



Rapid uplift and plate spreading observed by GPS in Iceland

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Two nationwide GPS campaigns (termed ISNET) were done in Iceland in 1993 and 2004, measuring at about 120 campaign sites evenly distributed over the whole country. The data were processed using the GAMIT/GLOBK software, estimating the site velocities in the ITRF2000. The time series were corrected for several $M > 5$ earthquakes, volcanic intrusions and eruptions that occurred during the time spanned by the two surveys. The results provide a unique map of the average velocity field over the whole country during 1993-2004. The vertical ISNET velocities indicate significant uplift rates (~ 1 cm/yr) over a large part of central and southeastern Iceland, providing a more coherent view of the extent of the area of uplift than has been obtained from previous GPS studies. Finite element models of glacio-isostatic adjustment due to the thinning of the Vatnajökull and three other large ice caps in Iceland since 1890, explain the broad area of high vertical velocities, assuming a viscosity of $8-10 \times 10^{18}$ Pa s, below a 10 km thick elastic plate. The residual vertical velocities indicate several areas of uplift or subsidence, which may be related to local magmatic processes. The horizontal ISNET velocities indicate that the spreading is mainly accommodated within ~ 100 km wide areas across the active volcanic zones in north and southeast Iceland. The horizontal velocities from 1993-2004 across the Northern Volcanic Zone, suggest little post-rifting signal following the 1975-1984 Krafla rifting episode. We explore a range of rheological models to reconcile the temporal horizontal velocity variation across the NVZ and spatial variation of vertical velocities in Iceland.