

Absolute Gravity Observations at principal New Zealand stations 2015

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ABSTRACT

From 26 January to 16 February 2015 absolute gravity observations were undertaken at three South Island and five North Island locations using the FG5/237 ballistic absolute gravimeter operated by Geoscience Australia. In the South Island observations were made at Godley Head (code AAJB) and Mt John (code MTJG) where earlier absolute gravity observations have been made, and at the IGSN71 site in Dunedin (code OUGG). In the North Island observations were made at the IGSN71 site in Wellington, WELLINGTON A (code WELG), the Measurement Standards Laboratory at Callaghan Innovation (code GCAG), new sites at Palmerston North (code MASG) and Tarawera (code TAAG), and at the Warkworth Radio Astronomy Observatory (code WARG). At the same time a relative gravity meter was used to measure the vertical gravity gradient at each site and to tie the absolute gravity observations to nearby New Zealand Primary Network sites and survey benchmarks that form part of the system of gravity reference marks around New Zealand.

With the exception of the Tarawera gravity observation, each absolute gravity observation consisted of an average of 100 mass drops every hour for between 24 and 40 hours. The Tarawera site was found to be unstable and experienced a lot of ground noise, and hence observations consisted of 10 sets of 100 mass drops, each set repeated at 20 minute intervals. For all sites the uncertainty in gravity determined at the instrument measurement height (1.3 m) varies from 1.84 to 2.60 μGal . Absolute gravity values are determined for measurement height and also transferred to survey mark or floor level after making observations to calculate the vertical gravity gradient. Observed vertical gravity gradients varied from -2.765 to -3.878 $\mu\text{Gal/cm}$. Sites with larger gradient observation errors have larger uncertainties at ground level. For observations at Godley Head and Mt John gravity values are also transferred to floor level and one metre above floor level using the vertical gravity gradients listed in Bilham (2000) to allow comparison with earlier observations.

The absolute gravity values presented here form part of a time series, particularly at Godley Head and Mt John where earlier observations have been made. It is expected that future absolute gravity observations will also be made at the other localities occupied during the 2015 survey, particularly at the Warkworth Radio Astronomy Observatory where a purpose-built mark has been established near the VLBI (Very Large Baseline Interferometry) facility

KEYWORDS

Absolute gravity, gravity gradient, New Zealand Primary Network, gravity reference marks, FG5 gravimeter, WELLINGTON A, AAJB, MTJG, OUGG, WELG, GCAG, MASG, TAAG, WARG

1.0 INTRODUCTION

From 26 January to 16 February 2015 absolute gravity observations were undertaken at three South Island and five North Island locations. There were several reasons for the survey:

1. Check and calibrate gravity at New Zealand Primary Network sites (Robertson and Reilly 1960).
2. Establish a calibration range for relative gravity meters in both North and South islands.
3. Contribute to the long-term record of absolute gravity observations at Godley Head and Mt John in the South Island.
4. Establish a new permanent absolute gravity station for long-term observations at Warkworth in the North Island.
5. Determine absolute gravity at the New Zealand Measurement Standards Laboratory at Callaghan Innovation in Lower Hutt.
6. Determine absolute gravity at the University of Otago for use by the Department of Physics.

Observations were undertaken using FG5/237 ballistic absolute gravimeter owned by AuScope/RSES of the Australian National University and operated by Nicholas Dando of Geoscience Australia. This report describes each gravity observation site and lists their absolute gravity values. The set processing logs for each observation are in Appendix 1.

Gravity observations to determine the vertical gradient were undertaken at each sites using Lacoste and Romberg gravity meter D-37 operated by GNS Science staff Vaughan Stagpoole, Fabio Caratori Tontini and Jenny Black. These observations were used to transfer absolute gravity to survey mark or floor level. For consistency absolute gravity values at Godley Head and Mt John sites are additionally listed using gravity gradient values adopted for earlier observations between 1995 and 2015. The D-37 gravity meter was also used to tie from each absolute gravity survey mark to nearby New Zealand Primary Network marks.

Absolute gravity values using the FG5 gravity meter are conventionally given in units of μGal and vertical gradients in $\mu\text{Gal}/\text{cm}$. In this report these units are maintained for the tables of absolute gravity observations (Table 1 and Table 2). For comparability with the New Zealand Primary Network gravity marks, values are also given in SI units ($\mu\text{N}/\text{kg}$) for each observation site.

1.1 HISTORY OF GRAVITY MEASUREMENTS

Robertson and Garrick (1960) describe early pendulum gravity observations in New Zealand dating back to 1882 and also document a systematic set of 19 reference gravity sites established using a Cambridge pendulum apparatus in 1947. Very few of these sites remain undisturbed and usable in 2015. During the 1950's the gravity observation site in the Christchurch botanic gardens (CHRISTCHURCH A) was connected to the international reference point at Potsdam and was adopted as the primary gravity datum for New Zealand establishing New Zealand Potsdam System (1959) (Robertson and Reilly 1960).

