Geophysical Research Abstracts
Vol. 18, EGU2016-1351, 2016
EGU General Assembly 2016

Long-term P weathering and recent N deposition control contemporary plant-soil C, N and P

Jessica Davies (2), Edward Tipping (1), Edwin Rowe (3), John Boyle (4), Elisabeth Graf Pannatier (5), and Vegard Martinsen (6)

(1) Centre for Ecology and Hydrology, Lancaster, UK, (2) Lancaster University, Lancaster, UK, (3) Centre for Ecology and Hydrology, Bangor, UK, (4) University of Liverpool, Liverpool, UK, (5) Swiss Federal Institute for Forest, Snow and Landscape Research WSL, Birmensdorf, Switzerland, (6) Norges Miljø- Og Biovitenskaplige Universitet (NMB), Aas, Norway

Models are needed to understand how plant-soil nutrient stores and fluxes have responded to the last two centuries of widespread anthropogenic nutrient pollution and predict future change. These models need to integrate across carbon, nitrogen and phosphorus (C, N, & P) cycles and simulate changes over suitable timescales using available driving data. It is also vital that they are constrainable against observed data to provide confidence in their outputs. To date, no models address all of these requirements. To meet this need, a new model, N14CP, is introduced, which is initially applied to Northern hemisphere temperate and boreal ecosystems over the Holocene. N14CP is parameterized and tested using 88 northern Europe plot-scale studies, providing the most robust test of such a model to date. The model simulates long-term P weathering, based on the assumption of a starting pool of weatherable P (Pweath0, g m-2), which is gradually transformed into organic and sorbed pools. Nitrogen fixation (and consequently primary production) is made dependent on available P. In the absence of knowledge about the spatial variability of Pweath0, N14CP produces good average soil and plant variables, but cannot simulate variations among sites. Allowing Pweath0 to vary between sites improves soil C, N and P results greatly, suggesting contemporary soil C, N and P are sensitive to long-term P weathering. Most sites were found to be N limited. Anthropogenic N deposition since 1800 was calculated to have increased plant biomass substantially, in agreement with observations, and consequently increased soil carbon pools.