International Congress on Environmental Modelling and Software

3rd International Congress on Environmental Modelling and Software - Burlington, Vermont, USA - July 2006

Jul 1st, 12:00 AM

Uncertainty analysis of WETLAND-DNDC: Errors and critical parameters for predicting carbon dynamics in wetland ecosystems

Harbin Li

Changsheng Li

Carl Trettin

Uncertainty analysis of WETLAND-DNDC: Errors and critical parameters for predicting carbon dynamics in wetland ecosystems

Harbin Li, Changsheng Li, Carl Trettin
USDA Forest Service, Charleston, SC USA.
hli@fs.fed.us

Abstract: WETLAND-DNDC, a process-based model that integrates soil, vegetation and hydrology, was developed to represent unique biogeochemical properties and processes of wetland ecosystems. Recent studies have demonstrated great potential of the model by applying it to different wetland sites, from Minnesota to Florida. However, to have a broad application of the model to more systems and at larger scales, a full uncertainty analysis is needed to understand its behaviors and determine its critical variables and parameters. With a wetland in Florida as the test site, we used the Monte Carlo method to run WETLAND-DNDC, simulating carbon (C) and nitrogen pools/fluxes driven by a combination of various input parameters (e.g., climate variables, soil properties, forest characteristics, hydrological conditions) and determining impacts of varying parameter values on C dynamics in wetland ecosystems. Input variables included daily maximum air temperature, total organic carbon content, soil saturated conductivity, available carbon in plants, water use efficiency, and water table fluctuation. The Latin hypercube sampling method was used to determine values of each input variable by taking ten samples within its range, one from each of the ten equal probability strata. The model predictions included annual net primary productivity (NPP), annual net ecosystem exchange (NEE), and annual methane flux (CH4). Error propagation from input parameters to output variables in the modeling process was examined and uncertainties associated with the critical parameters were quantified. The results indicated that the most critical uncertainty sources differed for NPP, NEE and CH4. For example, the accuracy of climate and soil fertility data needs to be improved to reduce uncertainty in NPP or NEE predictions, whereas water table data were the most critical to CH4 predictions. Uncertainty information is of great interest to both scientists and policy makers to assess the reliability of model predictions.