Mass flows and other hydrodynamic consequences of small and moderate earthquakes in the Sea of Marmara

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Abstract

Earthquake-induced submarine slope destabilization is known to cause mass wasting and turbidity currents, but the hydrodynamic processes associated with these events remain poorly understood. Instrumental records are rare and this notably limits our ability to interpret marine paleoseismological sedimentary records. An instrumented frame comprising a pressure recorder and a Doppler recording current meter deployed at the seafloor in the Sea of Marmara Central Basin recorded the consequences of a MW = 5.8 earthquake occurring Sept 26, 2019 and of a Mw = 4.7 foreshock two days before. The smaller event caused sediment resuspension and weak current ($<$ 4 cm/s) in the water column. The larger event triggered a complex response involving a debris flow and turbidity currents with variable velocities and orientations, which may result from multiple slope failures. A long delay of 10 hours is observed between the earthquake and the passing of the strongest turbidity current.

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The distance travelled by the sediment particles during the event is estimated to several kilometres, which could account for a local deposit on a sediment fan at the outlet of a canyon (where the instrument was located), but not for the covering of the whole basin floor. We show that after a moderate earthquake, delayed turbidity current initiation may occur, possibly by ignition of a cloud of resuspended sediment.