



## Research Highlight

### EQSIM: Coupled End-to-End Earthquake Hazard and Risk Simulations

Over the past five years an integrated, multidisciplinary team from Lawrence Berkeley National Laboratory and Lawrence Livermore National Laboratory have developed the Earthquake SIMulation (EQSIM) framework for fault-to-structure, regional-scale earthquake simulations under the U.S. DOE Exascale Computing Project. The EQSIM application development project is focused on creating an unprecedented computational tool set and workflow for earthquake hazard and risk assessment. Starting with a set of existing codes - SW4 (the fourth-order, 3D seismic wave propagation model developed at LLNL), NEVADA (a nonlinear, finite displacement program for building earthquake response), and OPENSEES (a nonlinear finite-element program for coupled soil-structure interaction) - EQSIM has created an end-to-end capability to simulate from the initiation of fault rupture to site-specific ground motions and ultimately to infrastructure response. EQSIM's ultimate goal is to remove computational limitations as a barrier to simulation-based scientific exploration, understanding earthquake phenomenology, and practical earthquake hazard and risk assessments. To achieve EQSIM goals, the SW4 code has been substantially advanced ... [\[full article\]](#)

contributed by

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## From HQ

Dear Community,

The summer workshop season wrapped-up at HQ with our newest training offering, [Crafting Quality Research Software and Navigating Publication in Software Journals](#). After over 20 years of championing open source software, it is heartening to see the interest from the community in sharing software. This includes a big welcome to the latest addition - *Geodynamic World Builder* (see article below) whose community is led by Menno Fraters. We hope this workshop series continues to foster open science and code communities. If you missed this workshop, use the link above to access recordings from Part I.

Part II of our workshop on software publishing was colocated with the SCEC Annual Meeting. The recent announcement of funding for two new centers in geohazards [\[NSF\]](#) energized conversations. Both CRESCENT and the expanded SCEC along with the SZ4D initiative provide opportunities for our community to grow and collaborate on the development of open source software and training for the next generation of scientists entrusted to improve society's resilience to natural hazards.

Did you catch that ASPECT has a new name? ASPECT, one of CIG's flagship software packages, is now the *Advanced Solver for Planetary Evolution, Convection, and Tectonics*. In the last several years, its community has grown in new directions. Originally established as a modern open source code in mantle convection, the community of user-developers has leveraged ASPECT's unique architecture and contributed code to study problems in lithospheric dynamics and tectonics on other celestial bodies than the Earth such as the moon, Mars or Io. I am excited to see what new directions are in store with the growing recognition of the importance of feedbacks between geodynamic processes, such as sediment transport, ice thickness, and sea level, especially under today's changing climate.

Looking forward to seeing you in San Francisco and catching up on your science. Don't forget to [send](#) us your presentation so community members can learn about your research [\[presentations\]](#).

Lorraine Hwang & Bruce Buffett, co-Directors

## New in Software

### Geodynamic World Builder

**NEW** to the CIG code community, the Geodynamic World Builder (GWB) is an open source code library used to set up initial conditions for computational geodynamic models and/or visualize complex 3D tectonic settings in both Cartesian and spherical geometries. The inputs for the JSON-style parameter file are not mathematical, but rather a structured nested list describing tectonic features such as a continental, an oceanic or a subducting plate. Each of these tectonic features can be assigned a specific temperature profile or composition label. GWB has been used to build models for ASPECT, ELEFANT, Fieldstone, and C-PRAN. Thanks to Principal Developer, Menno Fraters, *University of Florida*.

For more information see the [GWB](#) website and its extensive [online User Manual](#).

## Tool: ASPECT Jupyter Notebook

ASPECT can now be launched from within a Jupyter Notebook. From the *Software: Launch* menu, select *ASPECT Jupyter Notebooks* and either navigate to its software landing page for more information or launch the tool directly. This tool contains an installed version of ASPECT, the Advanced Solver for Planetary Evolution, Convection, and Tectonics, in a JupyterLab environment. Upload your Jupyter notebooks and try it out! Run `!conda list` to see which libraries are installed. For more information, see [ASPECT Jupyter Notebooks](#).

## Tool: Burnman Jupyter Notebooks in the Classroom

Our hosted notebooks can support learning in geodynamics. Learn how Robert Myhill, *University of Bristol*, uses Burnman Jupyter Notebooks to teach igneous petrology. Hosted Burnman notebooks allow easy, hands-on access to fundamental concepts in thermodynamics that can be supported by lectures and discussions. Learn more about how he uses notebooks to teach concepts in Gibbs free energy. [\[full article\]](#)

*Have a notebook you are interested in sharing with the community?*  
Please [contact us](#) to discuss creating a new resource for the community.

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## Governance

### Elections

The 2023 Elections are now open - 1 seat is open on the Executive Committee and 2 on the Science Steering Committee. We thank Alice Gabriel for her leadership on the EC and SSC members Ebru Bozdogan and Sylvain Barbot for their contributions to the community. Contact your [Member Representative](#) for voting. Elections close Monday November 30, 2023. [\[slate\]](#)

### Annual Meeting

Join us Wednesday December 13 from 5:30-7:30P for the CIG Annual Meeting during 2023 AGU. This year we will have an in person gathering at [SPIN](#), conveniently located across the street from the Moscone Convention Center. Come and network with fellow researchers and congratulate community honorees including: Alice Gabriel, James B. Macelewane Medal; Scott King, AGU Fellow; and Luca dal Zilio, Jason Morgan Early Career Award. Please remember to RSVP by December 5 to help us estimate attendance. Remember to subscribe to the [Announcements](#) in the [Forum](#) for future announcements. Additional details will be posted on our [website](#) as they become available.

### Working Groups

CIG seeks to engage its community and encourage new ideas by seeking members interested in participating as a member of a current working group or starting a new Focused Working Group (FWG). New FWGs should address a specific topic and have a clearly defined scope e.g., workshop, white paper, benchmark, etc. A FWG should define concrete outcome(s) achievable within a short time frame, < 2 years. Anyone can propose one! We look forward to your ideas in continuing the CIG community's dynamic leadership in the Earth sciences. [\[apply\]](#)

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## Events

### CIG Webinars

CIG Monthly Webinars have a **new time** Thursdays **@noon / 12P PT**. The 2024 webinar series will focus on current efforts to understand the relationship between different systems in geosciences. By presenting examples of coupled geodynamics models and the difficulties encountered in coupling them, speakers of this series invite us into exploration and discussions of the science opportunities and challenges in code coupling and multidisciplinary research. See the [webinar](#) page and the [calendar](#) for more information.

### Workshops and Meetings

#### 2023

<b>December 13</b>	CIG Annual Business Meeting	San Francisco, California
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#### 2024

<b>Winter-Spring 2024</b>	<a href="#">Webinar Series</a>	zoom
<b>June 10-14</b>	Crustal Deformation Modeling Workshop	Golden, Colorado
<b>Summer</b>	ASPECT Hackathon	tbd
<b>Summer</b>	Rayleigh Hackathon	tbd

See our [calendar](#) for details on all events and registration.

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