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User Interface for ATLSS Models

The U.S. Geological Survey (USGS) Across Trophic Level System Simulation (ATLSS) Program model interface, developed through the assistance of the National Science Foundation (NSF), provides a convenient means for natural resource managers to use the ATLSS high-performance ecological modeling package on their individual personal computers. This product was developed to provide an intuitive interface for model modification, while removing the burden of model software and hardware management and acquisition.

The development of ecological models as useful tools in ecological restoration has increased during the last few decades. However, such models are not always effectively used at the resource manager level. This can be traced to the lack of training, time, and resources needed to implement and run the models. The ATLSS model interface is a means of removing some of these impediments and providing an intuitive interface to the resource manager. This will become a larger issue as models become more complex and the computational demands require more advanced computing resources. The ATLSS model interface is a software tool for addressing the growing need to supply high-performance computational models and the resources needed for their effective use by the decision-making community.

How Does the ATLSS Model Interface Work?

The ATLSS model interface needs to satisfy two main criteria in providing a flexible means of hosting high performance models. The first is to provide access to the computational resources needed to run each of the models in the ATLSS suite. This requires access to hardware, such as computing clusters and software resources. The second criterion is to provide an intuitive interface that is easily accessible.

The computational platform used in the model interface is the Scalable Intracampus Research Grid (SINRG) supported by the NSF. The SINRG project provides access to research clusters and computers for interdisciplinary research using the emerging national research grid. The NetSolve and Internet Backplane Protocol (IBP) were deployed on the SINRG research grid and used to provide the access needed to allow implementation of the ATLSS ecological models. NetSolve is a remote-procedure call-based package that allows users to access a wide variety of hardware and software resources through a controlled interface without the need for individual user privileges. This allows us to provide access to several research grids that would otherwise be cumbersome or impossible to access. Because the model runs are being performed remotely, a method to move and manage the large hydrologic input files and output data was required and realized through the use of IBP. Through the use of a small ASCII key called an exnode, terabytes of disk storage become available for the transfer and short-term storage of files and data. Combining these two resources (fig. 1) allows the ATLSS model interface to transport large input files to a remote computer, perform a model run, and return large output files in a manner that maintains a secure environment for the remote system.

Using the Model Interface on the Web

Various agencies expressed an interest in a single portal for access to the models with execution and data-retrieval capabilities. A web interface (the part of the model interface that the user sees and interacts with) is a natural means to provide a universal cross-platform interface. The web interface can act as a configurator for model runs and an initiator of the grid-based ATLSS model runs. The resulting output can then be tabulated and displayed so that initial and subsequent users can access the data. Upon retrieval of the model run data, a pre-existing Geographic Information System (GIS) visualization and analysis

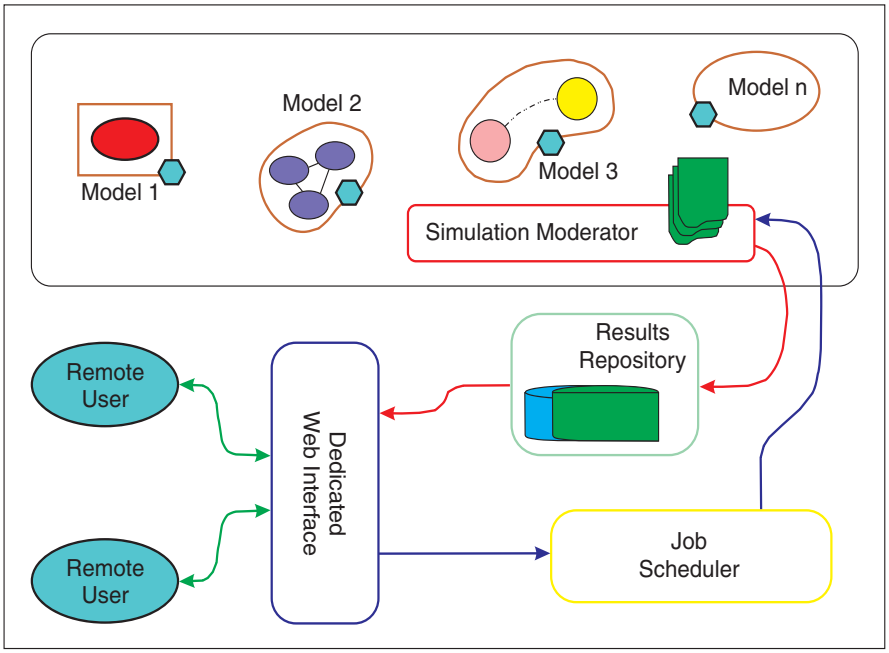

Figure 1. Architecture of the grid interface. The "grid" refers to the set of computer systems that are networked together to run and the several ATLSS models. The two "Model 1" boxes show different implementations of the same ATLSS model within the computer grid.

tool, the ATLSS Data Viewer, can be used to examine the output data. A login control was implemented within the interface to maintain a level of appropriate use without the problems associated with a completely public system. This is critical for model runs that require extended time periods to perform and use multiple computer resources.

