Supplementary information for

Insights on post-injection seismicity through analysis of the Enhanced Geothermal System at Basel (Switzerland)

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Introduction

We present in the Supporting Information the temporal evolution of numerically estimated plastic strain at the faults in the cases with fault C friction weakening enabled and disabled (Fig. S1). We also present the temporal evolution of the permeability at the faults (Fig. S2); and the temporal evolution of the plastic strain at the faults when each fault is the only one following a visco-plastic-behavior (Fig. S3). We illustrate on the Fig. S4 the difference of Coulomb Failure Stress changes calculated with COULOMB3 from the activation of the original clusters and from the simplified fault network.

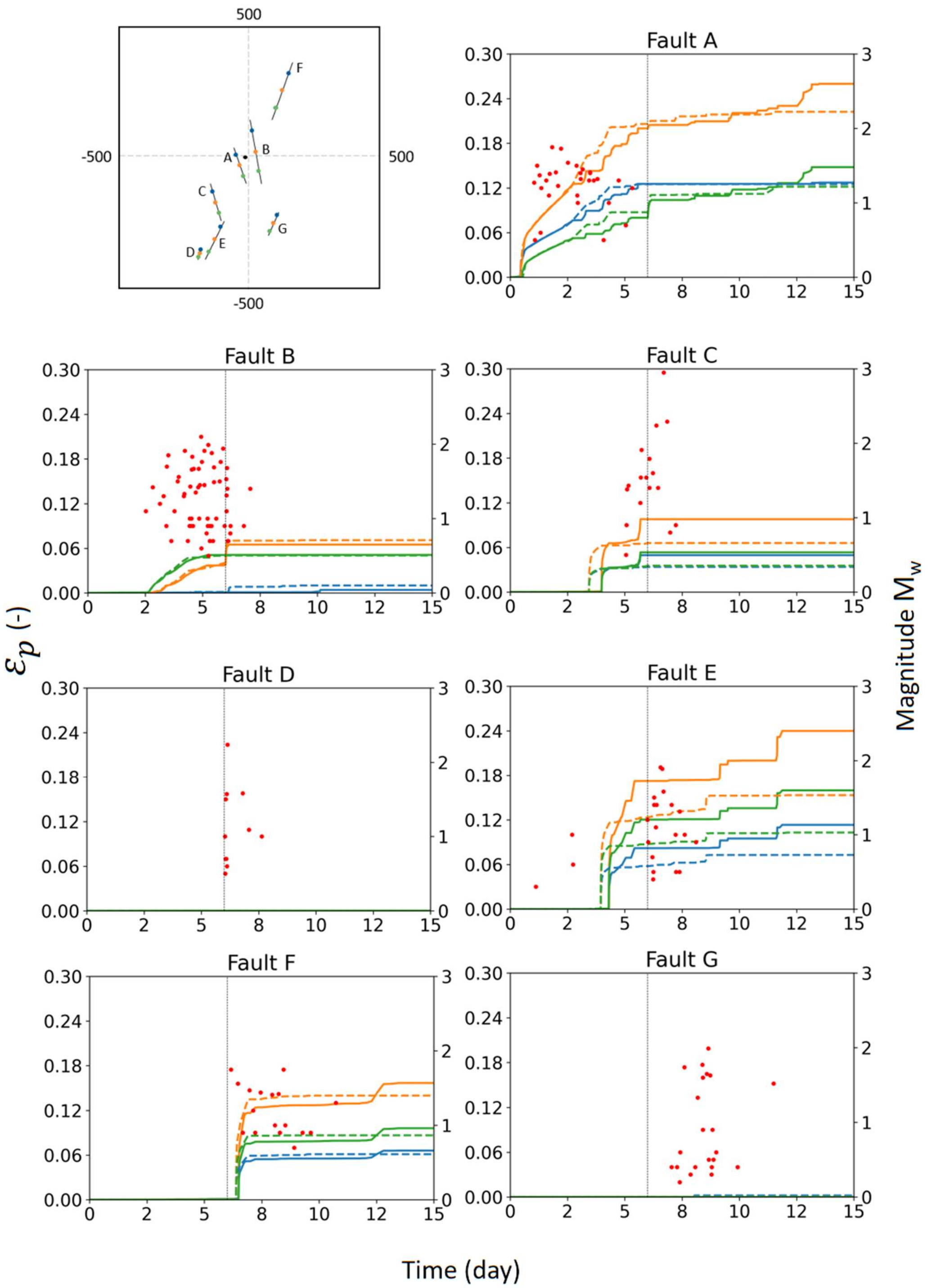

Fig. S1: Temporal evolution of numerically estimated plastic strain, ε_p (solid lines), at different locations on each fault as indicated in the upper left figure, and of the magnitude M_w of observed seismic events (dots) as reported by Deichmann et al. (2014). Solid and dashed lines correspond, respectively, to the cases with fault C friction weakening enabled and disabled. Fault C friction weakening affects the failure of the other faults in the reservoir, especially fault E.

