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Oblique-slip faulting at Tendürek volcano observed by using InSAR

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Calderas are structurally bounded by steep normal and/or reverse faults that are commonly considered to be purely dip-slip. Analog models, seismic data and geologic observations have recently indicated, however, that ring-faults may also display oblique-slip during subsidence.

Subsidence of Tendürek volcano in Turkey, as measured geodetically by using InSAR, occurred during 2003-2010. Simple analytical source models of a contracting sill-like source could explain most of the observed signal. However, residual displacement gradients revealed additional movement on a sub-surface ring fault. Moreover, this residual is mostly composed of a dominantly westward horizontal motion within the identified ring-fault structure.
Consequently, we used more complex boundary element numerical modeling to try to better explain the observed surface displacement. For that we consider the real topography, realistic ring-fault geometries and the interaction of the sill-like source with the ring-faults. The revised model results show that slip along the ring-fault, which is likely induced by the cooling-contracting sill-like source, varies systematically both in sense and magnitude along its circumference. The slip comprises both dip-slip and strike-slip components; the latter account for the observed westward horizontal motion. This result is similar to a "sliding-trapdoor" effect observed in some recent analog experiments.
This study hence provides the strongest geodetically-measured evidence to date for the existence of subsidence-related oblique-slip faulting at calderas.