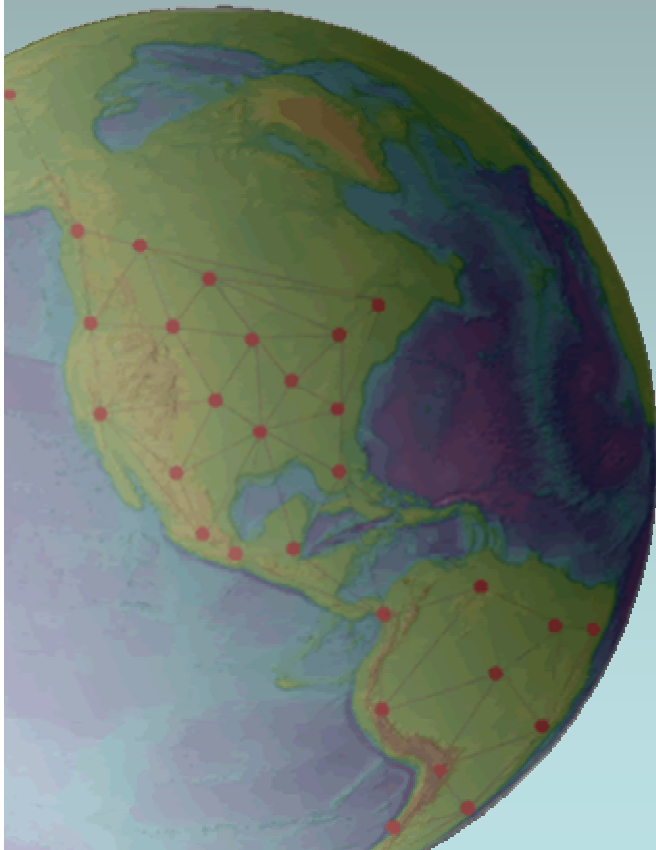


GEON: Geosciences Network

*A Research Project to Create
Cyberinfrastructure for the
Geosciences*



Dogan Seber
San Diego Supercomputer Center,
University of California, San Diego

Objectives

An in-depth look into the planet's history and its dynamic system through a collaborative research effort between earth scientists and computer scientists

- Enabling Scientific Discovery
- Intelligent Resource Management
- Natural Hazard Mitigation
- Improving lifestyles while preserving nature
- Understanding Earth's past history to predict the future



GEON

- Creating a Cyberinfrastructure for the Geosciences
- NSF Large ITR project – collaborative effort
 - GEON is creating an IT infrastructure to “enable” interdisciplinary geoscience research -- not a group of researchers, but the entire community will benefit
 - Project started in October 1, 2002 and will continue until September 30, 2007

GEON

- Research Issues (Earth Science and Computer Science)
 - Data Integration
 - Middleware development (Grid)
 - Portal (GEON Knowledge and Discovery Center)
 - Visualization
 - Education activities with DLESE (*Digital Library for Earth System Education*)

Current GEON member institutions (October 2003)

Members

- Arizona State University
- Bryn Mawr College
- Penn State University
- Rice University
- San Diego State University
- San Diego Supercomputer Center / University of California, San Diego
- University of Arizona
- University of Idaho
- University of Missouri, Columbia
- University of Texas at El Paso
- University of Utah
- Virginia Tech
- UNAVCO, Inc.
- Digital Library for Earth System Education (DLESE)

