Geophysical Research Abstracts
Vol. 20, EGU2018-9688-2, 2018
EGU General Assembly 2018

Understanding the effects of land cover change in southeastern Amazonia with a thermodynamically-constrained energy balance approach

Luigi Conte (1), Maik Renner (1), Paulo Brando (2,3), Claudinei Oliveira dos Santos (2), Divino Vicente Silvério (2), Susan E. Trumbore (1), and Axel Kleidon (1)

(1) Max Planck Institute for Biogeochemistry, Jena, Germany, (2) Instituto de Pesquisa Ambiental da Amazônia, Belém, Pará, Brazil, (3) Woods Hole Research Center, Falmouth, MA, USA

Tropical deforestation results in substantial changes in the land surface energy balance components. To understand and estimate these changes, we use a physical-based analytical formulation of the energy balance of the surface-atmosphere system in which turbulent heat fluxes are constrained by the thermodynamic maximum power limit and compare it to field observations over a rainforest (control) and a soybean site in southeastern Amazonia. We find very good agreement between modeled and observed total turbulent heat fluxes over both sites throughout the seasons ($r^2 > 0.96$, slopes near one and intercepts around zero). The sensible and latent heat flux are well estimated by a simple partitioning of the total heat flux, except in case of soil water limitation for the soybeans. The model bias can be reduced by improving the parameterization of the downwelling longwave radiation. Our results show that contrasting land cover types primarily control the absorption of solar radiation (and heat) at the surface and the partitioning between sensible and latent heat flux, while the total turbulent flux is well predicted by the thermodynamic limit, without involving any empirical aerodynamic parameter. These results suggest that is possible to infer first-order effects of land cover change from purely physical principles.