During the 1960s a comprehensive campaign to tie a worldwide network of observations and determine gravity values by a single least squares adjustment resulted in the International Gravity Standardization Net 1971 (Morelli 1974). The campaign occupied sites in Auckland (4), Hastings (2), Wellington (6), Christchurch (5) and Dunedin (3), including 20 observations at CHRISTCHURCH A. There is a 152.1 $\mu\text{N/kg}$ (15.21 mGal) difference between the New Zealand Potsdam (1959) system and gravity determined in the I.G.S.N.71 (Hunt and Ferry 1975). Conversion from the New Zealand Potsdam system (1959) to the I.G.S.N.71 gravity is obtained by subtracting 152.1 $\mu\text{N/kg}$ (15.21 mGal) from the calculated gravity.

The first absolute gravity observations in New Zealand were undertaken between 14 and 20 October 1995 at Godley Head (benchmark code AABJ) using an FG5 absolute gravity meter (FG5/102) prior to air shipment to McMurdo Station (Sasagawa 1995). Since then absolute gravity observations have continued to be made at Godley Head when suitable gravity meters have been in the country (Bilham et al. 2000, Rogister et al. 2009, Rogister et al. 2011, Nielson 2012, Bilham pers. comm. 2015 and this report).

Absolute gravity has also been observed at other sites in the South Island. In February 2000 Roger Bilham from the University of Colorado and colleagues observed gravity at 16 sites across the South Island using an FG5 absolute gravity meter (FG5/111). These sites included CHRISTCHURCH A, Godley Head and Mt John. There is a significant amount of cultural noise at the CHRISTCHURCH A site because of proximity to the city, however, the difference in gravity between IGNS71 (Morelli 1974) and Bilham (2000) was about 55 μGal . Nielson (2012) refers to observations made using an A10 gravity meter (A10/019) at both Godley Head and at Mt John in December 2011. In December 2014 and January 2015 Roger Bilham and colleagues repeated observations at the sites across the South Island to compare with the earlier observations and determine the long-term trend in gravity changes.

The 2015 gravity survey described in this report re-occupied the Godley Head and Mt John absolute gravity sites, the IGSN71 sites in Dunedin and Wellington and several new sites in the North Island including a purpose-built mark near the VLBI (Very Large Baseline Interferometry) facility of the Warkworth Radio Astronomy Observatory. In addition, a portable relative gravity meter was used to tie between the absolute gravity observations and nearby New Zealand Primary Network sites (Robertson and Reilly 1960) and survey benchmarks that form part of the network of gravity reference marks around New Zealand.

2.0 METER OPERATION AND METHODOLOGY

The FG5 ballistic absolute gravimeter uses physical standards of length and time realised through a Helium Iodine stabilised laser and a GPS constrained rubidium clock frequency to measure time distance pairs. The observation is performed by vertically dropping a test mass in a vacuum chamber. A laser interferometer is used to determine the position of the reflective test mass as a function of time during its fall. More detail can be found in the FG5 Absolute Gravimeters User's Manual, (Micro-g Lacoste 2006). Each measurement typically consists of an average of approximately 2400 mass drops over a 24 hour period. Every hour the instrument makes a set of 100 drops. For each drop corrections are applied for earth tide, ocean load, polar motion, barometric pressure, and instrument factors.

Geophysical corrections:

1. Modelled earth tides and ocean tide loading using the TPX07.2 tidal model to produce a zero tide system (IERS conventions 2010).
2. An inverse barometer correction is applied to remove variations in local atmospheric density using an admittance factor of $-3.0 \times 10^{-9} \text{ m/s}^2/\text{hPa}$ (Micro-g Lacoste 2012)
3. IERS Polar motion effects (variations of centrifugal force due to pole wandering) are estimated using IERS Bulletin A polar motion determinations (IERS conventions 2010).

Gravitational acceleration (in m/s^2) at a reference height is determined by measuring the mean free fall acceleration corrected for geophysical variations over the observation period. An incorporated instrument device called the 'superspring' is used to mechanically isolate/filter the observations from ground accelerations e.g. micro-seismic noise and any other high frequency (greater than 1Hz) vibration sources in the floor.

The instrument is set up and levelled over a survey benchmark to ensure the gravitational acceleration measurement can be spatially positioned with millimetre precision, relative to the benchmark. The FG5/237 gravimeter operation procedures were confirmed via participation of the instrument and its operators in an organised intercomparison of absolute gravimeters in the European Comparison of Absolute Gravimeter's (ECAG) in 2011, (Francis et al. 2013). The measurements were reduced to the gravitational acceleration value and uncertainty using Micro-g Lacoste proprietary software g9 (Micro-g Lacoste 2012). At sites with no survey benchmark or pin, a temporary floor mark was made with permanent marker at slab level, for later installation of a permanent mark. For these observations all heights are referenced to the slab level. After the installation of the benchmarks/pin and adjustment will need to be made to the gravity value for future observations at these sites.

The vertical gravity gradient at each observation site was determined using a Lacoste and Romberg gravity meter (number D-37). At each site a minimum of three sets of observations were made at the mark level and at 1.15 m above the mark. The vertical gradient was calculated from the difference between observed gravity at each elevation. The observation data were reduced using GNS Science G-SOLVE software (McCubbine in prep.) that uses a constrained least square approach based on the method of Reilly (1970). The programme also includes corrections for earth tides (Longman 1959), instrument drift and instrument calibration factors. On 19 February 2015 the calibration factor of the D-37 meter was checked by repeat observations between absolute gravity sites in the lower North Island. Vertical gravity gradients were then recalculated with the corrected calibration factor and used to determine gravity at survey mark or floor level at each observation site (Table 1).

