Reviewed research article

Crustal deformation in Iceland: Plate spreading and earthquake deformation

Thóra Árnadóttir [1], Halldór Geirsson[2] and Weiping Jiang[1,3]

[1] *Nordic Volcanological Center, Institute of Earth Sciences, University of Iceland, IS-101 Reykjavík, Iceland*

[2] *Physics Department, Icelandic Meteorological Office, Reykjavík, Iceland*

[3] *GPS Research Center, Wuhan University 129 Luoyu Road, Wuhan 430079, China;*

thora1@hi.is, dori@vedur.is, wpjiang@whu.edu.cn

Abstract — *Iceland is located on the Mid-Atlantic ridge, at a divergent plate boundary separating the North America and the Eurasia plates. It is therefore one of the few places on Earth where active plate spreading can be observed on land. Numerous GPS studies have been conducted in Iceland, starting in 1986 and a local network of continuous GPS stations (ISGPS), initiated in 1999, is rapidly expanding. In general, the relative horizontal velocities observed with GPS agree well with predictions from plate motion models, such as NUVEL-1A and REVEL. The plate spreading across Iceland is accommodated by extension across the Northern and Eastern Volcanic Zones, with shear across the Tjörnes Fracture Zone, the South Iceland Seismic Zone and the Reykjanes Peninsula. A small component of extension is observed across the Western Volcanic Zone and the Reykjanes Peninsula. Geodetic studies, including studies of post-seismic deformation following two* M_w*=6.5 earthquakes in June 2000, indicate that the elastic part of the crust in south Iceland is about 10 km thick, and that lower crust/upper mantle viscosities are low (5–10* $\cdot$ 10^{18} *Pa s). Early GPS surveys (1987–1992) in North Iceland showed high rates of extension across the Krafla fissure swarm while velocities determined from two nationwide GPS surveys in 1993 and 2004 agree with plate motion model preditions. This indicates that the post-rifting signal following the Krafla Fires (1975–1984) has decreased significantly. The transient deformation due to moderate size earthquakes and smaller rifting events, therefore appears to be a short lived phenomenon (on the order of a decade) compared to the typical time interval between events (hundred years).*