

LPJ-GUESS: validation and an application of a dynamic ecosystem model using EUROFLUX data and RCM model output

Pablo Morales, Deniz Koca, Martin T. Sykes & Ben Smith
Lund University, Geobiosphere Science Centre
Department of Physical Geography and Ecosystems Analysis

Abstract

LPJ-GUESS [Smith et al 2001, Sitch et al. 2003] is a dynamic ecosystem model that simulates ecosystem processes and vegetation distributions and dynamics. Within the PRUDENCE project LPJ-GUESS is being used to assess the responses of different European forest ecosystems to changing climate using the range of Regional Climate Model outputs generated within the project and also as a means of comparing different RCM outputs. Initially the model has been validated using flux measurements collected within the EUROFLUX project (providing at least three years of eddy covariance data) over a wide range of forests types and climatic regions in Europe. Secondly preliminary simulations have been completed with output from one RCM (SWECLIM) to predict potential natural vegetation distributions within Swedish forests.

In the validation exercise with EUROFLUX data, the model was run using present day climatology (and forest management history) for each of 15 sites in Europe to carbon and water fluxes over a three-year period. First simulations with an RCM model output was done for 200 years using time-series data and including as historical climate data the CRU05 (1901-1998) dataset and SWECLIM regional climate model outputs for (2071-2100) based on HadCM3/AM3 & ECHAM4/OPYC3.

In the case of the validation exercise, an analysis of the monthly model outputs and field data shows that, in general, the models accurately predict the seasonal patterns in Net Ecosystem Exchange (NEE) and Actual EvapoTranspiration (AET) for most EUROFLUX sites except for some Mediterranean and Maritime Evergreen forest sites. Using the SWECLIM RCM the ecosystem model predicts changing species composition in existing forests, increasing productivity in Swedish forest ecosystems and therefore increased sequestration of carbon into the future.

Next steps:

Simulations will be projected forward to 2071-2100 period using the modelled climate data available from different RCM outputs in the PRUDENCE EU project and vegetation fluxes will be compared with present –day simulations and data. LPJ-GUESS will be use to compare and assess the different RCM outputs.

References

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