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Characteristics of the 30 October 2020 Mw 7.0 Aegean Sea earthquake from sea level data analysis and numerical modeling

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The 30 October 2020 tsunami in the Aegean Sea was generated by an Mw 7.0 normal-faulting earthquake at a depth of 21 km. The earthquake epicenter was near the city of Izmir (Turkey) in the Aegean Sea and left 117 fatalities in Turkey and two deaths in Greece. A moderate tsunami was generated, which attacked the nearby coast of Turkey and the north coast of Samos island, Greece. A maximum runup height of ~3.8 m was observed in Akarca with extensive inundation at the low elevation nearshore areas of the small bays from Akarca (South) to Alacati (North) of the central Aegean coast of Turkey (field surveys by Yalciner et al., 2020). The maximum tsunami penetration was ~2500 m along Azmak streambed at Alacati, Turkey. One casualty and at least one injury were directly attributed to the tsunami in Sigacik, Turkey. The predecessors of this event were other normal-faulting events: i) Lesvos-Karaburun (Mw 6.3) earthquake (Greece-Turkey) on 12 June 2017 approximately 110 km to the North-northwest, and ii) Bodrum-Kos (Mw 6.6) earthquake (Turkey-Greece) on 20 July 2017 approximately 110 km to the south-southeast of the epicenter of the 30 October 2020 event. The events of 2017 and 2020 show high similarities in terms of faulting mechanism and tsunami-genesis. The tsunami generated by the last event caused extensive loss of properties and damage to marine vessels. Here, we study the 30 October 2020 tsunami through analysis of eight tide gauge records as well as numerical simulations. Tide gauge data revealed that the tsunami's zero-to-crest amplitudes, on tide gauges, was in the range of 5 – 12 cm with maximum amplitude (12 cm) recorded at Kos (Greece). The tsunami duration was unusually long and varied from 20 h to 35 h. Such long tsunami oscillations are not expected from an Mw 7.0 normal-faulting tsunamigenic earthquake and can be most likely attributed to several reflections due to the confined nature of the Aegean Sea region. We conducted Fourier and Wavelet analyses to detect tsunami's spectral characteristics. Our tsunami simulation was able to reproduce most features of the recorded waves both in terms of amplitudes and duration. This research is suported by Royal Society (UK), grant number CHL/R1/180173.