Geophysical Research Abstracts
Vol. 21, EGU2019-4142, 2019
EGU General Assembly 2019

P and S wave travel-time tomography of SE Asia-Australia collision zone

Aristides Zenonos (1), Luca De Siena (1), and Nicholas Rawlinson (2)

(1) University of Aberdeen, Aberdeen, United Kingdom (a.zenonos@abdn.ac.uk), (2) University of Cambridge, Cambridge, United Kingdom (nr441@cam.ac.uk)

The South-East (SE) Asia-Australia collision zone is one of the most tectonically active and seismogenic regions in the world. Relative plate motions have resulted in a complex and dynamic setting that encompasses a vast array of processes, from orogenesis, subduction and crustal accretion to rapid exhumation, megathrust earthquakes and volcanism. The collision zone is one of the best natural laboratories on Earth for the study of modern plate tectonics. It provides an unprecedented opportunity to understand the genesis of mountain belts, arc development, the formation of marginal basins, and the structure and dynamics of subduction zones. In recent times, this seismogenic region has produced a number of destructive earthquakes and associated tsunamis that have resulted in heavy casualties.

P-wave and S-wave travel-time tomography is the tool we use to image the active margins and interior of SE Asia and improve our capacity to understand the tectonic processes responsible for its current architecture. We provide new 3D P- and S-wave velocity models of the lithosphere and underlying mantle in the region. High-quality travel-time data produced by frequent earthquakes in the region are inverted for source location, velocity, and interface structure. Earthquake locations initially provided by standard catalogues were inverted using a non-linear localization oct-tree sampling algorithm (NLLoc). In addition, we use Fast Marching Tomography to retrieve velocity variations and interface structure from reference 1D velocity and Moho models.

The resultant tomographic models show multiple high wave-speed anomalies associated with subducting slabs in the region, specifically along the Sunda-Banda arc and in the neighbourhood of Sulawesi. The most obvious high wavespeed anomaly is found along the Sunda arc which exhibits a number of features of interest, including possible holes, tears and folds in the slab. The Banda arc subduction slab is depicted as a strong high velocity anomaly with a possible slab tear below 100 km. In the Molucca sea we can see the Sangihe and Halmahera slabs forming the only present-day example of active arc–arc collision, which dip west and east respectively. North Sulawesi is a complex region mostly bounded by subducting slabs such as the Sangihe, Celebes and Sula slabs.