Application of a 3D model Mixfor-3D for description of solar radiation regime in a tropical monsoon forest in the Cat Tien National Park in Vietnam

A. Olchev (1), J. Kurbatova (1), K. Radler (2), Pham Huu Khanh (3), Vu Xuan Khoi (4), and A. Kuznetsov (4)

(1) A.N. Severtsov Institute of Ecology and Evolution of RAS, Moscow, Russian Federation (aoltche@gmail.com), (2) Dept. of Bioclimatology, Buesgen Institute, Georg-August University, Goettingen, Germany (kradler1@gwdg.de), (3) Cat Tien National Park, Tan Phu - Dong Nai, Vietnam , (4) The Russian-Vietnamese Tropical Centre, Ho Chi Min, Vietnam

The radiation regime of lowland lagerstroemia tropical monsoon forests in the Cat Tien National Park in Vietnam was described using a 3D process-based model Mixfor-3D (Olchev et al. 2009). The Cat Tien National Park is situated in the south of Vietnam, approximately 150 km north of Ho Chi Minh City. It is unique area that protects one of the largest areas of lowland tropical rainforests left in Vietnam.

The main concept of the used Mixfor-3D model is a combined description of the physical and biological processes on the different spatial levels of a plant ecosystem, i.e. from individual leaf and plant (tree) to the entire ecosystem. The model effectively integrates a very high (3D) spatial resolution of ecosystem structure with 3D algorithms sophistically describing the processes of radiation, turbulent exchange of sensible heat and water vapour, water and heat transfer in plant canopy and soil. The Mixfor-3D model consists of several closely coupled 3D sub-models describing: structure of a forest stand; radiative transfer in a forest canopy; turbulent transfer of sensible heat and water vapour between ground surface, trees and the atmospheric surface layer; heat and moisture transfer in soil. Reasonable computing time and a number of input parameters are important factors that were taken into account during development of the model. Mixfor-3D has a horizontal resolution of 2 m x 2 m, a vertical canopy resolution of 1 m, a vertical soil resolution of 0.1 m and a primary time step of 1 hour. These spatial and temporal resolutions allow us to take into account small scale heterogeneity of the canopy and soil structure and to reproduce the 3D flux distribution and canopy microclimate.

For modeling experiments three different forest plots have been selected. They are characterized by very heterogeneous and diverse structure. Tree density of the forest plots is up to 660 trees per hectare, and number of tree species is ranged between 19 and 23. Upper canopy layer of the plots is presented mainly by lagerstroemia (Lagerstroemia calyculata) mixed with dipterocarp (Dipterocarpus alatus) and Tetrameles nudiflora.