



The Collaboratory for the Study of Earthquake Predictability Version 2 (CSEP2): Testing Forecasts that Generate Synthetic Earthquake Catalogs

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The Collaboratory for the Study of Earthquake Predictability (CSEP) supports an international effort to conduct and rigorously evaluate earthquake forecasting experiments. CSEP has concluded its first phase of testing (CSEP1) with recent results published in the June/July 2018 Special Issue of *Seismological Research Letters*. CSEP1 experiments evaluate forecasts expressed as expected rates in small space-magnitude bins that can be updated at regular intervals (e.g., daily or yearly). This experiment design is simple and allows a wide range of models to participate. However, recently developed forecast models, including candidate models for authoritative Operational Earthquake Forecasting (OEF), can simulate thousands of synthetic seismicity catalogs (stochastic event sets), which express important dependency structures between triggered earthquakes. These forecasts eliminate the assumption that seismicity can be described by independent Poisson processes. As part of CSEP's second phase (CSEP2), we are redesigning CSEP's software system to support the testing of such model classes. Requirements include access to high-performance computing, distributed processing of forecasts and evaluations, and simplifying data management, as well as adhering to CSEP's principles of transparency and reproducibility within a controlled, open-source software environment. To begin CSEP2, we have redesigned core CSEP1 evaluations to be consistent with forecasts that produce stochastic event sets; namely, the N-test, the M-test, and the S-test. We apply these tests as part of a retrospective experiment that initially focuses on evaluating UCERF3-ETAS within the California testing region. Additionally, the CSEP2 evaluations are available as part of an open-source Python package that provides tools to conduct regional forecasting experiments.