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Group B
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Preparing SCEC CFM 8.0: planning, updates, analysis and use cases

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Abstract

We present latest updates, analysis and use cases around the SCEC Community Fault Model (CFM). Plesch et al. (2026) showed how the main features of the model are implemented in the latest releases of the CFM: detailed 3d geometry, organization, and alternative representations of selected faults. Here, we illustrate these features, and document progress towards fully and uniformly applying underlying standards across the statewide scope of the CFM.

We base our efforts on our 2025 comprehensive peer evaluation that included the central and northern California portions of CFM 7.0 (132 faults). Additionally, in 2026, the CRESCENT (Cascadia Region Earthquake Science Center) CFM group successfully concluded a peer review of their 3d fault model which overlaps with SCEC in northern California, north of the Mendocino Triple Junction. It resulted in significant feedback for this region of overlap (46 faults).

This year, the SCEC and CRESCENT CFM groups held multiple meetings coordinating activities efficiently. Both groups adopted new shared representations of CA-OR border crossing faults we had developed last year (Plesch et al., 2025) and are working together to incorporate additional northern California revisions from combined peer reviews. For example, significant revisions and additions by the CRESCENT CFM group, including initial 3d geometries, have been incorporated in the onshore Mendocino Triple Junction area, with upcoming conjoined focus on fault systems near Mt. Lassen and the Modoc Plateau. These updates are being adopted by the SCEC CFM in parallel.

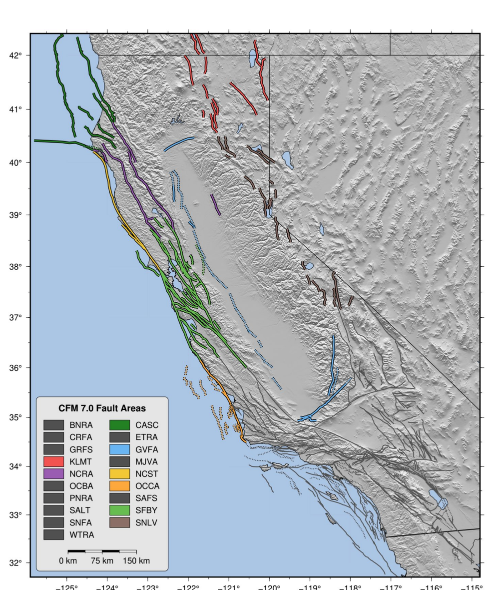
Another focus of updates is the San Francisco Bay area. Here, we fully revised the representation of Calaveras–Hayward–Rodgers Creek fault system using new results from mapping and modeling, with particular attention to fault linkages between the Hayward and Calaveras faults, as well as the Hayward and Rodgers Creek faults. A notable addition prompted by the peer review is the Mercuryville fault which is connected to the large geothermal Geysers field. The fault is recognized as bounding the field as it plays a role in controlling seismic activity in the area.

Finally, Callejas et al. (this meeting) present an initial analysis of CFM 7.0 by comparing it with NSHM 23 using statistical earthquake-to-fault associations. The CFM is also directly supporting earthquake scenarios evaluated for enhancing public preparedness in the large-scale Shakeout exercises (Scharer, this meeting; Harris et al., this meeting).

1. The SCEC Community Fault Model

The Community Fault Model (CFM) 7.0 is the first 3D fault model with a scope of covering the State of California completely. The model comprises more than 550 fault objects (fig. 1) which are organized in a self-consistent manner with a system-level hierarchy. This organization required defining and updating metadata for all of the 113 fault objects which were added to an existing database of faults in the central and southern portion of the state. The metadata includes information on four levels of hierarchy, source data, estimated sense of slip, average strike and dip, fault size and noteworthy features. The model is released under 10.5281/zenodo.13685611, is available for download in multiple resolutions and can be explored interactively.