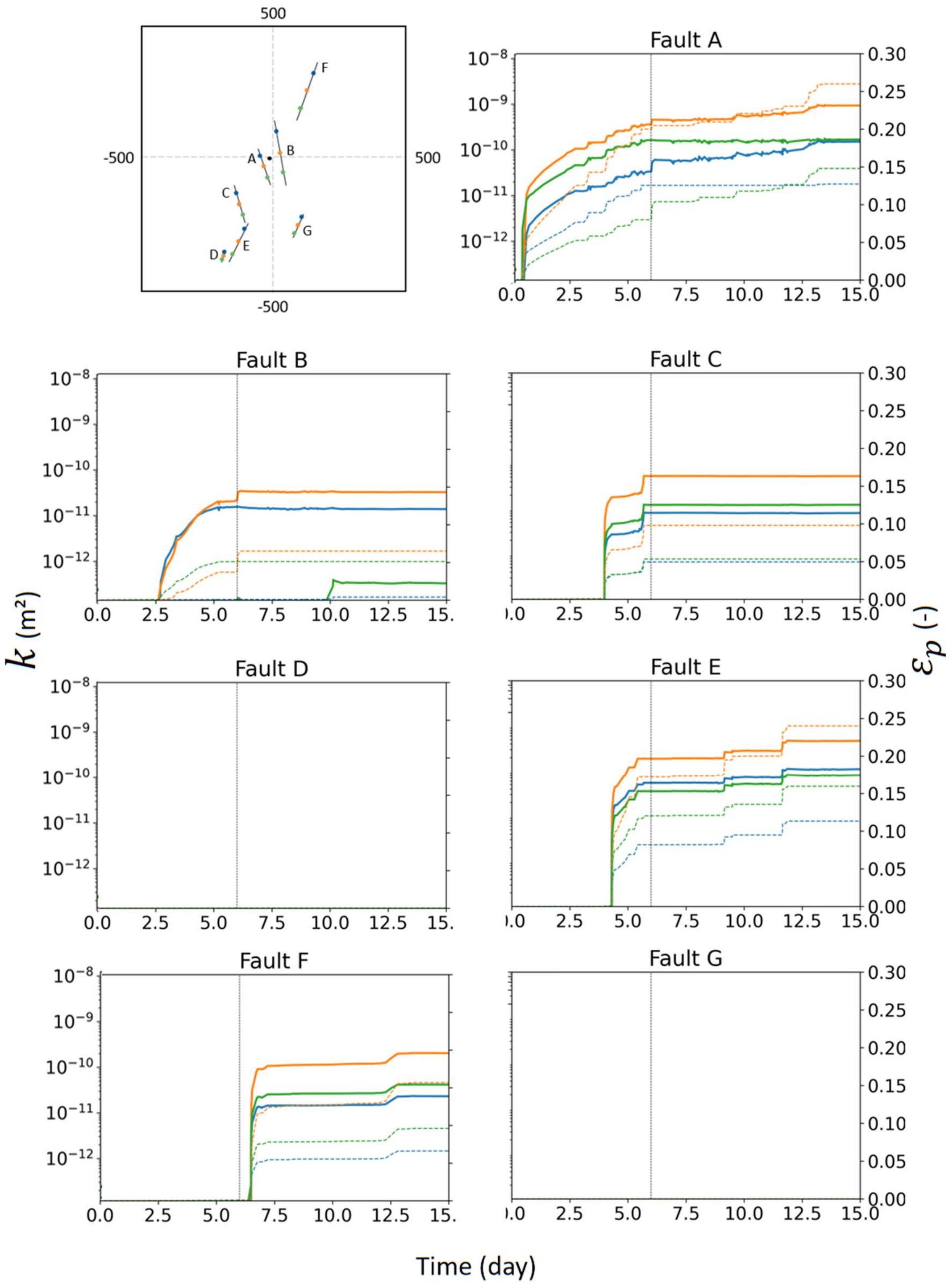

Fig. S2: Temporal evolution of numerically estimated permeability, k (continuous lines), and plastic strain, ε_p (dashed lines), at different locations on each fault as indicated in the first plot. Permeability variation evolves in agreement with ε_p and it is irreversible.

