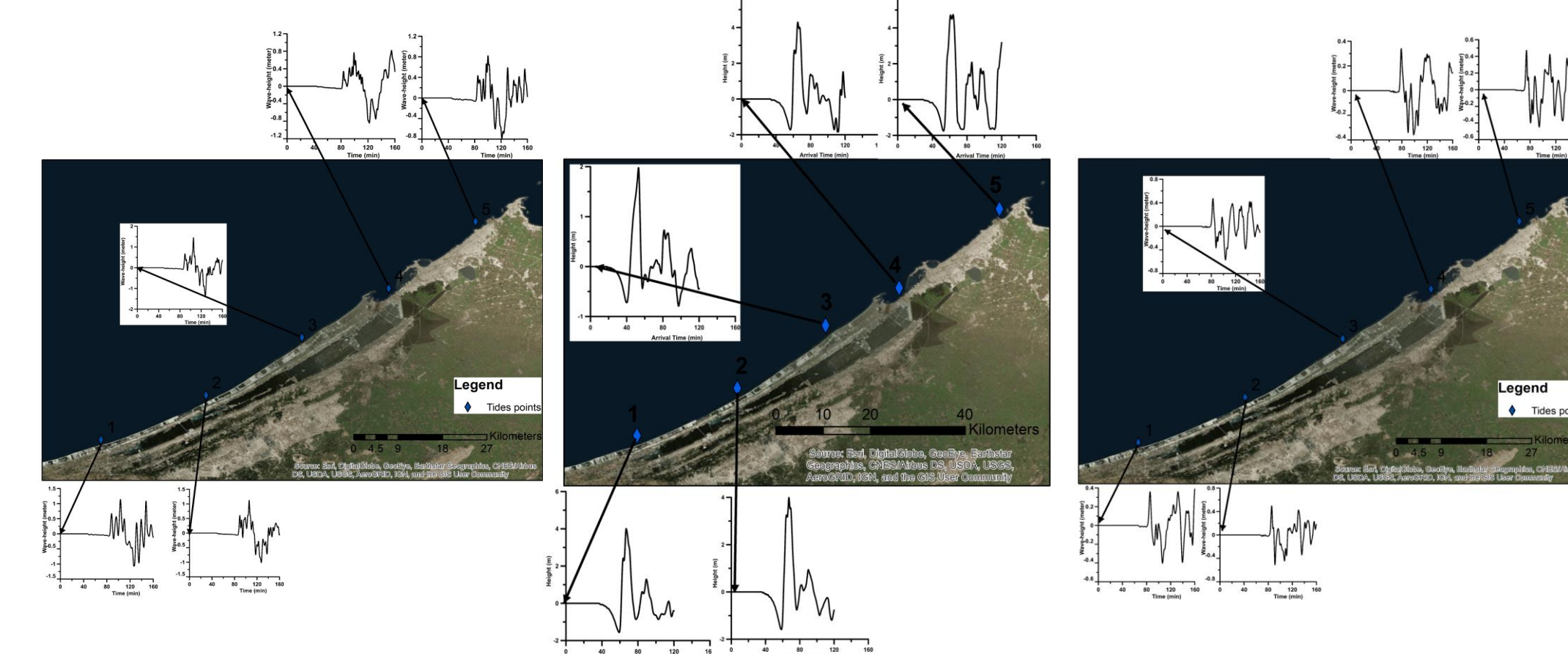


Figure4: Synthetic time series of tsunami wave computed at different points along Alexandria & the Aggregated scenario built from an envelope of the extreme values of wave heights.

