10 YEARS OF MODIS: THE MODIS FIRE PRODUCTS WITH AN EMPHASIS ON SOUTHERN AFRICAN VALIDATION

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David. P. Roy, Geographic Information Science Center of Excellence, South Dakota State University, Wecota Hall, Box 506B, Brookings, SD 57007, USA; david.roy@sdstate.edu

Louis Giglio, Science Systems and Applications, Inc., Lanham, Maryland, USA; louis_giglio@ssaihq.com

Luigi Boschetti, Department of Geography, University of Maryland, 2181 LeFrak Hall, College Park, MD 20740, USA; luigi.boschetti@hermes.geog.umd.edu

Christopher O. Justice, Department of Geography, University of Maryland, 2181 LeFrak Hall, College Park, MD 20740, USA; justice@hermes.geog.umd.edu

Mapping the timing and extent of fires is important as fire is a prominent disturbance factor affecting ecosystem structure and the cycling of carbon and nutrients and is a globally-significant cause of greenhouse gas emissions. There is a growing debate on the relationship between fire and climate change and a perceived increasing incidence, extent, and severity of uncontrolled burning globally that has lead to calls for international environmental policy concerning fire. Africa has by continent the most extensive burning globally. Until recently there were no adequate data on continental fire occurrence, characteristics, or trends in fire numbers or areas burned annually to meet the information needs of scientists and decision-makers. Resource managers need such information to identify areas that are most under threat of too-frequent burning, the likely points of origin of such fires, and what management strategies and operations would best enable more effective control of fire. Scientists require this information to investigate the impact of fire on plant and animal species, ecosystems, soils and biogeochemical cycles, to estimate trace gas and particulate emissions and their associated radiative forcing and the forcing of surface albedo change on the climate, and the relationships between fire, land cover land use, and climate.

Satellite data have been used to monitor biomass burning at regional to global scale for more than two decades using algorithms that detect the location of active fires at the time of satellite overpass, and in the last decade using burned area mapping algorithms that map directly the spatial extent of the areas affected by fires. The NASA Moderate Resolution Imaging Spectroradiometer (MODIS) on the Terra (morning) and Aqua (afternoon) satellites has specific features for fire monitoring and has been used to systematically generate a suite of global MODIS land products, including a 1km active fire product with associated fire radiative power retrieval, and a burned area product that maps the approximate day and extent of burning at 500 m resolution. The MODIS land

products have been reprocessed several times, applying the latest available version of the science algorithms to the MODIS instrument data and using the best available calibration and geolocation information. A collection numbering scheme is used to differentiate between different reprocessings - the active fire product was generated for all collections, whereas the burned area product was developed and tested on a regional basis using data from Collection 1 and Collection 4, with the first global burned area product generated under Collection 5. Illustrative Collection 5 MODIS fire product results are shown for Africa and globally, and differences between the active fire and burned area products are described and the reasons for differences discussed in terms of environmental spatio-temporal fire characteristics and remote sensing factors.

Inter-comparison of different products provides an indication of gross differences and possibly insights into their causes, however product comparison with independent reference data is needed to determine product accuracy. Validation of satellite active fire products is difficult because of practical problems in collecting independent reference data that characterize the location and physical properties of actively burning fires. The validation of burned area products is less sensitive to the need for simultaneous collection of independent reference data with satellite overpasses, as the surface effects of fire may persist for weeks to years. Validation of the MODIS active fire product by comparison with contemporaneous high spatial resolution ASTER data is illustrated. Validation of the MODIS burned area product and two other moderate resolution global burned area products, L3JRC and GLOBCARBON, by comparison with Southern Africa Fire Network (SAFNet) interpreted Landsat data is presented. Quantitative results are described and the implications for global and local fire product usages discussed. Future plans for the MODIS Collection 6 reprocessing are described briefly.