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High resolution infrared acquisitions droning over the LUSI mud eruption.

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The use of low-cost hand-held infrared (IR) thermal cameras based on uncooled micro-bolometer detector arrays became more widespread during the recent years. Thermal cameras have the ability to estimate temperature values without contact and therefore can be used in circumstances where objects are difficult or dangerous to reach such as volcanic eruptions.
Since May 2006 the Indonesian LUSI mud eruption continues to spew boiling mud, water, aqueous vapor, CO_2, CH4 and covers a surface of nearly 7 km2. At this locality we performed surveys over the unreachable erupting crater.
In the framework of the LUSI Lab project (ERC grant n° 308126), in 2014 and 2015, we acquired high resolution infrared images using a specifically equipped remote-controlled drone flying at an altitude of m 100. The drone is equipped with GPS and an autopilot system that allows pre-programming the flying path or designing grids. The mounted thermal camera has peak spectral sensitivity in LW wavelength (μm 10) that is characterized by low water vapor and CO_2 absorption. The low distance (high resolution) acquisitions have a temperature detail every cm 40, therefore it is possible to detect and observe physical phenomena such as thermodynamic behavior, hot mud and fluids emissions locations and their time shifts.
Despite the harsh logistics and the continuously varying gas concentrations we managed to collect thermal images to estimate the crater zone spatial thermal variations. We applied atmosphere corrections to calculate infrared absorption by high concentration of water vapor. Thousands of images have been stitched together to obtain a mosaic of the crater zone.
Regular monitoring with heat variation measurements collected, e.g. every six months, could give important information about the volcano activity estimating its evolution. A future data base of infrared high resolution and visible images stored in a web server could be a useful monitoring tool. An interesting development will be to use a multi-spectral thermal camera to perform a complete near remote sensing to detect, not only temperature, but gas, sensitive to particular wavelengths.