3.0 RESULTS

Results are listed in Table 1 in μGal ($1.0 \mu\text{Gal} = 0.01 \mu/\text{kg}$) and the set processing logs for each site are in the Appendix 1. Table 1 lists the gravitational acceleration value from the g9 software (Micro-g Lacoste 2012). The calculated value of gravitational acceleration was transferred from 1.3 m down to the ground mark using the vertical gravity gradient measurement at each site. Observed gradients varied from -2.765 to $-3.878 \mu\text{Gal}/\text{cm}$ ($1.0 \mu\text{Gal}/\text{cm} = 1.0 \mu/\text{kg}/\text{m}$) and sites with larger gradient observation errors have larger uncertainties at ground level. The gravity gradient observations at Godley Head (code AABJ) and Mt John (code MTJG) during the 2015 survey differ slightly from previous observations, hence Table 2 gives gravity values at floor level and one metre above floor level using the gravity gradients listed in Bilham (2000) to allow comparison with earlier observations.

3.1 GODLEY HEAD (AAJB)

The Godley Head gravity mark (code AAJB) is located a historic army building at the WWII coastal defence area. The mark is identified with a metal pin flush with the concrete floor. Gravity observations were undertaken on 28 and 29 January 2015 and consisted of 24 sets of 100 drops, each set repeated every hour. The environmental and instrumental parameters are given in Appendix 1. No instrumental problems were encountered.

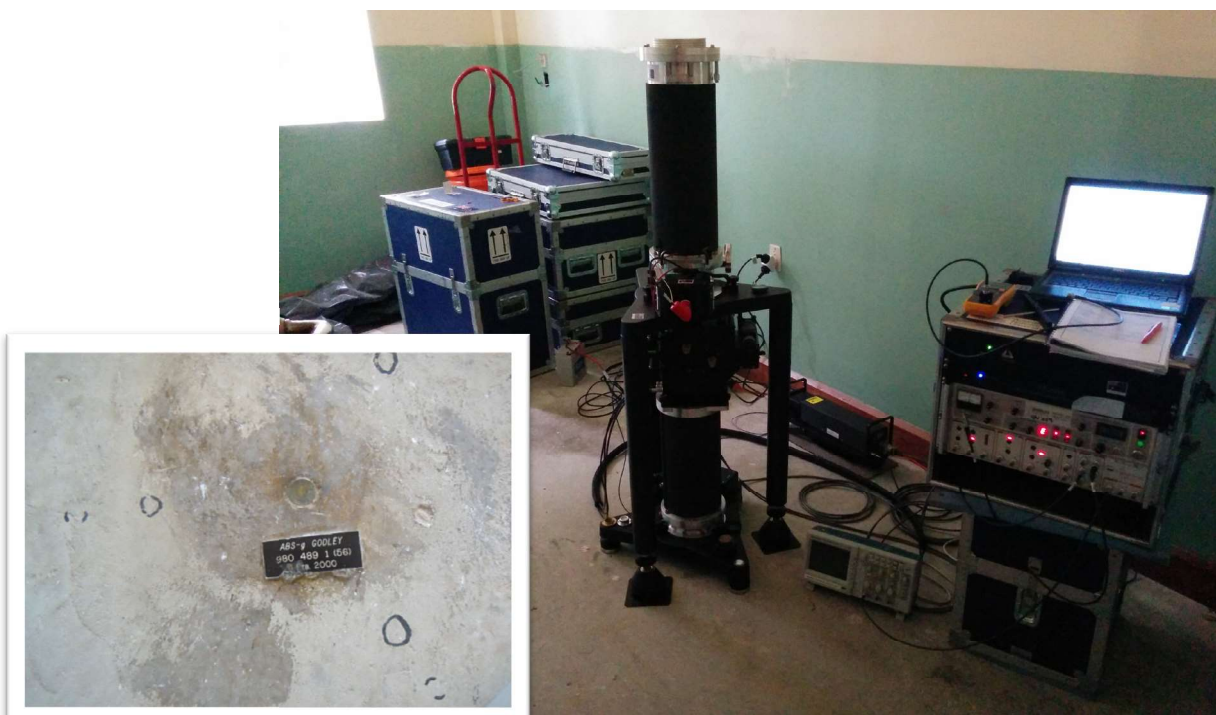


Figure 1 FG5/237 set up over the Godley Head absolute gravity mark (inset)

Other information on the site can be found in Rogister et al. (2009), Rogister et al. (2011) and Nielson (2012).

At the end of the absolute gravity observations a relative gravity meter (Lacoste and Romberg D-37) was used to tie nearby benchmarks (Code DD4U and B9DV) to the absolute gravity mark.

Mark code	Gravity(μ /kg)	Std. error (μ /kg)	No of obs.
AAJB	9804894.95*	0.047	-
DD4U	9804896.05	0.20	5
B9DV	9804889.14	0.42	1

* at benchmark height (concrete floor level) using gradient of $-3.504 \mu\text{Gal}/\text{cm}$

3.2 DUNEDIN – UNIVERSITY OF OTAGO (OUGG)

The Dunedin mark (code OUGG) is located in the basement at the south end of the Geology Department building at the University of Otago. The mark is a metal pin (installed in 2015 after the observations) set in the concrete sub-floor beneath a wooden cover. Observations are referenced to a temporary ink mark on the concrete floor. The mark is a principal gravity station of New Zealand (Hunt and Ferry 1975) and part of the IGSN71 (Morelli 1974) network (no. 48750A). Gravity observations were undertaken on 30 and 31 January 2015 and consisted of 27 sets of 100 drops, each set repeated every hour. The environmental and instrumental parameters are given in Appendix 1. No instrumental problems were encountered.



