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Summary of activities for DOE Award DE-FG02-02ER63444 for "Modeling dynamic vegetation for decadal to multi-century climate change studies"

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The DOE Award DE-FG02-02ER63444 was awarded to Dr. Andrew D. Friend to conduct studies for "Modeling dynamic vegetation for decadal to multi-century climate change studies" during the period 09/01/2001-11/30/2004. Dr. Friend was originally at Rutgers University then transferred to the Columbia University Center for Climate Systems Research (CCSR) at the beginning of the award. When Dr. Friend took a position in France in the middle of the second year of the project, Dr. Nancy Y. Kiang was brought on as a post-doc on 03/28/2003 to continue the work in collaboration with Dr. Friend. Dr. Igor Aleinov, a Columbia Associate Research Scientist who is involved with land surface modeling at the CCSR, agreed to serve as the administrative PI.

The goal of this research has been to produce a process-based vegetation activity model suitable for coupling with a general circulation model (GCM) of the atmosphere, to simulate the biophysics of vegetation transpiration and photosynthesis, seasonal growth, and vegetation cover change. The model was to be developed within the NASA Goddard Institute for Space Studies (GISS) GCM. The model as envisioned in the original proposal was to be an adaptation of Dr. Friend's previous well-known dynamic vegetation model, HYBRID (Friend, et.al., 1997; Friend and White, 2000). After examining the issues of GCM model coupling, Dr. Friend realized some of the complexities of HYBRID would not be computationally suitable for the GCM. He wrote a review paper on 'big-leaf' modeling issues (Friend, 2001), and concentrated on developing a new vegetation biophysics approach, which involved a computationally simply canopy-level conductance scheme (thus avoiding the problem of leaf-to-canopy scaling) and photosynthesis based on the work of Kull and Kruijt (1998), which distinguished the portion of leaf nitrogen that is photosynthetic. Dr. Friend presented the results photosynthesis/conductance scheme coupled to the Model II' version of the GISS GCM (Hansen, et.al., 1983) in a talk at the 2002 AGU Fall Meeting in San Francisco. After Dr. Kiang arrived in April 2003, she, Dr. Friend, and Dr. Aleinov implemented the new scheme in the Model E version of the GISS GCM (Schmidt, et.al., accepted), and published results of improved surface temperatures and cloud cover in the Journal of Climate (Friend and Kiang, 2005). Till the end of the award period, Dr. Friend continued to develop a new vegetation growth model involving nitrogen allocation to light-stratified canopy layers compatible with the photosynthesis scheme. Dr. Kiang assembled a larger collaborative team, proposing a complete dynamic vegetation model with nitrogen cycling and vegetation change for GCMs. The model design was presented at the SciDac Conference in March 2004 in Charleston, SC, and the AGU Spring Meeting in May 2004 in Montreal.

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