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Velocity structure around the 2006 M6.3 Yogyakarta Earthquake zone inferred from seismic tomography

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On 26 May 2006 at 23:54 UTC, a moderate shallow crustal earthquake with a moment magnitude of 6.3 occurred in the southern part of the city of Yogyakarta in Java, Indonesia. The earthquake caused severe damage in the area in addition to over 5700 deaths. The cause of this earthquake was initially believed to have been a rupture on the northeas–southwest trending Opak Fault; however, the role of this fault in the earthquake continues to be debated. Therefore, this study presents a subsurface model constructed to characterize the fault geometry associated with the earthquake. We utilized previously reported aftershock data to image subsurface velocity variations through seismic tomographic inversion of primary waves, shear waves and their velocity ratio (Vp/Vs). Using data from 10 stations around the hypothetical fault, 588 aftershock events were relocated to positions mostly situated 10–15 km east of the Opak River Fault with a maximum depth of approximately 20 km. The seismic tomography inversion results indicate that severe damage during the earthquake occurred in areas with larger Vp/Vs ratios that are associated with unconsolidated sediments, in accordance with previous findings. Furthermore, the configuration of an unnamed fault that was activated in a sinistral motion during the earthquake is delineated by a velocity anomaly with a depth of up to 5–7 km. This structure is interpreted as a reverse fault, of which the hanging wall and footwall are located on the east and west sides of the fault, respectively.