Figure 2 University of Otago Geology Department building with relative gravity meter D-37 set up on Primary Gravity Network site No. 272 (top left). The absolute gravity mark in the basement of the building (lower left) and FG5/237 set up over the mark (right).

At the end of the absolute gravity observations a relative gravity meter (Lacoste and Romberg D-37) was used to tie the nearby Dunedin Primary Gravity Network site No. 272 (Robertson and Reilly 1960) to the Dunedin OUGG mark.

Mark code	Gravity (μkg)	Std. error (μkg)	No of obs.
OUGG	9807275.27*	0.044	-
Dunedin Primary	9807273.48	0.15	7

* at concrete floor level using gradient of $-2.748 \mu\text{Gal/cm}$ (Table 1)

3.3 MT JOHN (MTJG)

The Mt John mark (code MTJG) is located the mechanical workshop building approximately 80 m west of the summit. The mark is identified with a metal pin in the concrete floor (installed after the observations) of the storeroom on the north side of the building. Gravity observations are referenced to a temporary ink mark on the concrete floor. Observations were undertaken on 1 and 2 February 2015 and consisted of 24 sets of 100 drops, each set repeated every hour. The environmental and instrumental parameters are given in Appendix 1. No instrumental problems were encountered. At the time of the gravity observations Lake Tekapo had an elevation of 707.71 m above mean sea level (with respect to Lyttelton), (Gareth Gray, Genesis Energy Ltd - pers com. 17/7/2015).

Other information on the site can be found in Nielson (2012).



Figure 3 Mt John absolute gravity site is in the mechanical workshop (closest building in top left photo) and FG5/237 was set up in a storeroom on north side of building (right). Relative gravity meter D-37 was used to tie to mark 6702 (bottom left).

At the end of the absolute gravity observations a relative gravity meter (Lacoste and Romberg D-37) was used to tie a nearby benchmark at the summit of Mt John (Code 6702) to the Mt John MTJG mark.

Mark code	Gravity (μkg)	Std. error (μkg)	No of obs.
MTJG	9802489.31*	0.049	-
6702	9802467.03	0.15	8

* at concrete floor level using gradient of $-3.878 \mu\text{Gal}/\text{cm}$ (Table 1)

3.4 WELLINGTON A (WELG)

The Wellington A mark (code WELG) is located in the basement tunnel beneath the historic Dominion Observatory building near the top of the Wellington cable car. The mark is a steel pin, flush with the concrete floor, close to a brass plate labelled “GRAVITY CALIBRATION BASE”. The mark is a principal gravity station of New Zealand (Hunt and Ferry 1975) and part of the IGSN71 (Morelli 1974) network (no. 48714B). Gravity observations were undertaken on 5 and 6 February 2015 and consisted of 30 sets of 100 drops, each set repeated every hour. The environmental and instrumental parameters are given in Appendix 1. No instrumental problems were encountered.

At the end of the absolute gravity observations a relative gravity meter (Lacoste and Romberg D-37) was used to tie a nearby benchmark adjacent to the Dominion Observatory building (Code 8105) to the Wellington A mark.

Mark code	Gravity (μkg)	Std. error (μkg)	No of obs.
WELG	9802510.04*	0.043	-
8105	9802501.87	0.22	2

* at benchmark height (concrete floor level) using gradient of $-2.922 \mu\text{Gal}/\text{cm}$ (Table 1)



Figure 4 FG5/237 set up over the Wellington A mark (right) and inset showing the location of the mark in the concrete floor. Relative gravity meter D-37 was used to tie to mark 8105 adjacent to the Dominion Observatory building (right).

3.5 CALLAGHAN – LOWER HUTT (GCAG)

The Callaghan Abs mark (code GCAG) is located in the Measurement Standards Laboratory (Robertson Building) at Callaghan Innovation on Gracefield Road, Gracefield, Lower Hutt. The mark is a brass pin in the floor of the pressure standards laboratory. The original Lower Hutt pendulum gravity station is no longer accessible. Gravity observations were undertaken on 7 and 8 February 2015 and consisted of 25 sets of 100 drops, each set repeated every hour. The environmental and instrumental parameters are given in Appendix 1. No instrumental problems were encountered, although vertical gravity gradient observations experience a lot of ground noise probably related to traffic on the nearby site. Expanded uncertainty and corrections based on Francis et al. (2012) and Francis et al. (2013) will be calculated later and included in a separate report.

During the absolute gravity survey a relative gravity meter (Lacoste and Romberg D-37) was used to tie nearby marks in the laboratory and adjacent buildings (Lower Hutt A-mod, Lower Hutt B) to the Callaghan Abs (GCAG) mark.

