

**ANALYSIS, INTEGRATION AND MODELING OF THE EARTH SYSTEM (AIMES):  
INTEGRATING HUMAN PROCESSES WITH THE GLOBAL CARBON CYCLE INTO EARTH  
SYSTEMS MODELS**

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**ABSTRACT**

There is a growing recognition that the Earth itself is a single system within which the biosphere is an active component. Human activities are now so pervasive and profound in their consequences that they affect the Earth at a global scale in complex, interactive and apparently accelerating ways. The new IGBP project, Analysis, Integration and Modeling of the Earth System (AIMES) is charged with integrating human processes with Earth system processes.

The grand challenge for global modeling in the 1990's was to integrate biogeochemistry and land surface processes into the climate system leading to Earth system modeling. Earth system processes can be considered as three unique, yet interwoven tapestries. Using the carbon cycle as an example, the system includes physical processes such as the ocean's thermohaline circulation and temperature dependence of CO<sub>2</sub> uptake by oceans. Secondly, the carbon cycle involves biological processes in marine and terrestrial ecosystems. Thirdly, both physical and biological dynamics are driven by human land use and industrial processes.

Industrial emissions are one of the key human processes driving changes in atmospheric chemistry. The Global Emissions Inventory Activity (GEIA) is an AIMES-sponsored activity that will develop human emissions datasets that include results from emission models, factors and their associated feedbacks. Databases generated by GEIA will be integrated with the Coupled Carbon Cycle-Climate Model Intercomparison Project (C4MIP) modeling framework, improving our understanding of the relationships between emissions and concentrations of CO<sub>2</sub> and other greenhouse gasses and how climate feedbacks influence the emission-concentration relationships.

As AIMES develops, this integrated approach is planned to expand to include other greenhouse gasses and aerosols and preliminary linking to socio-economic drivers of human activities and decisions and their subsequent feedbacks on Earth System dynamics.