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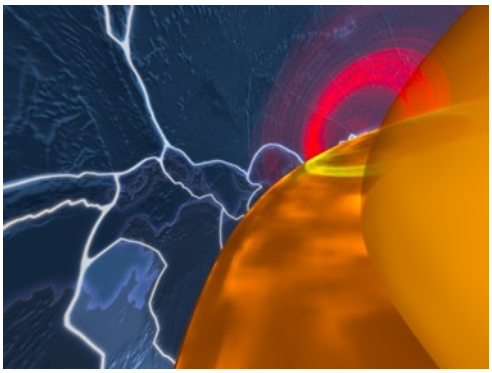
CIG News Elements

A Quarterly Newsletter

Computational Infrastructure for Geodynamics



A scene from the CAS "Earthquake" show viewing ground motions at the surface (red) and along a radial cross-section of the Earth (yellow) for the M 7.9 1906 San Francisco earthquake. The view is from the interior looking outward with the Aleutian and Kuril Islands in the center of the view. Plate boundaries are shown as white lines and the outer core is visible in the lower right. Temperature variations in the mantle are indicated by orange shading, inferred from seismic tomography[1].

[1] Simmons, N. A., S. C. Myers and G. Johannesson (2011), Global-scale P-wave tomography optimized for prediction of teleseismic and regional travel times for Middle East events: 2. Tomographic inversion, J. Geophys. Res., 116, B04305, doi:10.1029/2010JB007969.

Announcements

- **Webinar Series Kicks Off Fall 2012**
- **New Allocation at NCAR**
- **December 4, CIG Business Meeting @ 2012 AGU Fall Meeting**

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Research Highlight

CIG code SPECFEM3D_Globe Used in California Academy of Sciences Earthquake Exhibit

The California Academy of Sciences (CAS) opened their latest exhibit *Earthquake* on May 26. The exhibit, occupying the entire west wing of the museum, features a walk-through Earth and a shake house as well as explores topics such as mantle convection, seismic tomography, plate boundaries, tectonic impacts on evolution, and earthquake preparedness. Its companion show, *Evidence of a Restless Planet* at the Morrison Planetarium, explores the forces that transform the surface of our planet including accurate, data-driven visualizations in a dramatic immersive video format on the 75-foot "full-dome" digital screen. For the show, scientists at Lawrence Livermore National Laboratory (LLNL) calculated earthquake ground motions of the 1906 San Francisco M7.9 earthquake and a possible M 7.05 Hayward Fault scenario using WPP (an elastic finite difference code of seismic simulations developed at LLNL) and the CIG maintained code SPECFEM3D_GLOBE (developed by Princeton University, CNRS/Aix-Marseille and others). The SPECFEM3D_GLOBE calculation for the 1906 earthquake shows the surface ground motions as well as motions along a radial cross-section paralleling the San Andreas Fault on the scale of North America. The exhibit and planetarium show will remain open for over a year. Make time to visit this exciting exhibit during Fall AGU.

More information is available online at: https://www.calacademy.org/academy/exhibits/earthquake

Submitted by Artie Rodgers, LLNL

Webinar Series

New this fall - the CIG Webinar Series. Webinars will draw from a pool of experts from mathematicians, to computer scientists, and to geoscientists, among others to bring together a cross-cutting community of faculty, students and researchers to both inform and disseminate knowledge on the tools and methodologies employed to further the study of problems in geodynamics.

The one hour webinars will be held the 2nd Thursday of each month October through May (no webinar in December due to AGU) at 11 am PT. Webinars will be recorded for later viewing. Reminders and details will be sent out through the cig-all mailing list.

Computing

Geodynamics in the Cloud

http://images.zeit.de/digital/internet/2010-07/cloud-computing/cloud-computing-220x124.jpg

If you have a google account, share photos or store music online, you are in the cloud. The cloud provides Infrastructure-as-a-Service such as server farms, Platform-as-a-Service (PaaS) such as Google App Engine, and Software-as-a-Service such as WebEx. The PaaS model supplies remote computing capacity with a set of software-development tools for use by outside software programmers[1]. Cloud resources, as in this instance, can provide internet access to ready-to run applications as well as cpu and memory scalability in a pay-as-you go model. Installation of CIG codes in the cloud helps users to quickly and easily try CIG codes negating the need for users to download and install the codes on their own machines. In addition, service providers such as Amazon EC2 provide scalable HPC options allowing users to run larger computations. CIG is considering offering cloud oriented tools to help those researchers who would find cloud computing to be cost effective source of computing resources. Let us know what you think.

