

# Uncertainty in Cyberinfrastructure

## Fall 2008 Progress Report

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## 1. Overview

- A highlighted accomplishment
- Applications to geosciences
- Applications to environmental sciences
- New opportunities
- General research on uncertainty in cyberinfrastructure
- Publications

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## 2. A Highlighted Accomplishment: Progress Towards Model Fusion

- *Why* cyberinfrastructure is needed in geosciences?
- *Because* we need to combine different types of data: seismic, gravity, etc.
- *At present:* different types of data are processed separately.
- *Ideal situation:* joint inversion.
- *Problem:* computationally difficult.
- *Solution:* fuse the resulting partial models.
- *What has been achieved:* formulas obtained and tested on toy examples.
- *Who:* Aaron Velasco, Omar Ochoa, Christian Servin.

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### 3. Applications to Geosciences: Additional Research Topics

- *Foundations of seismic inverse problem*: working on a document that provides
  - mathematical foundations and
  - detailed description of Hole's code(w/Aaron Velasco, students).
- *Estimating uncertainty*: gauging the uncertainty of the results (w/Aaron Velasco and Kate Miller).
- *Taking constraints into account*: w/Aaron Velasco, Martine Ceberio, students.
- *Trust*: taking trust into account in addition to uncertainty (w/Paulo Pinheiro da Silva).
- *Taking into account model's uncertainty*: w/Mark Baker.

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## 4. Applications to Environmental Sciences

- *Towards more efficient algorithms:*
  - for computing correlation between the earth and satellite measurements (w/C. Tweedie and S. Goswami);
  - for selecting the best place for a monitoring station: (w/Craig Tweedie and Aline Jaimes).
- *Towards an optimal sensor placement:* w/Craig Tweedie.
- *Towards the best way of storing and processing multi-D data:* w/C. Tweedie, I. Gallegos, and S. Goswami.

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## 5. General Research on Uncertainty in Cyberinfrastructure

- *Summary*: generalizing methods developed for a particular situation to a general case.
- *General combination of probabilistic and interval uncertainty*: w/Julian Ortiz-Perez and Christian Servin.
- *Optimal experiment design under uncertainty*: w/C. Tweedie, R. Araiza, and S. Ferson (Applied Biomathematics).
- *General combination of trust and uncertainty*: w/Paulo Pinheiro da Silva.

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## 6. New Opportunities

- *Pavement engineering*: w/Soheil Nazarian and Mark Baker.
- *Thermal problems*: uncertainty in Sandia-related projects (w/Jaime Nava).
- *Chemistry*: predicting properties of chemical substances, w/J. Nava and G. Restrepo (UT Galveston & Texas A&M).
- *Tensor techniques*: potential NSF workshop (w/Martine Ceberio).

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## 7. Publications

- *Some* results have been published in journals and refereed conference proceedings.
- *Most* results were reported at the international interval conference SCAN'2008 (El Paso, Sept.–Oct. 2008).
- *Abstracts* of these results have been published.
- *Full papers* are being prepared for post-SCAN'08 special issues.

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