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Assessment of the geodynamical setting around the main active faults at Aswan area, Egypt

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The proper evaluation of crustal deformations in the Aswan region especially around the main active faults is crucial due to the existence of one major artificial structure: the Aswan High Dam. This construction created one of the major artificial lakes: Lake Nasser. The Aswan area is considered as an active seismic area in Egypt since many recent and historical felted earthquakes occurred such as the impressive earthquake occurred on November 14, 1981 at Kalabsha fault with a local magnitude ML=5.7. Lately, on 26 December 2011, a moderate earthquake with a local magnitude Ml=4.1 occurred at Kalabsha area too. The main target of this study is to evaluate the active geological structures that can potentially affect the Aswan High Dam and that are being monitored in detail. For implementing this objective, two different geophysical tools (magnetic, seismic) in addition to the Global Positioning System (GPS) have been utilized.
Detailed land magnetic survey was carried out for the total component of geomagnetic field using two proton magnetometers. The obtained magnetic results reveal that there are three major faults parallel {F1 (Kalabsha), F2 (Seiyal) and F3} affecting the area. The most dominant magnetic trend strikes those faults in the WNW-ESE direction. The seismicity and fault plain solutions of the 26 December 2011 earthquake and its two aftershocks have been investigated. The source mechanisms of those events delineate two nodal plains. The trending ENE-WSW to E-W is consistent with the direction of Kalabsha fault and its extension towards east for the events located over it. The trending NNW-SSE to N-S is consistent with the N-S fault trending. The movement along the ENE-WSW plain is right lateral, but it is left lateral along the NNW-SSE plain. Based on the estimated relative motions using GPS, dextral strike-slip motion at the Kalabsha and Seiyal fault systems is clearly identified by changing in the velocity gradient between south and north stations. However, at the area between Kalabha and Seiyal faults, the movement has been changed in a different direction which is consistent with the other set of faults (N-S).