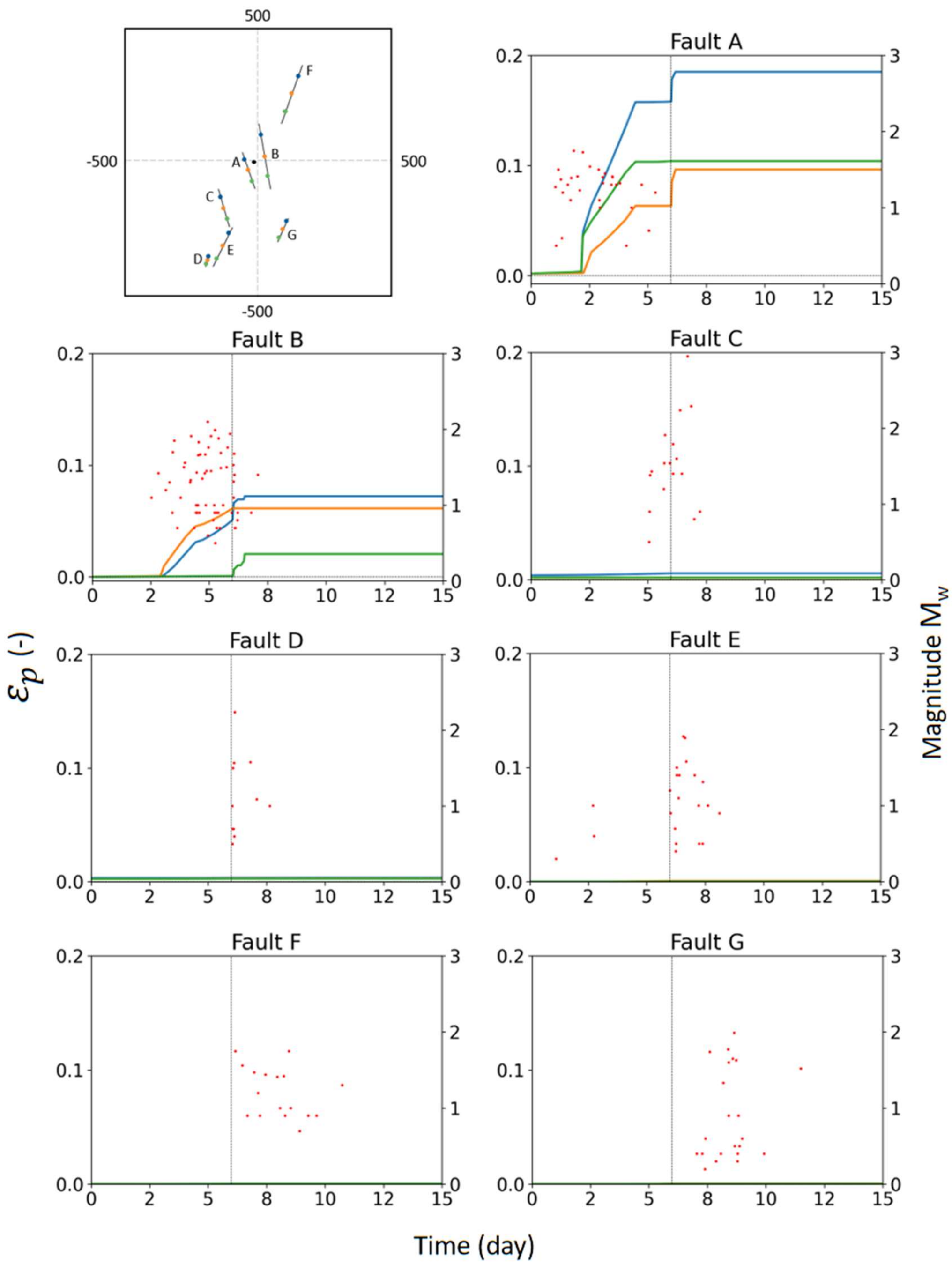

Fig. S3. Temporal evolution of numerically estimated plastic strain, ε_p (solid lines), at different locations on each fault when each fault is the only one following a visco-plastic-behavior, i.e., the stability of the fault is not influenced by shear-slip stress transfer of the other faults, and of the magnitude M_w of observed seismic events (dots) as reported by Deichmann et al. (2014). Note that ε_p is equal to 0 or close to 0 for most faults.

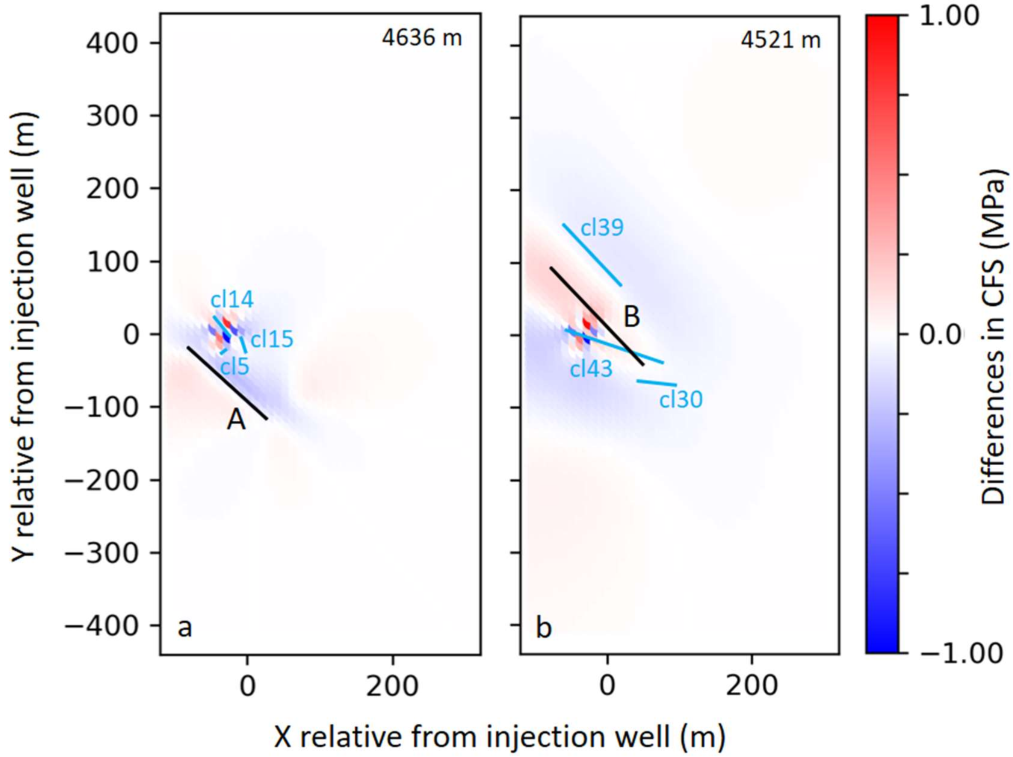

Fig. S4: Difference between the Coulomb Failure Stress (CFS) changes calculated with COULOMB3 for the case with activation of the original clusters (from Deichmann et al.,2014) and the simplified fault network reconstructed from the clusters oriented with the north, not the axes of the model. (a) difference of CFS changes (calculated on the orientation 120/88/-170) between the activation of clusters 14, 15, and 5, and the reactivation of fault A. (b) Difference of Coulomb stress changes (calculated on the orientation 155/50/-50) between the activation of clusters 43, 39, and 30 and the reactivation of fault B. Both results exhibit absolute values smaller than 1, confirming that the combination of three clusters into one fault is valid.