Reference

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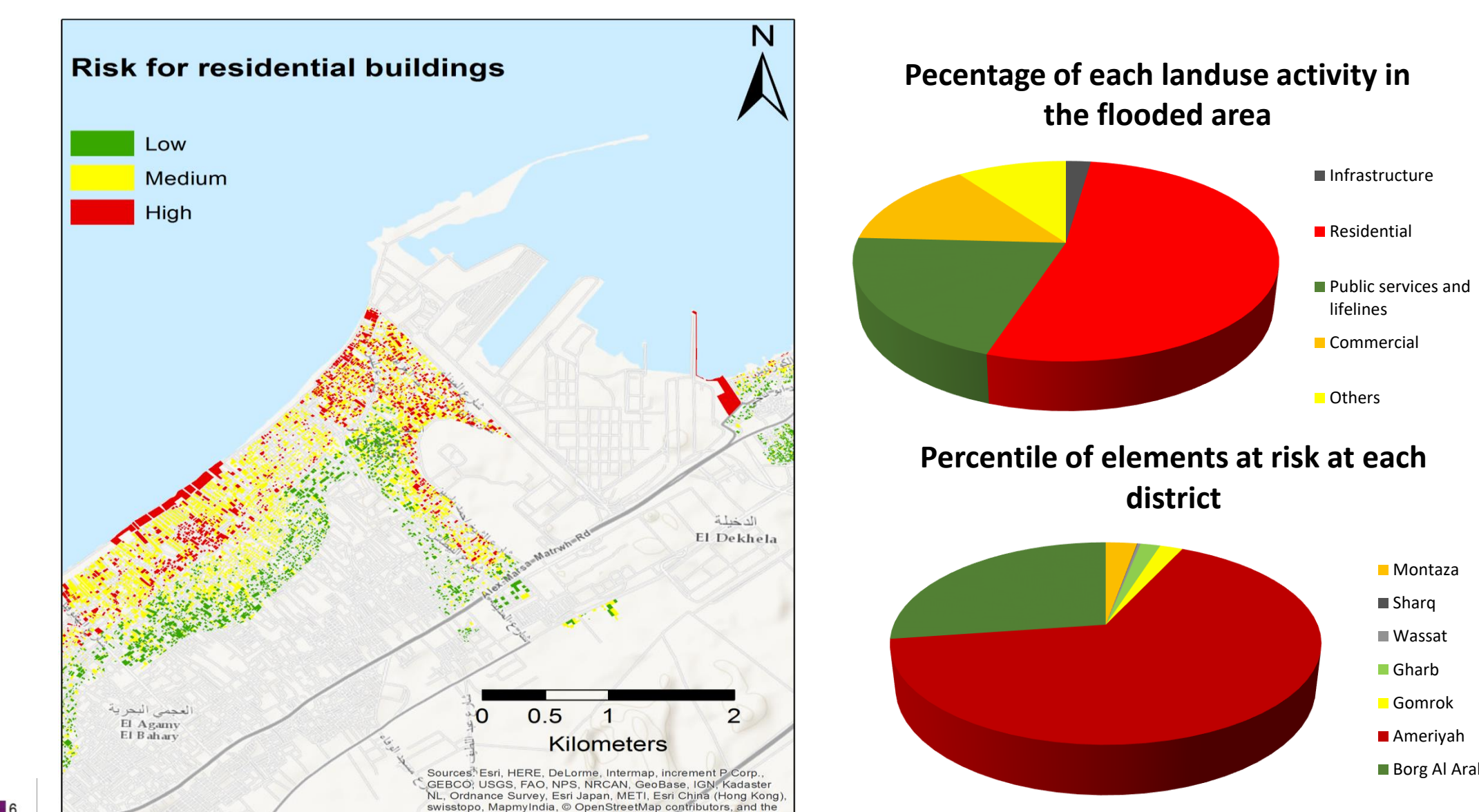
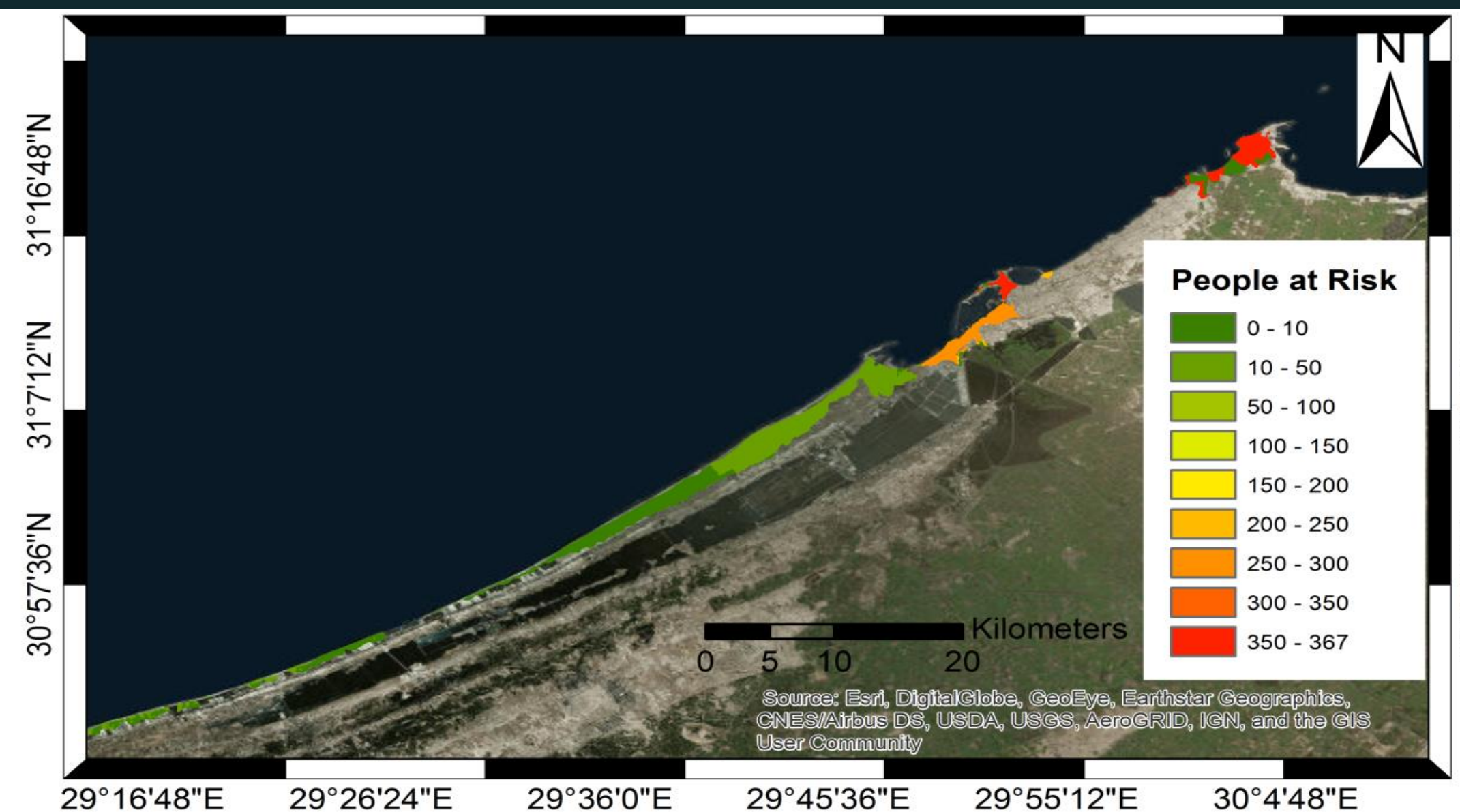


Figure 5: a) The density of exposed population. b) Risk assessment for residential buildings in Ameriyah, the most exposed district c) Number of persons per 100 square meter and The percentage of buildings at each district relative to the total number of buildings exposed

Detailed tsunami hazard assessment for Alexandria from three potential sources located in the EM basin using numerical modeling. Extensive damage is expected from the EHA scenario. The vulnerability analysis for residential buildings shows that the buildings of high vulnerability represent about 21% of the entire building stock while the low vulnerable buildings reach about 24% of total. The percentage of residential buildings in medium vulnerability class is about 55% of total residential buildings. The presence of about 79% of the total buildings in the high and medium vulnerability classes recalls for the importance of finding the proper procedure and knowledgeable strategies for decreasing the vulnerability of residential building.

Figure 1: paleo-tsunami evidence from northern Egypt

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