6C Recordings at Active Volcanoes

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Near field recordings and thus finite source inversions of volcano-induced events often suffer from unaccounted effects of local tilt, saturation of classical instrumentation, unknown shallow velocity structure and doubtful orientation of the instruments. In addition, if the station number is limited the results of moment tensor inversion are very often doubtful and not well constrained. Recent advances in hardware development made it possible to install several very broadband, high sensitive rotational motion sensor based on fibre optical gyroscope technology in very close distance of two activate volcanoes, i.e. the Halema'uma'u pit of Kilauea's summit apparatus during its final stage of the 2018 eruption and on Stromboli volcano in 2016 and 2018, respectively. Using this new instrument together with classical instrumentation (i.e., translational seismometer, infra sound and tilt meter) we were able to record three magnitude Mw5 earthquakes at Kilauea and two weeks of permanent strombolian activity at Stromboli. The resulting six axis measurements reveal clear rotations around all three coordinate axis. Outstanding is hereby the observation of rotation around the vertical axis, a motion which will not be detectable using classical instrumentation only. We are furthermore able to demonstrate how this six axis measurements can help to improve the location procedure due to its property to act as a physical wave polariser. We also demonstrate the application of a single site shallow velocity estimation using volcanic background noise only which further will improve the estimation of the source mechanism. As a concluding step we will demonstrate how the use of sparse 6C measurement might be able to reduce the ambiguity of moment tensor inversions of volcano related signals.