Absolute gravimetry at UMB in 2005 – preliminary results obtained with FG5-226

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Abstract
We review the field observation campaigns with the absolute gravimeter FG5-226 in Norway and Sweden in 2005. First epoch observations were collected at two new sites in Finnmark (Honningsvåg and Kautokeino) and Hordaland (Jondal 1 and 2). Follow-up observations to first epoch results by IfE (FG5-220) in 2004 were made at Bodø and Andøya. The other sites (Hønefoss, Kolsnes 1 and 2, Onsala AS and AN, Smøgen, Trysil, Trondheim, Tromsø, and Ås) all have a history of previous observations by several instruments. The standard deviations are typically ±2μGal. Strong winds added noise to some coastal sites. Insufficient modeling of ocean loading tides also affects the preliminary error estimates of Arctic latitude sites. Final values will be derived with improved data processing following an ongoing study of the ocean loading phenomenon.

Introduction

FG5-226 visited the manufacturer Micro-g Solutions Inc. (now: MicrogLaCoste Inc.) in USA for maintenance and alterations in early 2005. Upon its return to Norway in June 2005 it was mounted in the gravimetry laboratory at Ås for alignment and verification measurements. Field campaigns were carried out in Norway in June-July-August and in Sweden in October. During the latter, FG5-226 was compared to FG5-220 by simultaneous observing at Onsala. Verification measurements were made at Ås between and after the campaigns.

Observational campaigns

Table 1 lists the observing dates and other information for each site. The campaign in June included one mountain station (1200 meters above sea level) and one station near sea level in the neighbourhood of the Folgefonni glacier complex. Two other sites on the west coast of Norway are located close to each other and were observed in 1997 with a US NGS FG5 by University of California. The campaign in July and August included stations separated by about one day of driving. The stations in Finnmark are new additions to the network. Tromsø required special coordination due to ongoing measurements with other types of equipment.

None of the sites in these campaigns were supplemented by ground water measurements, except Trysil where all three wells were measured repeatedly. Most sites lack ground water wells altogether. The coastal sites are near tide gauges.

Table 1. Observing log

Date	Site	Observers	Remarks
2005 Jun 14-22	Ås	JGOG	
2005 Jun 25-27	Jondal 1 and 2	JGOG	New stations
2005 Jun 27-30	Kolsnes 1 and 2	JGOG, DIL	
2005 Jul 4-5	Ås	JGOG	
2005 Jul 13-14	Hønefoss	BRP	
2005 Jul 16-17	Trondheim	OCDO	
2005 Jul 19-21	Bodø	OCDO	
2005 Jul 23-24	Andøya	OCDO	
2005 Jul 28-30	Honningsvåg	DIL	New station
2005 Aug 1-2	Kautokeino	DIL	New station
2005 Aug 4-5	Tromsø	DIL	
2005 Aug 10-14	Ås	JGOG, BRP	
2005 Aug 15-17	Trysil	BRP	
2005 Oct 7-10	Smögen	BRP, KB, AE	
2005 Oct 10-12	Onsala AN	BRP, KB, AE	
2005 Oct 12-13	Onsala AS	BRP, KB, AE	
2005 Dec 13-18	Ås	KB, BRP	

Preliminary results

With the exception of the home site Ås, each site occupation generated between 2000 and 3000 observations (Table 2). Each occupation consisted of 2-3 runs, mostly of duration 24 hours. Hourly data sets consisted of 50 or 100 drops.

Table 2. Preliminary results

Site	**Date**	**No. of obs**	**precision [µGal]**	**Remarks**
Ås	2005 Jun 14-18	4769	± 1.5	
Ås	2005 Jun 22-23	1490	± 1.2	
Jondal-1	2005 Jun 25-26	4232	± 2.0	Near glacier
Jondal-2	2005 Jun 26-27	3373	± 1.2	Ocean level
Kolsnes-1	2005 Jun 27-31	2440	± 2.2	
Kolsnes-2	2005 Jun 28-30	2189	± 1.5	
Ås	2005 Jul 04-05	2140	± 1.3	EQ removed
Hønefoss	2005 Jul 13-14	2292	± 3.1	
Trondheim	2005 Jul 16-17	2341	± 2.2	
Bodø	2005 Jul 19-21	2840	± 3.0	Strong wind
Andøya	2005 Jul 23-24	2198	± 3.1	Strong wind, EQ
Honningsvåg	2005 Jul 28-30	2976	± 4.5	Strong wind
Kautokeino	2005 Aug 01-02	2290	± 2.2	
Tromsø	2005 Aug 05-07	2394	± 2.0	
Ås	2005 Aug 10-14	4030	± 2.7	
Trysil	2005 Aug 15-17	2634	± 2.3	EQ removed
Smögen	2005 Oct 7-10	2341	± 2.3	EQ removed
Onsala-AN	2005 Oct 10-12	2747	± 2.4	
Onsala-AS	2005 Oct 12-13	2044	± 2.2	
Ås	2005 Dec 13-18	7178	± 2.8	

The rms-scatter around the mean is typically ±2μGal. This value reflects the instrumental noise at the site as well as effects of subjective operator alignments between each run. Bodø, Andøya, and Honningsvåg show rms-values of ±3 - 4.5 μGal. These three sites were affected by prevailing strong winds during the observations. The added ground noise was supplemented by nearby breaking ocean waves for these coastal sites.

A major component of the preliminary rms-value is due to insufficient modelling of ocean loading tides at Arctic latitudes, however. This is directly identifiable from the observed time series. Improved data processing will reduce the rms-values of future final results. This problem is now being addressed in a separate study.

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