The lowest place on earth is rising due to the dead-sea water level drop: evidence from InSAR time series analysis

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The Dead-Sea water level has been dropping in recent decades at an average rate of about 1 meter per year. It is expected that such a water level change can cause lithospheric rebound and uplift, with spatial extent that is controlled by the effective mechanical behavior of the crust and upper mantle combined. The uplift is expected to decay with distance from the Dead-Sea shoreline. In quest for the lithospheric response to water level drop, we analyzed 31 Synthetic Aperture Radar (SAR) images of satellites ERS1 and ERS2 descending track from the years 1993 to 2001, which were processed into 167 short perpendicular baseline (<300 m) interferograms. Our analysis assumed constant line-of-sight (LOS) rate, because conventional unconstrained time-series approach failed to resolve the expected rebound. Data selection, processing and analysis are designed and optimized to overcome the presence of strong atmospheric phase delays. Despite the low signal-to-noise ratio of individual interferograms, we show that the lithospheric response to the water level drop is well resolved. Our calculations indicate a 2.5-4 mm/year maximum LOS uplift rates near the Dead Sea shorelines. Our result is consistent with the observed vertical motion at two permanent GPS sites within the study area (DRAG and JSLM). Finally, we show that a simple homogeneous elastic half space model, with Poisson's ratio of 0.25 and Young modulus of 30 GPa provides good fit to the observed LOS rates.