Geophysical Research Abstracts
Vol. 12, EGU2010-7949, 2010
EGU General Assembly 2010

Soil-vegetation feedbacks driving early ecosystems genesis

Willis Gwenzi (1), Christoph Hinz (1), Gavan McGrath (1), and Erik Veneklaas (2)

(1) The University of Western Australia, School of Earth and Environment, Crawley, Australia (christoph.hinz@uwa.edu.au), (2) The University of Western Australia, School of Plant Biology, Crawley, Australia

During the early phase of terrestrial ecosystems genesis feedbacks between soil and vegetation may become a key driver determining whether and how the systems will converge to a stable state. This is particular true for water-limited ecosystems for which water availability determines biomass. Based on a review of how vegetation growth affects soil hydraulic properties, we propose a simple conceptual model that captures the feedbacks between soil water storage in soil and soil hydraulic behaviour and vegetation biomass. The feedbacks that we considered are (i) vegetation biomass and soil water storage, (ii) root growth and infiltration capacity, (iii) vegetation biomass and bare soil evaporation, and (iv) root growth and soil water drainage. In water-limited environments, these feedbacks are responsible for highly organized vegetation patterns in space and may also lead to oscillating behaviour of soil water storage and vegetation biomass in time. Biomass overshooting as a result of initially high soil water content is predicted, which is consistent with observations made in forested catchments after clearing or during re-vegetation of mine tailings. We furthermore study how the oscillation of rainfall and evaporative demand affects the biomass fluctuations in time. We can show that such systems may converge to either an equilibrium point or a limit cycle. Climate oscillation can cause period doubling and for large periods it may control the biomass dynamics.