Continental Africa Biomass Burning Temporal Dynamics derived from MSG SEVIRI

G. Roberts, M. J. Wooster, E. Lagoudakis, P. Freeborn and W. Xu

King's College London
Environmental Monitoring and Modeling Research Group,
Department of Geography
Strand, London, WC2R 2LS, UK.

Email: gareth.j.roberts@kcl.ac.uk

Abstract

Biomass burning is a key Earth system process, a major element of the terrestrial carbon cycle and a significant source of atmospheric trace gases and aerosols. Africa is the single largest continental source of biomass burning emissions and fire in Africa is characterized by strong diurnal and seasonal variability. An analysis of one year of METEOSAT Spinning Enhanced Visible and Infrared Imager (SEVIRI) active fire data is presented. Fire Radiative Power (FRP) observations, acquired at 15-minute temporal resolution and 3 km spatial resolution (nadir), are used to derive estimates of the rates and total amount of African biomass combustion. In the northern hemisphere, peak burning occurs in January where up to 9 Tg (9 million tonnes) of biomass burn each day, whilst in the southern hemisphere burning peaks in July at 6 Tg per day. The total amount of fuel combustion between February 2004 and January 2005 is at least 855 million tonnes. Analysis carried out with regard to fire pixel temporal persistence indicates that the majority of African fires are detected only once in consecutive 15 minute imaging slots. Fire pixel duration is longest during the peak biomass burning season with a greater proportion of pixels detected only once during the wet season. The latter most likely results from non-ideal burning conditions and increased cloud cover in the wet season. An investigation of the variability of the diurnal fire cycle is carried out with respect to 20 land cover types, and whilst differences are noted between land covers, the diurnal characteristics for a given land cover type are similar in both African hemispheres. We compare the FRP-derived biomass combustion estimates to burned-areas, both at the scale of individual fires and over the entire continent at a 1-degree spatial scale. FRP-derived fuel consumption estimates are found to be less than 2 kg/m^2 for most land cover types. In savanna grasslands, where literature values are commonly reported, the FRP-derived median fuel consumption estimate of 300 g/m^2 appears to be in good agreement. The geostationary FRP data of the type presented here are available in near real-time from the European Organisation for the Exploitation of Meteorological Satellites (EUMETSAT) Land Surface Analysis Satellite Applications Facility (LandSAF), allowing analysis to be undertaken on multi-year datasets where relationships between climate variables, active fires and fuel consumption can be further explored.