

Report from the 2016 UCGIS Symposium: The GIScience Research Challenges Initiative

The University Consortium for Geographic Information Science (UCGIS) held its [21st Annual Symposium](#) May 24-26, 2016 in Scottsdale, Arizona, with a focus on the [GIScience Research Challenges](#) initiative. The aim of the initiative is to identify the key research advances in Geographic Information Science and Technology (GIS&T) that are necessary to address the most pressing problems now facing society. Two keynote presentations anchored the meeting. [Dr. David Maidment](#), the Hussein M. Alharthy Centennial Chair in Civil Engineering at the University of Texas at Austin, presented “CyberGIS and the National Water Model,” which detailed how advances in high performance spatial computing are being used to develop U.S. national-scale water modeling that addresses real-time response to flood disasters and water management. The second keynote was given by [Damian Gessler](#), founder of Semantic Options and Lead Applications and Systems Developer at the Common Logic expert-firm Highfleet, titled “Science, Semantics, and Big Data,” which explored how big data analytics can be used to discover and employ knowledge content to advance spatial science, engineering, and business applications.

A series of interactive sessions were employed to elicit the most important GIS&T research challenges and limitations, both in terms of the research topics and questions, as well as the infrastructural needs to facilitate such research advances. First, prominent junior and senior GIScience scholars presented brief ‘[lightning talks](#)’ to stimulate discussion, with topics ranging in scope from [incorporating notions of place into GIS representation](#) to [developing human-computer interaction strategies for guiding spatial simulation models](#) to [the development and utilization of unmanned aerial vehicles \(UAVs\) in geographic surveillance](#). Breakout groups and discussions followed the lightning talks, where participants were instructed to consider both the societal problems to which GIScience can contribute (e.g. political instability, involuntary migration, global environmental change) and the infrastructure developments that are necessary to address those problems (e.g. GIScience workforce development, interdisciplinary collaborations, high performance computing environments). A panel presentation of renowned domain and GIScience scholars, consisting of [Dr. Pat Gober](#) (Arizona State University), [Dr. Michael Mason](#) (Virginia Commonwealth University), [Dr. Serge Rey](#) (Arizona State University), and [Dr. Shaowen Wang](#) (University of Illinois) presented on the successes and challenges regarding collaborations between GIScientists and domain researchers in the realms of environmental management and public health.

Several overarching themes emerged from these activities:

1. **Improving processing for big, spatial-temporal data in real-time.** A wide range of societal problems demand immediate spatial decision support, such as responses to natural and technological disasters (e.g. flooding or an industrial accident), refugee crises, or outbreaks of infectious disease. GIS&T can play a key role in effectively responding to such crises, but collecting, integrating, and analyzing very large, streaming spatial and temporal data sets limit the ability of responders to use GIS&T effectively. Thus, the development of high performance computing methods for handling very large spatial-temporal data sets is key.

2. **Leveraging new sources of high-fidelity spatial data.** Advances in spatial data collection technologies such as UAVs, social media, biosensors, and sensor networks, among others, are revolutionizing our ability to monitor the movement and state of entities ranging from individuals to complex systems, such as entire cities, often in real-time. The development of new methods for integrating and analyzing such data can open possibilities for addressing societal problems in fields such as health (i.e. modeling personal health trajectories), urban sustainability (i.e. smart cities), and other fields.
3. **Enhancing GIS&T accessibility.** Participants noted that effective use of GIS&T for addressing societal problems is severely limited by the complexity of GIS&T tools, which makes them both difficult to use and to understand for many decision-makers and the public. Developments in GIS&T human-computer interaction that allow more intuitive interaction with GIS&T is necessary, along with the continued development of open data/models, civic engagement with GIS&T, and GIScience educational infrastructure.
4. **Enabling interdisciplinary research.** Developing GIScience solutions to societal problems demands interdisciplinary research. Successful collaborations require not only the participation of researchers from a diversity of disciplinary backgrounds but also a shared basis of knowledge of GIScience and the domain problem being addressed. Developments in educational, research, and funding mechanisms that support such collaboration should be pursued.

These 2016 UCGIS Symposium Research Challenges activities are intended to serve as a springboard for the development of future GIScience research initiatives, including UCGIS-sponsored webinars, specialist meetings, and funding proposals geared towards motivating collaborative research among GIScientists and domain researchers for addressing the most pressing societal problems that can benefit from GIS&T approaches.

Several scholars were also honored for their contributions to GIScience at the Symposium. The [UCGIS Research Award](#), which recognizes outstanding contributions to Geographic Information Science research, was presented to [Dr. Serge Rey](#), (Arizona State University), for his contributions to spatial econometrics, inter-regional modeling, and regional income dynamics, and for his leadership in the movement to develop open source GIS and spatial analytical software. The [UCGIS Education Award](#), which recognizes outstanding contributions to Geographic Information Science education, was presented to UCGIS's very own Executive Director [Dr. Diana Sinton](#) for her work in connecting GIScience, cognitive science, and the learning sciences; promoting GIS across multiple curricula and disciplines; and developing GIS as an integrating technology linking curricula, infrastructure, and administration. The inaugural [Carolyn Merry Mentoring Award](#) was presented to [Dr. Nina Lam](#), (Louisiana State University) for her work in student mentoring and advising. The award honors Dr. Carolyn Merry, Professor Emerita of Civil, Environmental and Geodetic Engineering at The Ohio State University, to recognize the commitment she demonstrated to mentoring. Dr. Lam also joins [Dr. Donna Peuquet](#) (Pennsylvania State University), as the two 2016 inductees as [UCGIS Fellows](#), a status conferred to honor members of the geospatial community who have extraordinary records of accomplishments, including service to the mission of UCGIS. UCGIS also welcomes new President [Dr. Shaowen Wang](#) (University of Illinois) and President-Elect [Dr. Shashi Shekhar](#) (University of Minnesota), as well as new Board Directors [Dr. Ross Meentemeyer](#) (North Carolina State University) and [Dr. Kathleen Stewart](#) (University of Maryland).