

Combining Multi Data Sources for a Better Understanding of Volcanoes and Earthquakes



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Earthquakes and volcanic eruptions can affect our lives in many different ways causing significant damages, casualties and huge economic loss. These events often take place in remote regions challenging traditional ground-based observations. Here we summarize our major findings of studying recent volcanic and tectonic events using geodetic, remote sensing and seismological data. Two new islands formed during two eruptions in the Zubair archipelago (Red Sea) in 2011 and 2013, respectively. Through analysis of a series of high-resolution optical images and InSAR data, we found that the eruptions were fed by dikes much larger than the small size of the new islands might suggest. Together with several seismic swarms, these eruptions indicate that the southern Red Sea has been experiencing a rifting episode with multiple dike events and meter-scale extension and show that this plate boundary is more active than previously thought. Another volcanic activity occurred in Bárðarbunga volcano in central Iceland in 2014-15. From the study of high-resolution TerraSAR-X and COSMO-SkyMed data, we found that the meter-scale opening across the graben was accompanied with a significant amount of left-lateral shear implying that pre-existing fracture zones play a key role in controlling dike emplacements in rifts. The nature of faulting and mechanism of earthquake cycles are somehow different from those of volcanoes. In the study of a moderate magnitude earthquake that occurred within the Arabian plate, we combined geodetic data and Bayesian estimation to quantify the fault model uncertainties and found out the active fault causing the earthquake assisting seismic hazard evaluations. To understand the mechanism of aftershock triggering processes, we studied the early afterslip of the Mw 8.4 Illapel earthquake by combining aftershocks and geodetic data. We found that aseismic afterslip on the subduction thrust surrounding the coseismic rupture is an important triggering mechanism of aftershocks.

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