2. SCEC / CRESCENT CFM Evaluations



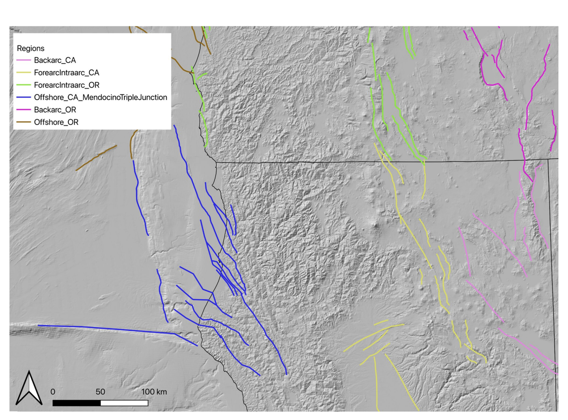


Fig. 3: Map of the CA faults within the CRESCENT CFM that was evaluated in Spring 2026. Each region underwent evaluation by multiple community members. The offshore CA and Mendocino Triple Junction areas were updated to a more complete inventory and to include more detailed fault traces following these reviews (fig. 8).

Fig. 2: Map of the evaluated faults colored by fault area. Each fault area was evaluated by a dedicated team of the CFM Evaluation Working Group.

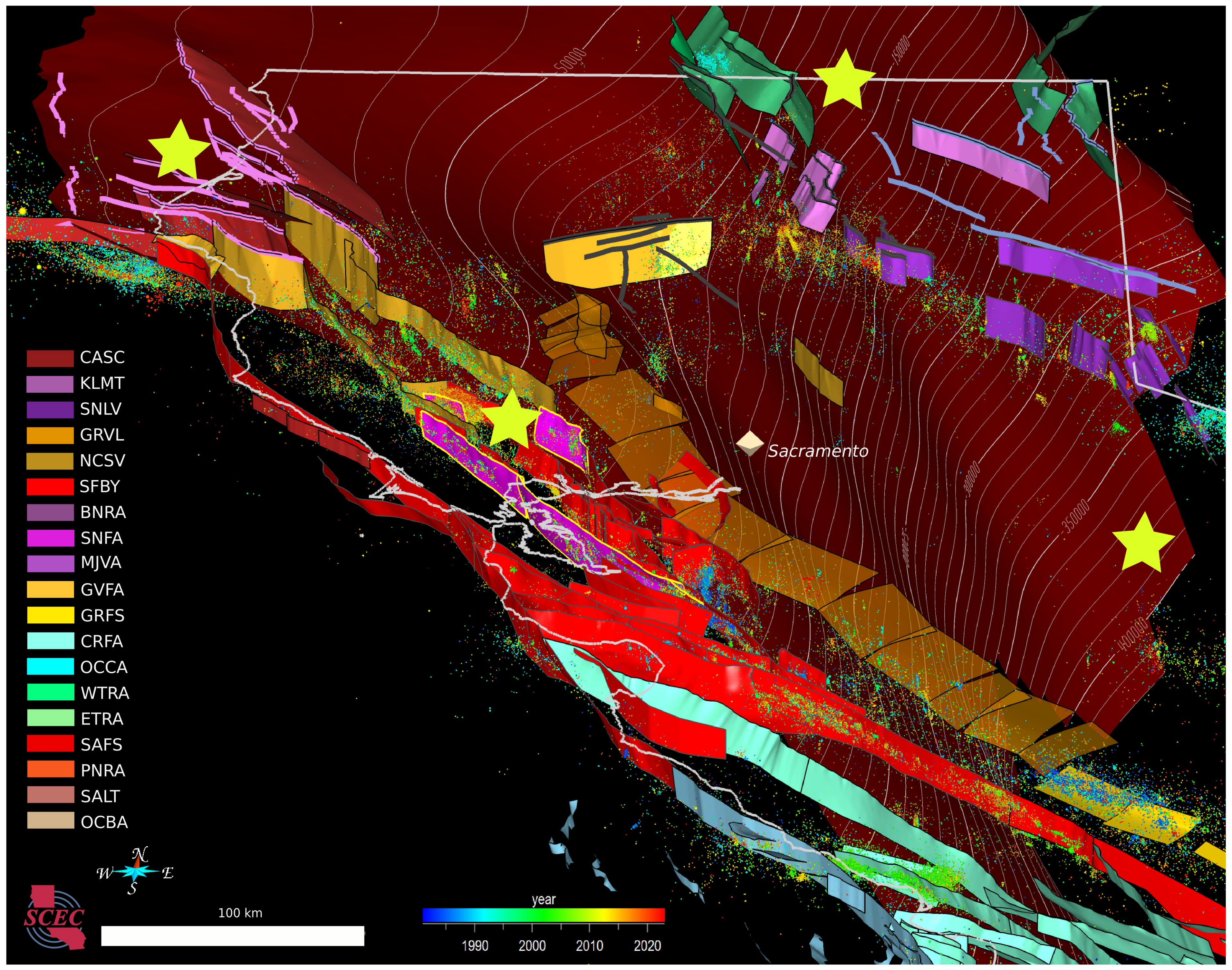


Fig. 1: **Perspective view of the statewide model** for Northern and Central California, with updates after peer review. Stars denote areas of completed and ongoing revision. Small dots are relocated hypocenters (Hauksson et al., 2012, and updates, Waldhauser et al., 2018) which are colored by their time of occurrence. Faults are colored by fault area, the top level in the fault hierarchy. CASC: Cascadia, KLMT: Klamath Mountains, SNLV: Sierra Nevada-Long Valley-Mammoth, GRVL: Great Valley, Sacramento and San Joaquin Valley, SFBY: San Francisco Bay, Delta, BNRA: Basin and Range, SNFA: Sierra Nevada, MJVA: Mojave, GVFA: Great Valley, GRFS: Garlock Fault, CRFA: Coast Ranges, OCCA: Offshore Central California, WTRA: Western Transverse Ranges, ETRA: Eastern Transverse Ranges, SAFS: San Andreas Fault, PNRA: Peninsular Ranges, SALT: Salton Sea, OCBA: Offshore Continental Borderland

3. Updates in the SF Bay area, MTJ area and Cascadia's fore-arc and back-arc

We updated the Hayward fault system (figs. 4-7), faults in Cascadia's fore-arc and back-arc (fig. 1) and the inventory and fault trace representations (fig. 3) in the Mendocino Triple Junction onshore and offshore regions (fig. 8).

