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Detection of sinkhole precursors along the Dead Sea, Israel by SAR interferometry

Ran Nof (1,2), Gidon Baer (1), Alon Ziv (3), Yehuda Eyal (2), Eli Raz (4), Simone Atzori (5), and Stefano Salvi (5)

(1) Geological Survey of Israel, Geological hazards and engineering geology, Jerusalem, Israel (baer@gsi.gov.il), (2) Ben Gurion University, Beer Sheva, Israel, (3) Tel Aviv University, Israel, (4) The Dead Sea and Arava Science Center, Tamar Regional Council, Israel, (5) Istituto Nazionale di Geofisica e Vulcanologia, Rome, Italy

The water level of the Dead Sea (Israel and Jordan) has been dropping at an increasing rate since the 1960s, exceeding a meter per year during the last decade. This water-level drop has triggered the formation of sinkholes and widespread land subsidence along the Dead Sea shorelines, resulting in severe economic loss and infrastructural damage. In this study, sinkhole-related precursory subsidence and the effects of human activities on sinkhole development are examined through Interferometric Synthetic Aperture Radar (InSAR) measurements and field surveys conducted in Israel during the year 2012. Interferograms were generated using the COSMO-SkyMed satellite images and a high-resolution (0.5 m/pixel) elevation model that was obtained from airborne Light Detection and Ranging (LiDAR). Thanks to this unique integration of high-resolution datasets, mm-scale subsidence may be resolved in both undisturbed and human-disturbed environments. A few months long precursory subsidence occurred in all three sinkhole sites reported in this study. The centers of the subsiding areas and successive sinkholes in a specific site show lateral migration, possibly due to progressive dissolution and widening of the underlying cavities. Certain human activities, such as filling of newly formed sinkholes by gravel, or mud injections into nearby drill holes, seem to enhance land subsidence, widen existing sinkholes or even generate new sinkholes.