Conjugate fault model of the 2018 Anchorage, Alaska, intraplate earthquake (M_W 7.1) based on strong-motion waveform inversion

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The Anchorage, Alaska, earthquake (M_W 7.1) on 30 November 2018 occurred in the upper part of the Pacific plate or Yakutat microplate subducting beneath the North American plate. A relocated aftershock distribution (Ruppert *et al.*, 2020) and moment tensor solutions (Richards, 2019; West *et al.*, 2020) suggested the possibility that this earthquake was a rare intraplate event with conjugate source faults. Based on this possibility, we performed a source inversion using strong-motion waveforms at periods of 2.5–20 s and investigated the source characteristics of this earthquake.

The source inversion was performed using the multi-time-window linear waveform inversion method (Hartzell and Heaton, 1983). The assumed conjugate faults consist of a gently east-dipping (strike = 5˚, dip = 30˚) fault and a steeply west-dipping (strike = 185˚, dip = 60˚) fault. The hypocenter was located on the former. The Green's functions were calculated by the discrete wavenumber method (Bouchon, 1981) and the reflection/transmission coefficient matrix method (Kennett and Kerry, 1979). For the calculations, 1D seismic velocity structure models (Dutta *et al.*, 2007; Eberhart-Phillips *et al.*, 2019) were adjusted using waveforms of an M_W 5.0 aftershock.

Our inversion estimated the seismic moment, average slip, and maximum slip to be 5.91×10^{19} Nm (M_W 7.11), 0.97 m, and 2.7 m, respectively. Two large slips were estimated on the steeply west-dipping fault and the deeper part of the gently east-dipping fault, respectively. Because the rupture initiated on the gently east-dipping fault, we also tested an inversion without assuming the steeply west-dipping fault. The test result showed that, compared with the inversion with assuming the steeply west-dipping fault (i.e., the large slip on the steeply west-dipping fault), the inversion without assuming could not sufficiently reproduce the waveforms observed at the stations on the northern and western sides of the source region. The necessity of the steeply west-dipping fault was also reported by the analyses of teleseismic body waves (Liu *et al.*, 2019) and GPS static displacements (West *et al.*, 2020).

Although this earthquake was a rare event with conjugate faults, the source scaling relationships of its source parameters (e.g., average slip, entire rupture area, and large slip area) to the seismic moment were consistent with the empirical relationships derived by Iwata and Asano (2011) and Allen and Hayes (2017). This consistency was found for the 2016 Iniskin, Alaska, intraplate earthquake (M_W 7.1), but not for the 2017 Puebla intraplate earthquake (M_W 7.1), which occurred in the Cocos plate beneath the central Mexico and severely damaged the Mexico City (Guo *et al.*, 2019). In spite of the same M_W of these recent earthquakes, the difference between Alaska and central Mexico implies that the source parameters of intraplate earthquakes have regional characteristics.

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