# *The SCEC Community Fault Model Version 6.0: additions and updates after community evaluation*

SCEC 2022 Annual Meeting, Poster 259
SCEC Contribution #12043

*Andreas Plesch[1], Scott T. Marshall[2], Ana Luiza Nicolae[1], John H. Shaw[1], Mei-Hoi Su[3], Philip J. Maechling[3], Tran T. Huynh[3] & Edrik Paul[3]*

[1]Harvard University, MA; [2]Appalachian State University, NC; [3]Southern California Earthquake Center, CA

## Abstract

**We present a new, comprehensive update to the SCEC Community Fault Model (CFM 6.0) along with enhancements to the web-based model viewer and database. This model version is designated with a major release number due to significant revisions from the previous CFM version, following an in-depth and thorough community evaluation process. The CFM 6.0 features 37 new or revised fault representations, including updates to the San Andreas system, faults in the Los Angeles and Ventura basins, offshore areas, and other regions. All additions and revisions come with a complete set of metadata that includes, among other information, naming based on fault system hierarchy, average strike/dip, source references, and the associated fault ID number in the USGS Quaternary fault and fold database.**

**The updated CFM model was developed through an open peer-review process involving 29 SCEC investigators, who evaluated and quantitatively ranked 23 current and alternative fault representations under consideration for CFM 6.0, and provided ca. 14K words of written comments. They used the SCEC CFM viewer and a web-based survey tool developed specifically for this purpose. The fault representations receiving the highest overall ranking by the reviewers were incorporated as "preferred representation" in CFM 6.0. As a result, 14 out the 23 faults were designated as new preferred version in CFM 6.0.**

**The CFM web viewer developed by SCEC (https://www.scec.org/research/cfm-viewer/) has been updated to deliver both the preferred and alternative fault representations in map and 3D views, and allows users to query and download fault surface meshes. In addition, the updated CFM viewer includes improvements to the selection of historic earthquake rupture, more UI enhancements, and the option to upload georegistered images and other data in Google Earth (.kml/.kmz) format. Finally, the SCEC community can now request additions or modifications to the CFM via a new webform, which also allows for upload of datasets and key references to constrain new fault representations. All these enhancements together will further facilitate the use of the SCEC CFM in earthquake science and seismic hazard assessment applications and the development of other related community-based structural models.**

