Project Context & Purpose

Please include the original project purpose statement and revise for any changes that occurred in the project after the start date with a short explanation of the changes.

In Fall 2012, Dr. Scott St. George and Dr. Snigdhansu Chatterjee were awarded a Mini Grant from the Institute on the Environment to create a new interdisciplinary collaboration on the Twin Cities campus between the School of Statistics and the Department of Geography, Environment and Society focused on decadal predictability in the Earth’s climate system.

Our grant included support for two main activities. First, we began a new collaborative project with scientists at the National Center for Atmospheric Research (NCAR) to test how well NCAR’s Community Earth System Model (CESM) simulates decadal variability within the climate system. Second, we sponsored a campus visit by Dr. Ben Cook on March 7, 2014. Dr. Cook is a climate scientist with NASA's Goddard Institute of Space Studies, and is an expert in the causes and consequences of long-term hydroclimatic change in North America.

In our original proposal, we intended to use IonE support to sponsor a visit from Dr. Toby Ault, who at the time of submission was a postdoctoral researcher affiliated with NCAR in Boulder, Colorado. During the course of our grant, Dr. Ault accepted a faculty position at Cornell University’s Department of Earth and Atmospheric Sciences and was not able to visit Minnesota because of his move to Ithaca. We were pleased that Dr. Cook was able to fill this role; during his visit, he met with students from Geography and Soil, Water and Climate and his public lecture on ‘Global warming and 21st century drying’ was delivered to a packed house. Despite not being able to visit the Twin Cities campus, Dr. Ault was still able to play a lead role in our analysis of NCAR’s CESM model and continues to be a collaborator with Dr. St. George and his students on this ongoing research.
Most of the funds from this Mini Grant were used to provide Ms. Xiaolu (Grace) Li with a graduate student stipend in the summer of 2013. During that period, Ms. Li obtained model output from NCAR’s most recent ‘Last Millennium’ simulation and identified those places and time intervals where annual precipitation in the model exhibited major long-term shifts ‘long term’ ranging from a decade to about a century).

Working in collaboration with Dr. Ault, Ms. Li demonstrated that (according to the CCSM4 model), certain regions are more prone to experiencing very strong decadal variability (meaning, prolonged wet and dry conditions). Her most promising result showed that the CCSM4 model is, in fact, able to reproduce the strong decade-to-decade swings observed in northern California and southern Oregon over the last century. If that result is correct, it could indicate this behavior is the result of a forced response to the broader climate system and, as such, may be predictable (which would be a major boon for regional water resources management).

In this map, the red and dark red shading highlights those places that experienced major decade-to-decade shifts in annual precipitation over the period A.D. 1851 to 2005 (according to NCAR’s CCSM4 model). The model points out the central Pacific Coast of North America as one area with particularly strong ‘decadal variability’, which matches observed changes in winter precipitation and river flow in the same area since roughly A.D. 1930.
Please provide a summary of the project personnel, partnerships and collaborations that worked directly on the project or were started as a direct result of the mini grant project.

One of the main goals of this Mini Grant was to provide a starting point for interdisciplinary collaborations between faculty and students from the School of Statistics and the Department of Geography, Environment and Society. Traditionally, there has been little interaction between these two units, and the Mini Grant (along with the university’s ‘Understanding climate change - a data driven approach’ program) has helped spark several informal and formal collaborations.

For example, thanks to the Mini Grant, Dr. St. George and Dr. Chatterjee have become involved in graduate student research on statistical climatology and climate change. Dr. Chatterjee has agreed to serve as a member of Xiaolu (Grace) Li’s MA committee. For her thesis, Ms. Li is using a process model of tree-ring formation to (1) simulate tree growth across the Northern Hemisphere over the last century and (2) explain why the hemispheric network of tree-ring records exhibits major regional differences in the climate ‘signals’ recorded by tree rings. She has also enrolled in Dr. Chatterjee’s STAT8932 course (Climate Statistics) which makes her, so far as we know, the first student in Geography to take a graduate-level course offered by the School of Statistics. This semester, Dr. St. George was invited to join the committee of Ms. Lindsey Dietz, who is a Ph.D. student in Statistics. Her dissertation research is using novel statistical methods to address outstanding questions in climate science (particularly focused on modeling tropical cyclones and the Indian monsoon).

In addition, support from this Mini Grant has been used to start a new collaboration between Dr. Chatterjee, Dr. St. George and Dr. Toby Ault at Cornell University. The work conducted by Ms. Li in summer 2013 was incorporated into an NSF proposal submitted by Dr. St. George and Dr. Ault in October 2013 (decision pending) and will provide the foundation for her dissertation research in the Ph.D. program in Cornell (starting September 2014).
Project Outcomes

Please provide a summary of the outcomes of the mini grant project including future plans for the project.

Thanks to support from the Mini Grant program, we have a preliminary set of results showing that NCAR’s CCSM4 climate model is able to reproduce the strong decade-to-decade changes in precipitation observed in northern California and southern Oregon over the last 70 years. That result is important because the California Department of Water Resources (DWR) has identified this ‘decadal see-saw’ in northern California as a research priority. Dr. St. George has been invited to present the group’s research at a workshop sponsored by the California DWR at the Scripps Institute of Oceanography in May 2014.

We’re very optimistic that this workshop (which will include scientists from the US Geological Survey, the US Bureau of Reclamation, and NOAA) will help set an agenda for future research on decadal climate variability and water resource management, and potentially lead to one or more collaborative proposals for new research.

Dr. St. George is also working with Ms. Li and Dr. Ault to draft a position paper describing the unusual decadal character of northern California’s wintertime climate (and the possibilities and perils of using it to make intermediate-term predictions), which should be finished by the middle of summer.