Geophysical Research Abstracts
Vol. 15, EGU2013-9759, 2013
EGU General Assembly 2013

Soil dynamics and accelerated erosion: a sensitivity analysis of the LPJ Dynamic vegetation model

Samuel Bouchoms (1), Kristof Van Oost (1), Veerle Vanacker (1), Jed O. Kaplan (2), and Tom Vanwalleghem (3)

(1) ELI-TECLIM - Georges Lemaître Centre for Earth and Climate Research, Louvain-la-Neuve BE 1348, BelgiumBelgium (samuel.bouchoms@uclouvain.be), (2) ARVE Group, Environmental Engineering Institute, Ecole Polytechnique Fédérale de Lausanne, Station 2, 1015 Lausanne, Switzerland , (3) Department of Agronomy, University of Cordoba, 14080 Cordoba, Spain

It is widely accepted that humans have become a major geomorphic force by disturbing natural vegetation patterns. Land conversion for agriculture purposes removes the protection of soils by the natural vegetation and leads to increased soil erosion by one to two orders of magnitude, breaking the balance that exists between the loss of soils and its production. Accelerated erosion and deposition have a strong influence on evolution and heterogeneity of basic soil characteristics (soil thickness, hydrology, horizon development,. . .) as well as on organic matter storage and cycling. Yet, since they are operating at a long time scale, those processes are not represented in state-of-art Dynamic Global Vegetation Models, which is a clear lack when exploring vegetation dynamics over past centuries.

The main objectives of this paper are (i) to test the sensitivity of a Dynamic Global Vegetation Model, in terms of NPP and organic matter turnover, variations in state variables in response to accelerated erosion and (ii) to assess the performance of the model under the impact of erosion for a case-study in Central Spain. We evaluated the Lund-Postdam-Jena Dynamic Vegetation Model (LPJ DVGM) (Sitch et al, 2003) which simulates vegetation growth and carbon pools at the surface and in the soil based on climatic, pedologic and topographic variables. We assessed its reactions to changes in key soil properties that are affected by erosion such as texture and soil depth.

We present the results of where we manipulated soil texture and bulk density while keeping the environmental drivers of climate, slope and altitude constant. For parameters exhibiting a strong control on NPP or SOM, a factorial analysis was conducted to test for interaction effects. The simulations show an important dependence on the clay content, especially for the slow cycling carbon pools and the biomass production, though the underground litter seems to be mostly influenced by the silt content. The fast cycling C pools and/or the surface pools vary with sand and silt richness, the highest values being reached with a combination of 50% silt and 25% sand while the lowest are for a 100% clay soil.

Finally, LPJ is run for three cases corresponding to a stable, erosive and depositional soil profile. These simulations show how the model reacts and performs under erosion/deposition conditions which are recreated by changing the soil's texture and soil depth over time. We discuss the performance of the LPJ model in the context of accelerated erosion and conclusions drawn from the sensitivity analysis.