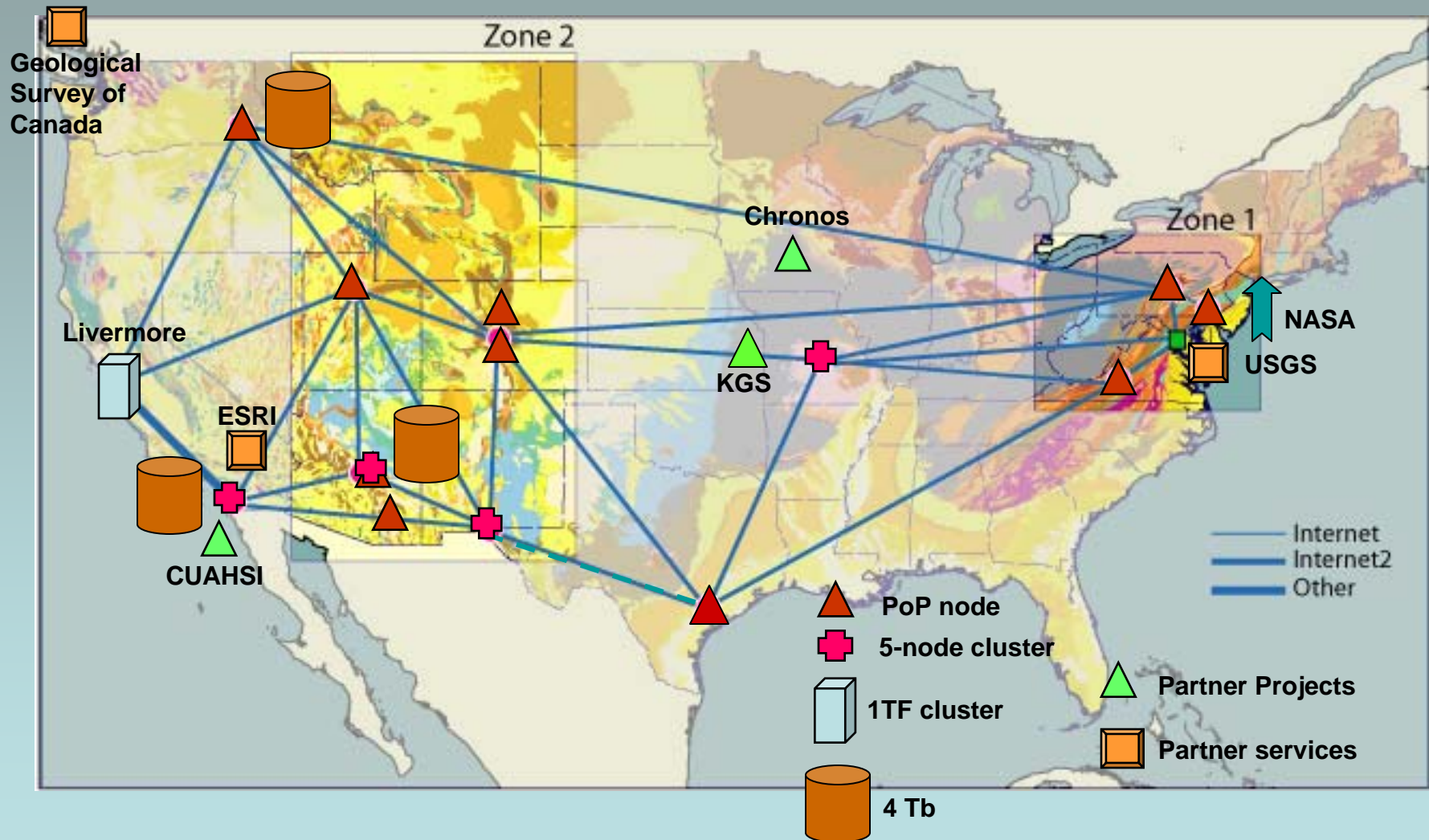
Partners

- California Institute for Telecommunications and Information Technology (Cal-(IT)²)
- Chronos
- CUAHSI
- ESRI
- Geological Survey of Canada
- Georeference Online
- IBM
- Kansas Geological Survey
- Lawrence Livermore National Laboratory
- U.S. Geological Survey (USGS)
- CIG

Other Affiliates

- Southern California Earthquake Center (SCEC), EarthScope, IRIS, NASA

GEONgrid Under Construction



GEONgrid Infrastructure

- GEON Certificate Authority
- GEON PoP (Point-of-Presence node)
 - Linux node with GEON Rocks
 - OGSA stack
 - At least 350GB of cache disk for data replication
- Heterogeneous environment
 - Links range from 10GBps, Internet2, commodity Internet
 - Sites range from 1TF cluster (in plan) to 1 or more node Linux clusters
- Develop codes locally, and execute remotely

Science & IT Research Activities

- Geology map integration
 - Use of ontologies, Web services, XML-based mediation, mapping software
 - Data reconciliation at state boundaries
- Data compilation for 4D analysis
 - Compilation of data sets for addressing tectonic history of the Northern Rockies (0-15Ma)
- Concept space development for Igneous Rocks, metamorphic petrology and crustal structure (e.g. Moho)

