Geophysical Research Abstracts
Vol. 12, EGU2010-4058, 2010
EGU General Assembly 2010

Thermal remote sensing as a part of Exupéry volcano fast response system

Klemen Zakšek and Matthias Hort
Inst. of Geophysics, Univ. Hamburg, Bundesstr. 55, 20146 Hamburg, Germany

In order to understand the eruptive potential of a volcanic system one has to characterize the actual state of stress of a volcanic system that involves proper monitoring strategies. As several volcanoes in highly populated areas especially in south east Asia are still nearly unmonitored a mobile volcano monitoring system is currently being developed in Germany. One of the major novelties of this mobile volcano fast response system called Exupéry is the direct inclusion of satellite based observations. Remote sensing data are introduced together with ground based field measurements into the GIS database, where the statistical properties of all recorded data are estimated. Using physical modelling and statistical methods we hope to constrain the probability of future eruptions.
The emphasis of this contribution is on using thermal remote sensing as tool for monitoring active volcanoes. One can detect thermal anomalies originating from a volcano by comparing signals in mid and thermal infrared spectra. A reliable and effective thermal anomalies detection algorithm was developed by Wright (2002) for MODIS sensor; it is based on the threshold of the so called normalized thermal index (NTI). This is the method we use in Exupéry, where we characterize each detected thermal anomaly by temperature, area, heat flux and effusion rate.
The recent work has shown that radiant flux is the most robust parameter for this characterization. Its derivation depends on atmosphere, satellite viewing angle and sensor characteristics. Some of these influences are easy to correct using standard remote sensing pre-processing techniques, however, some noise still remains in data. In addition, satellites in polar orbits have long revisit times and thus they might fail to follow a fast evolving volcanic crisis due to long revisit times. Thus we are currently testing Kalman filter on simultaneous use of MODIS and AVHRR data to improve the thermal anomaly characterization. The advantage of this technique is that it increases the temporal resolution through using images from different satellites having different resolution and sensitivity. This algorithm has been tested for an eruption at Mt. Etna (2002) and successfully captures more details of the eruption evolution than would be seen by using only one satellite source.
At the moment for Exupéry, merely MODIS (a sensor aboard NASA's Terra and Aqua satellite) data are used for the operational use. As MODIS is a meteorological sensor, it is suitable also for producing general overview images of the crisis area. Therefore, for each processed MODIS image we also produce RGB image where some basic meteorological features are classified: e.g. clouds, volcanic ash plumes, ocean, etc. In the case of detected hotspot an additional image is created; it contains the original measured radiances of the selected channels for the crisis area. All anomaly and processing parameters are additionally written into an XML file. The results are available in web GIS in the worst case two hours after NASA provides level 1b data online.