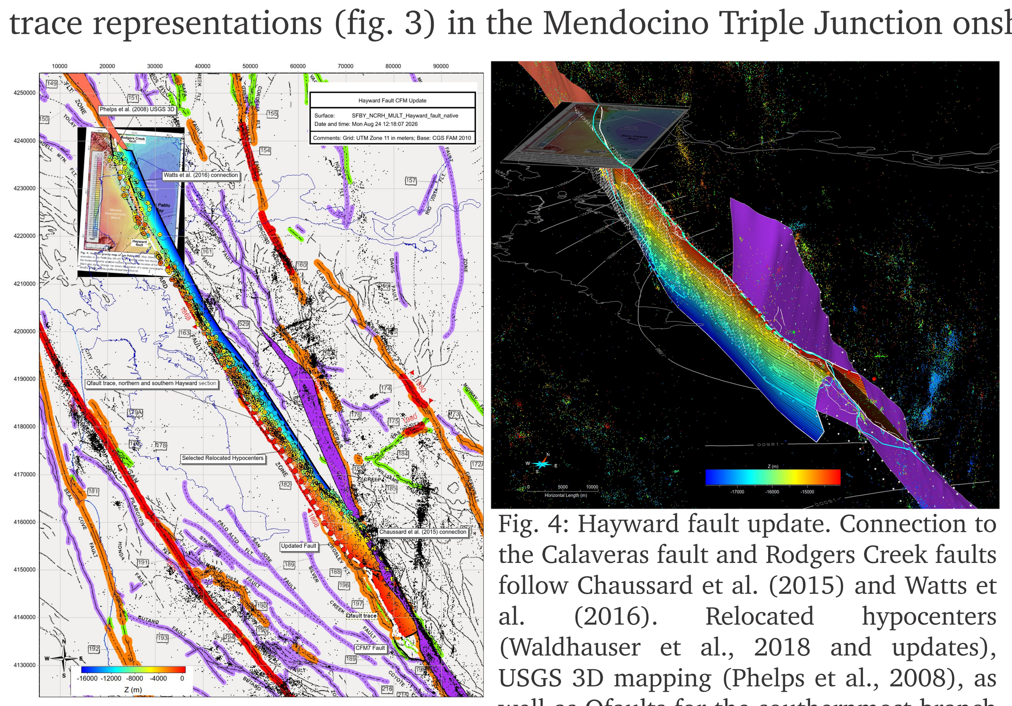


Fig. 4: Hayward fault update. Connection to the Calaveras fault and Rodgers Creek faults follow Chaussard et al. (2015) and Watts et al. (2016). Relocated hypocenters (Waldhauser et al., 2018 and updates), USGS 3D mapping (Phelps et al., 2008), as well as Qfaults for the southernmost branch are additional data sources.

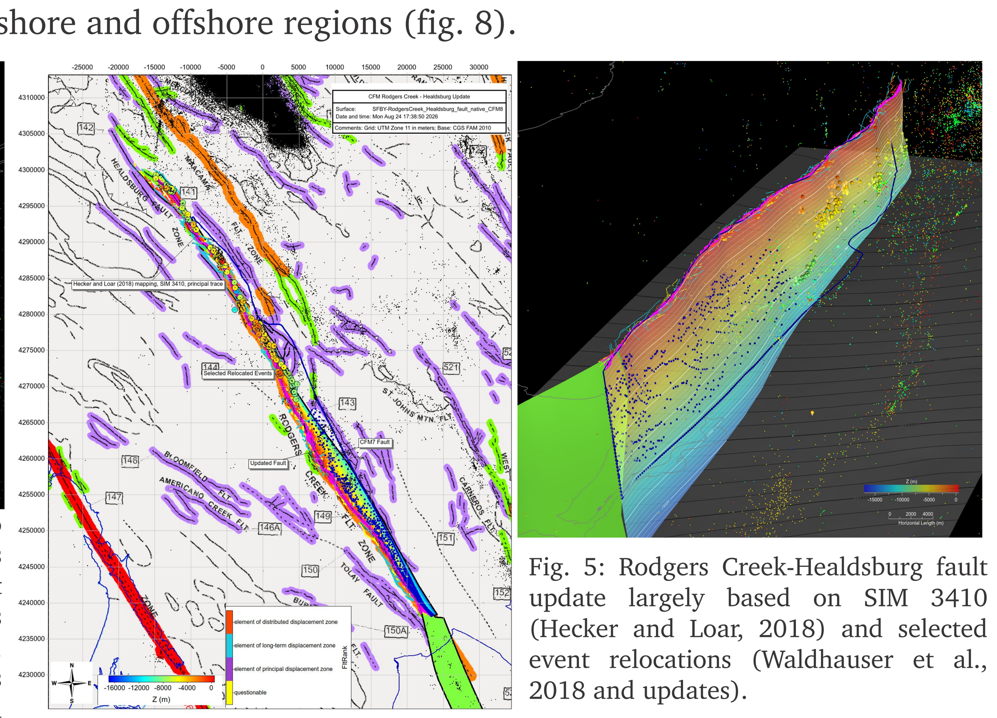


Fig. 5: Rodgers Creek-Healdsburg fault update largely based on SIM 3410 (Hecker and Loar, 2018) and selected event relocations (Waldhauser et al., 2018 and updates).