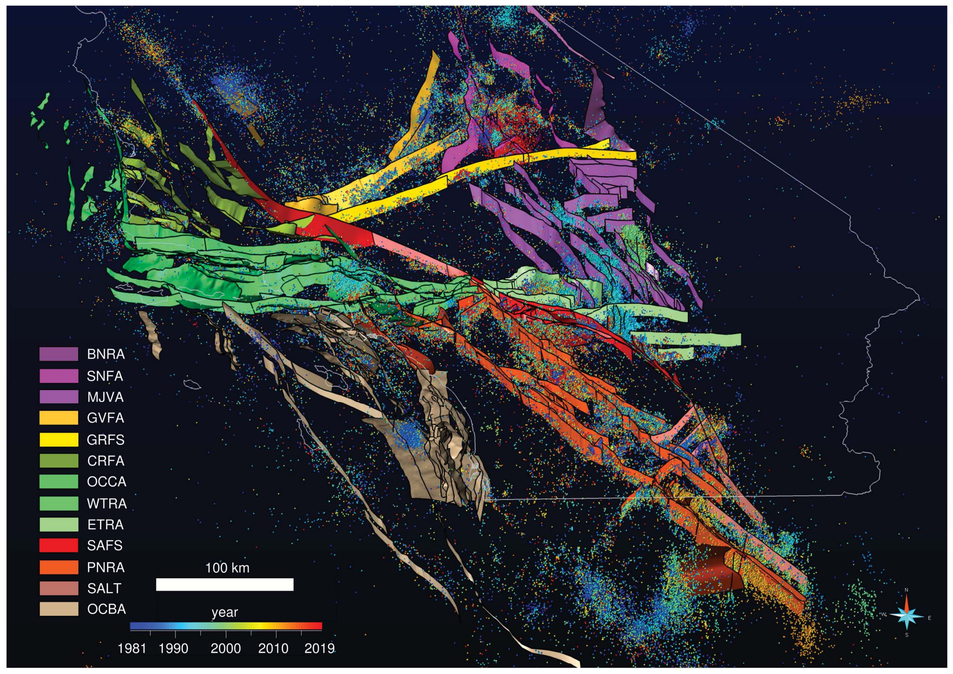


Fig. 1: Perspective view of the CFM v. 6.0. Faults are bounded at depth by the local seismogenic thickness and appear as bands. Fault color is mapped to fault area, the top level in a hierarchical naming system. Small dots are relocated hypocenters (Hauksson et al., 2012) which are colored by their time of occurrence. 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

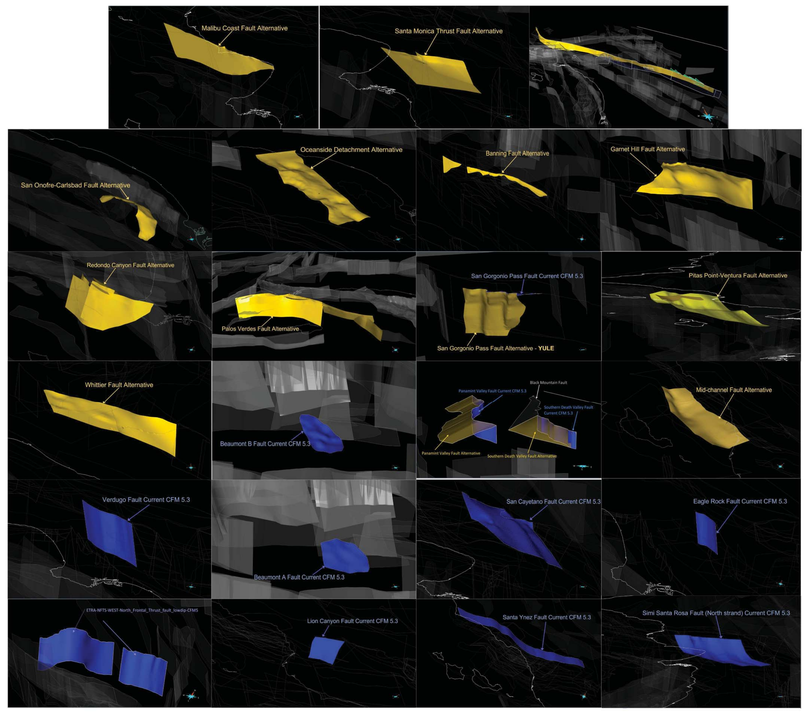


Fig. 4: All best ranked representations after peer review. Yellow representations are new and now preferred. Blue representations did not change status.

## 1. The Community Fault Model

The Community Fault Model 6.0 is the latest in a series of continued, incremental improvements to our understanding of the fault structure in Southern California. The model comprises more than 430 fault objects (figure 1) which are organized in a self-consistent manner with a system-level hierarchy (figure 2) that is reflected in its naming system. The top level of the hierarchy consists of 13 large, geomorphological fault areas (figure 1). The model considers faults and fault systems that are deemed capable of generating damaging earthquakes. The model will be formally released to the SCEC community and public this fall.