Mark code	Gravity (μkg)	Std. error (μkg)	No of obs.
GCAG	9802792.33*	0.34	-
Lower Hutt A_mod	9802791.89	0.29	1
Lower Hutt B	9802791.63	0.22	2

* at benchmark height (7 mm above floor level) using gradient of $-2.765 \mu\text{Gal}/\text{cm}$ (Table 1)

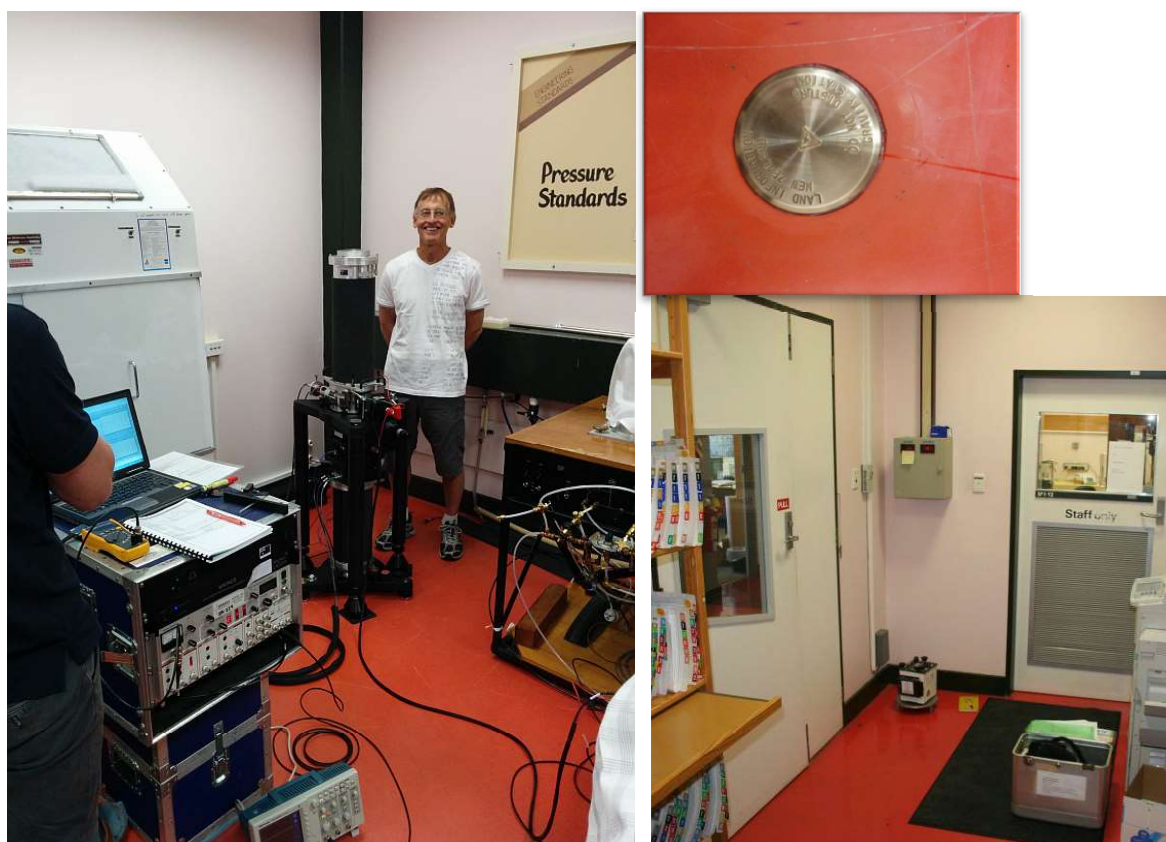


Figure 5 FG5/237 set up in the Pressure Standards Laboratory at Callaghan Innovation (left) over a brass mark in the floor (top right). Relative gravity meter D-37 was used to tie to mark Lower Hutt B (bottom right).

3.6 PAMERSTON NORTH - MASSEY (MASG)

The Palmerston North – Massey mark (code MASG) is located in the Old Dairy Factory on Dairy Farm Road, Palmerston North (NZ Historic Places Trust registration number 7180). Observations are referenced to a temporary ink mark on the concrete floor. The mark (installed after the observation) is a metal pin at floor level in a passageway in the building. Gravity observations were undertaken on 9 and 10 February 2015 and consisted of 21 sets of 100 drops, each set repeated every hour. The environmental and instrumental parameters are given in Appendix 1. No instrumental problems were encountered, although the site appeared to tilt slightly during the observation period, possibly related to high winds during the observation.



Figure 6 FG5/237 set up at Old Dairy Factory, Palmerston North (left) and metal pin in the floor (right).

Mark code	Gravity (μkg)	Std. error (μkg)	No of obs.
MASG	9801074.10*	0.14	-

* at concrete floor level (benchmark height) using gradient of $-2.983 \mu\text{Gal/cm}$ (Table 1)

3.7 TARAWERA (TAAG)

The Tarawera mark is located in a garage/storage room at the Tarawera Café on SH5 (Napier – Taupo highway). Observations were referenced to a temporary ink mark on the concrete floor. A permanent mark will be installed at a later date. Gravity observations were undertaken on 12 February 2015. The site was found to be unstable and experience a lot of ground noise probably related to traffic on the nearby highway. Observations consisted of 10 sets of 100 drops, each set repeated 20 minutes. The environmental and instrumental parameters are given in Appendix 1. No instrumental problems were encountered.

