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The accumulated seismic moment of the locked Húsavík-Flatey fault, North Iceland, derived from an interseismic model using GPS time-series 1997-2010

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The Tjörnes Fracture Zone, North Iceland, is a 120 km transform offset of the Mid-Atlantic-Ridge that accommodates 18 mm/yr plate motion on two parallel transform structures and connects the offshore Kolbeinsey Ridge in the North to the on-shore Northern Volcanic Zone in the South. This transform zone is mostly offshore, except for a part of the right-lateral strike-slip Húsavík-Flatey fault (HFF) system that lies close to the coastal town of Húsavík, inducing a significant seismic risk to its inhabitants. In our previous work we used 4 years of continuous GPS measurements to constrain the locking depth and slip-rate of the HFF and found that the accumulated stress on the fault is equivalent to a $M_w 6.8\pm0.1$ earthquake, assuming a complete stress release in the last major earthquakes in 1872 and a steady accumulation since then (Metzger et al., 2011).

We here improve our previous analysis by adding 44 campaign GPS (EGPS) data to the 14 continuous GPS (CGPS) data. The EGPS points have been regularly observed since 1997 and substantially complement the CGPS data. We furthermore use InSAR time-series analysis to model temporal evolution of inflation of Theistareykir (the westernmost volcano of the NVZ) that mostly took place between 2007 and 2008 and derive an total volume change of 0.025 km^3. We use this modeling result to remove the transient volcanic signal from our GPS data in order to isolate the steady-state deformation rates within the TFZ.

The improved steady-state velocity field confirms the robustness of our previous result and allows us to better constrain the free model parameters. The uncertainties of the model parameters were estimated using two different methods, which both show that the addition of the EGPS data reduces the model parameter uncertainties by a factor of 2. For the HFF we find a slightly shallower locking depth of $6.1^{+0.8}_{-0.7}$ km and a slightly larger slip-rate of 6.8 ± 0.3 mm/yr than in our previous study, which again results in the same seismic potential as obtained in our previous work ($M_w 6.8\pm0.1$).

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