Geophysical Research Abstracts, Vol. 8, 05175, 2006
SRef-ID: 1607-7962/gra/EGU06-A-05175

Climate is affected more by maritime than by continental land use change: a multiple scale analysis

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Tropical deforestation appears to have larger impacts on local, regional and global climate when it occurs under maritime conditions rather then under continental conditions.

At the local scale, we compare results from a field experiment in Puerto Rico with other long-term studies of the changes in surface fluxes after deforestation. Changes in surface fluxes are larger in maritime situations because a number of feedback mechanisms appears less relevant (e.g.: the dependency of soil moisture on recycling of water and the larger reduction of net radiation in the wet season due to clouds in continental regions). Pastures may evaporate at similarly high rates as forests when soil moisture is sufficient, which has a strong reducing effect on the sensible heat flux after deforestation.

At the regional scale ($\sim 10^2$ km^2), model simulations show that the meso-scale sea breeze circulation under maritime conditions is more effective in transporting heat and moisture to the upper troposphere than convection is in the continental case. Thus islands function as triggers of convection, whereas the intensity of the sea breeze-trigger is sensitive to land use change.

At the global scale, using satellite-derived latent heating rates of the upper troposphere, it is shown that 40 % of the latent heating associated with deep convection takes place in the Maritime Continent (Indonesia and surroundings) and may be produced mostly by small islands. Continents contribute only 20 % of the latent heating of the upper troposphere. Thus, sea breeze circulations exert significant influence on the Hadley cell circulation. These results imply that, from a climate perspective, further deforestation studies would do well to focus more on maritime conditions.