Poster #1-66

What Drives Phosphatase Activity in Tropical Forests – A Modeling Study Using E3SM Land Model

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BER Program: TES
Project: NGEE-Tropics
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Phosphorus is generally considered as the most limiting nutrient in the lowland tropical forests where soils are highly weathered with low soil phosphorus (P) availability. Most of P in tropical soils is either in organic forms or in occluded forms associated with Al and Fe oxides. Phosphatase activity, which can release phosphate from organic matter directly without carbon oxidation, provides an important pathway for sustaining P availability in tropical ecosystems. Despite its importance in providing available P, the representation of this process in models is not well constrained due to lack of measurements. Our recent field study in Puerto Rico focusing on phosphatase activity found that 1) there was an apparent inverse correlation between P availability and phosphatase activity 2) phosphatase activity varied more with tree species than with site differences in P availability due to variations in root traits. In this study our objective is to integrate the observational data with modeling in order to better understand this process and improve their representation in E3SM Land model (ELM). We first applied the ELM v1 at the three sites in Puerto Rico to evaluate the model's capability in capturing the variation in phosphatase activity between sites. We found that although the model is able to capture the inverse relationship between phosphatase activity and P availability, it overestimated the differences between the 3 sites compared with the observations. We were able to better capture the variation in phosphatase activity between sites after we improved the parameterization based on observations. We also show that by introducing root traits such as root diameters into the model, we were able to reproduce the large variation of phosphatase between species. Comprehensive sensitivity analysis has also been done to identify the most significant parameters in ELM.