

**Welcome to the
(online) SCEC SEAS Workshop!**

Brittany Erickson, Junle Jiang, Valère Lambert
Many thanks to Tran Huynh and Edric Pauk

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Session 1: Workshop Goals and Science Targets



Goals of this workshop:

- Welcome new participants and provide a history of SEAS activities.
- Review and discuss recent SEAS efforts and benchmark problems and how they related to scientific targets.
- Discuss upcoming benchmark problems.

History of SEAS:

- Held 1st workshop with dynamic rupture group in April, 2018 (thanks Ruth Harris)
- 1st SEAS-specific meeting (November) and acquired SCEC funding in 2018.
- This is our 5th workshop to date.

History of SEAS:

- Launched SEAS platform in 2018 (Michael Barall)
 - <https://strike.scec.org/cvws/seas/index.html>
- Have completed 6 benchmark problems, one paper published (24 co-authors) and one submitted (19 co-authors).

History of SEAS:

- First two benchmarks, BP1-QD and BP2-QD involving 11 modeling groups...

TABLE 2

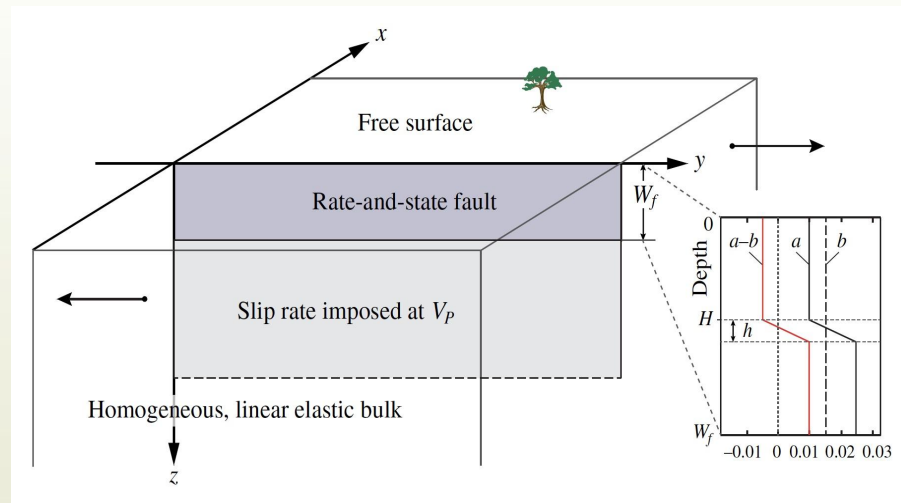
Details of Participating SEAS Codes and Modeling Groups

Code Name	Type	Modeler Name and Group Members	References
SCycle	FDM	abrahams (Abrahams/Allison/Dunham)	Erickson and Dunham (2014) , Allison and Dunham (2018) , see Data and Resources
FDCycle	FDM	erickson (Erickson/Mckay)	Erickson and Dunham (2014) , see Data and Resources
QDESDG	FEM	kozdon (Kozdon)	see Data and Resources
Unicycle	BEM	barbot (Barbot)	Barbot (2019)
FDRA	BEM	cattania (Cattania/Segall)	Segall and Bradley (2012b) , Bradley (2014)
BICycle	BEM	jiang (Jiang); lambert (Lambert/Lapusta); xma (Ma/Elbanna)	Lapusta et al. (2000) , Lapusta and Liu (2009)
QDYN	BEM	luo (Luo/Idini/van den Ende/Ampuero)	Luo and Ampuero (2017) , see Data and Resources
ESAM	BEM	liu (Liu); wei (Wei/Shi)	Liu and Rice (2007)

Erickson, Jiang et al. **SRL** (2020)

History of SEAS:

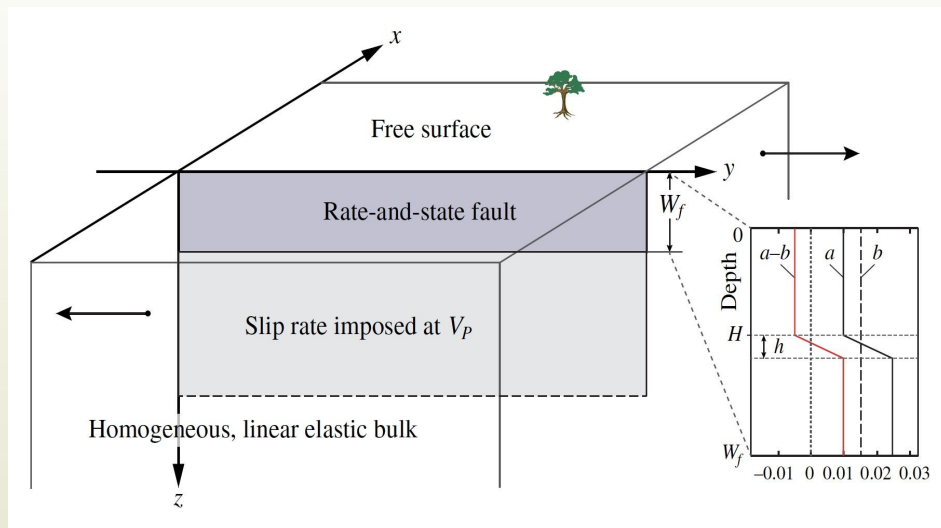
- ... and focused on a fundamental problem in crustal faulting based on Rice (1993), done in 2D with quasi-dynamic rupture.



Erickson, Jiang et al. **SRL** (2020)

History of SEAS:

- Our follow up benchmarks have focused on 3D problems, full dynamics and dipping fault geometries.



Erickson, Jiang et al. **SRL** (2020)

Overarching Science Targets:

- Advancing robust predictive models of earthquake source processes.
- Determining what physical processes explain observables.
- Complimenting and informing dynamic rupture simulations and earthquake simulators.

Persistent Numerical Challenges in SEAS modeling

- Variable time-stepping
- Choices in computational domain size and boundary conditions
- Problem nonlinearity and round-off errors
- How to determine legitimate solution differences?
- Numerical efficiency and computational performance
- Resolution of important spatial/temporal scales

Current Science Targets:

- Verifying SEAS models with increased complexity (e.g., full dynamics, dipping geometries, free surface).
- New benchmarks focused on fluid effects and additional problems in 3D.