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Combined geophysical surveys and coring data to investigate the pattern of the Watukosek fault system around the Lusi eruption site, Indonesia.

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The Lusi mud eruption is located in the Sidoarjo area, Indonesia and is continuously erupting hot mud since its birth in May 2006. The Watukosek fault system originates from the neighboring Arjuno-Welirang volcanic complex extending towards the NE of Java. After the 27-06-2006 M 6.3 earthquake this fault system was reactivated and hosted numerous hot mud eruptions in the Sidoarjo area. Until now, no targeted investigations have been conducted to understand the geometry of the faults system crossing the Lusi eruption site.
A comprehensive combined electrical resistivity and self-potential (SP) survey was performed in the 7 km2 area inside the Lusi embankment that had been built to contain the erupted mud and to prevent flooding of the surrounding roads and settlements. The goal of the geophysical survey is to map the near-surface occurrence of the Watukosek fault system upon which Lusi resides, delineate its spatial pattern, and monitor its development. We completed six lines of resistivity measurements using Wenner configuration and SP measurements using roll-along technique. Three subparallel lines were located to the north and to the south of the main crater. Each line was approximately W-E oriented extending for ∼1.26 km. The surveyed regions consist of mud breccia (containing clayey-silty-sandy mixture with clast up to ∼10 cm in size). The geophysical data have been complemented with a N-S oriented profile consisting of 6 cores (∼30m long) drilled in the dry area inside the Lusi embankment.
The resistivity data were inverted into 2-D resistivity images with a maximum penetration depth of almost 200 m. These images consistently reveal a region of about 300 m in width (between 30-90 m depth) characterized by anomalous resistivities, which are lower than the values observed in the surrounding area. The results of the SP data correspond well with the resistivity profiles in the anomalous parts, which suggests that their origin is related to fluid flow paths in the subsurface. The coring results reveal varying thickness of the dry walkable mud overlying water saturated mud. The retrieved material also helped to constrain the subsidence depth of the original ground level that continuously collapses since the initiation of the eruption. These results have been used to complement the resistivity profiles and to provide a better model for the Watukosek fault system and the regional subsidence.