3rd International Conference on Earth System Modelling
Vol. , 3ICESM-339, 2012
3rd International Conference on Earth System Modelling


# Modeling Socio-Ecological Systems Interaction with Climate Change: The Mason-Smithsonian Joint Project on Climate and Society

C. Cioffi-Revilla (1), P. Schopf (1), D. Rogers (2), and S. Luke (1)
(1) George Mason University, Fairfax, VA, USA, (2) Smithsonian Institution, Washington, DC, USA

The synergy between climate change and social dynamics is a major challenge at the intersection of Earth science (climate variability), anthropology (culture and social groups), and political science (governance and public policy), integrated by computational science. Understanding complexity has moved from decreasing uncertainties in climate and societal models to complex socio-natural system science. New computational thinking is needed for advancing our understanding of complexity in climate-social change.

This paper introduces a new project underway to link agent-based models of social dynamics with explicit geography and climate. The fundamental question is how to explain human/social behavior when climate change occurs, given the incompleteness of science on both climate and society. It is an extension of work modeling the social dynamics of long-term change in Inner Asia since 2500BC, and work developing a suite of agent-based models including local, national, and international dynamics (albeit with minimal climatological complexity), including a series of agent-based models of Eastern Africa.

Our computational methodology is based on new simulation models (specifically socio-natural agent-based models [ABMs] and general circulation models [GCMs]) applied to two geographic regions chosen for their significance (the Circumboreal region and Sub-Saharan Africa). The methodology requires computational formalization, verification, validation, and analysis of our theoretical framework in selected geographical regions.

The objectives are to (1) understand complexity in socio-ecological systems subject to climate change and, thereby, (2) promote transformative computational paradigm in anthropology, political science — generally the social sciences — and Earth system science via tightly integrated multiagent systems, general circulation climate models, and evolutionary computation algorithms. The integrated application of the "MASON" multiagent system and the "ECJ" evolutionary computation system is new and will enable discovery in complex socio-natural systems combining anthropology, political science, and Earth system science.

Initial efforts are aimed at utilizing output from GCMs in social-dynamics solutions. This is non-trivial as we envision the need for ensembles of climate histories applied to the social-dynamics systems. This one-way coupling phase will be accompanied by an opposite investigation of whether the social-ecological systems changes provide significant impact on climate simulations themselves. A future is envisioned where Earth System Models include human social dynamics.