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Numerical biogeochemistry science inside next generation global coupled climate models*

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Oak Ridge National Laboratory (ORNL) has established a focus area in global computational Climate and Carbon Research (CCR) Modeling. Several new climate, carbon and biogeochemical modeling results that require multi-Tera flop computational resources will be discussed within the context of climate science and high performance computing. The impact and extent of coupling of atmospheric iron deposition and the time scale of the response of ocean biota is examined employing a global numerical model of dust generation, transport and deposition coupled with remotely sensed ocean color data. Extremely tight coupling between atmospheric iron flux and ocean biology is found in specific regions of the Southern Ocean. As part of the Geophysical Statistics Project, within the CCR, a multi-variate clustering algorithm to assess terrestrial ecosystem niche evolution in a warming greenhouse world will be presented. Essentially, the spatial distribution of concurrent changes in temperature, precipitation, radiation and soil moisture drive ecosystem niche evolution in complex and interactive ways. Using climate prediction from 1870-2100, computed by the Parallel Climate Model, ecosystem niche evolution at mid-high latitudes will be presented with an eye toward resource management. Finally, a description of the on-going SCIDAC supported biogeochemical ocean modeling project between LANL and ORNL will be discussed, with an emphasis on using the LANL POP-based ecosystem model to create global ocean to atmosphere DMS flux estimates. These DMS flux fields are being coupled into a global atmospheric chemistry-climate model that explicitly treats aerosols physics and allows more accurate climate simulation and prediction.

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