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Seismic doublets and a complex seismic sequence controlled by the rotation of the Juan Fernández microplate

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A complex seismic sequence took place in 2014 at the Juan Fernández microplate, a small microplate located between Pacific, Nazca and Antarctica plates. Despite the remoteness of the study region and the lack of local data, we were able to resolve earthquake source parameters and to reconstruct the complex seismic sequence, by using modern waveform-based seismological techniques. The sequence started with an exceptional Mw 7.1-6.7 thrust – strike slip earthquake doublet, the first subevent being the largest earthquake ever recorded in the region and one of the few rare thrust earthquakes in a region otherwise characterized by normal faulting and strike slip earthquakes. The joint analysis of seismicity and focal mechanisms suggest the activation of E-W and NE-SW faults or of an internal curved pseudofault, which is formed in response to the microplate rotation, with alternation of thrust and strike-slip earthquakes. Seismicity migrated Northward in its final phase, towards the microplate edge, where a second doublet with uneven focal mechanisms occurred. The sequence rupture kinematics is well explained by Coulomb stress changes imparted by the first subevent. Our analysis show that compressional stresses, which have been mapped at the northern boundary of the microplate, but never accompanied by large thrust earthquakes, can be accommodated by the rare occurrence of large, impulsive, shallow thrust earthquakes, with a considerable tsunamigenic potential.