Geophysical Research Abstracts
Vol. 15, EGU2013-13688, 2013
EGU General Assembly 2013

The impact of global land-cover change on the terrestrial water cycle

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Floods and droughts cause perhaps the most human suffering of all climate-related events; a major goal is to understand of how humans alter the incidence and severity of these events by changing the terrestrial water cycle. Here we use over 1,500 estimates of annual evapotranspiration (ET) and a database of global land-cover change1 to project alterations of global scale terrestrial ET (TET) from current anthropogenic land-cover change. Geographic modelling reveals that land-cover change reduces annual TET by approximately 3,500 km3 yr-1 (5%) and that the largest changes in ET are associated with wetlands and reservoirs. Land surface model simulations support these ET changes, and project increased runoff (7.6%) as a result of land-cover changes. Next we create a synthesis of the major anthropogenic impacts on annual runoff and find that the net result is an increase in annual runoff, although this is uncertain. The results demonstrate that land-cover change alters annual global runoff to a similar or greater extent than other major drivers, affirming the important role of land
cover change in the Earth System. Last, we identify which major anthropogenic drivers to runoff change have a mean global change statistic that masks large regional increases and decreases: land-cover change, changes in meteorological
forcing, and direct CO_2 effects on plants.