Geophysical Research Abstracts
Vol. 19, EGU2017-311, 2017
EGU General Assembly 2017

3-D Seismic Structure around Abu Dabbab Area, Southcentral Eastern Desert, Egypt: Geodynamic Implications

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Abu-Dabbab area is the most active part of the Eastern Desert of Egypt where long, continued, seismic activity and frequent earthquake swarms have been detected in the last decades. In this study, we apply a seismic tomography method on a number of arrival time data of P and S waves to determine 3-D tomographic images of the crust beneath Abu-Dabbab area as well as its surrounding region. The selected events are recorded at least by three seismic stations and all unreliable arrivals have been excluded before the final tomographic inversion. Moreover, the availability of additional travel time data collected just beneath Abu Dabbab area from a temporary network enabled us to image a more detailed crustal structure below the target zone. From the obtained P- and S-wave velocity models, we additionally determined the Vp/Vs ratio for a better interpretation of the obtained velocity anomalies. The 3-D velocity and Vp/Vs images display clear lateral crustal heterogeneities in the study area. Lower than average velocity anomalies are revealed down to a depth of 25 km, which are accompanied by large number of seismic events. High Vp/Vs anomalies are clearly detected at lower crustal levels although not located directly beneath the seismogenic zone of Abu Dabbab area. Based on the obtained results of seismic tomography; we propose that the intense seismic activity in the region could be induced by the existence of fluids and/or magma at lower crustal levels. The recent geotectonic activities in the area and the consequent faulting accompanying the rifting processes leading to the formation of the Red Sea at the end of the Paleogene and the early Neogene serve as a mechanism that trigger the formation and migration of these fluids. Our tomographic results are also consistent with previous geophysical investigations carried out beneath Abu Dabbab area.