Goldschmidt 2022 Abstract
https://doi.org/10.46427/gold2022.11156

Integrating Models and Observations to Understand the Impact of Changing Climate on Mountainous Watershed Nitrogen Cycling

HELEN WEIERBACH[1], TAYLOR MAAVARA[2], ERICA WOODBURN[3] AND NICHOLAS BOUSKILL[1]

[1]Lawrence Berkeley National Lab
[2]Yale School of the Environment
[3]Lawrence Berkeley National Laboratory

Presenting Author: hweierbach@lbl.gov

Terrestrial nitrogen cycling plays an important role in regulating the export of nitrogen to surface waters. Terrestrial nitrogen transformations are regulated by plant-microbe interactions and are sensitive to inter-annual hydrological conditions and long term climate perturbations. Here we develop a data-driven model representation of plant-microbial controls on terrestrial nitrogen cycling at the watershed scale under historical conditions. Using this new model representation, we investigate how the cycling of nitrogen and it's export from different catchments changes due to inter-annual variability and under climate perturbations.

Specifically, we update and run simulations using the High Altitude Nitrogen Suite of Models (HAN-SoMo) which was developed to model hydro-biogeochemical nitrogen interactions in the East River Watershed (ERW): a nearly pristine, mountainous watershed in the Upper Colorado River Basin. HAN-SoMo is a semi-distributed ensemble of process based models which represents nitrogen (N) transformations through the vadose zone, surface waters and groundwater at a subwatershed resolution. HAN-SoMo has been benchmarked against over 1600 N concentration measurements representing the unique atmospheric, biological, and geogenic N sources and sinks throughout the watershed, enabling us to accurately characterize the magnitude and seasonality of inter-annual nitrogen exports. In the present work, we report on recent updates to the model's microbial representation by defining relationships between microbial activity, temperature, and soil moisture, using site-specific data. We then extend these relationships to the watershed scale. With this new watershed-scale microbial parametrization, we run simulations to examine how climate extremes within the catchment impact terrestrial nitrogen cycling and export to surface waters. Climate forcing experiments focus on, a) inter-annual variability in snowpack depth, b) atmospheric warming of +2.5 and + 4 °C, and c) prolonged drought conditions.