Dynamic rupture on the pre-events prior to the 2024 Mw 7.6 Noto Peninsula, Japan, earthquake

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We analyze the dynamic rupture parameters of the pre-events prior to the 2024 Mw7.6 Noto Peninsula, Japan, earthquake, using the six closest seismic stations from K-net and Kik-net. The targets are the pre-event at 16:10:9.5 M(JMA)=5.9 and the one at 16:06:6.1 M(JMA)=5.5, close to the hypocenter of the mainshock at 16:10:22.5 on the same day (1st January 2024). The aim is to find a ruptured patch (dimension, direction and stress drop) relative to the nucleation point on an assumed fault plane, whose focal mechanism is determined by a point-source waveform inversion using the same stations. The dynamic rupture simulations were prepared using Boundary Integral Equation Method (BIEM) with a small nucleation patch and a target patch. The analysis shows that both pre-events have rupture directivity toward the up-dip direction (NNE direction), namely away from the hypocenter of the mainshock. The ruptured areas of these two pre-events are superposed on map but they have different dips (36˚ for the 16:06 pre-event and 67˚ for the 16:10 one, respectively) so that they are not aligned on one fault plane. Thus, the mainshock should have its own nucleation process if any, independently from these pre-events, although the dynamic stress perturbation due to the wave propagation may have accelerated the nucleation process.

Keywords: 2024 Noto earthquake, Dynamic rupture, Near-field ground motion