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Fuel moisture content estimation: a land-surface modelling approach applied to African savannas

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Abstract
Despite the importance of fire to the global climate system, in terms of emissions from biomass burning, ecosystem structure and function, and changes to surface albedo, current land-surface models do not adequately estimate key variables affecting fire ignition and propagation. Fuel moisture content (FMC) is considered one of the most important of these variables (Chuvieco et al., 2004). Biophysical models, with appropriate plant functional type parameterisations, are the most viable option to adequately predict FMC over continental scales at high temporal resolution. However, the complexity of plant-water interactions, and the variability associated with short-term climate changes, means it is one of the most difficult fire variables to quantify and predict. Our work attempts to resolve this issue using a combination of satellite data and biophysical modelling applied to Africa.
The approach we take is to represent live FMC as a surface dryness index; expressed as the ratio between the Normalised Difference Vegetation Index (NDVI) and land-surface temperature (LST). It has been argued in previous studies (Sandholt et al., 2002; Snyder et al., 2006), that this ratio displays a statistically stronger correlation to FMC than either of the variables, considered separately. In this study, simulated FMC is constrained through the assimilation of remotely sensed LST and NDVI data into the land-surface model JULES (Joint-UK Land Environment Simulator).
Previous modelling studies of fire activity in Africa savannas, such as Lehsten et al. (2008), have reported significant levels of uncertainty associated with the simulations. This uncertainty is important because African savannas are among some of the most frequently burnt ecosystems and are a major source of greenhouse trace gases and aerosol emissions (Scholes et al., 1996). Furthermore, regional climate model studies indicate that many parts of the African savannas will experience drier and warmer conditions in future (IPCC 2007). The simulation of realistic fire disturbance regimes with biophysical and biogeochemical models is a prerequisite for reducing the uncertainty of the African carbon cycle, and the feedbacks associated with this cycle and the global climate system. Using multi-temporal modelling analysis techniques, we present preliminary results that provide a more robust estimation of live FMC.

References

Chuvieco, E., Aguado, I. and Dimitrakopoulos, A. P. (2004) Conversion of fuel moisture content values to ignition potential for integrated fire danger assessment. Canadian Journal of Forest Research-Revue Canadienne De Recherche Forestiere 34(11): 2284-2293.

IPCC (2007) 'Climate Change 2007: Synthesis Report. Contribution of Working Groups I, II and III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, Pachauri, R.K and Reisinger, A. (eds.)].' IPCC, (Geneva, Switzerland).

Lehsten, V., Tansey, K. J., Balzter, H, Thonicke, K., Spessa, A., Weber, U., Smith, B., and Arneth, A. (2008). Estimating carbon emissions from African wildfires. Accepted Biogeosciences.

Sandholt, I., Rasmussen, K. & Andersen, J. (2002) A simple interpretation of the surface temperature/vegetation index space for assessment of surface moisture status. Remote Sensing of Environment 79(2-3): 213-224.

Scholes, R. J., Ward, D. E. and Justice, C. O. (1996) Emissions of trace gases and aerosol particles due to vegetation burning in southern hemisphere Africa. Journal of Geophysical Research-Atmospheres 101(D19): 23677-23682.

Snyder, R. L., Spano, D., Duce, P., Baldocchi, D., Xu, L. K. & Kyaw, T. P. U. (2006) A fuel dryness index for grassland fire-danger assessment. Agricultural and Forest Meteorology 139(1-2): 1-11.