Geophysical Research Abstracts
Vol. 16, EGU2014-2960, 2014
EGU General Assembly 2014


# Volcanic lava flow hot-spots monitoring from remote sensing data using neural networks

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Neural networks are an effective and well-established technique for the classification of satellite images. In addition, once well trained, they prove to be very fast in the application stage. Furthermore satellite remote sensing is a very effective and safe way to monitor volcanic eruptions in order to safeguard the environment and the people affected by such natural hazards.
In our study a Back Propagation Neural Network was used for the recognition of thermal anomalies affecting hot lava pixels in multispectral remote sensed images. The network was trained using the three thermal channels of the Advanced Very High Resolution Radiometer (AVHHR) sensor as inputs and the corresponding values of heat flux, estimated using a two thermal component model, as reference outputs.
As a case study the volcano Etna (Eastern Sicily, Italy) was chosen and the neural network was trained with a time series of AVHRR images belonging to an effusive eruption which took place during the month of July 2006, and validated on three independent data sets of images of the same eruption and on two relative to an eruption occurred the following month.
Whilst for both night-time and day-time validation images the neural network identified the image pixels affected by hot lava with a 100% success rate, for the daytime images also adjacent pixels were included, apparently not interested by lava flow. Despite these performance differences under different illumination conditions, the proposed method can be considered effective both in terms of classification accuracy and generalization capability. In particular our approach proved to be robust in the rejection of false positives, often corresponding to noisy or cloudy pixels, whose presence in multispectral images can often undermine the performance of traditional classification algorithms. Future work shall address application of the proposed method to data from different eruptions provided by the MODIS sensor aboard the Terra and Aqua satellites.