Evaluation of the MODIS Fire Detection Algorithm Performance for Local Environmental Conditions

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Abstract: Tenerife, the largest island of the Canary Islands archipelago (Spain), represents a unique set of environmental conditions due to its complex topography and large variations of climatic conditions and vegetation cover over a relatively small area (2,034.38 km²). Fire occurrence on the island is common as a consequence of favorable meteorological conditions and human activity. Over the past decade, the Moderate Resolution Imaging Spectroradiometer (MODIS) sensors on the polar orbiting NASA Earth Observing System Terra and Aqua satellites have been providing high quality active fire observations. As the fire detection algorithm for the standard MODIS Fires and Thermal Anomalies product (MOD14 and MYD14 for Terra and Aqua respectively) was designed to maximize detection while minimizing commission errors globally, the evaluation of the product performance for local environmental conditions is necessary. On the island of Tenerife, the Forest and Fire Management Service has compiled a Geographic Information System database of all in-situ fire observations from 2001 to 2011. The database includes the date and time of detection, location and areal extent of approximately 900 fires, and the type of vegetation burned. This information was correlated with MODIS fire detections to provide detection rates as a function of observing and environmental conditions. Many major fire events, in particular a great fire of 2007, were detected on the island of Tenerife by Terra and Aqua MODIS. However, many fire events remained undetected. We attribute this to the low temporal coverage of MODIS observations and the persistent cloud obscuration over the Northern part of the island. An unexpected outcome of this study was the discovery of persistent false detection over a photovoltaic power plant on the Southern part of the island. Ironically, cloud cover tends to be low on the South side of Tenerife and therefore such false detections are frequent. At the scale of Tenerife, such false detections however can easily be eliminated by applying of static mask of known sources of false alarms. This validation study therefore underlines the importance of combining fire detections from polar and geostationary satellites to reduce omission errors.

Keywords: MODIS, fire detection algorithm, Tenerife