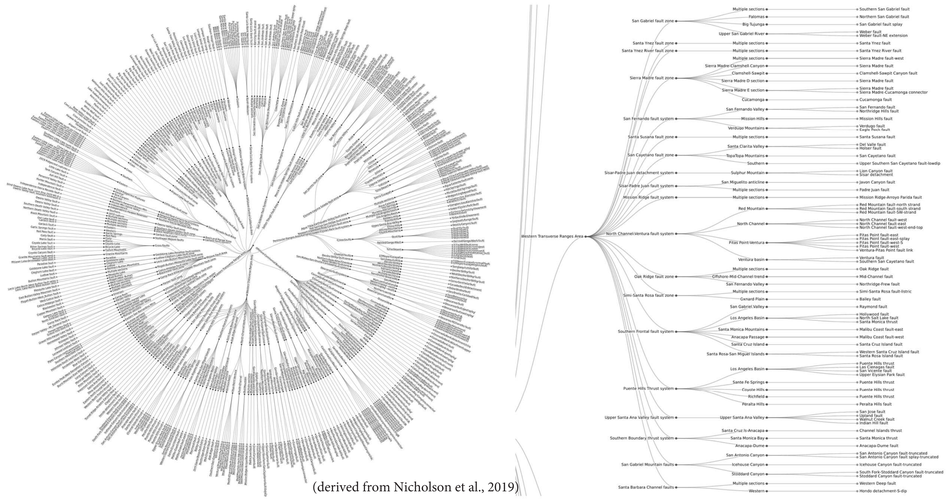


Fig. 2: Left: A radial tree diagram of 432 fault objects included in CFM 6. The hierarchical levels from the center outwards can be described as: fault area, fault zone, fault section and fault or fault strand. Right: A branch of the tree detailing the Western Transverse Ranges.

## 2. Community Peer Review of Fault Alternatives

The CFM includes alternative representations of many faults. In this year's open peer review of the model, participants evaluated and quantitatively ranked 23 current and alternative faults and fault assemblages, using written descriptions with references to source materials, as well as maps and 3d views for seismological and tectonic context. The review was completely web based (figure 3). As a result of the ranking process, 14 fault representations (figure 4) were designated as new preferred versions.

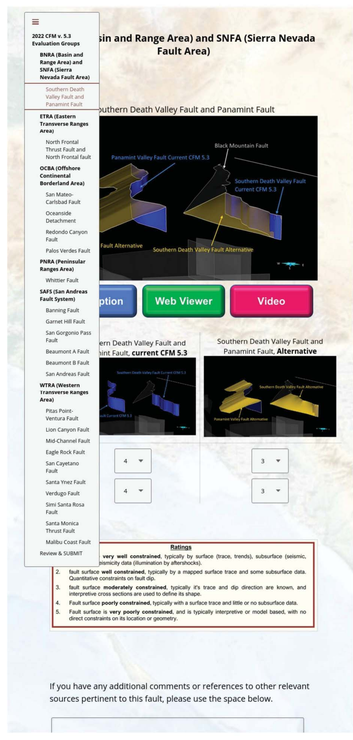


Fig. 3: Survey web page used to facilitate peer review. Each fault to review had such a page where a reviewer could access concise, written descriptions of faults and fault alternatives, could visualize alternative fault representations in map and 3d view, and provide ranking and comments. The underlying survey software tool managed access, distribution and the collection of responses.

## 3. Improvements to CFM Web Interface


Fig. 5: View of the updated CFM web tools zoomed to the Los Angeles region with new features highlighted. The view above shows two kml/kmz files loaded. The circles show locations of permanent GPS stations. The image overlay is a map from Dolan & Pratt (1997) of the Santa Monica Mountains regional geology. Allowing users to upload their own kml files allows for direct and easy comparison of user data to the CFM.

Fig. 6: Draft of new web form to collect requests for additions or modifications to the CFM.

References

Nicholson, C., Plesch, A., Sorlien, C. C., Shaw, J. H., Marshall, S. T., & Hauksson, E. (2019, 08). Continued Updates, Expansion and Improvements to the Community Fault Model (CFM version 5.3). Poster Presentation at 2019 SCEC Annual Meeting.

## Acknowledgments

We would like to express our warmest gratitude to all evaluators who agreed to participate and delivered: Akciz, Sinan; Carena, Sara; Cooke, Michele; Dawson, Tim; Don, Jessica; Elliot, Austin; Frost, Erik; Fuis, Gary; Ganas, Athanassios; Gath, Eldon; Hatem, Alex; Janecke, Susanne; Kamerling, Marc; Kyriakopoulos, Christodoulos; Legg, Mark; Luttrell, Karen; Madugo, Chris; Marshall, Scott; Meigs, Andrew; Nicholson, Craig; Onderdonk, Nate; Padilla Rodriguez, Alba; Plesch, Andreas; Scharer, Kate; Shaw, John H.; Sorlien, Chris; Wolfe, Franklin; Yule, John D; Zachariasen, Judy.

We thank Aspentech/Paradigm, and the Harvard Summer student program for generous support. SCEC grant #22066 helped fund this work.