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A 3D Seismic Velocity Model of Central Sumatra from Simultaneous Inversion of Local and Teleseismic Source Data

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The Australian plate subducts beneath the Sunda plate at a rate of ∼60mmyr-1 offshore Sumatra. The subduction zone has created many devastating earthquakes in recent history, e.g the 2004 Mw 9.2 event. The zone shows distinct earthquake and structural segmentation along strike with segments periodically rupturing throughout time. Offshore central Sumatra contains two segments of the subduction zone plate boundary; one ruptured in 1861 and 2005 but the other has not ruptured since 1797. It is thus an ideal area to look at subduction mechanics as the two segments are at different stages in there seismic cycle and to analyse the structural changes along strike within the forearc. During 2008-2009 a temporary seismic array was deployed in central Sumatra. The network comprised 52 seismometers, of which 10 were ocean bottom seismometers, and extended from the trench to the margin-parallel, strike-slip Great Sumatran fault on the mainland and includes along strike the forearc islands of Nias, Siberut and Batu. From these data a tomography study was conducted. Local tomography studies at subduction zones are often limited in resolving the slab and sub-slab mantle due to the shallow concentration of hypocentres. We modify the program Simulps to jointly invert local and teleseismic arrival times and derive P and S wave velocity structure from 200km depth to the surface based on 654 local events and 92 teleseismic events. We present Vp and Vp/Vs models of central Sumatra as well as relocating the local events within the new velocity model. The velocity models and earthquake locations are used to make interpretations of and comparisons between: properties of the sub-slab mantle; tectonic features and structure of the crust and mantle; the history of past major ruptures; and seismic activity of individual structures.