TECHNOLOGY

Did you know?
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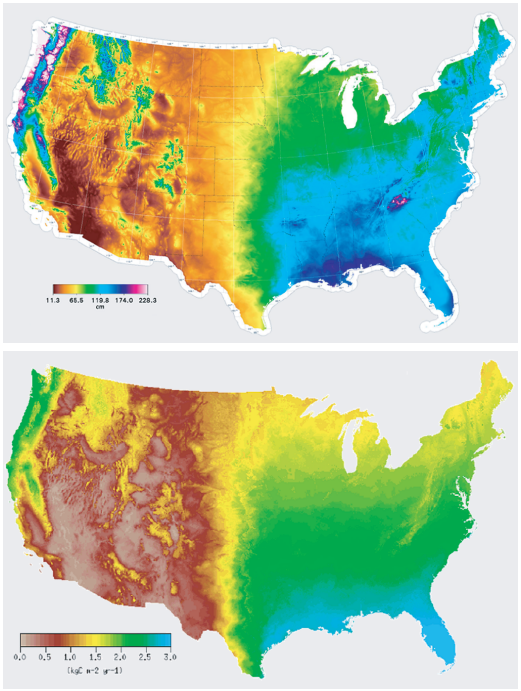
Carbon Cycle Modeling System Receives Interest, Infusion Opportunities

The Grid-BGC project, a grid-compute architecture for terrestrial biogeochemical modeling at the National Center for Atmospheric Research (NCAR), is garnering attention from the Earth-science community for reducing the time and infrastructure costs of carbon cycle modeling and climate research.

A recent graduate of the NASA Earth science technology program, Grid-BGC is a complete solution for carbon cycle research and model development that utilizes cutting edge simulations as well as grid computing, which integrates multiple off-site data libraries, computational resources, hardware components, and legacy Earth science applications. By incorporating this wide array of resources, Grid-BGC closes a critical gap between the abundance of carbon cycle observations and the limitations of current simulation platforms.



An example of a simulation domain targeted by the Grid-BGC project. The top image shows one input, total precipitation (18-year annual Mean), from the Daymet model. The bottom image, showing potential gross primary productivity for evergreen needleleaf forest (18-year annual Mean), is an output from the Biome-BGC model, which ingests Daymet variables and produces estimates of the state and flux variables for carbon, nitrogen, and water cycles.

Access to these distributed resources is made possible by Grid-BGC's novel web services, workflow management, job execution, and data transfer technologies, which create an architecture that enables truly user-oriented research. The Grid-BGC system consists of a single software framework that integrates five components: data ingest and interpolation; a state-of-the-art model of terrestrial carbon, water, and nitrogen cycles; a post-processing engine; static and dynamic visualization tools; and a mass storage system with high-speed connections. These technology subcomponents form an end-to-end solution for high-resolution surface weather interpolation and terrestrial biogeochemistry modeling that can accommodate science applications over very large (continental scale) domains.

The Grid-BGC system is fully functional and has been exercised with several full-scale research applications. These include a 24-year (1980-2003), 1km grid simulation run of the continental United States (see inset) that utilized the Daymet database of daily temperature, precipitation, humidity, and radiation and the Biome-BGC model that estimates fluxes and storage of energy, water, carbon, and nitrogen for the vegetation and soil components of terrestrial ecosystems. The system was also operationally tested in a 42- year (1961-2003), 10km simulation of Canada that incorporated min/max temperature, precipitation, radiation, and vapor pressure.

New NASA funding has been obtained to implement Grid-BGC for the North American Carbon Program at the new Modeling and Synthesis Center at Oak Ridge National Laboratory. The system will be used to generate 1 km daily surface weather fields over North America. The Consortium of Universities for Advancement of Hydrologic Science, an organization of over 100 universities across the U.S., is developing several projects that will integrate Grid-BGC output with hydrologic sciences and web-based Geographic Information System tools.

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