[1] http:/www.academicroom.com/topics/cloud-computing

NEW RELEASES

- ⇒ Pylith 1.7.1 [2012 June 12]
- ⇒ Relax 1.0.3 [2012 June 18]
- ⇒ Specfem3D_Geotech 1.1b [2012 April 23].
- ⇒ Specfem1D 1.0.3 [2012 April 30].

New Allocation at NCAR

CIG has been award an allocation of 490,000 core-hours on the new NCAR supercomputer Yellowstone. Hours have been allocated to support code benchmarking, to conduct training sessions, and to offer help to new users by providing small allocations of computational time for CitcomS, Aspect, Pylith and Gale. Technical details for Yellowstone can be found at: https://www2.cisl.ucar.edu/resources/yellowstone

Hours expire June 30, 2015.

If you are interested in using some of this allocation to test code or perform small runs (<1000 processors), contact Eric Heien at: emheien@geodynamics.org

XSEDE12 Conference

Eric Heien from CIG recently presented visualization work at the XSEDE12 conference. This work examined the flow of passive tracer particles in a 3D box environment using the new CIG code ASPECT (Advanced Solver for Problems in Earth's ConvecTion) on the XSEDE supercomputer Lonestar. By evaluating mixing in a suite of configurations, researchers hope to qualitatively understand the dynamics of regional and global mixing in the Earth's mantle.

Comings and Goings

CIG welcomes Eric Heien and Lorraine Hwang to its Staff at headquarters at UC Davis. Eric is CIG's Lead Programmer responsible for the technical direction of CIG code development. Eric received his Ph.D. from Osaka University and completed postdoctoral work at INRIA and UC Davis studying parallel, distributed and cloud computing. While at UC Davis, he led the development of Virtual California (VC). VC supports both OpenMP and MPI based parallel computing for large scale models on the order of hundreds and thousands of elements requiring hundreds of GB of memory to compute.

Lorraine Hwang is CIG's Associate Director assisting with project planning and management and outreach and development. Lorraine received her Ph.D. from the California Institute of Technology studying earthquake source ruptures. More recently, she has led WESTCARB's efforts to characterize the western U.S. for the geologic sequestration of CO_2 and managed projects relating to energy and the environment.

CIG welcomes new institutional members Northwestern University and University of Houston, and foreign affiliate, Earth Observatory of Singapore.

Events

Recent Meetings

Participants at the CDM 2012 Workshop.

18-22 June 2012. Crustal Dynamics Modeling Workshop, Colorado School of Mines, Golden, Colorado. Thanks to all participants for a successful workshop. This year's format included PyLith, Relax and CUBIT tutorial sessions; tinker time for hands-on help, and scientific talks. Over 60 scientists attended the 5 day workshop with 11 featured science talks and 10 posters presented. Special thanks to conference organizers organizers Brad Aargard, Thorsten Becker, Andrew Freed, Eric Hetland, Rowena Lohman, and Charles Williams for a well balanced program.

29 July – 02 August 2012. Mantle Convection and Lithospheric Dynamics Workshop, UC Davis. The 2012 Mantle Convection and Lithospheric Dynamics Workshop was held at UC Davis July 29-August 1. 80 participants, half of which were junior scientists including graduate students and postdocs, gathered to present research, discuss the state of the art and future needs for computational modeling for mantle and lithospheric scale dynamics, hear and discuss keynote talks on numerical methods and applications to mantle and lithospheric scale problems, and participate in tutorials on CitCom, Deal.II, Gale, and TerraFerma. The three day workshop showed the community to be active and growing, with strong interest to make use of advances from the computational sciences. Thanks to the participants, speakers, tutorial leaders, and especially to conference organizers Peter van Keken, Shijie Zhong, Roger Buck, Marc Spiegelman, Claire Currie, Mousumi Roy, and Louise Kellogg.

