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On the tsunamigenic potential of the Makran accretionary wedge resulting from its seismicity

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Subduction zones generate earthquakes that cause ocean floor displacement leading to tsunamis. Movement along sedimentary accretionary wedges adjoining their trenches is another cause for tsunamis (Kanamori and Kikuchi, 1993). Intra-plate events on the overriding plates at distances > 200 km are also known to be tsunamigenic, like the 2013 Balochistan earthquake (Hoffmann et al., 2014). This tsunami was sourced on the accretionary wedge, the largest of its kind, along the Makran Subduction Zone (MSZ), the Arabia-Eurasia plate boundary. Assessing the tsunamigenic potential of the MSZ is of grave importance, given its geographic proximity to the coasts of Pakistan, Iran, Oman, and India. The only known and well-studied large tsunami here was in 1945, following the Mw 8.1 earthquake. The resultant tsunami had two separate pulses; the first caused by direct ocean floor displacement (Byrne et al., 1992), and the second attributed to a submarine slump (Rajendran et al., 2013). The 2013 tsunami, although much smaller, was also triggered by a submarine slump off the coast of Pakistan (Heidarzadeh and Satake, 2014). Both these earthquakes occurred on the eastern part of the trench, considered more active than its western counterpart. The idea of the MSZ being segmented stands debated (Smith et al., 2013; Rajendran et al., 2013), and settling this issue is crucial in evaluating the size of a potential megathrust earthquake. However, based on current observations, the mechanism of faulting close to the MSZ trench is mostly oblique strike-slip/pure strike-slip due to the plate dynamics along the left-lateral Ornach-Nal fault in the east and the right-lateral Minab-Zendan fault in the west. Although the potential for a megathrust event and its size are major concerns, it is important to evaluate the impending hazard due to moderate/large earthquakes adjacent to the trench and their effect on the Makran accretionary wedge. In this study, we generate the seismic source model for the 2013 Balochistan event using moment inversion of teleseismic body-waves, and compare it with available satellite imagery (Zhou et al., 2016) suggesting an oblique component in the southern leg of the rupture. We also compute the Coulomb static and dynamic stress-changes caused by the earthquake on the accretionary wedge to evaluate its tsunamigenic potential as a secondary effect of both onshore and offshore seismic events.