Improving Earth hot-spot detection from MODIS data using MODVOLC algorithm

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Space-borne hot-spot detection on the Earth surface is key to monitoring and studying volcanic activity, wildfires and anthropogenic heat sources from space. Lower intensity thermal emission hot-spots, which often represent the onset of volcanic eruptions and large wildfires, are difficult to detect. We are improving the MODVOLC algorithm, which monitors Earth's surface for hot-spots by analyzing Moderate Resolution Imaging Spectroradiometer (MODIS) data every 48 hours, to allow lower intensity thermal emission detection. Improving the existing MODVOLC algorithm for hot-spot detection from MODIS image data is not trivial. A new approach, which we refer to as the Maximum Radiance Algorithm for MODIS, has been explored. The new approach requires a MODIS 4 µm and accompanying 12 µm global radiance time-series at ~1 km grid spacing. This reference data set describes the maximum radiance that has been measured from each square km of Earth's surface over a ten year period (having first excluded high natural and anthropogenic heat sources from the time-series, using the existing MODVOLC approach). For each new geolocated MODIS image data, the observed radiance for each pixel is compared with this reference, and if its radiance exceeds the historical maximum, it can be considered a potential hot-spot. A dynamic tolerance is used to then confirm if the potential hot-spot is an actual hot-spot. We show that this new approach for hot-spot detection offers significant advantage over existing techniques for lower intensity thermal emission hot-spot detection during both day and nighttime conditions.