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## From Elastic Deformation Loading Rates to Heat Flow Anomalies: Constraints on Seismic Efficiency and Friction Coefficient

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A long standing debate in seismology revolves around the nonexistent heat flow anomaly across the San Andreas fault. Given the fault's average slip rate and age, a strong San Andreas fault, i.e. characterized by a relatively high static friction coefficient of  $\mu \geq 0.6$ , should produce a significant local heat flow anomaly across the fault [1]. Since the work of Lachenbruch and Sass [1], this anomaly has not been observed and although many possible causes for the lack of a heat flow anomaly have been explored, the static or dynamic weakness of the San Andreas fault remains a favorable explanation [2,3].

Recently, we have introduced the ENergy CONserving Seismicity (ENCOS) framework that relates elastic deformation energy loading rates to the long-term average energy release of the seismic process. Within the presented implementation of ENCOS for Southern California with an elastic loading rate between 300 MW and 1.9 GW, the two most significant parameters are the static friction coefficient and the average efficiency. In particular, they are the most significant sources of uncertainty in harnessing the GPS-derived strain rates and the stress data within the ENCOS framework.

Here, we show how ENCOS can be leveraged in combination with the constraints from heat flow measurements and observed seismicity to restrict the parameter space of the average efficiency and the static friction coefficient. This can help to reduce the uncertainty of the ENCOS model parameters, such as the elastic deformation energy loading rate, and opens a new viewpoint on the heat flow paradox.

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[3] E. E. Brodsky et al. (2020), The State of Stress on the Fault Before, During, and After a Major Earthquake, *Annu. Rev. Earth Planet. Sci.* 48:2.1–2.26.