Geophysical Research Abstracts
Vol. 20, EGU2018-5120, 2018
EGU General Assembly 2018

On the value of ecosystem manipulation experiments for testing mechanistic models

Simone Fatichi
ETH Zürich, Institute of Environmental Engineering, Zürich, Switzerland

Scenarios of future terrestrial carbon and water cycle are based on numerical tools that simulate energy and water exchanges at the land surface and the dynamics of vegetation from assimilation of carbon through stomata to long-term forest development. However, these tools are rarely tested to perform well in conditions different from the historical climate. Several ecosystem manipulation experiments have been carried out to understand the vegetation response to change in water availability, CO_2, temperature, and nutrients. Results from these experiments are rarely used for model testing and development. Here, we demonstrate the potential of combining numerical modelling and observations from manipulation experiments by testing a mechanistic ecosystem model (T&C) in simulating the hydrology and the vegetation response in a number of ecosystems exposed to environmental manipulations. Model simulations are forced with meteorological inputs, and boundary conditions (vegetation and soil), corresponding to different biomes and climates where free air CO_2 enrichment (FACE), rainfall exclusion or addition and chronic fire regime have been imposed. While in several cases model simulations capture the direction and the magnitude of the long-term vegetation productivity response to the treatment, there are behaviours that are not reproduced, including the interannual variability of the treatment effect. Overall, results suggest that ecosystem models can be used to gain insights on changes in energy, water, and carbon fluxes for environmental conditions different from observations and to carry out numerical experiments. However, long-term projections of forest and carbon dynamics are very problematic because of remaining model limitations and paucity of data to constrain specific model components (e.g., carbon allocation).