Geophysical Research Abstracts
Vol. 15, EGU2013-7941, 2013
EGU General Assembly 2013

Long-term simulation of terrestrial and freshwater C, N and P at the UK scale.

Jessica Davies (1), John Quinton (1), and Ed Tipping (2)
(1) Lancaster University, United Kingdom (j.davies4@lancaster.ac.uk), (2) Centre for Ecology and Hydrology, Lancaster, UK.

Understanding C, N and P pools and fluxes throughout the landscape is vital for improving agricultural sustainability, preserving carbon stocks, and reducing the eutrophication of freshwater systems and delivery of nutrients to the sea. Understanding in this area is also instrumental in predicting and mitigating the impacts of climate change and a perturbed C cycle. However, accounting for C, N and P behaviour is challenging as they are determined by highly spatially variable, inter-connected factors such as the underlying substrate, vegetation and soil types, hydrological conditions, topography, and land use. Also, long turnover times in soil organic matter may mean that current C, N and P states have a significant dependency on a site's history of inputs and human perturbations. In addition, the dynamics of C, N and P are highly coupled, increasing the complexity of these processes. This interacting nature of C, N and P and dependency on inter-connected processes makes it important that they are considered simultaneously in an integrated manner, ideally with a long-term perspective.
The research presented aims to account for current observable conditions at a UK scale by drawing on expertise in soil science, geochemistry, and hydrology. Ultimately, mechanistic biogeochemical, soil physics and hydrological models are to be integrated and applied at the regional scale over a time scale stretching from the last glaciation up until the present day. This modelling is based on 'terrestrial units', defined as land areas with relatively homogeneous vegetation or land-use (e.g. natural grassland, arable farmland), to which a biogeochemical model (the N14CP model in the case of semi-natural terrestrial units and RothC in agricultural units) is applied to simulate plant-soil C, N and P pools and fluxes. Erosional losses from these pools are then simulated using a mechanistic, energy-based representation, and aquatic loads are calculated by combining these erosion outputs with leaching outputs from the plant-soil nutrient models. Aquatic loadings are then routed through the landscape using the Grid-to-Grid model, which also provides soil moisture characteristics and overland flow that feed into the erosion and biogeochemical models.
Early progress in this research is presented, and the challenges associated with determining nutrient export at large spatial and temporal scales are discussed. In particular, the role of soil erosion on determining C, N and P cycles and stores within semi-natural terrestrial settings is examined and suitable representations of these processes at this large spatial and temporal scale are explored.