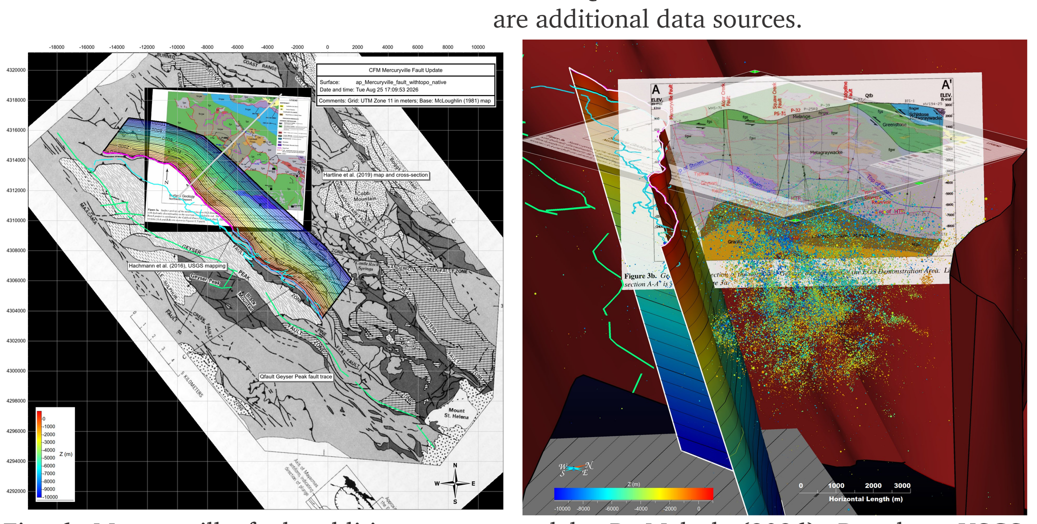


Fig. 6: Mercuryville fault addition as proposed by B. Melosh (2026). Based on USGS mapping by Hachmann, Melosh et al. (2016), Hartline et al. (2019) mapping for field characterisation and USGS McLoughlin (1981) mapping.