Science & IT Research Activities

- Finite element modeling of crustal deformation
 - Modeling tectonic deformation in Western US since the Laramide
- 3D modeling of earthquake records for lithospheric studies
- Gravity/Magnetic data compilations and tools development (USGS/NIMA/NOAA collaboration)
- Physical properties database development
 - Participation by Computer Science Software Engineering students and Earth science students

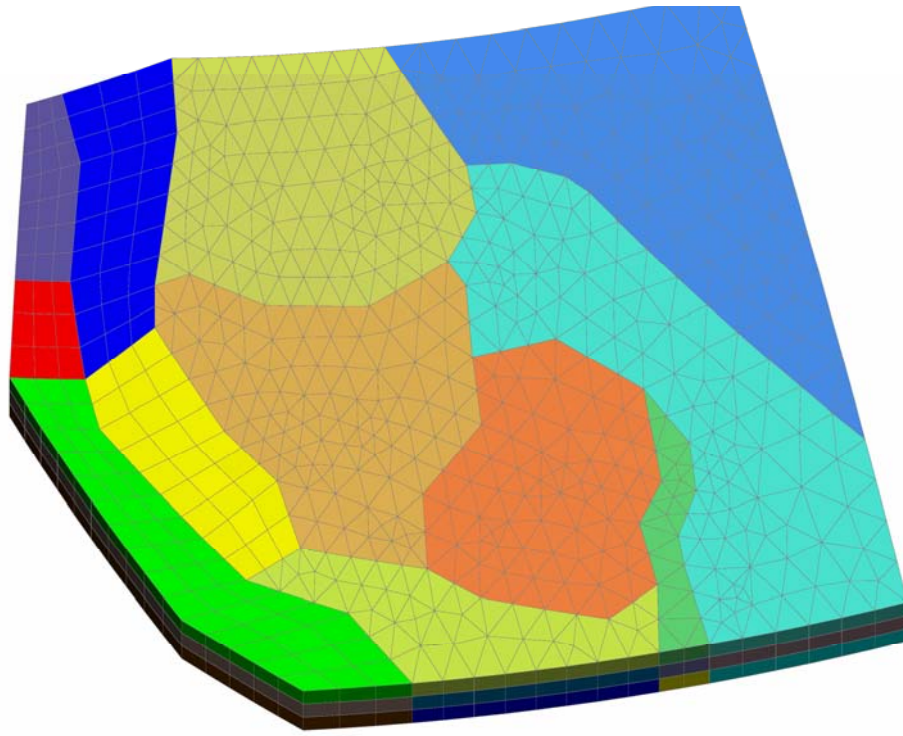
Science & IT Research Activities

- Paleogeography (PGAP) database development
- Yellowstone database development
- Education and DLESE
 - Course in Geoinformatics
 - Involvement of CS/ES undergrad students in Web portal development via 1-year Software Engineering course sequence

Computational Geodynamics and High Performance Computing examples in GEON

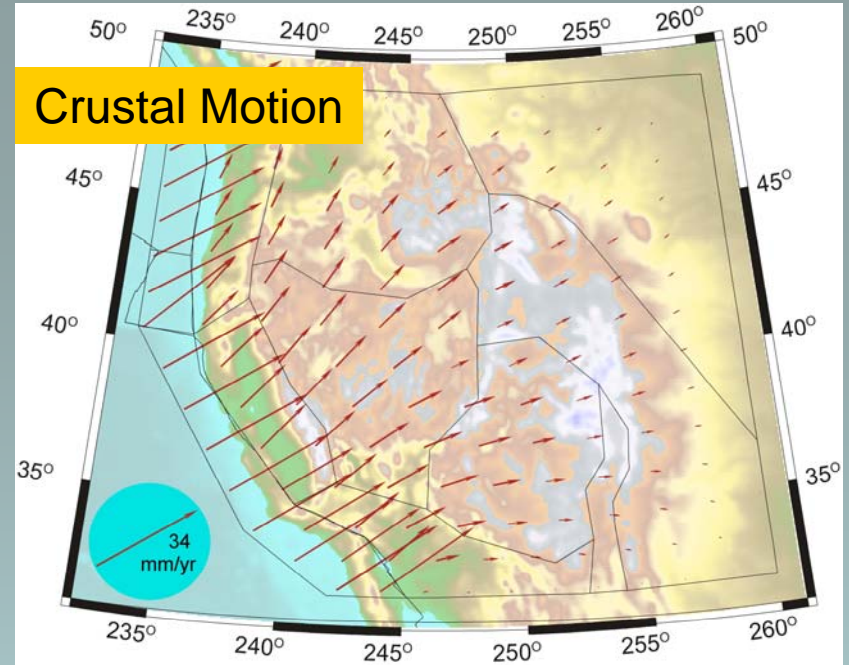
- **Finite Element Modeling of
Lithospheric Structure**
- **3D Seismic Wave Propagation**

