

Why the Hope fault bypassed during the 2016 Kaikoura earthquake?

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The complex multi-fault rupture is observed in the 2016 Kaikoura (New Zealand) earthquake. Although the overall slip pattern was well explained by dynamic rupture simulations (Ando and Kaneko, 2018, GRL), a big question remains on the reason why the Hope fault was bypassed during the 2016 event. The Hope fault is one of the most active upper plate faults in the focal area, accommodating the relative motion between the Pacific Plate and the Australian Plate. In this study, we first test a hypothesis: The stress level of the Hope fault (see fig.) is lower than the surrounding faults due to the effect of the last event before 2016. A set of parameter studies shows that 70-80% lower stress level on the Hope fault leads to the passive partial slip resembling the observation of the 2016 event. So far, we do not exclude the possibility that the Hope fault is bypassed through a more complicated rupture path than that obtained in A&R (2018). To explore this hypothesis, we adopt the 3D fault geometry developed by Nicol et al. (in prep July 2021) to revise the geometry of the Point Kean and Papatea faults based on the aftershock distribution (Chamberlain et al., 2021).

