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Interseismic stress field variations in Hjalli-Ölfus, SW Iceland

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Western South Iceland Seismic Zone (SISZ) plate boundary lies adjacent to the Hengill central volcano. The sinistral SISZ connects the two arms of the divergent Mid-Atlantic Ridge (MAR) plate boundaries (Western and Eastern Volcanic Zones; WVZ, EVZ), while Hengill is a part of the WVZ. Seismicity in western SISZ, also known as the Hjalli-Ölfus region, closely interacts with the seismicity and magmatism in Hengill. For instance, the 4 June 1998 Mw 5.4 Hengill earthquake witnessed aftershocks that extended south to meet the Hjalli-Ölfus segment. This segment then hosted the Mw 5.1 Hjalli-Ölfus earthquake that occurred on 13 November 1998; elucidating the Hengill-Ölfus interaction. Relative relocations of earthquakes from July 1991 to December 1999 in Hjalli-Ölfus indicate that the seismogenic zone is predominant at 4-8 km depth, with 80% of the events occuring along an ~ENE-WSW trending seismic zone with lateral extension of ~12 km. The remaining occur along N-S faults, much like the observed norm of dextral faulting along the rest of the SISZ (e.g., 17 June 2000, 29 May 2008 earthquakes; Árnadottir et al., 2001; Brandsdottir et al., 2010). These relocated earthquake sequences were used to perform stress inversions within specified spatio-temporal grids. The results show that from 1994 to 1997, the western part of the Hjalli-Ölfus region exhibits an oblique normal stress regime, while the eastern part remains consistently strike-slip in nature. From mid-1997 to June 1998 western Hjalli-Ölfus shifts from an oblique normal to a strike-slip stress regime, while the eastern part maintains the strike-slip character of the SISZ. However, two months after the 4 June 1998 Hengill earthquake, the western part shifts back to an oblique normal regime, which loses a part of its normal-faulting tendency after the 13 November 1998 Hjalli-Ölfus earthquake. This variation in stress fields between two significant events on conjugately oriented prodominantly strike-slip faults is a clear example of these features influencing one another between seismic episodes.