Workshop report: Biogeochemical cross-site intercomparison using the DayCent-Chem model.

Working Group Organizer: Jill Baron

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Atmospheric deposition of sulfur and nitrogen species have the potential to acidify terrestrial and aquatic ecosystems, but nitrate and ammonium are also critical nutrients for plant and microbial productivity. We developed a non-spatial biogeochemical model, DayCent-Chem, to simulate both the ecological response and the hydrochemical response of ecosystems to atmospheric deposition. DayCent-Chem simulates the daily dynamics of plant production, soil organic matter, cation exchange, mineral weathering, elution, stream discharge, and solute concentrations in soil water and stream flow. This model is appropriate for accurately describing ecosystem and surface water chemical response to atmospheric deposition and climate change.

In this interactive workshop we presented an overview of the DayCent-Chem model and its applications to date, and we introduced potential future applications. Specifically, the objectives of the workshop were

- to introduce the model to participants to who were unfamiliar with it,
- to share our progress in model development and application with LTER scientists,
- to seek input for further model refinement,
- to consider what the model tells us about future data that need to be collected and made available for modeling at LTER sites, and
- to consider future activities that include more LTER and non-LTER sites that have need for this kind of information.

The workshop was attended ay a group of current collaborators including Charlie Driscoll, Kate Lajtha, Mark Williams, Dennis Ojima, and Melannie Hartman, plus about a dozen other people with an interest in modeling atmospheric deposition and other effects on nutrient cycling dynamics.

As a group we discussed how to improve model predictions of stream nitrate, sulfate, and chloride concentrations for HBR, HJA, CWT, and NWT. We focused much of this discussion on anion absorption. Simulating anion adsorption well is particularly important for the developed soils of HBR, CWT, and HJA. The model implements a Langmuir isotherm for sulfate adsorption, but we may not have good isotherm parameters for some of the sites. We also discussed chloride adsorption, a process DayCent-Chem does not currently account for. Chloride adsorption seems to be important at HBR and CWT.

Some future data collection efforts were proposed by Kate Lajtha and Charlie Driscoll who would like to secure funding for some students to collect soil samples at various

sites (each with a unique set of soil and vegetation characteristics) for cross-site soil comparisons. Analysis of these soil samples could provide a consistent set of cross-site soil parameters, such as sulfate and chloride isotherm parameters, that DayCent-Chem and other like models could use.

Our next steps and future research directions for applying DayCent-Chem include:

- Finalizing model simulations for the eight LTER and National Park sites within the U.S., completing the scenarios of future deposition and climate for these sites, and publishing our results.
- Applying the model to Luquillo, another LTER site with a rich dataset for parameterizing, testing, and validating the model. Luquillo data will enable us to test the model for a tropical forest, and evaluate our understanding of important processes there.
- Fostering interest in new collaborations. The workshop attracted at least two potential new collaborators who are interested in applying the DayCent-Chem model to their research sites. We have established communication with both of them since the workshop. One is interested in using the model to examine effects of lime treatments on acidified soil, and the other is meeting with us in the next month to discuss his research interests.
- Using the model across many LTER sites to compare sensitivity of ecosystem and biogeochemical parameters to changing climate and deposition across sites, and to explore using the model as a tool for informing on ecological thresholds.

LIST OF PARTICIPANTS

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