Geophysical Research Abstracts
Vol. 12, EGU2010-13037, 2010
EGU General Assembly 2010

Climate controls on the variability of fires in the tropics and subtropics

Guido van der Werf (1), Jim Randerson (2), Louis Giglio (3), and Han Dolman (1)
(1) VU University, Amsterdam, Netherlands, (2) UCI Irvine, California, US, (3) UMD, Maryland, US

In the tropics and subtropics, most fires are set by humans for a wide range of purposes. The total amount of burned area and fire emissions reflects a complex interaction between climate, human activities, and ecosystem processes. Here we used satellite-derived data sets of active fire detections, burned area, precipitation, and the fraction of absorbed photosynthetically active radiation (fAPAR) during 1998–2008 from the Global Fire Emissions Database (GFED3) to investigate this interaction. The total number of active fire detections and burned area was highest in areas that had intermediate levels of both net primary production and precipitation, with limits imposed by the length of the fire season in wetter ecosystems and by fuel availability in drier ecosystems.

For wet tropical forest ecosystems we developed a metric called the fire-driven deforestation potential (FDP) that integrated information about the length and intensity of the dry season. FDP partly explained the spatial and interannual pattern of fire-driven deforestation across tropical forest regions. This climate-fire link in combination with higher precipitation rates in the interior of the Amazon suggests that a negative feedback on fire-driven deforestation may exist as the deforestation front moves inward. In Africa, compared to the Amazon, a smaller fraction of the tropical forest area had FDP values sufficiently low to prevent fire use. Tropical forests in mainland Asia were highly vulnerable to fire, whereas forest areas in equatorial Asia had, on average, the lowest FDP values. FDP and active fire detections increased exponentially in forests of equatorial Asia, however, during El Niño periods.

In contrast to these wet ecosystems we found a positive relationship between precipitation, fAPAR, NPP, and active fire detections in arid ecosystems. This relationship was strongest in northern Australia and arid regions in Africa. Highest levels of fire activity were observed in savanna ecosystems that were limited neither by fuel nor by the length of the fire season. However, relations between annual precipitation or drought extent and active fire detections were often poor here, hinting at the important role of other factors, including land managers, in controlling spatial and temporal variability of fire.