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Soil and Water Science Department

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Soil and Water Science Department Seminar

Speaker: **Yuanyuan Huang**
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Advisor: Dr. Stefan Gerber

Title: **Terrestrial Soil Nitrous Oxide Emissions and Responses of Carbon Cycling to Drought**

Date: Monday, November 2nd

Time: 3:00 pm

Location: McCarty Hall B, Room G086

The coupled cycles of water, carbon (C) and nitrogen (N) in terrestrial systems are crucial to future greenhouse gas concentration and thus climate change. The understanding of terrestrial emissions of nitrous oxide (N_2O) and CO_2 sequestration are therefore a major concern. In my work I adopt a Terrestrial Biosphere Model (TBM) to explore soil N_2O emissions and carbon-drought responses in the context of C-N interaction globally. Key questions tackled include: spatiotemporal dynamics of global soil N_2O emission; sensitivity of N_2O emission to soil moisture regimes, step rises in atmospheric CO_2 and temperature; response of N_2O emission to historical global enviromental changes (climate change, atmospheric N deposition and CO_2) and land cover transitions; representation of droughts in TBMs; and the role of N in the C cycle's response to drought. I added a N_2O emission module to LM3V-N and found that N_2O fluxes were highly sensitive to soil moisture regime indicated by water filled pore space. The global response of N_2O to step rise of CO_2 was largely determined by tropical emissions where initial N_2O emission reductions transitioned into higher emissions, while the extratropical response was weaker but always positive. These results highlight the need to expand field studies in tropics. Although land cover transition alone had a minor impact on N_2O emissions over 1970-2000, its contribution varied spatiotemporally and peaked in the 1920s, balanced between positive responses in temperate regions and negative responses in the tropics. To investigate the performance of current TBMs' response to drought, I evaluated 9 Earth System Models from the historical experiment of the Coupled Model Intercomparison Project Phase 5 (CMIP5). Models are on average more responsive to meteorological drought compared to data-derived estimates. The over-response is less robust based on soil moisture drought indicated by surface (less than 10cm) soil moisture anomalies. Nevertheless, N is found to buffer (reduce sensitivity) vegetation's response (net primary productivity and net ecosystem productivity) to precipitation anomalies in models.

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