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Interseismic deformation of the Tjörnes Fracture Zone in North Iceland, inferred from GPS

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The Tjörnes Fracture Zone in northern Iceland is a 120 km-wide transform area connecting the offshore Kolbeinsey Ridge to the onshore Northern Volcanic Zone and accommodating about 18 mm/yr of transform motion. The transfer motion in the Tjörnes Fracture Zone is focused on two main lineaments. On one hand is the offshore Grímsey Oblique Rift to the North that consists of a set of left-stepping en-echelon basins bounded by N-S oriented strike-slip and normal faults, defining an overall bookshelf-like structure. The Húsavík-Flatey Fault to the South, on the other hand, is a 100 km-long right-lateral strike-slip fault, which is also mostly located offshore. The 20 km-long onshore part of the Húsavík-Flatey Fault lies beneath the town of Húsavík, resulting in a significant seismic hazard for the town.

We use geodetic data to study the present-day kinematics of the Tjörnes Fracture Zone, assess the distribution of the deformation in northern Iceland and determine the seismic moment accumulation rate on the Húsavík-Flatey Fault. Since 2006, the existing continuous GPS (CGPS) network in North Iceland has been progressively enhanced, improving the resolution and monitoring of the crustal deformation in the area. In 2017, we added two new CGPS stations, bringing the total number of operating CGPS stations in North Iceland to 20. Similarly, the number of campaign GPS (EGPS) markers has increased considerably during the past decade. We expanded the network to the west in 2013 with 23 new sites and added four more points in 2016, resulting in a dense EGPS network of 84 markers. The campaign GPS network has been completely or partially remeasured 12 times since 1997, with the last two full campaigns in 2013 and 2016, providing us with almost 20 year-long GPS time-series. We use these long GPS time-series (both continuous and campaign GPS) to produce a new velocity field of the Tjörnes Fracture Zone and to further improve the slip-rate and locking depth determinations of the main lineaments.