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Grid-BGC:

A Grid-Enabled Terrestrial Carbon Cycle Modeling System

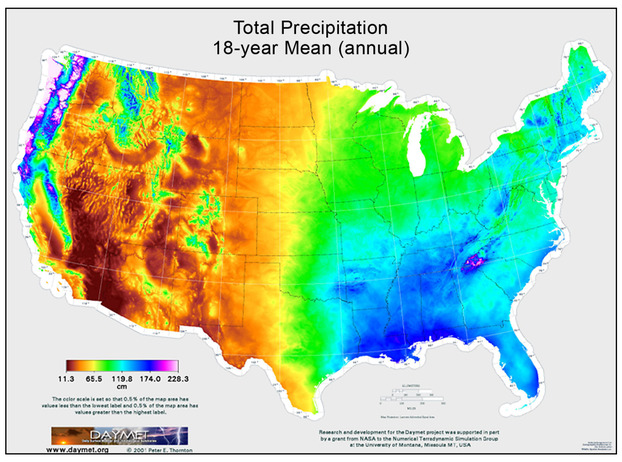
The objective of the Grid-BGC project is to create an end-to-end solution for terrestrial ecosystem modeling.

Setting up and running high-resolution simulations of terrestrial biogeochemical (BGC) processes is an involved process for scientists. For NCAR's models, raw surface data is interpolated using the Daymet program and then used by the Biome-BGC model to simulate the terrestrial carbon, water, and nitrogen cycles. Grid-BGC is currently in use by scientists generating high-resolution summaries of the Canadian climate for the past 43 years.

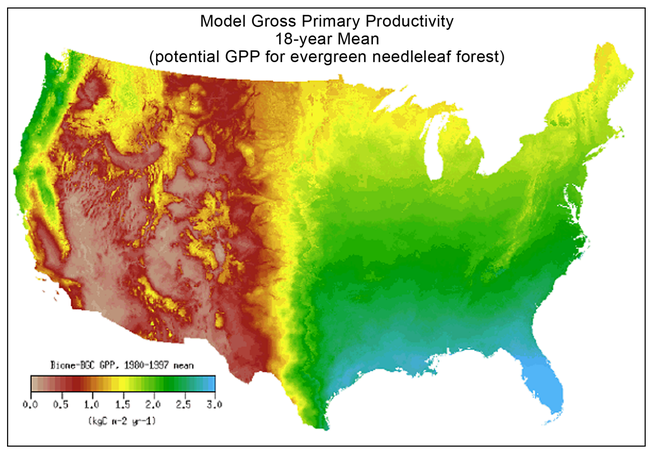
Our Globus Toolkit 4.0 solution integrates distributed resources using Web services for model configuration, workflow management, job execution, and data transfer.

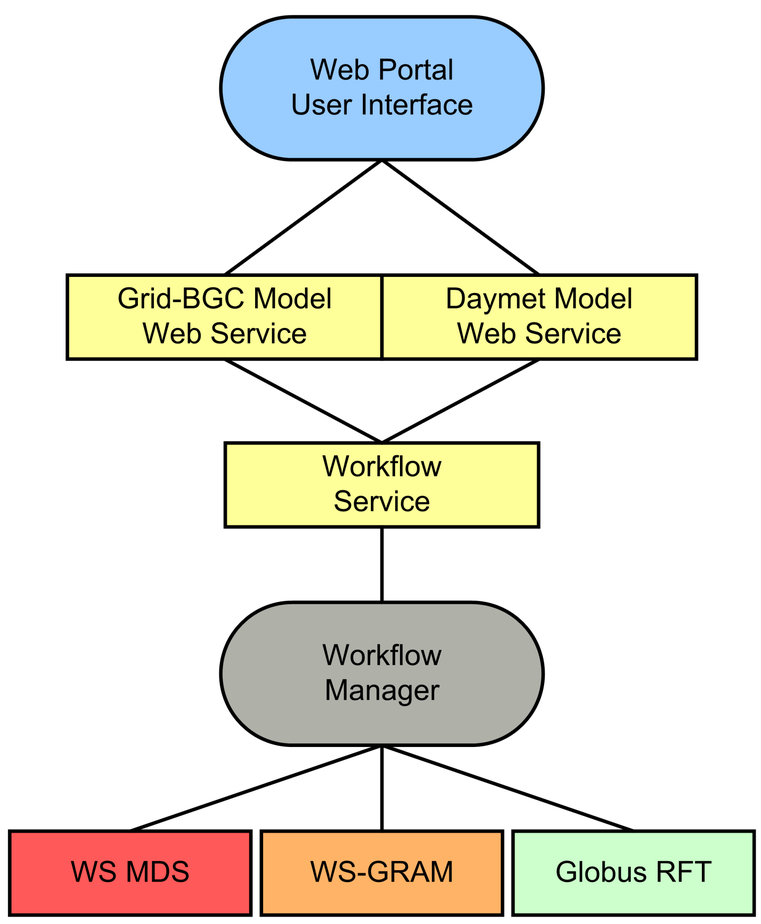
Grid-BGC and the Globus Toolkit provide the infrastructure necessary to develop a more general and multidisciplinary Earth Science Service-Oriented Architecture for NCAR scientists and their collaborators. Currently under development, this service-oriented Grid will integrate additional legacy Earth Science applications, the data libraries used by these applications, and TeraGrid computational resources.