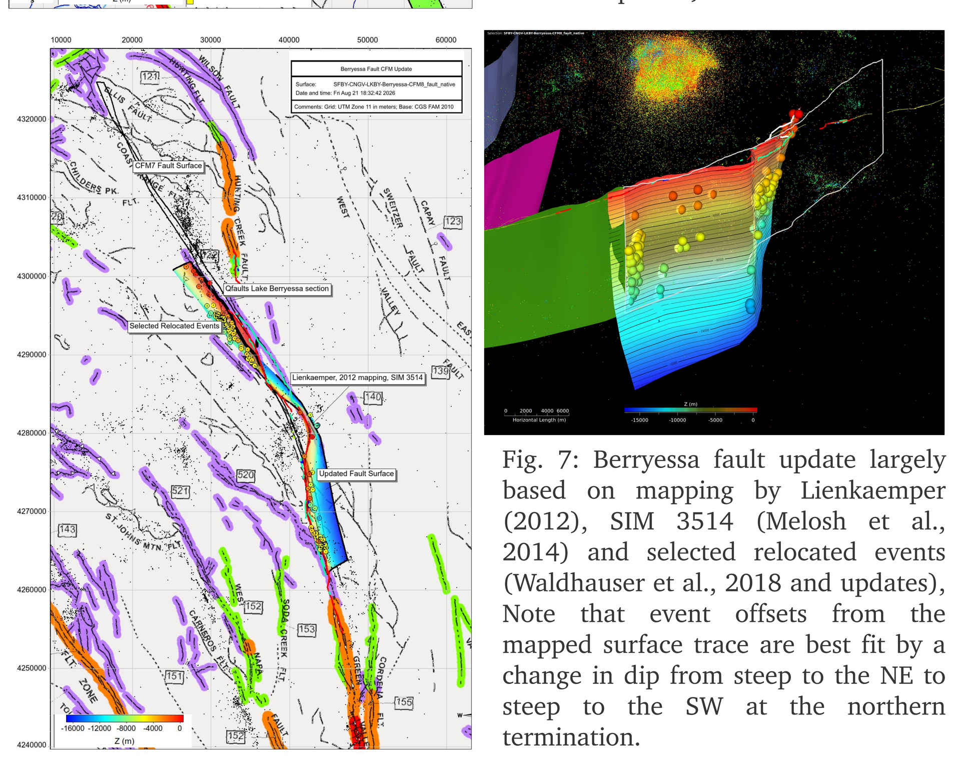


Fig. 7: Berryessa fault update largely based on mapping by Lienkaemper (2012), SIM 3514 (Melosh et al., 2014) and selected relocated events (Waldhauser et al., 2018 and updates), Note that event offsets from the mapped surface trace are best fit by a change in dip from steep to the NE to steep to the SW at the northern termination.

4. The CFM Technical Activity Group: year 1, and outlook

We established a TAG focused on the continued development of the SCEC Community Fault Model (CFM). First year TAG efforts focus on addressing feedback from community evaluation in coordination with colleagues at CRESCENT and USGS. We aim to release the next major CFM version (8.0) by the end of 2027, once the northern California evaluation feedback has been addressed. Achieving these goals will require well-organized efforts focused on 3D fault model construction, database development, model automation, IT coordination, and, ultimately, a community evaluation during the final year of the TAG.

In years 2 and 3, our TAG's vision will go beyond fault model construction and delivery:

- In collaboration with Travis Alongi (USGS), we will test the SURF (Seismicity Utilized for Reconstructing Faults) algorithm.
- In collaboration with Christodoulos Kyriakopoulos (CERI, University of Memphis), we plan to produce two new outreach-focused deliverables: 3D-print-ready CFM files and a VR-based CFM experience.
- In collaboration with John Suppe and post-doc Yu-Huan Hsieh (University of Houston), we will evaluate new crustal-scale fault models.
- We plan to support the work of Badie Rowshandel (California Earthquake Authority) involving improved near-source ground motion characterization by directly utilizing the CFM faults as sources.

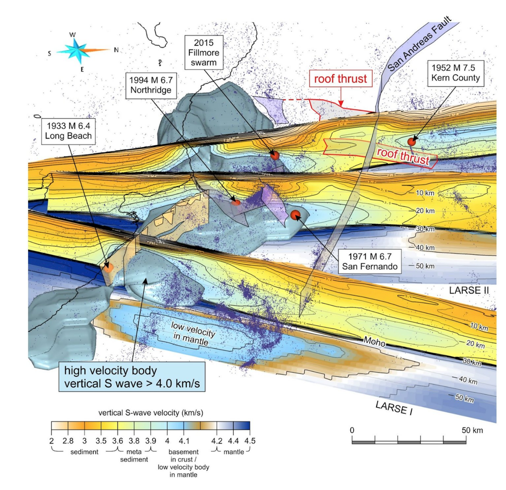


Fig. 9: Example of crustal scale fault model incorporating tomography, from John Suppe and Yu-Huan Hsieh.

