

SEIB-Explorer User Manual

Overview

This software is a Windows-based application that interactively visualizes vegetation dynamics simulated by SEIB-DGVM. It also includes the model core (SEIB-DGVM) itself, allowing users to run simulations under user-specified conditions and visualize the results.

In the visualization screen, changes in vegetation functions (such as carbon storage and water cycling) associated with vegetation development are displayed as time-series graphs. Some graphs have "?" button that shows a brief explanation when clicked.

In addition, a "Real" display option is available. This mode uses realistic 3D tree models originally developed for game production, allowing users to view visually lifelike representations of trees—mainly for fun! Conversely, the "Simple" display option faithfully represents the tree structure assumed in the SEIB-DGVM model—crowns and stems expressed as cylinders—making it suitable for academic use.

Note that SEIB-Explorer assumes the numbering of woody PFTs (Plant Functional Types) introduced in SEIB-DGVM version 3.10 or later. Therefore, when visualizing output generated by earlier versions, the labels shown in the legend may differ from the actual PFT assignments. Please keep this in mind.

Operation Summary

Menu A (Viewer Mode)

A pop-up window appears for selecting the file to be visualized. The input files can be any of the following SEIB-DGVM outputs: *output_forest.txt*, *output_VegStructure.txt*, or *output_VegStructure2.txt*. Files generated in Mode B can also be loaded.

When opening files other than *output_forest.txt*, the program displays meteorological data used as simulator inputs, as well as the simulated material and energy fluxes. This enables users to intuitively understand how ecosystem functions change in response to vegetation development and succession.

Menu B (Simulation Mode)

After setting the simulation parameters, press the Start button to begin the simulation. Once the computation is completed, a simulation output file will be generated, followed by automatic visualization. This output file is in the same format of *output_VegStructure2.txt* in the standalone version of SEIB-DGVM.

When you select “*I Specify It*” from the drop-down menu for simulation sites, you can manually specify the latitude and longitude, CO₂ time-series data, and climate time-series data for the simulation location. All input data must conform to the SEIB-DGVM input format. CO₂ time-series data and sample climate data are available from the official SEIB-DGVM website, and are also included in the /External/ directory of the installation folder (e.g., *co2_1850_2005_hist.dat*, *climate_Nakagawa_1981_1990.txt*). Climate data for your selected sites and time periods can also be generated using the Climate Data Generator provided on the official SEIB-DGVM website.

In simulations conducted within SEIB-Explorer, users can easily perform simple sensitivity experiments on climate and atmospheric CO₂ concentration by shifting the annual mean values of the input forcing data within a specified range.

For more advanced sensitivity analyses—such as those involving additional parameters or woody PFT establishment scenarios—you can edit the *parameter.txt* file located in the the /External/ directory.

Operation in the Visualization Screen

Viewpoint Control

The camera is always directed toward the center of the virtual forest stand. Drag the forest view with the mouse to change the viewing angle. Use the mouse wheel to adjust the camera distance.

Keyboard Shortcuts

All operations can be performed with the mouse, but the following shortcuts are also available:

Arrow Keys: Move camera horizontally / vertically

PgUp / PgDn: Move camera forward / backward

A: Toggle language

B: Toggle between Real Display and Simple Display

C: Switch vegetation type display (woody only → woody + herb → herb only)

<: Switch items on the left panel left

>: Switch items on the left panel right

P: Advance simulation time

O: Rewind simulation time

I: Expand the time range shown in the information panel

U: Shrink the time range shown in the information panel

ESC: Display a dialog box asking whether to return to the menu screen. Pressing ESC again on the menu screen displays a dialog box asking whether to exit the software.

Virtual Forest Stand Display

The main visualization window offers two display modes:

Simple Display Mode

SEIB-DGVM summarizes a large number of plant species into a limited number of Plant Functional Types (PFTs), each classified by ecological and physiological traits. In the model, each woody plant consists of leaf biomass, stem (including coarse roots), and fine roots. The Simple Mode visualizes trees according to these structural approximations, representing crowns and stems as cylindrical forms. The color of each crown indicates its corresponding PFT.

Real Display Mode

Woody plants are rendered using 3D models originally developed for game applications. These do not correspond to the actual plant species being simulated. This mode is designed to enhance the visual appeal of the simulation results.

Model Core

Simulations executed in Menu B are performed by `/External/SEIB.exe` within the installation folder. The source code for this executable (a set of `.f90` files) and the parameter file (`parameter.txt`) are also stored in the same directory.

If the Fortran compiler `gfortran` is installed, the executable can be rebuilt by entering the following command:

```
gfortran start_point.f90 -o SEIB.exe
```

The source code is based on the public version 3.20 of SEIB-DGVM. Sections added for integration with Unity are marked with a comment "*[For SEIB-Explorer]*".