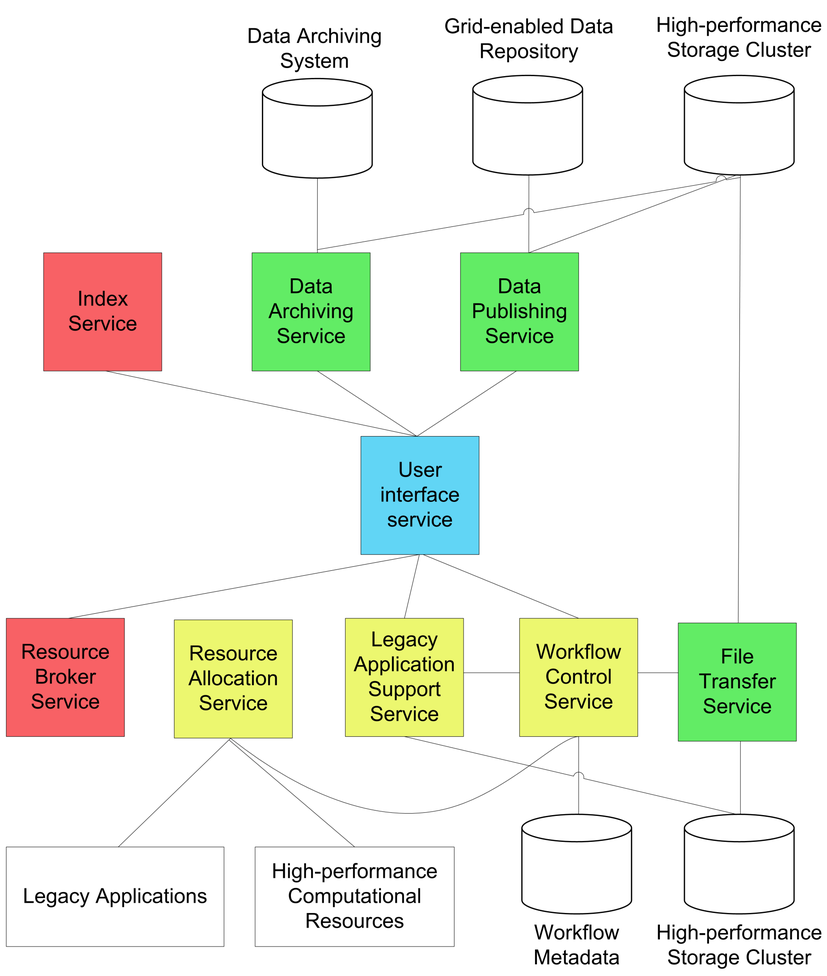
Daymet
Surface Weather Input



Biome-BGC
Carbon Cycle Model Output







- **A Web Portal presents the user interface for configuring simulations, uploading data, and downloading results**
- **Model Web Services convert abstract science operations into Grid-specific workflows**
- **Workflow Services provide reliable automated task management**
- **Security, Data, Execution, and Information Services are provided by the Globus Toolkit**

- **User interfaces present a virtualized and simplified computational environment focusing on scientific processing tasks**
- **Legacy application and workflow control services manage the execution of Earth Science applications**
- **Data management services provide file transfer capability and integrate with external archival and data stewarding resources**
- **Information services provide dynamic data to services and users about the state of the Grid**

www.gridbgc.ucar.edu

NCAR

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References

1. Cope, J., Hartsough, C., Thornton, P., Tufo, H.M., Wilhelmi, N., and Woitaszek, M. Grid-BGC: A Grid-Enabled Terrestrial Carbon Cycle Modeling System, proceedings of the 11th European Conference on Parallel Processing (Euro-Par), Lisbon, Portugal, August 2005.
2. Globus. The Globus Project, 2006, http://www.globus.org/
3. Thornton, P.E., S.W. Running, and M.A. White. Generating surfaces of daily meteorological variables over large regions of complex terrain. *Journal of Hydrology*, 190: 214-251, 1997.
4. Thornton, P.E., Law, B.E., Gholz, H., Clark, K., Falge, E., Ellsworth, D., Goldstein, A., Monson, R., Hollinger, D., Falk, M., Chen, J., and Sparks, J. Modeling and measuring the effects of disturbance history and climate on carbon and water budgets in evergreen needleleaf forests. *Agriculture and Forest Meteorology* 113 (2002), 185-222.