EGU21-14037
https://doi.org/10.5194/egusphere-egu21-14037
EGU General Assembly 2021

Asynchronous effects of vegetation protection on landform evolution

Juan Quijano Baron, Patricia Saco, and Jose Rodriguez
Centre for Water Security and Environmental Sustainability and School of Engineering, The University of Newcastle, Callaghan, Australia (juan.quijanobaron@uon.edu.au)

Vegetation protects soil against erosion by intercepting rain, increasing flow resistance, promoting soil infiltration and improving soil strength. However, the representation of vegetation dynamics in Landform Evolution Models (LEMs) is very simplified, which could result in over/under estimations of erosion rates. Here we use a new model framework to study the differences in erosion rates when considering different processes associated with vegetation protection. We analysed the changes in erosion rates by considering: (1) the effect of root biomass on soil erodibility, (2) the effect of leaf cover on soil diffusivity, (3) the effect of litter on flow resistance, and (4) the effect of soil carbon on soil infiltration. We implemented the model in an open-forest savannah catchment situated in Howard Springs (Northern Territory, Australia) and ran simulations using daily time step for 100 years. The modelling framework comprises a coupled Landform Evolution Model (LEM) with dynamic biochemical vegetation and biomass pools dynamics. Our results show that bare soil conditions generate a 100% increase in erosion compared to those using the full dynamic vegetation (that include protection from all carbon pools). We find that the effects from vegetation protection and rainfall are asynchronous, with substantial vegetation growth typically lagging behind substantial rainfall events. This means that rainfall events at the beginning of the rainy season contribute heavily to erosion. For the specific case of Howard Springs, leaves and roots are the most important factors that control erosion except when they are not fully recovered after the dry season. At this time the effect of the litter, and to a lesser extent the soil carbon, turn out to be determinant. Overall, this study highlights the importance of including dynamic vegetation and the effects of the biomass pools on controlling erosion in order to estimate erosion rates.