

RELATIVE GRAVITY MEASUREMENTS IN KELLYVILLE AND KANGERLUSSUAQ IN JULY 2013



Final Report

June 22, 2015

Prof. Dr. Olivier Francis
*University of Luxembourg
Faculty of Sciences, Technology and Communication
Campus Kirchberg
6, rue Coudenhove-Kalergi
L-1359 Luxembourg
Grand-Duché de Luxembourg*

Tel. : +352 46 66 44 6264, Email : olivier.francis@uni.lu

Foreword

This report contains the results of relative gravity measurements carried out in Kellyville and Kangerlussaq (Greenland) in July 2013. They were performed during the absolute gravity measurements with the FG5X-216 from the University of Luxembourg in Kellyville. This station was established by NGS/NOAA in 1995. Absolute gravity measurements have been repeated several times but irregularly.

René Forsberg kindly provided us with the gravity station descriptions from the National Gravity Net. We present the results of the vertical gravity gradient at the absolute gravity station and the gravity ties from that station to two stations from the National Gravity Net. We are grateful to René Forsberg for his kind and friendly cooperation.

1. Vertical Gravity Gradient

The vertical gravity gradient was measured at the outdoor absolute gravity site in Kellyville. We measured the gravity differences between three different levels (0.260 m, 0.861 m and 1.263 m) above the benchmark (Figure 1). We obtained a linear vertical gravity gradient of -3.316 ± 0.012 microGal/cm.



Figure 1. Vertical gravity gradient measurements with a Scintrex CG5 at outdoor absolute gravity station in Kellyville.

2. Relative measurements

Relative gravity measurements were carried out with the Scintrex CG5-010 from the University of Luxembourg. The base station of the network is the outdoor absolute gravity station in Kellyville, named "00001".

Two gravity stations (68201, 68202) from the National Gravity Net were visited (see Figures 2 and descriptions in the annexes). Both stations established in 1982 are still existing. There is no plate at the station 68201 while the plate at the station 68202 is in excellent condition.



Station 00001: Absolute gravity site in Kellyville



Station 68201: Kangerlussuaq Terminal Airport.



Station 68202: Previously Hotel "Arctic" hotel, in 2013 City Jail.

Figures 2. Gravity stations of the relative network measured in Kellyville and Kangerlussuaq.