A Preliminary Finite Element Model Continental Deformation in Western US

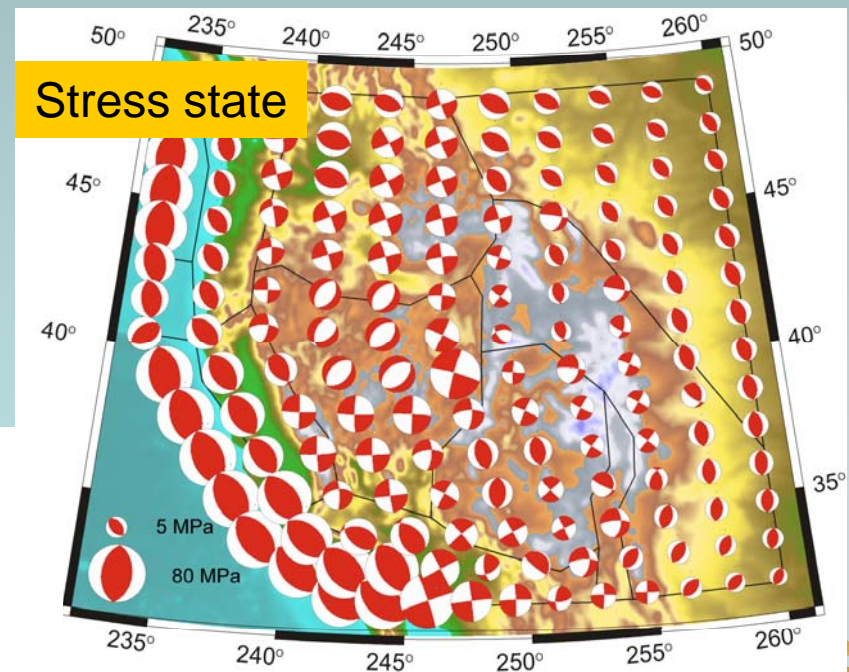


(Liu, 2003)

Simulation of the initiation of Tertiary crustal collapse of the Sevier-orogenic core zone



