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ABSTRACT TITLE: Modeling P dynamics and P limitation on productivity in tropical forests

ABSTRACT: One of the major uncertainties in the prediction of future carbon(C) uptake and storage comes from the treatment of carbon-nutrient interactions in global C-climate models. Phosphorus (P), the most limiting nutrient in tropical regions, has yet to be incorporated into global C-climate models (except for CASA-CNP and JSBACH). Here we introduce P dynamics and C-N-P interactions into the CLM4-CN model and investigate the role of P cycling in controlling the productivity of tropical ecosystems. The newly developed CLM-CNP model includes all major biological and geochemical processes controlling P availability in soils and the interactions between C, N, and P cycles. The model is first evaluated against measurements from four sites along a Hawaiian soil chronosequence. Preliminary results indicate that the introduction of P limitation greatly improved the model estimated NPP. The modeled vegetation and soil organic C, N and P as well as inorganic P pools compare well with the observations. The model is also able to predict the shift in nutrient limitation along this chronosequence (from N limited, to N-P co-limited, to P limited). We also apply the CLM-CNP model at five intensively studied RAINFOR sites in the Amazon watershed to evaluate the model performance against the observations and investigate how P status affects above ground productivity in tropical forests. These site level simulations improve our understanding of how P dynamics affect terrestrial C dynamics. The evaluations against site-level observations increase confidence in applying the model more broadly to regional and global scales.