Geophysical Research Abstracts
Vol. 18, EGU2016-6440, 2016
EGU General Assembly 2016

Improved Dead Sea sinkhole site characterization at Ghor Al Haditha, Jordan, based on repeated shear wave reflection seismic profiling

Ulrich Polom (1), Hussam Alrshdan (2), Djamil Al-Halbouni (3), Ali Sawarieh (2), Torsten Dahm (3), CharLotte M. Krawczyk (1,3)

(1) LIAG, Hannover, Germany, (2) Ministry of Energy & Mineral Resources, Amman, Jordan, (3) now at: GFZ German Research Centre for Geosciences, Potsdam, Germany (lotte@gfz-potsdam.de)

In October 2014 a high-resolution shallow shear wave reflection seismic survey was carried out at the Dead Sea sinkhole site Ghor Al Haditha, Jordan. It extended a survey undertaken in 2013, also in order to gather time-lapse profiles. In the framework of the DEad SEa Research Venue (DESERVE), a virtual institute of the Helmholtz Association and international partners, this investigation is part of a cross-disciplinary and cooperative international project of the Helmholtz Centers KIT, GFZ, and UFZ. At the investigation site, characterized by alluvial fan deposits, ongoing subsidence and sinkhole processes in the subsurface create massive reshaping of farming areas, including the destruction of housings, industrial sites, and infrastructure. The sinkhole hazard at the Dead Sea is significant, since similar processes are observed at several coastal segments of the Dead Sea.

The new survey (in total 2.1 profile km) was targeted to improve the knowledge about the subsurface structures and to confine the results of the initial survey (1.8 km profile km), with respect to the presence or non-presence of a massive salt layer proposed at nearly 40 m depth. This salt layer is the central part of a widely established process hypothesis to generate shallow cavities by salt subrosion, which subsequently collapse to sinkholes at the surface. Results of the initial survey carried out in 2013 highlighted a new process hypothesis of subsurface mass transport by Dead Sea mud mobilization enclosed in the alluvial fan, so that an extended survey was undertaken in 2014. This, indeed, confirmed that there are no reflection seismic signal responses that would be expected to occur in the presence of a massive salt layer. Since evaluation of both hypothesis by new drilling could not be carried out due to safety reasons and permissions, it remained unclear which hypothesis is valid for the investigation site.

However, we combined the 2013 and 2014 reflection seismic profiles and the lithology of wells carried out in 1995 to yield a high-resolution structural image of the subsurface. The profiles show a complex interlock of alluvial fan deposits (mainly gravel and sand) and marine sedimentation layers of the Dead Sea (Dead Sea mud) between 0-200 m in depth. The reflection patterns indicate destabilized subsurface zones by a weak reflection response below 40 m depth, and stable subsurface zones by stronger reflection responses. At some locations newly developing sinkhole signatures are evident in the data. We discuss the results of the reflection seismic surveying in the context of alluvial sequences described in well logs, including a re-interpretation of lithological findings.