2012 CIDER Summer Program. Shijie Zhong and Bruce Buffett led a two-part tutorial on CitComS at the 2012 CIDER summer program on "Deep Time: How did early Earth become our modern world?", held at the Kavli Institute for Theoretical Physics (KITP) at UC Santa Barbara. 43 graduate students and postdocs from geochemistry, seismology, geodynamics, mineral physics, and geomagnetism learned how to create an input file, run CitComS, plot output, and interpret the results. Bill Broadley and Eric Heien from CIG configured a Virtual Machine to distribute the compiled code, tutorial input files, and scripts for plotting output, enabling tutorial participants to download and use the code in one step.

Webinar

2012 October 11 @ 11 am PT – *Wolfgang Bangerth*

Using Existing Libraries to Improve and Solve Computational Problems

http://www.trinitysem.edu/images/webinar.jpg

Over the past 20 years, there have been two landmark shifts in computational science and engineering The transition from sequential to parallel computing, and the emergence of very large libraries that provide a huge amount of functionality to application programs in much the same way as MATLAB does for many tasks that can be written in the language of linear algebra. Unfortunately, while the codes written in many applications areas are well parallelized today, they have only recently started to be based on existing libraries.

In this webinar, I will explore what led to these libraries, what they offer, and how they can help communities write codes that are far better, faster, and less complex, yet utilizing far more complex algorithms, that are smaller, better tested, and better documented. Our software, the open source library deal.II (see http://www.dealii.org), is used as an example to exemplify these benefits and its application to geodynamics.

While this talk will focus on deal.II as the underlying library, the following talk in this webinar series, by Timo Heister, will focus on an application built on deal.II, the mantle convection code ASPECT.

Please go to geodynamics.org for instructions on how to connect to the meeting.

Submitted by Wolfgang Bangerth, TAMU

Webinar continued

November 8	Timo Heister. *Modern Numerical Methods for Modeling Convection in the Earth's Mantle*
December	NONE (AGU)
January 10	Jed Brown. *High Performance Implicit Solvers for Geodynamics*
February 14	Sarah Minson. *Bayesian Earthquake Modeling*
March 14	TBD
April 11	TBD
May 9	TBD

Do you have a suggestion for or have heard a talk recently you think may interest the CIG community? Let us know by contacting lorraine@geodynamics.org

Recent Publications

Please send us your recent publications as well as research highlights so we may continue to keep the geosciences community informed of all the current research being conducted in geodynamics with CIG codes.

Mantle Convection and Lithospheric Dynamics Workshop participants tour Keck CAVES— a 3-D visualization facility housed within the Department of Geology at UC Davis.

Upcoming Meetings

December 3-7, 2012, Fall AGU Meeting
Join more than 20,000 Earth and space scientists, educators, students, and other leaders in San Francisco, California 3–7 December as they gather to present groundbreaking research and connect with colleagues. http://fallmeeting.agu.org/2012/

December 4, 2012, CIG Annual Business Meeting
The CIG Annual Business Meeting will be held on Tuesday, December 4 during Fall AGU. Please join us and meet our new staff members at a reception with light hors d'oeuvres beginning at 6pm followed by the Business Meeting at 6:30pm. More details will be announced at a later date. We hope to see many of you there!
Agenda items can be sent to: ariel@geodynamics.org to be forwarded to the meeting committee.

December 16-20, 2012, 1st International Conference on Frontiers in Computational Physics: Modeling the Earth System, Boulder, Colorado
Computational science complements the classical paradigm of theory and observation, and leads where neither is available. In particular, computational models play an essential role in diagnosis and prognosis of all elements of the Earth System, from solar variability through space weather, geomechanics, terrestrial climate and weather, down to ground water flow. This inaugural four-day Conference on Frontiers in Computational Physics will provide a forum for exchanging and sharing experiences, knowledge and on advanced computational techniques, methods, and models for simulation of the Earth System. With computational aspects in focus, the physical emphasis is on natural problems that are complex, coupled and multiscale. http://www.frontiersincomputationalphysics.com/

July 15-17, 2013, Seismic Imaging of Structure and Source, University of Alaska, Fairbanks

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Computational Infrastructure for Geodynamics (CIG) is a membership-governed organization that supports and promotes Earth science by developing and maintaining software for computational geophysics and related fields.

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