After the absolute gravity survey a relative gravity meter (Lacoste and Romberg D-37) was used to tie nearby benchmarks (Code B400 and B401) to the Tarawera (TAAG) mark.

Mark code	Gravity (μkg)	Std. error (μkg)	No of obs.
TAAG	9799223.38*	0.18	-
B400	9798714.19	0.30	1
B401	9799223.18	0.21	4

* at concrete floor level using gradient of $-2.87 \mu\text{Gal}/\text{cm}$ (Table 1)



Figure 7 View of the Tarawera Café in 2015 (top), the mark is in a storage room at the back of the main building. FG5/237 set up over the Tarawera mark (lower left) and relative gravity meter D-37 on mark B401 (lower right).

3.8 WARKWORTH (WARG)

The Warkworth mark is located in a purpose-built shed adjacent to the VLBI facility on the south side of Satellite Station Road. The mark is identified with a brass pin set in an isolated concrete block. Gravity observations were undertaken from 13 to 15 February 2015 and

consisted of 48 sets of 100 drops, each set repeated every hour. The environmental and instrumental parameters are given in Appendix 1. No instrumental problems were encountered.

During the absolute gravity survey a relative gravity meter (Lacoste and Romberg D-37) was used to tie nearby benchmark (Code WAR1) to the Warkworth (WARG) mark.

Mark code	Gravity ($\mu\text{kg l}$)	Std. error (μkg)	No of obs.
WARG*	9798862.53*	0.08	-
WAR1	9798862.60	0.21	8

* at benchmark height (7 mm above floor level) using gradient of $-3.348 \mu\text{Gal/cm}$ (Table 1)

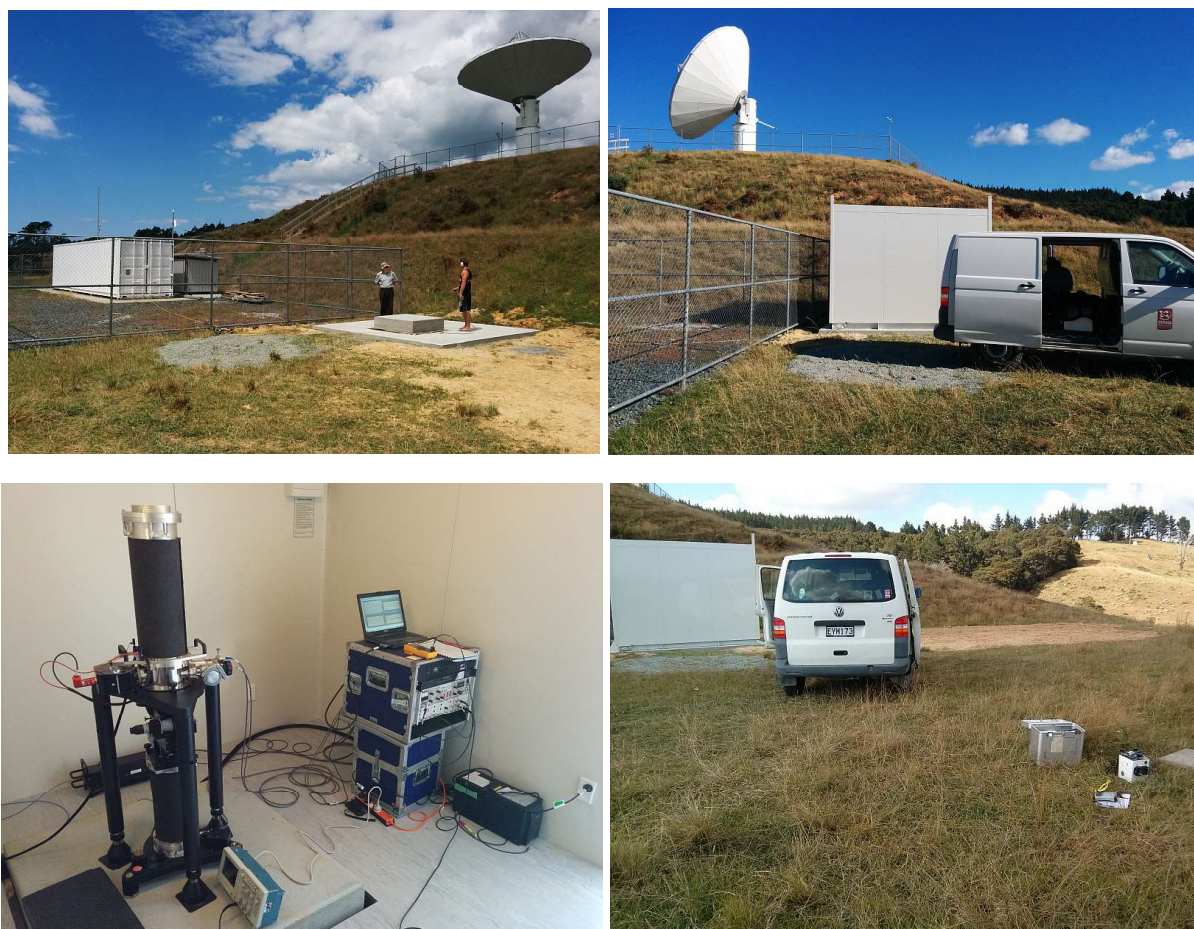


Figure 8 View of the Warkworth absolute gravity mark (top left) before and after installation of the shed (top right). FG5/237 set up over the mark (lower left) and relative gravity meter D-37 on benchmark (Code WAR1) adjacent to the site (lower right).