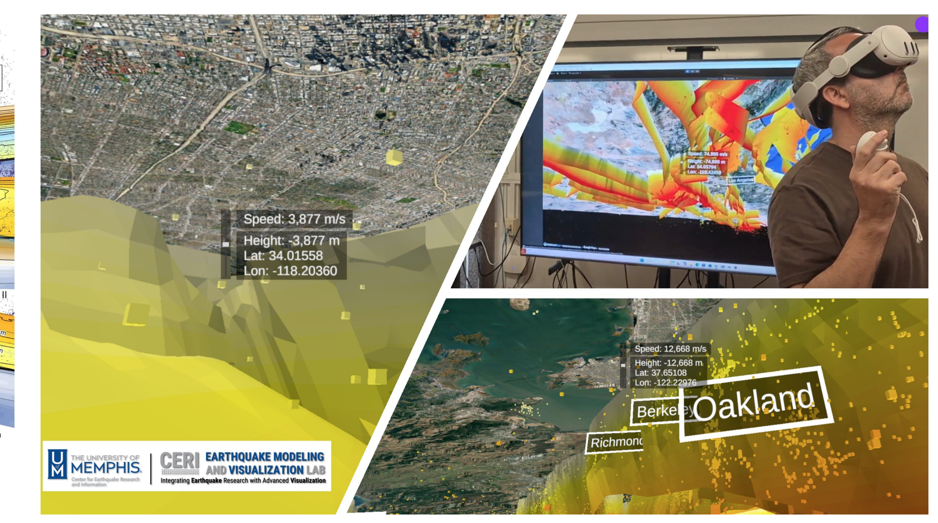


Fig. 10: Prototype VR experience using commercial grade 3D engine, from C. Kyriakopoulos.

5. SCEC TAG interactions and applications

The CFM is intended to serve as a shared resource for activities across SCEC. This year, we actively participated in Shakeout 2 scenario preparations enabling discussions of fault model selections used for rupture simulations.

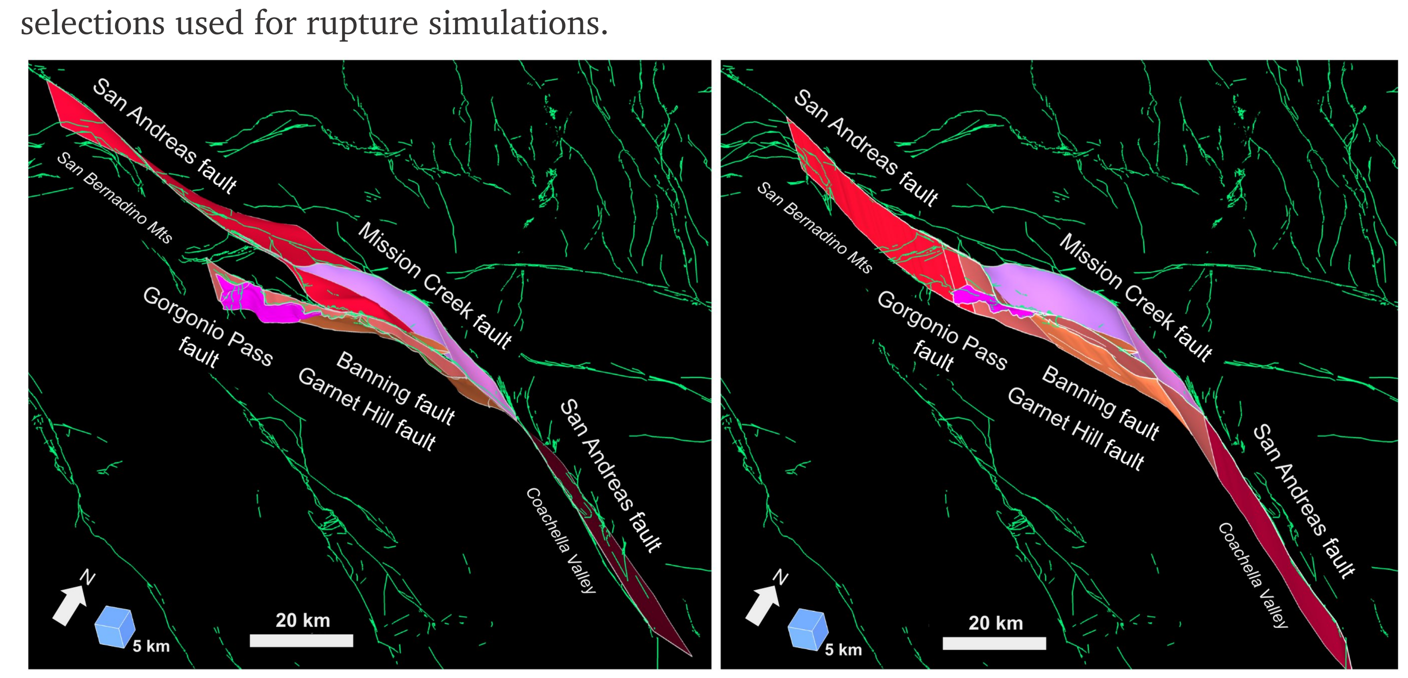


Fig. 11: SAF alternative representations in Gorgonio Pass region (Plesch et al., 2026) initially discussed for Shakeout 2 scenarios.

