Geophysical Research Abstracts
Vol. 17, EGU2015-5106-4, 2015
EGU General Assembly 2015

Land subsidence, structures and processes at the Dead Sea shoreline as revealed by a near-field photogrammetry survey at Ghor Haditha, Jordan

Djamil Al-Halbouni (1), Eoghan P. Holohan (1), Thomas Walter (1), Hussam Alrshdan (2), Ali Sawarieh (2), and Torsten Dahm (1)

(1) GFZ German Research Center for Geosciences, Physics of the Earth, Potsdam, Germany (halbouni@gfz-potsdam.de), (2) Ministry of Energy and Mineral Resources, Amman, Jordan

Rapid recession of the Dead Sea in the last few decades has led to an increasing rate of sinkhole formation around the lake shore. The development of these sinkholes and other land subsidence phenomena poses a major geological hazard to the local population, agriculture and industry. For a better understanding of the underlying physical processes and for determining current and future areas of sinkhole hazard, we conducted field investigations and a first low altitude ("near-field") aerial photogrammetric survey with a Helikite Balloon at Ghor Haditha, Jordan, in October 2014.

From the near-field photogrammetry, we generated a high resolution Digital Elevation Model of the surveyed area. This enables a detailed quantification of sinkhole sizes and distribution as well of morphological parameters such as the sinkhole depth/diameter ratio (D). Values of the latter are generally greater in the mechanically stronger alluvial fan sediments (D = 3.0 – 0.4) than in the weaker muds of the former Dead Sea lakebed (D = 0.3 – 0.1). Importantly, the point of emanation of a very recent and sediment-laden stream at c. 10m below the former floor of the Dead Sea can be structurally and morphologically connected to the main sinkhole area. This provides evidence for channelised subterranean groundwater flows beneath this area.

From our observations, two processes were identified as key factors for the development of large land subsidence structures and local sinkhole clusters: (1) Subrosion of weak material due to groundwater following preferred flow paths of ancient and current wadi riverbeds and (2) rapid dissolution of soluble material (salt) in this aragonite-rich mud. The heterogeneous geology and alternation of aquifers (alluvial fan sediments) and aquicludes (mud-flats) lead to the formation of complex subsurface flow channels that represent the secondary porosity of the internal structure of karst aquifers. As a consequence of these subterranean channels, local bending and strong heterogeneity of the saltwater/freshwater interface is expected in the affected area.

In conclusion, the observed interplay of these two processes and the relative importance of subrosion compared to salt dissolution provide a new insight into the rapid land subsidence occurring along the Dead Sea shoreline.