Table 1 Gravity survey results.

Observation	Station Name	Mark Code	Latitude	Longitude	Orthometric height (m)	Gradient (μGal/cm)	S/dev (1σ, Gal)	Adopted Gradient error (1σ, μGal/cm)	meas. Uncert. (1σ, μGal)	set scatter (1σ, μGal)	gravity at 130cm (μGal)	Uncertainty at 130cm (1σ, μGal)	Gravity at 0 cm (μGal)	Uncertainty at 0 cm (1σ, μGal)
28-29 Jan	Godley Head	AAJB	-43.5882	172.8040	150	-3.504	0.003	0.030	1.86	9.09	980489039.69	2.60	980489495.11	4.68
30-31 Jan	Dunedin	OUGG	-45.8649	170.5152	10	-2.748	0.002	0.030	1.10	5.63	980727170.07	2.12	980727527.36	4.43
1-2 Feb	Mt John	MTJG	-43.9855	170.4641	1025	-3.878	0.004	0.035	0.31	1.54	980248427.02	1.84	980248931.02	4.90
5-6 Feb	Wellington A	WELG	-41.2842	174.7682	122	-2.922	0.002	0.030	0.54	2.94	980250624.54	1.90	980251004.49	4.33
7-8 Feb	Callaghan Abs	GCAG	-41.2342	174.9173	2	-2.765	0.030	0.261	0.38	1.90	980278871.88	1.88	980279233.31*	33.90
9-10 Feb	Palmerston North - Massey	MASG	-40.3801	175.6138	29	-2.983	0.012	0.104	0.89	4.09	980107021.75	2.03	980107409.55	13.61
12 Feb	Tarawera	TAAG	-39.0265	176.5736	470	-2.870	0.016	0.139	1.17	3.69	979921965.13	2.20	979922338.20	18.16
13-15Feb	Warkworth	WARG	-36.4345	174.6630	74	-3.348	0.007	0.061	0.28	1.97	979885815.97	1.86	979886253.49*	8.18

* Gravity values calculated at benchmark height (7 mm above slab height)

Table 2 Gravity survey results at Godley Head and Mt John calculated using gravity gradient of Bilham (2000).

Observation	Station Name	Mark Code	Latitude	Longitude	Orthometric height (m)	Gradient ($\mu\text{Gal}/\text{cm}$)	S/dev (1σ , Gal)	Adopted Gradient error (1σ , $\mu\text{Gal}/\text{cm}$)	meas. Uncert. (1σ , μGal)	set scatter (1σ , μGal)	gravity at 100cm (μGal)	Uncertainty at 130cm (1σ , μGal)	Gravity at 0 cm (μGal)	Uncertainty at 0 cm (1σ , μGal)
28-29 Jan	Godley Head	AAJB	-43.5882	172.8040	150	-3.60	-	-	1.86	9.09	980489146.79	2.75	980489506.79	-
1-2 Feb	Mt John	MTJG	-43.9855	170.4641	1025	-3.91	-	-	0.31	1.54	980248543.93	2.11	980248934.93	-

4.0 ACKNOWLEDGEMENTS

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A1.0 APPENDIX 1 – SET PROCESSING LOGS

A1.1 GODLEY HEAD (AABJ)

Micro-g LaCoste g Processing Report
File Created: 05/18/15, 16:54:09

Project Name: Godley_Head_20150128
g Acquisition Version: 3.102100
g Processing Version: 9.120423

Company/Institution:
Operator: Nick Dando

Station Data

Name: Godley Head
Site Code: AAJB
Lat: -43.58820 Long: 172.80400 Elev: 150.00 m
Setup Height: 12.95 cm
Transfer Height: 0.00 cm
Actual Height: 129.56 cm
Gradient: -3.504 $\mu\text{Gal}/\text{cm}$
Nominal Air Pressure: 995.36 mBar
Barometric Admittance Factor: 0.30
Polar Motion Coord: 0.0023 " 0.3044 "
Earth Tide (ETGTAB) Selected
Potential Filename: C:\gData\gWavefiles\ETCPOT.DAT
Delta Factor Filename: C:\gData\NZ_Data\WD_Bodytide.dff
Delta Factors

Start	Stop	Amplitude	Phase Term
0.000000	0.000001	1.000000	0.0000 DC
0.000002	0.249951	1.160000	0.0000 Long
0.721500	0.906315	1.154250	0.0000 Q1
0.921941	0.974188	1.154240	0.0000 O1
0.989049	0.998028	1.149150	0.0000 P1
0.999853	1.216397	1.134890	0.0000 K1
1.719381	1.906462	1.161720	0.0000 N2
1.923766	1.976926	1.161720	0.0000 M2
1.991787	2.002885	1.161720	0.0000 S2
2.003032	2.182843	1.161720	0.0000 K2
2.753244	3.081254	1.07338	0.0000 M3
3.791964	3.937897	1.03900	0.0000

Ocean Load ON, Filename:

