



Monitoring Thermal Activity of Eastern Anatolian Volcanoes Using MODIS Images

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MODIS (Moderate Resolution Imaging Spectroradiometer) instrument is used for imaging atmosphere, land and ocean with 36 bands. Both AQUA and TERRA platforms acquire 2 images daily (daytime and nighttime). Low temperature anomalies on volcanoes comprise important clues. Low temperature anomalies on Holocene volcanoes of Eastern Anatolia were investigated for these clues using MODIS Land Surface Temperature (LST) images. A total of 16800 daily LST images dated between 2001 and 2012 have been processed using a code written in IDL (Interactive Data Language). Factors like shadow, ice/snow and clouds that are affecting the reflectance data are masked. The mask is derived from MODIS reflectance data state image. Various LST images are calculated: Two nested region of interest (ROI) windows (square/rectangular) have been selected on the images. First is the bigger window, which covers the whole area of the volcano (Total volcano area). Second one is a smaller window which circumference the summit (crater and/or caldera) of the volcano (Summit cone) where thermal output is generally higher when compared to the flanks. Two data sets have been calculated using the ROI's for each volcano. The first set contains daytime and nighttime raw data without any correction. The second set contains topographically corrected images; daytime images are corrected using Cosine and Minnaert methods and nighttime images are corrected using three step normalization method. Calculated surface temperatures (T_{max} , T_{min} , T_{mean}) are plotted annually. On Nemrut Volcano as an example, maximum and minimum temperatures are between 26.31°C and -44.87°C on nighttime data for twelve years period. Temperature difference between total volcano area ROI and summit cone ROI are calculated (ΔT). High ΔT indicates that there is an increase of temperature at the summit cone when compared to the total volcano area. STA/LTA (Short Term Average/Long Term Average) filter was applied to maximum temperature and ΔT data. Determination of a threshold value for STA/LTA curve has a potential for volcano monitoring. This method could be a useful and low cost tool to detect low temperature anomalies on volcanoes.

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