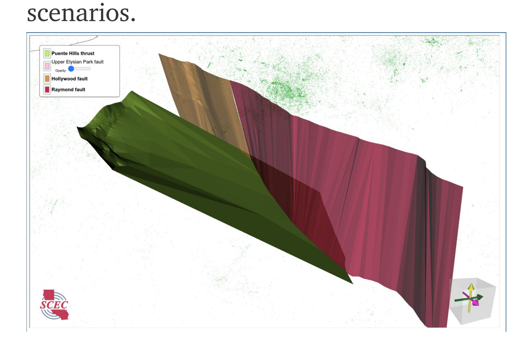


Fig. 12: Raymond-Hollywood fault CFM representation before adaption for Shakeout 2 scenario.

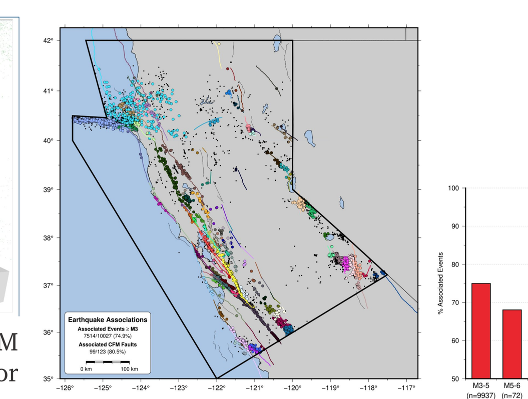


Fig. 13: Initial earthqake-to-fault association results (Callejas et al., this meeting). The events are color-coded to the fault they are associated with. Unassociated events are in black. The histogram shows that 74.9% of M3+ events associate with a CFM fault. See poster for more details and discussion.

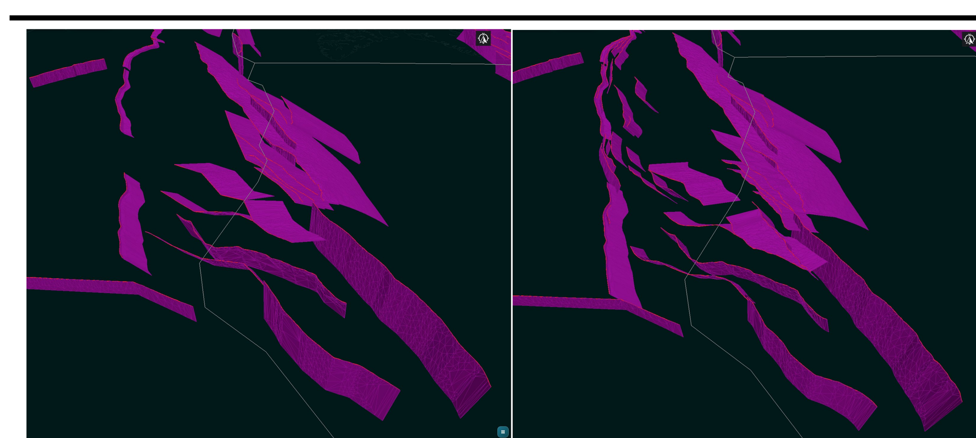


Fig. 8: Left: MTJ region of CRESCENT CFM v1.0 that underwent community review in Spring 2026. Right: Updates to CRESCENT CFM v1.0 MTJ onshore and offshore faults based on both SCEC and CRESCENT community reviews of the region.

Acknowledgments

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