AGU FALL MEETING
San Francisco | 14 – 18 December 2015

H13C-1541: Integration of a Physically based Distributed Hydrological Model with a Model of Carbon and Nitrogen Cycling: A Case Study at the Luquillo Critical Zone Observatory, Puerto Rico

Monday, 14 December 2015
13:40 - 18:00
Moscone_South - Poster Hall

The dynamics of carbon and nitrogen cycles, increasingly influenced by human activities, are the key to the functioning of ecosystems. These cycles are influenced by the composition of the substrate, availability of nitrogen, the population of microorganisms, and by environmental factors. Therefore, land management and use, climate change, and nitrogen deposition patterns influence the dynamics of these macronutrients at the landscape scale.

In this work a physically based distributed hydrological model, the tRIBS model, is coupled with a process-based multi-compartment model of the biogeochemical cycle to simulate the dynamics of carbon and nitrogen (CN) in the Mameyes River basin, Puerto Rico. The model includes a wide range of processes that influence the movement, production, alteration of nutrients in the landscape and factors that affect the CN cycling. The tRIBS integrates geomorphological and climatic factors that influence the cycling of CN in soil. Implementing the decomposition module into tRIBS makes the model a powerful complement to a biogeochemical observation system and a forecast tool able to analyze the influences of future changes on ecosystem services.

The soil hydrologic parameters of the model were obtained using ranges of published parameters and observed streamflow data at the outlet. The parameters of the decomposition module are based on previously published data from studies conducted in the Luquillio CZO (budgets of soil organic matter and CN ratio for each of the dominant vegetation types across the landscape). Hydrological fluxes, wet depositon of nitrogen, litter fall and its corresponding CN ratio drive the decomposition model. The simulation results demonstrate a strong influence of soil moisture dynamics on the spatiotemporal distribution of nutrients at the landscape level. The carbon in the litter pool and the nitrate and ammonia pool respond quickly to soil moisture content. Moreover, the CN ratios of the plant litter have significant influence in the dynamics of CN cycling.

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