Detection and Classification of Volcanic Earthquakes/Tremors in Central Anatolian Volcanic Province

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Central Anatolia has been characterized by active volcanism since ∼10 Ma which created the so called Central Anatolia Volcanic Province (CAVP) where a series of volcanoes are located along the NE-SW trend. The petrological investigations reveal that the magma source in the CAVP has both subduction and asthenospheric signature possibly due to tearing of ongoing northward subduction of African plate along Aegean and Cyprus arcs. Recently, a temporary seismic array was deployed within the scope of Continental Dynamics: Central Anatolian Tectonics (CD-CAT) project and provided a unique opportunity to study the deep seismic signature of the CAVP. Passive seismic imaging efforts and magnetotellurics (MT) observations revealed low velocity and high conductivity zones supporting the presence of localized partial melt bodies beneath the CAVP at varying depths, especially around Mt. Hasan which exhibits both geological and archeological evidences for its eruption around 7500 B.C. In Central Anatolia, local seismicity detected by the CD-CAT array coincides well with the active faults zones. However, active or potentially active volcanoes within CAVP are characterized by the lack of seismic activity. In this study, seismic data recorded by permanent stations of Regional Earthquake-Tsunami Monitoring Center were combined with temporary seismic data collected by the CD-CAT array to improve sampling density across the CAVP. Later, the continuous seismic waveforms of randomly selected time intervals were manually analyzed to identify initially undetected seismic sources which have signal characters matching to volcanic earthquakes/tremors. For candidate events, frequency spectrums are constructed to classify the sources according to their physical mechanisms. Preliminary results support the presence of both volcano-tectonic (VT) and low-period (LT) events within the CAVP. In the next stage, the spectral and polarization analyses techniques will be utilized to the entire seismic database to detect and classify the seismic source associated to volcanism, and identified events will be relocated and jointly interpreted with subsurface features detected by seismic imaging and MT.

Keywords: Volcanic earthquakes, Central Anatolia Volcanic Province, seismic imaging, magnetotellurics