



The Armutlu Network: An Investigation on seismotectonic setting of Armutlu-Yalova-Gemlik and Surrounding Regions

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Yalova-Armutlu-Gemlik region is located on the Marmara Region and western-southwestern part of the 1999 Kocaeli rupture. This region is characterized by strong deformations and is located between two main strands of the North Anatolian Fault system. The Armutlu peninsula is believed to be adjacent to the Intra-Pontid Suture Zone or is even a part of it. This zone and region has a key role to understand neo-tectonic feature of the region and the interaction between high seismicity with high thermal activity and neo-tectonic faults originated by ongoing movement of the two branches of north and south of Armutlu. A horst and graben structure appears in this region whereby the Armutlu Peninsula represents a horst between two branches of the North Anatolian Fault System, resulting in a complex dextral zone.

In order to have a better understanding of the relation between micro-earthquake activity, hydrothermal activity and recent stress state of the study region, ARNET (Armutlu Network) was installed by Kocaeli University Earth and Space Science Research Center (ESSRC-YUBAM) at September 2005 with 10 broadband seismic stations. After 6 months, another 10 short period REFTEK stations were added to the network. As a result, we now have 23 seismic stations and 5 hydrothermal stations in and around study area. In June 2009, we replaced REFTEK digitizers with GURALP digitizers at the short period seismic stations. The phase readings obtained from network are performed by zSacWin algorithm. We also installed ADSL data transmission systems at 12 seismic stations. Currently, we are in the process of installing online communication system to the remaining seismic stations in our network. We also installed SeisComP3 software for data acquisition and automatic location procedure at September 2009. This system is now in the testing phase.

We obtained preliminary micro-earthquake activity of the said region and it shows that the (present) seismic activity increased after the 1999 events at the western part of the 1999 rupture zone while the rupture zone itself is quiet. Micro-earthquake activity shows some clusters but most of them are unexpectedly scattered. This region is highly deformed and is of a brittle structure with many small, medium-sized faults and it contains metamorphic rocks. The tectonic structure, geology and aging of the rocks are still under discussions and there is no consensus about them. We believe that this region has very complex tectonic features and thus seismicity is not showing clear clustering and lineaments along the well-known faults traces. We are also monitoring hydrothermal activity, pressure changes of the hot-spring and natural water wells combined with water leveling, temperature and chemical content in this region to reveal the relation between micro-earthquake activity with hydrothermal reservoirs. We are also trying to obtain 1-D and 3-D velocity structure for this region to improve the location of micro-earthquake activity.

The Armutlu-Yalova region is of a very complicated tectonic structure and has scattered micro-earthquake activity. Upper part of the crust shows low velocity zone conforming to present tectonic activity and brittle deformed metamorphic rocks. We need to analyze more earthquake data and improve 1-D velocity models with active seismic by using data from quarry blasts or by conducting seismic experiments. Recent seismic activity is confined to Gemlik Bay, Yalova Termal regions and special attention is needed to monitor seismic activity in these regions to understand likely and forthcoming larger event(s) in the Marmara Region. We believe that this region will play an important role to understand the formation of the next larger earthquake on the western extension of the North Anatolian Fault System.

Keywords: armutlu peninsula, micro-earthquake activity, clustering, 1-D crustal structure, 3-D velocity structure, hydrothermal activity, SeisComP3.