**Strain rates and earthquake sequences in the South Iceland Seismic Zone**

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Abstract:

The South Iceland Seismic Zone (SISZ) accommodates E-W translation due to oblique spreading between the North American/Hreppar microplate and Eurasian plate, in South Iceland. Strain is released in the SISZ during earthquake sequences that last days to years, at average intervals of 80-100 years. The SISZ is currently in the midst of an earthquake sequence that started with two M6.5 earthquakes in June 2000, and continued with two M6 earthquakes in May 2008. Estimates of geometric strain accumulation, and seismic strain release in these events indicate that they released at most only half of the strain accumulated since the last earthquake cycle in 1896-1912. Annual GPS campaigns and continuous measurements during 2001-2015 were used to calculate station velocities and strain rates from a new method using the vertical derivatives of horizontal stress (VDoHS). This new method allows higher resolution of strain rates than other (older) approaches, as the strain rates are estimated by integrating VDoHS rates obtained by inversion rather than differentiating interpolated GPS velocities. Estimating the strain rates for eight 1-2 year intervals indicates temporal and spatial variation of strain rates in the SISZ. In addition to earthquake faulting, the strain rates in the SISZ are influenced by anthropogenic signals due to geothermal exploitation, and magma movements in neighboring volcanoes – Hekla and Eyjafjallajökull. Subtle signals of post-seismic strain rate changes are seen following the June 2000 M6.5 main shocks, but interestingly, much larger strain rate variations are observed after the two May 2008 M6 main shocks. A prominent strain anomaly is evident in the epicentral area prior to the May 2008 earthquake sequence. The strain signal persists over at least 4 years in the epicentral area, leading up to the M6 main shocks, increasing in magnitude with time. The strain rates are very large during the first year after the May 2008 main shocks, and remain still larger than the strain rates observed following the June 2000 mains hocks.