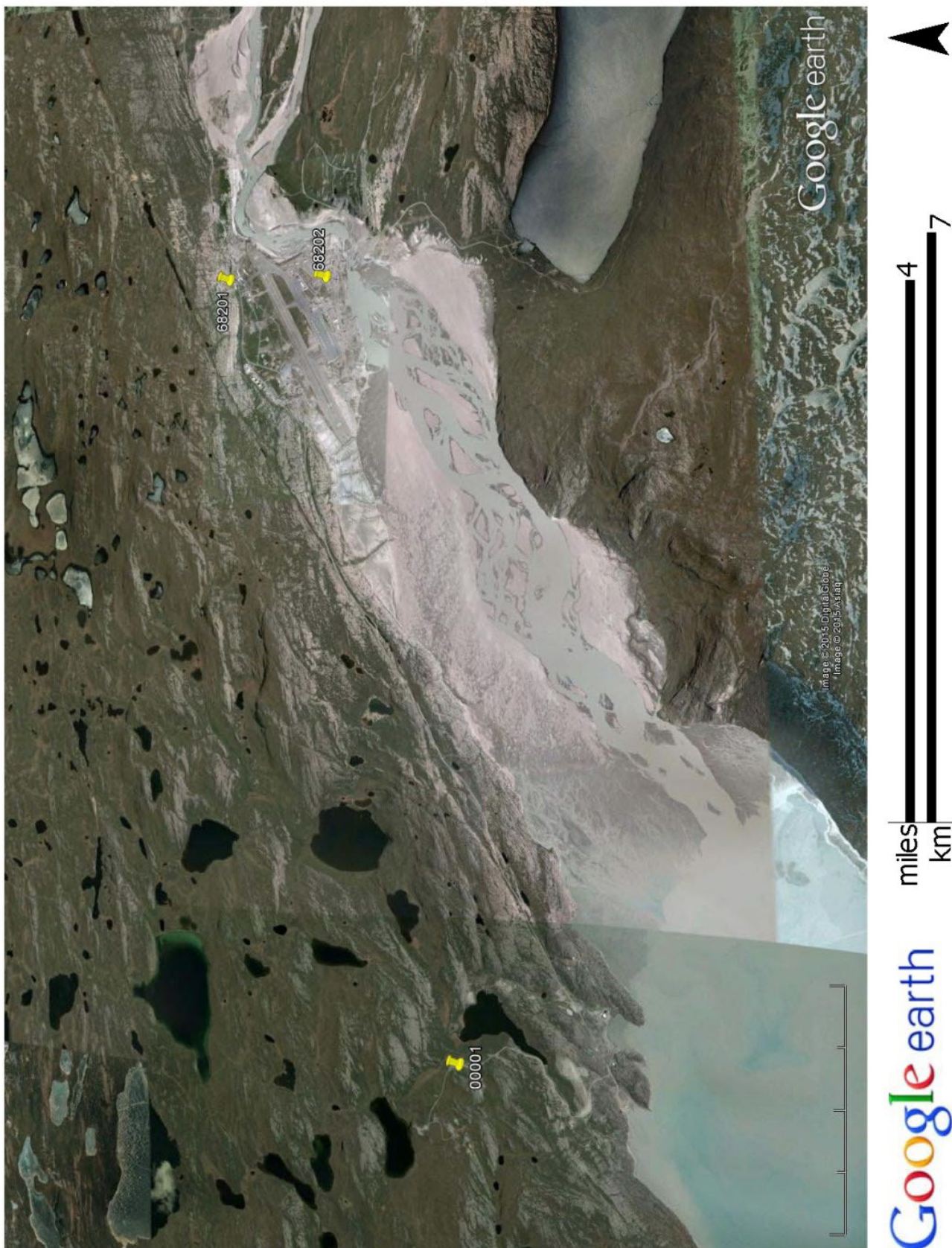


Figure 3. Locations of the gravity network sites measured in Kellyville (00001) and Kangerlussuaq (68201 and 68202)

First, we measured the gravity difference between stations 68201 and 68202. Then, we measured the difference between the station 68201 and the absolute gravity station in Kellyville (00001). The data are presented in table 1.

Table 1. Measured relative gravity ties in Kangerlussuaq and Kellyville in microgal.

Station	00001	68201	68202
00001	0	20715.1 ± 3.4	
68201		0	5309.7 ± 3.6
68202			0

We can then calculate the gravity differences between each station and the absolute gravity station (Table 2).

Table 2. Relative ties in Ilulissat.

Site	Code	Lat	Long	Altitude	Δg	RMS
				/m	/microGal	microGal
Outdoor absolute station in Kellyville	00001	66.9873	-50.9448	195	0	
Airport Terminal Kangerlussuaq	68201	67.0195	-50.6950	49	20715.1	3.4
Hotel "Arctic" Kangerlussuaq	68202	67.0066	-50.6958	34	26024.8	5.0

Now, from the absolute gravity values obtained with the FG5X-216 of the University of Luxembourg at the station 00001, we can deduce the gravity values at the two other stations (Table 3).

Table 3. Gravity value at the Gravity Net stations in Ilulissat.

Station	g	Uncertainty
	/microgal	/microgal
00001	982 347 118.9	2.2
68201	982 367 834.0	4.0
68202	982 352 428.6	5.4

Conclusions

In July 2013, two National Gravity Net stations from Kangerlussuaq have been re-measured with respect to the absolute gravity station in Kellyville with a relative gravimeter Scintrex CG5. From these measured gravity differences and the absolute gravity measurements of the FG5X-216 made at the same epoch, we estimated the gravity values as well as their uncertainties at those stations.

References

- Nielsen J. E., Absolute gravimetry - for monitoring climate change and geodynamics in Greenland, Ph. D. Thesis, DTU Space, (ISBN: 978-87-92477-19-4), pages: 152, 2013.
- Timmen, L., Gitlein, O., Müller, J., Strykowski, G. and R. Forsberg, Absolute gravimetry with the Hannover meters JILAg-3 and FG5-220, and their deployment in a Danish-German cooperation, Zeitschrift für Vermessungswesen (zfv), Heft 3/2008, 133. Jahrgang, S. 149-163, 2008.

ANNEXES - Gravity station descriptions



Station Nr. 68201 Søndre Strømfjord term.



FPB 9122-82

Beliggenhed: Geografiske koordinater (hele sek.).

Bredde: 67°01.4' N. Længde: 50°42.0' W. Kote: 49 m.

