EGU2020-6806
https://doi.org/10.5194/egusphere-egu2020-6806
EGU General Assembly 2020

Fault geometry and dynamics during the 1993-1998 uplift episode in Hengill, SW-Iceland

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The Hengill volcanic complex in SW-Iceland is located on a triple junction where two extensive and one conservative plate boundary meet. An uplift event, possibly caused by a magmatic intrusion, in the 1990ies caused a landrise of 8 cm over the period of 4 years and was accompanied by more than 90.000, mostly very small, earthquakes. We used cross-correlation to improve pick accuracy and applied a relative relocation algorithm to get high resolution earthquake locations of the earthquakes in the direct vicinity of the centre of the uplift. Relocated earthquake location reveal clustering and alignments of earthquakes that are mostly oriented in NNE and ENE direction. Then we recalculated focal mechanisms for the new locations and then use the Quakelook software to select the best fitting focal mechanism. Quakelook calculates a plane that best fits the locations of a cluster of earthquakes which then is compared to the database of possible focal mechanisms that all explain the polarity and amplitude data similar well. The projection of the slip vectors into the fault plane is then used to estimate the average movement along the fault. From the fault dynamics we learn about the stresses activating that fault.

The relocated earthquake distribution shows that the stresses induced by the uplift event must have been small in comparison to the regional stress since the activated faults do not respect the geometry of the uplift source but are rather in agreement to the regional stress field. The uplift did not cause any new breaks in the crust but rather reactivated existing faults which sub-optimally oriented in relation to the uplift.