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The 2016 Mw 7.8 Kaikōura Earthquake: a rare snapshot of coseismic-slip transfer between the plate-interface and faults in the upper-crust

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The 2016 M7.8 Kaikōura Earthquake triggered global scientific interest. This is because this earthquake ruptured multiple faults (n>20), mainly onshore, and across an active subduction margin providing, thus, a unique opportunity to examine co-seismic fault interactions between various elements of a subduction system. Although to date, numerous studies have modeled this earthquake, it is still unclear whether or not the plate-interface was involved and if so, to what extent. Here we use published and new (this study) field measurements of uplifted marine biota together with displacements recorded by LiDAR, GPS, seismographs and tide-gauges to chart coseismic deformation patterns in the broader Kaikōura region and model the major seismic sources involved in this event. Our analysis captures a rare snapshot of slip-transfer between upper-plate faults and the plate-interface. Despite its apparent involvement in the Kaikōura Earthquake, the plate-interface moved with a mean slip of only 0.6 m. This is because a significant amount of convergent-related slip was accommodated by a thrust fault that splays off the plate-interface and extends within the upper crust. The Kaikōura earthquake suggests that these large splay-thrust faults provide a key mechanism in the transfer of plate motion at the termination of a subduction margin and represent an important seismic/tsunami hazard.