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Global estimation of burned area using MODIS active fire observations

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Abstract. We present a method for estimating monthly burned area globally at 1° spatial resolution using Terra MODIS data and ancillary vegetation cover information. Using regression trees constructed for 14 different global regions, MODIS active fire observations were calibrated to burned area estimates derived from 500-m MODIS imagery based on the assumption that burned area is proportional to counts of fire pixels. Unlike earlier methods, we allow the constant of proportionality to vary as a function of tree and herbaceous vegetation cover, and the mean size of monthly cumulative fire-pixel clusters. In areas undergoing active deforestation, we implemented a subsequent correction based on tree cover information and a simple measure of fire persistence. Regions showing good agreement between predicted and observed burned area included Boreal Asia, Central Asia, Europe, and Temperate North America, where the estimates produced by the regression trees were relatively accurate and precise. Poorest agreement was found for southern-hemisphere South America, where predicted values of burned area are both inaccurate and imprecise; this is most likely a consequence of multiple factors that include extremely persistent cloud cover, and lower quality of the 500-m burned area maps used for calibration. Application of our approach to the nine remaining regions yielded comparatively accurate, but less precise, estimates of monthly burned area. We applied the regional regression trees to the entire archive of Terra MODIS fire data to produce a monthly global burned area data set spanning late 2000 through mid-2005. Annual totals derived from this approach showed good agreement with independent annual estimates available for nine Canadian provinces, the United States, and Russia. With our data set we estimate the global annual burned area for the years 2001-2004 to vary between 2.97 million and 3.74 million km^2, with the maximum occurring in 2001. These coarse-resolution burned area estimates may serve as a useful interim product until long-term burned area data sets from multiple sensors and retrieval approaches become available.

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