Geophysical Research Abstracts
Vol. 21, EGU2019-8455-3, 2019
EGU General Assembly 2019

Very long period signals and seismic swarm activity offshore Mayotte, Comoro Islands

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Volcanic areas usually display a variety of seismic signals due to the complex interaction of pressurized fluids, transient stress changes and local tectonic structures. Among these signals, high-frequency signals are the signature of brittle failure events while long-period signals are thought to be produced by resonance of pressurized magmatic fluids in cavities or conduits. Such low-frequency signals are usually recorded at local to regional distance and rarely at teleseismic distances. A long-lasting and heterogeneous seismic sequence is affecting a region offshore Mayotte, Comoro Islands, Western Indian Ocean, since May 2018 and is still ongoing (January 2019). During the first two months of its sequence, the seismic activity appeared in form of a seismic swarm at deep crustal depths, reaching a peak on May 15th, 2019, with a Mw5.9 event. The seismicity slowly decayed in the following months, with almost no Mw4.5+ events between mid July and mid September, and was replaced by the appearance of a new peculiar very long period (VLP) activity. The outstanding VLP signals are monochromatic with a dominant period around 15.5s, they are characterized by a long duration of usually 10-30 min, and were recorded beyond 2000 km distance. The VLP activity continued steadily in the following months and experienced a substantial increase in the number of events in September 2018, accompanied by new seismic activity at shallower depth and closer to Mayotte Island. In the last days of December 2018, the VLP activity again experienced a new increase. GNSS stations located on Mayotte island, about 20-30 km to the west of the focal area, registered continuous subsidence (up to ∼8 cm) and eastward migration (∼10 cm) over the duration of the seismic sequence. In this work we investigate the seismic sequence using seismological (IU, II, GE, G, RA, PF networks) and deformation (CNES, Exagone, Réseau Lél@ sarl) data, in order to investigate location, focal mechanisms, spectral and waveform patterns and statistics of the different observed signals, and single out the potential physical processes for the observed heterogeneous signals. We found that both the VLP source and the deformation source are located eastward of Mayotte Island. We observed upward and lateral migration of the seismic sources. Based on the spatiotemporal evolution of seismicity and the focal mechanisms, the first part of the sequence appears to be the result of the fracturing induced by a magmatic intrusion in the crust and eventually triggering earthquakes on nearby tectonic structures. Instead, the VLP activity may originate from the resonance of a slowly drained magmatic reservoir, in agreement with the large subsidence observed at the surface.