A typical utilization of the ATLSS web interface is shown in figure 2. A user logs into the interface and selects the desired model to be run. The hydrologic scenario is then chosen, and the configuration parameters are varied as needed for the model run. Upon initiating the run, a Run ID number is provided, and the user is informed by email when the run is complete. Most runs take at least 3 hours (some are much longer) depending on parameter settings. The email provides a link to the output page where a user can reference a run by the Run ID and also browse previously run scenarios. Each run of the model is referenced in a table that includes the hydrologic scenario and parameter fields associated with that model. Depending upon the model selected, various forms of output are supplied with formatted input files for the ATLSS data viewer (fig. 3).

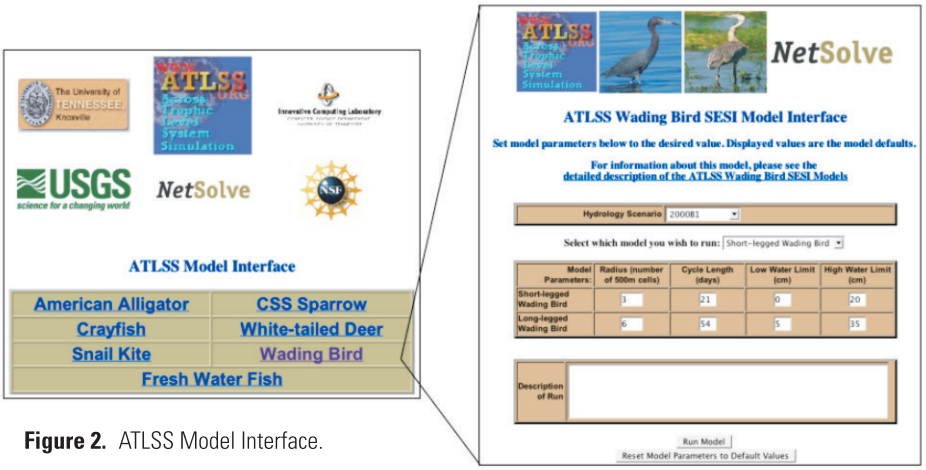

Figure 2. ATLSS Model Interface.

Advantages of the ATLSS Model Interface

In summary, the ATLSS model interface:

- Provides access to models for a wide range of resources for the manager in many locations;
- Removes the need for technical skills to install, manage, and run the model code, support files, and software;
- Removes the need for hardware capabilities to run the various models by using research grid computers, thereby providing a valuable resource that otherwise would be unusable by the resource manager;
- Allows for the sharing of model runs performed by other users, removing the need for duplication of runs, which save time and resources for the manager; and
- Provides flexibility in the platform upon which the models natively run. Microsoft Windows, Linux, OS X, and SOLARIS operating system models can be incorporated side by side in the interface, creating an all-inclusive modeling resource.

As grid computing resources become more sophisticated and the complexity of ecological models increases, the ATLSS model interface will be an invaluable tool in allowing complex ecological models to be used as a tool by resource managers.

Acknowledgments

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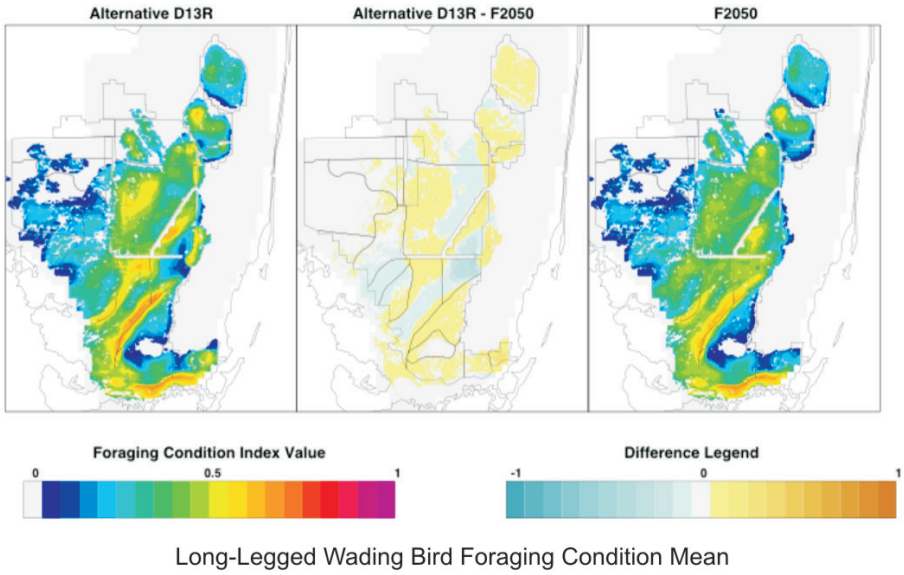

Figure 3. Output from the ATLSS Long-Legged Wading Bird Model.

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