Geophysical Research Abstracts
Vol. 17, EGU2015-14110, 2015
EGU General Assembly 2015

Human amplification of drought-driven fire in tropical regions

Michael Tosca
Jet Propulsion Laboratory, Los Angeles, United States (Michael.G.Tosca@jpl.nasa.gov)

The change in globally-measured radiative forcing from the pre-industrial to the present due to interactions between aerosol particles and cloud cover has the largest uncertainty of all anthropogenic factors. Uncertainties are largest in the tropics, where total cloud amount and incoming solar radiation are highest, and where 50% of all aerosol emissions originate from anthropogenic fire. It is well understood that interactions between smoke particles and cloud droplets modify cloud cover , which in turn affects climate, however, few studies have observed the temporal nature of aerosol-cloud interactions without the use of a model. Here we apply a novel approach to measure the effect of fire aerosols on convective clouds in tropical regions (Brazil, Africa and Indonesia) through a combination of remote sensing and meteorological data. We attribute a reduction in cloud fraction during periods of high aerosol optical depths to a smoke-driven inhibition of convection. We find that higher smoke burdens limit vertical updrafts, increase surface pressure, and increase low- level divergence-meteorological indicators of convective suppression. These results are corroborated by climate model simulations that show a smoke-driven increase in regionally averaged shortwave tropospheric heating and boundary layer stratification, and a decrease in vertical velocity and precipitation during the fire season (December-February). We then quantify the human response to decreased cloud cover using a combination of socioeconomic and climate data Our results suggest that, in tropical regions, anthropogenic fire initiates a positive feedback loop where increased aerosol emissions limit convection, dry the surface and enable increased fire activity via human ignition. This result has far-reaching implications for fire management and climate policy in emerging countries along the equator that utilize fire.