Implementing the Collaboratory for the Study of Earthquake Predictability (CSEP): Challenges and Solutions.

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Abstract

The Collaboratory for the Study of Earthquake Predictability (CSEP) aims to develop the infrastructure for a facility for earthquake forecast experiments. It succeeds the Regional Earthquake Likelihood Model project (RELM), which first established a testing center for forecasts, currently performing analyses of 5-year models. CSEP will extend the mission of RELM by considering regions outside of California and considering forecasts that are not grid-based and/or probabilistic. To make testing of different types of models in different regions of the world possible, technical as well as logistical problems have to be considered.

CSEP Objectives

- Establish rigorous procedures for registering and evaluating prediction experiments.
- Construct community standards and protocols for comparative testing of predictions.
- Develop an infrastructure that allows groups of researchers to participate in prediction experiments.
- Provide access to authorized data sets and monitoring products for calibrating and testing prediction algorithms.
- Accommodate experiments involving fault systems in different geographic and tectonic environments.

CSEP Goals

- Reduce the controversy surrounding earthquake prediction through a collaborative infrastructure to support a wide range of scientific prediction experiments.
- Promote rigorous research on earthquake predictability through the SCEC program and its global partnerships.
- Help the responsible government agencies assess the feasibility of earthquake prediction and the performance of proposed prediction algorithms.

Discus with us the collaborative issues of CSEP!

Three Questions

Q1 How should scientific earthquake predictions be stated and tested?
Q2 What is the intrinsic predictability of the earthquake rupture process?
Q3 Can knowledge of large-earthquake predictability be deployed as useful predictions? Is operational earthquake prediction feasible?

These questions form a hierarchy in the sense that the latter can be more effectively addressed if the answer to the former is known. This project will answer Q1 and provide the experimental infrastructure for research on Q2, which forms an important component of the SCEC program in earthquake system science. From a scientific point of view, efforts to understand and improve predictability can be worthwhile even if probability gains for potentially destructive earthquakes are small.

This project is not intended to answer Q3 directly. Many years or even decades of research will probably be needed for a definitive answer. However, should breakthroughs in the study of earthquake predictability improve the chances for a positive answer to Q3, this project will provide the facility needed to develop a feasible methodology for useful earthquake prediction.

Questions for a community-wide discussion

The RELM testing center for California is established. In order to extend this effort to CSEP, many issues need to be resolved. We want to invite the community to participate in this process:

How should natural laboratories be established?

- Region?
- Authorized (independent) data?
- Reference models?
- Testing rules?

How will CSEP be organized?

SCEC3 Organization

- Interface layer: Must provide access to algorithm developers and users worldwide.
- Integration layer, which permits algorithm developers to contribute and certify their software.
- Operational layer: A stable and secure environment, accessible to external users, designed to maintain the long-term integrity of ongoing tests.

What type of predictions will CSEP cover?

RELM is currently testing probabilistic grid-based models for all of California. In CSEP, we want to include other model types:

- Prospective and retrospective
- Time scales (short-term to long-term)
- Data-based and model-based input

How to implement the computational infrastructure?

- Software for testing center operation will be developed under open source licenses and can be distributed among the regional testing centers.
- The framework and its interfaces will allow others to participate in developing regional-specific extensions.

What natural laboratories will CSEP include?

The 1st generation RELM models are covering all of California. CSEP aims to additionally define other regions and the globe as natural laboratories for which experiments can be conducted:

- Selection of regions
- Collaboration on an international level
- Regional testing centers
- Logistical problems

How to participate?

- Run an experiment
- Attend and organize workshops
- Provide methods, models, and regional infrastructure

Timetable

In January, 2006, SCEC received a generous grant from the W. M. Keck Foundation. CSEP will be developed during the next three years with international collaboration.