First Epoch GPS Survey of the Hengill Triple Junction, SW Iceland, and the Effect of Ocean Loading.

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Abstract *– In 1991 a 23 point, 30 x 25 km Global Positioning System (GPS) geodetic network was established in the Hengill ridge-ridge-transform triple junction, South Iceland. The network was tied to regional points up to 75 km distant to the west and east. Measurements were made using Ashtech C/A code receivers during sessions which averaged eight hours for baselines of 35 km or less and 20 hours for the 75 km baselines. Data processing was conducted using the Bernese V3.2 software. The best solution was an ambiguity-fixed solution, which, after network adjustment, yielded scaled formal errors (accuracies) of less than 1 cm in the horizontal and about 1 cm in the vertical for the majority of the points. Theoretical predictions of the effect of ocean loading in S Iceland suggest that diurnal variations of up to 6 mm in the vertical and 2 mm in the horizontal components are to be expected for lines up to about 75 km long (Wu-Ling and Morgan, unpublished computer program). Diurnal variations in the height differences between points were generally 50-60 mm however, indicating that the effects of other error sources far exceeded those of ocean loading in the case of our survey. The effect of ocean loading therefore does not need to be modelled for surveys of the kind we conducted, although the importance of this effect would increase with line length and for surveys of higher accuracy.*

INTRODUCTION

Iceland is a uniquely large, subaerial exposure of oceanic crust traversed by up to 700 km of accretionary plate boundary, which contain over 30 spreading segments and two complex fracture zones (Saemundsson, 1986). It offers unparalleled opportunity to study crustal deformation processes associated with oceanic crustal extension. These processes include coseismic, and possible preseismic deformations associated with large-magnitude earthquakes, magma chamber inflation and deflation (e.g., Björnsson *et al.*, 1977), dyke injections (e.g., Moller and Ritter, 1980), post-seismic and post-dyking deformation (e.g., Foulger *et al.*, 1992; Heki *et al.*, 1993) and slow, continuous plate movements and rift deformation (e.g., Tryggvason, 1982).

Geodetic surveys using the Global Positioning System (GPS) have been conducted in Iceland almost annually since the system became usable for field surveying. Large, regional networks encompassing most of the country were installed and measured in 1986 and 1987, and remeasured and extended in 1989, 1990, 1991, 1992 and 1993 (Foulger *et al.*, 1987; 1993; Jahn *et al.*, 1989; Hackman, 1991; Jahn *et al.*, 1994; Sigmundsson *et al.*, 1992; Foulger *et al.*, 1992; Heki *et al.*, 1993; Sturkell *et al.*, 1994). Deformations detected by this work include shearing in the South Iceland Seismic Zone (SISZ) and the Reykjanes Peninsula, deflation of a magma chamber beneath the Hekla volcano and post-dyking viscoelastic strain release in North Iceland.

The Hengill triple junction is the meeting point of the Reykjanes Peninsula and the Western Volcanic accretionary zones and the SISZ. It has a recent history of volcanism, rifting and destructive earthquake ac-