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Assimilation of observations into physical models of the seismic cycle at subduction thrusts.

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Seismo-thermo-mechanical (STM) models are physics-based numerical models able to reproduce the main characteristics of the seismic cycles observed at subduction zones. By combining these models with surface observations through a sequential data assimilation technique, van Dinther et al. (GJI, in review) recently found it is possible to estimate the evolution of the stress on and around a fault in a simple subduction setup, when physical parameters are perfectly known. However, one of the crucial steps inhibiting the application of this method to nature is precisely the uncertainty on physical parameters. Here, we explore the possibility to jointly estimate physical parameters and the evolution of the state of stress using sequential data assimilation. Through appending parameters to the state vector in an Ensemble Kalman Filter, we will test the estimation of the shear modulus and seismogenic zone width in the same synthetic setup of an analogue seismic cycle model.

Reference:
Ylona Van Dinther, Hans R Künsch, and Andreas Fichtner. Sequential data assimilation for seismicity: Stress estimation on faults with pde models. submitted to Geophysical Journal International.