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Large displacement of Mount Etna's submerged south-eastern flank: evidence from seafloor geodetic monitoring

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At Mount Etna in Southern Italy continuous onshore satellite-based geodetic measurements document large-scale seaward motion at 3-5 cm per year with highest rates at the coast. The volcanic edifice itself builds upon continental crust, but the eastern unstable flank extends well into the Ionian Sea. Owing to the opacity of seawater to electromagnetic waves no information on movement of the submarine part of the flank has been available so far. This lack of data has veiled a comprehensive understanding of the causes of flank instability as well as the hazard that emanates from it. In 2016 we installed a network of five transponders that measure the acoustic range between each other at the submerged part of the volcano's south-eastern flank. The instruments monitor length changes across the fault that marks the boundary between the stable and the unstable sectors for a period of three years. In July 2017 we downloaded 14 months of data via an acoustic link. The data show clear evidence for sliding of the volcanic flank towards the Ionian offshore. Fault slip was 4 cm during one eight-day long event, implying that deformation increases away from the magmatic system. The successful measurements demonstrate the capability of direct-path acoustic ranging for characterising offshore volcanic flank motion and pave the way for future monitoring of submarine volcanic flanks worldwide using seafloor geodesy.