Model parameterization as method for data analysis in dendroecology

Ivan Tychkov, Vladimir Shishov, and Margarita Popkova

Siberian Federal University, Krasnoyarsk, Russian Federation (ivan.tychkov@gmail.com)

There is no argue in usefulness of process-based models in ecological studies. Only limitations is how developed algorithm of model and how it will be applied for research. Simulation of tree-ring growth based on climate provides valuable information of tree-ring growth response on different environmental conditions, but also shares light on species-specifics of tree-ring growth process.

Visual parameterization of the Vaganov-Shashkin model, allows to estimate non-linear response of tree-ring growth based on daily climate data: daily temperature, estimated day light and soil moisture. Previous using of the VS-Oscilloscope (a software tool of the visual parameterization) shows a good ability to recreate unique patterns of tree-ring growth for coniferous species in Siberian Russia, USA, China, Mediterranean Spain and Tunisia.

But using of the models mostly is one-sided to better understand different tree growth processes, opposite to statistical methods of analysis (e.g. Generalized Linear Models, Mixed Models, Structural Equations.) which can be used for reconstruction and forecast. Usually the models are used either for checking of new hypothesis or quantitative assessment of physiological tree growth data to reveal a growth process mechanisms, while statistical methods used for data mining assessment and as a study tool itself.

The high sensitivity of the model's VS-parameters reflects the ability of the model to simulate tree-ring growth and evaluates value of limiting growth climate factors. Precise parameterization of VS-Oscilloscope provides valuable information about growth processes of trees and under what conditions these processes occur (e.g. day of growth season onset, length of season, value of minimal/maximum temperature for tree-ring growth, formation of wide or narrow rings etc.).