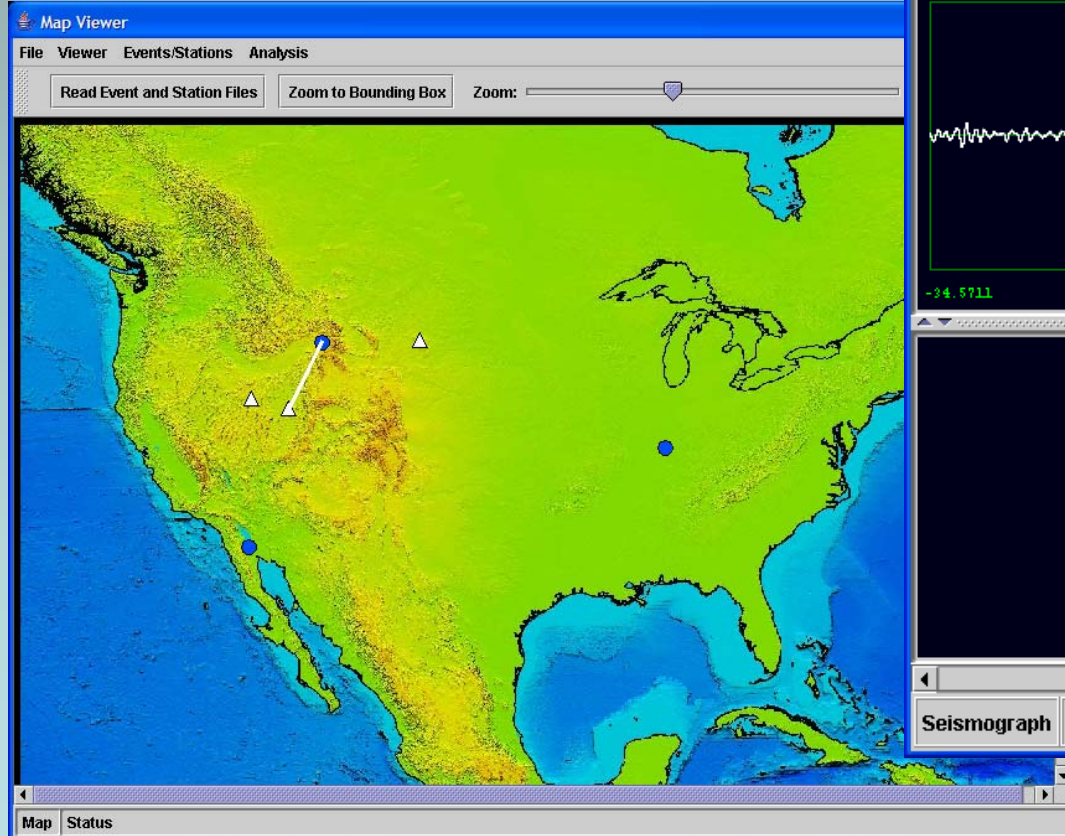
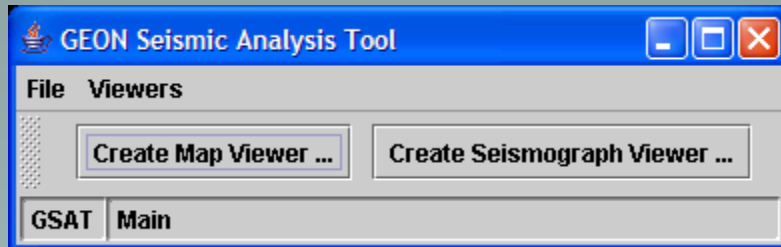
Crustal Motion



Stress state

3D Seismic Wave Propagation

(In collaboration with LLNL)




Modeling earthquake recordings in 2D/3D environment to study the interior of the Earth

IRIS

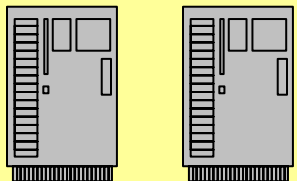
- Earthquakes
- Stations
- Waveform

Gsat

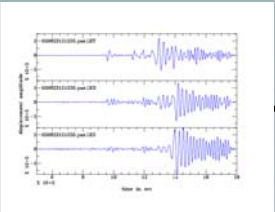


e3d

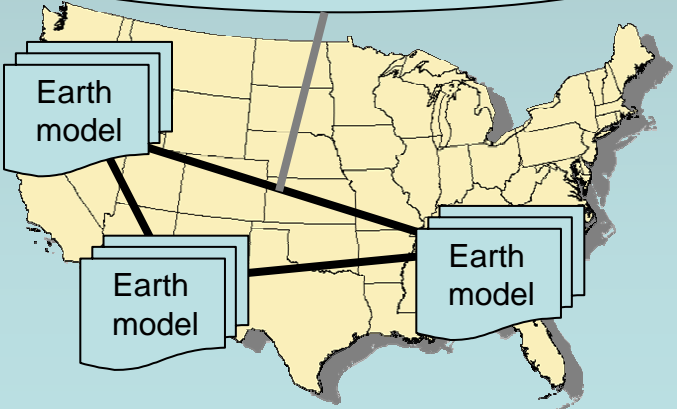
HPC Centers



LLNL **SDSC**



Digital Libraries/GEON Data Grid



Workflows in Scientific Research

Modal Classification for Naming Igneous Rocks.
Retrieves classification Points from the Virginia Igneous Rock database and classifies it with the Igneous rocks diagrams.

Diagrams and transitions between them.

Inside the classifier

Uses the transitions table, the region and the mineral info to return the identifier of the next level diagram.

Calculates the point according to the mineral info and the diagram coordinates.

Calculates the region of the point in the diagram. If this is the final level outputs the rock name.

The diagram used in this level.

A pointer to the next level diagram.

<http://www.geongrid.org/>