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Caldera formation at Tendurek, East Turkey

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Volcanoes of eastern Turkey have been historically active and are located in an active tectonic system with abundant faults and fissures. Tendurek is a low relief shield volcano with an edifice height of about 3580 m and covers an area of 650km^2. It has an elliptical shape and the two summit craters and a flank crater are arranged in the direction of the long axis. The summit area is surrounded by an also elliptical ring fracture system with a 9km long axis and a 6km minor axis. This system is more developed in the south than in the north, therefore it is called a half caldera.
Tendurek is located in an active tectonic region with right lateral motion near to the Balik Gölü fault, and has been affected by significant tectonic earthquakes, such as in 1840 (M7.4). The last eruption occurred in 1855, since then it is considered to be dormant. Little is known about the deep magma plumbing system, and the state of its current activity.

Here we report on a radar interferometric study where we combine SAR images acquired by the Envisat satellite in the years from 2004- 2008 and 2003- 2010 in ascending and descending orbits, respectively. We used the software's ROI_Pac and Doris to create interferograms. The StaMPS software was used to analyze the temporal evolution and to estimate a mean annual velocity of the deformation signal in both tracks. Due to the poor coherence in the summit area, less stable pixel have been identified there in the processing. Where at the lower flanks and further away from the volcanic edifice a lot of stable pixel could be identified.
These data allows us to investigate the ground deformation pattern at unprecedented spatial detail. We observe various localized but evident deformation occurrences, associated with volcanic activity at Tendurek volcano. Deformation affected the upper region of the volcano, including the summit craters within the dimension of the previously mentioned ring fault system at a very low rate.
By using a genetic algorithm for the optimization and accounting for model uncertainties by using the data error variance covariance matrix an Okada source is best explaining the signal and suggests a sill like intrusion subject to deflation or cooling.

After the subtraction of the synthetic deformation due to this source, the residual deformation velocity shows a ring like structure that is aligned with the previously mentioned ring fault system. Thus the observed deformation signal might be also explained by the subsidence along these ring faults.