Using high-resolution TerraSAR-X Persistent Scatterer Interferometry (PSI) to quantify the surface deformation of salt diapirs, Zagros mountains, southern Iran

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Salt diapirs are prominent features in the Zagros fold-and-thrust belt (ZFTB), but their growth dynamics are poorly understood. To better understand the interplay between the buoyant forces driving rock salt to the surface and dynamics of surface processes, knowledge about high-resolution spatiotemporal surface deformation is required. With the aid of high-resolution PSI measurements derived from TerraSAR-X data, we are able to detect high-precision spatiotemporal deformation patterns of the surfaces of salt diapirs. Further, time-series analysis helps to distinguish between salt-supply-driven domal uplift and vertical surface modification induced by precipitation, dissolution, and erosion.
In this study, we analyze TerraSAR-X PSI time-series, processed by the German Aerospace Center (DLR), to obtain the highest available spatiotemporal resolution of the vertical surface-deformation pattern across several diapirs in the Zagros. The selected salt diapirs represent different activity classes defined by Talbot (1998) and Jahani et al. (2007) based on diapir morphology and their perceived degree of reactivation stage in the framework of the ZFTB. The chosen diapirs represent class 2 and 3. Class 2 is characterized by domal uplift with deformed caprock and protruding rock salt in the central summit. Class 3 is represented by widespread extrusion of rock salt forming glaciers indicating a mature stage of reactivation. Class 1 represent circular diapirs above buries Hormus salt, class 4 are crater filled diapirs once active, and class 5 are dead diapirs with completely eroded salt. Given the high data resolution, we expect to identify varying activity patterns from diapir to diapir. We will present our preliminary results in their geologic context and interpret these data within the tectonically active ZFTB. The detection of surface deformation, in the LOS, using TerraSAR-X will help to better understand the growth dynamics of salt diapirs and their contemporary vertical activity. The understanding of the activity of salt diapirs in general is important for example in the feasibility surveys of salt diapirs for strategic storage facilities of hydrocarbons, waste material and CO_2 over longer time-scales worldwide.

References:

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