Journal side: 41203, 41252 Måleår: 1982 Observator: RF, KE, PW
1988, 1991 RF, SE

Afmærket på foto	rute	billede	rute	billede
Lodfoto 1:150 000			Skråfoto	
— —			—	
— 1:50 000			—	
— —				
—			Terr. foto	nr. 8220-8
—			—	8221-2

Etableringsform:

Bronzeplade (1991)
Bolt
Boret hul
Anden: Canadisk plade?
Ingen

Signalering:

Varde m
Pille m
Stang m
Terrænsignal
Anden:
Ingen

Naturligt fixpunkt:

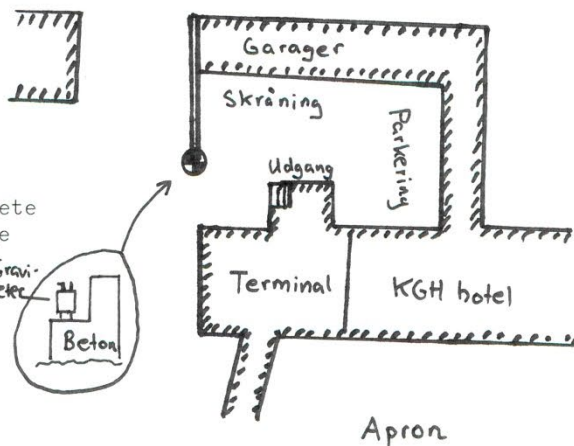
Observationer:

Astro Doppl Trig Baro Grav Vandst Niv

Supplerende oplysninger (skitser, opstigning etc.):

Ud for transithallens bagside på betonstøbning ved rækværk mellem udkørsel og parkeringsplads. Ca. 1 m fra S.enden af støbningen på kant ca. 45 cm over jordniveau.

Søndre Strømfjord, outside SAS terminal, on a ledge of a concrete wall extending south of a garage building N of the combined hotel/terminal building. Station is 1 m from the south end of the small wall, ca. 45 cm above ground level.





Station Nr. 68202 Søndre Strømfjord "Arctic"

EPB 9143-82



Beliggenhed: Geografiske koordinater (hele sek.).

Bredde: 67°00.7' N. Længde: 50°42.0' W. Kote: 34 m.

Journal side: 41203, 41252 Måleår: 1982 Observator: RF, KE

Afmærket på foto	rute	billede	rute	billede
Lodfoto 1:150 000			Skråfoto	
— —			—	
— 1:50 000			—	
— —				
—			Terr. foto	nr. 8220-1,2,3
—			—	

Etableringsform:

Bronzeplade
 Bolt
 Boret hul
 Anden:
 Ingen

Signalering:

Varde m
 Pille m
 Stang m
 Terrænsignal
 Anden:
 Ingen

Naturligt fixpunkt:

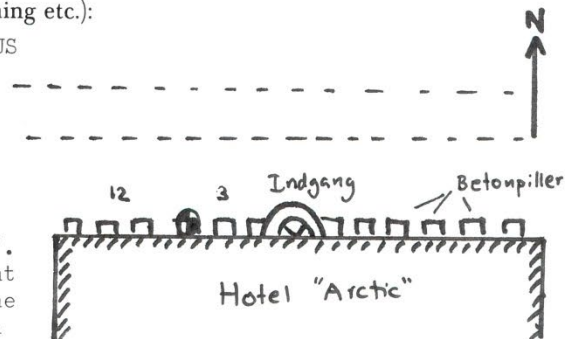
Observationer:

Astro Doppl Trig Baro Grav Vandst Niv

Supplerende oplysninger (skitser, opstigning etc.):

Søndre Strømfjord, Hotel "Arctic", US basen. På betonpille på nordsiden af bygningen, nr. 3 til højre (vest) for hovedindgangen (= nr. 12 fra vesthjørnet). ca. 80 cm over jordniveau, ca. 55 cm fra bygningens underkant.

Søndrestrom Air Base, Hotel "Arctic". On concrete pillar no. 3 to the right of the main entrance, no. 12 from the W corner of the building. Station on top of pillar, ca. 80 cm above ground level. Not monumented.



GREENLAND

NATIONAL GRAVITY NET



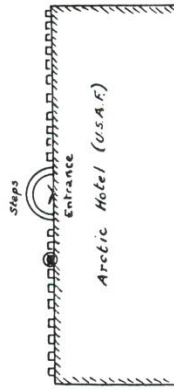
NAME SONDRSTROMFJORD

EARTH PHYSICS BRANCH
CANADA Number 9143-82

GEODETIC INSTITUTE
DENMARK Number 68202

The station is located on concrete pillar No.3, to the W of the main entrance of the hotel. It is 80cm above ground level and on the 12th pier E of the NW corner of the hotel. The station is not monumented.

JUN 1982



No Photos Available

JUN 1982

68202 Søndre Strømfjord, hotel "Arctic"

