4.140 Impacts of tropical land-use change on the atmosphere and the climate.

Early Career Scientist

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Abstract:

Extensive land-use change has occurred over the past few decades across the tropics, with large areas of forest converted to agriculture and pasture. Such changes impact the climate through emissions of CO_2, but also through a number of biophysical and biogeochemical changes. Previous studies have demonstrated that changes in well-mixed greenhouse gases, short-lived climate forcers (SLCFs), such as ozone and aerosol, and surface albedo from deforestation directly affect the climate.

We combine data from different satellites to quantify the impacts of land-use change on surface albedo over the Amazon. Using data derived from Landsat satellite observations, we identify regions of significant deforestation between 2000 and 2014. We combine this with data collected with the Moderate Resolution Imaging Spectroradiometer (MODIS) and observations from the South American Biomass Burning Analysis (SAMBBA) campaign in 2012, to assess the impacts of changing forest cover on surface albedo.

The albedo changes we calculate (ranging from 0.008 to 0.034), are considerably less than previous observationally derived estimates and substantially lower than the values prescribed in model simulations found in the literature, which average 0.06.

We use a radiative transfer model to investigate the impacts of this reduced albedo change on top-of-atmosphere radiative forcing. Using an idealised Amazonian deforestation scenario, we calculate the associated global radiative forcing is reduced from -0.097 W m^{-2} using albedo values typically prescribed in models to -0.031 W m^{-2} using our observationally derived best estimate. Our findings suggest that model simulations are currently underestimating the warming effects from Amazonian deforestation.