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Three Dimensional Velocity Structure of the Armutlu Peninsula

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The Armutlu peninsula is located in the north-western part of Turkey and south-eastern part of the Marmara Region. The North Anatolian Fault Zone, the most active tectonic structure of Turkey, extends throughout the north of Turkey. The Armutlu peninsula is limited by two branches of the North Anatolian Fault Zone. The peninsula has rather high micro-earthquake activity compared with the surrounding regions. The region has very complex tectonic structure as well as its seismic activity. There are also many active thermal areas on the peninsula. The Armutlu peninsula is thought to be a transition zone to the Intra-Pontid Suture Zone or a part of it. This zone is important to understand the relationship among neo-tectonic features, high seismic activity and high thermal activity of the peninsula.

ARNET (Armutlu Network) was started to be installed around the Armutlu peninsula in September 2005. ARNET is a local seismic network, which has 23 broadband and short period seismic stations and 5 hydrothermal stations. In this study, three dimensional velocity structure of the peninsula has been researched by applying tomographic inversion to the P and S-waves arrival time data which are obtained from ARNET. The dataset covers the time period between September 2005 and December 2010. The magnitudes of the earthquakes are changing from 0.5 to 6.8. The most suitable one-dimensional velocity model for the region has been selected and the earthquakes have been relocated with this model. After the relocation, high quality and well distributed earthquakes are selected by considering by RMS values between 0-0.3, the azimuthal gap between 0-180° and the stations which have minimum 10 P observations. 1245 earthquakes are obtained and used at tomographic inversion. LOTOS-10, the last version of LOTOS code, has been used in tomographic inversion. As an advantage of the LOTOS-10, one dimensional velocity model, which is used for the relocation of the earthquakes, has been improved. This improved model has been accepted as the best one-dimensional velocity model for the region and used in tomographic inversion as an initial model.

In this study, the three-dimensional velocity perturbations, Vp/Vs distributions and absolute velocity structure of the Armutlu peninsula have been obtained in good resolution up to 20km depth with 5km slices. The images show that the western part of the Armutlu peninsula and partly Marmara Sea represent low velocity anomaly. The Izmit bay has relatively high velocity structure. The sudden velocity transitions confirm the complex tectonics and existence of the hot springs and hot spots. The resolution of the results and selected inversion parameters has been tested with different testing algorithms and compared with the other tomographic studies as well as seismic and magnetic profile results.