

NSF-IIS Workshop March 26-27, 2015 Arlington VA

For geoscientists, we ask that you:

1) 2-3 computing innovations in recent years that you believe have had the most impact in your field

- More capable computers. Faster, more parallelizable, more and more easily accessed storage. (Everyone will say this so I provide 2-3 more)

-Hardware advances, including bigger screens, touch screens, non-immersive 3D visualization, and, perhaps, finally, truly useful immersion facilities like caves.

-Development of optimization methods and software for integrating models and data, including Bayesian methods. These methods allow the consequences of different data and model development methods to be tested. This testing is at a rudimentary stage for any but very simple circumstances (those characterized by readily measured data for which simulated results can be compared over short time periods like hours, days and, at most, weeks.) Systems with longer timeframes require testing of model development methods that use cross-validation or comparison of simple and complex models, and generally require high performance computing.

- Better software for quantifying uncertainty with consideration of all kinds of data, including dense data streams, such as remotely sensed data. What are considered the best methods of uncertainty quantification require high performance computing. Having these computationally demanding methods enables testing of computationally frugal methods that can be used more routinely.

- Recognition that many models of environmental systems have “numerical daemons” that make the model more nonlinear in some ways than the real systems the models are intended to simulate. This makes the models difficult to analyze (providing some of the motivation for the computationally demanding uncertainty analysis software, for example) and obscures important consequences of real model nonlinearities

- Gaming technology and all computer methods and hardware (like touch screens) that contribute to understand and perhaps even experiment a sense of controlling something outside our present experience. Things like SimCity and the few environmental games like “It’s a Beautiful World” have been a beginning. Flight simulators are effective means to learn to fly. In the last 50 years most people have been introduced to the future through radio and movies. Increasingly, interactive games will be able to play an important role.

2) science challenges that you think would benefit from innovations in intelligent and information systems research.

- Make computer simulations come alive. The simulations would include what we know of natural systems. This includes environmental systems, human bodies, human social systems, planetary and solar interactions....

- Make access to large data sets like satellite data routine in graduate and undergraduate classes in a wide range of departments.

- Identify and communicate what are robust and probable and what are unlikely consequences. Bring consequences that may be many years away closer so that they may be considered more seriously while we have the chance to change.

Mary C Hill, University of Kansas

We realize that these working papers are hard to write without more knowledge about the other disciplines. However, we ask that you put your best foot forward and draft a working paper that best reflects your thoughts on the workshop topics.