ABSTRACT

P-WAVE TRAVEL TIME SEISMIC TOMOGRAPHY STUDY USING RAY TRACING SHOOTING STRAIGHTFORWARD ON JAVA ISLAND

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Java Island is one of the highest seismicity activities areas due to the NNE directed active movement of Indo-Australian plate colliding with the Eurasian plate. The tectonic reconstruction shows Indo-Australian plate movement definitely starting in the Mesozoic era about 50 Ma and start to down-going of the Eurasian plate during the Neogene Era with a relative speed of 7 cm/y. The travel time seismic tomography method can represent the subsurface of Java Island based on the P wave velocity structure.

Hypocenters of 1063 earthquakes and 20 stations data distribution obtained by IRIS catalog show subduction relief along Java island. Furthermore, the calculation of damped linear inversion based on the shooting straightforward ray-tracing method on the travel time seismic tomography provides a vertical cross-section subsurface of Java Island with ΔVp values distribution in relative balance to the AK-135 velocity model.

The distribution of positive ΔVp values in the range of 0-10% indicates high density associated with down-going Indo-Australian slab subduction. Meanwhile, negative ΔVp values distribution indicate low structural density or fluid's presence linked with upper mantle and partial melting by the tomography result. Tomography results verified using Derivative Weight Sum (DWS) resolution test certainly present a well-interpreted grid block's ray density. Slab pull force and age difference closely affect depth of subduction in 300 km depth only of West Java and up to 600 km depth of East Java. The appearance of a seismic gap in the earthquake hypocenters distribution is further reviewed using tomography results in East Java confirms the presence of 250-500 km slab gap. The slab gap remarkably provides partial or complete loss of the slab pull force and inflow of hot asthenosphere. Negative ΔVp values along the slab gap indicate a sub-slab mantle inflow that has loaded the gap. It's closely associated with the mass transfer of heat advection to thermal contrast in the lithosphere and subcrustal level.

Keywords: *ΔVp, Travel Time Seismic Tomography, Subduction, Slab Gap, Mantle Inflow*