C:\gData\NZ_Data\NZ_Godley_Head\g8_TPX072_GDHD-OceanLoad.olf

Waves: M2 S2 K1 O1 N2 P1 K2 Q1 Mf Mm Ssa

Amplitude (μGal): 3.034 0.672 0.440 0.612 0.756 0.160 0.253 0.191 0.268 0.122 0.000

Phase (deg): 40.5 -155.3 66.4 153.3 91.8 83.0 -164.1 164.7 -5.4 3.1 0.0

Instrument Data

Meter Type: FG5

Meter S/N: 237

Factory Height: 116.61 cm

Rubidium Frequency: 10000000.00300 Hz

Laser: WEO100 (229)

ID: 632.99117754 nm (0.78 V)

IE: 632.99119473 nm (0.33 V)

IF: 632.99121259 nm (-0.02 V)

IG: 632.99123023 nm (-0.42 V)

IH: 632.99136890 nm (0.00 V)

II: 632.99139822 nm (0.00 V)

IJ: 632.99142704 nm (0.00 V)

Modulation Frequency: 8333.350 Hz

Processing Results

Date: 01/28/15

Time: 09:37:34

DOY: 028

Year: 2015

Time Offset (D h:m:s): 0 0:0:0

Gravity: 980489495.11 μ Gal

Set Scatter: 9.09 μ Gal

Measurement Precision: 1.86 μ Gal

Total Uncertainty: 4.68 μ Gal

Number of Sets Collected: 24

Number of Sets Processed: 24

Set #s Processed: 1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,21,22,23,24

Number of Sets NOT Processed: 0

Set #s NOT Processed:

Number of Drops/Set: 100

Total Drops Accepted: 2393

Total Drops Rejected: 7

Total Fringes Acquired: 700

Fringe Start: 19

Processed Fringes: 601

GuideCard Multiplex: 4

GuideCard Scale Factor: 250

Acquisition Settings

Set Interval: 60 min

Drop Interval: 10 sec

Number of Sets: 48

Number of Drops: 100

Gravity Corrections

Earth Tide (ETGTAB): -15.38 μ Gal

Ocean Load: -0.06 μ Gal

Polar Motion: -0.77 μ Gal

Barometric Pressure: 0.60 μ Gal

Transfer Height: 453.98 μ Gal

Reference Xo: -0.00 μ Gal

Uncertainties

Sigma Reject: 3.00

Earth Tide Factor: 0.001
 Average Earth Tide Uncertainty: 0.02 μGal
 Ocean Load Factor: 0.10
 Average Ocean Load Uncertainty: 0.01 μGal
 Barometric: 1.00 μGal
 Polar Motion: 0.05 μGal
 Laser: 0.01 μGal
 Clock: 0.50 μGal
 System Type: 1.00 μGal
 Tidal Swell: 0.00 μGal
 Water Table: 0.00 μGal
 Unmodeled: 0.00 μGal
 System Setup: 1.00 μGal
 Gradient: 3.887 μGal (0.030 $\mu\text{Gal}/\text{cm}$)

g Acquisition Version: 3.102100
 g Processing Version: 9.120423

Set	Time	DOY	Gravity	Sigma	Error	Uncert.	Tide	Load	Baro.	Temp.	Press.
1	22:07:37	27	980489496.3	65.282	6.528	7.812	41.392	-2.26	0.676	32.063	997.612
2	23:07:39	27	980489498.2	57.928	5.793	7.215	23.244	-3.72	0.732	33.972	997.8
3	0:07:34	28	980489495.4	76.727	7.673	8.798	4.017	-4.206	0.473	34.504	996.938
4	1:07:34	28	980489499.6	74.157	7.416	8.572	-13.305	-3.607	0.337	34.803	996.485
5	2:07:34	28	980489485.9	77.273	7.727	8.838	-26.447	-2.08	0.245	35.139	996.176
6	3:07:34	28	980489489	80.441	8.044	9.114	-34.448	-0.019	0.165	35.307	995.911
7	4:07:34	28	980489477.6	88.694	8.869	9.852	-37.792	2.047	0.161	35.534	995.898
8	5:07:33	28	980489484.4	82.786	8.32	9.366	-38.186	3.586	0.243	35.341	996.169
9	6:07:34	28	980489483.7	81.409	8.141	9.209	-37.972	4.203	0.267	35.457	996.248
10	7:07:34	28	980489493.3	70.909	7.091	8.293	-39.358	3.73	0.195	35.435	996.01
11	8:07:34	28	980489498.9	80.559	8.056	9.127	-43.677	2.276	0.268	35.306	996.253
12	9:07:34	28	980489503.7	68.486	6.849	8.079	-50.911	0.2	0.497	35.179	997.017
13	10:07:34	28	980489515.4	76.063	7.606	8.733	-59.628	-1.983	0.779	35.027	997.956
14	11:07:32	28	980489493.6	70.646	7.173	8.364	-67.336	-3.727	0.699	34.979	997.691
15	12:07:36	28	980489509.4	63.662	6.398	7.715	-71.166	-4.599	0.821	34.905	998.097
16	13:07:34	28	980489500.7	67.494	6.749	8.007	-68.607	-4.375	0.696	34.806	997.679
17	14:07:34	28	980489494.4	68.227	6.823	8.063	-58.222	-3.11	0.765	34.618	997.911
18	15:07:34	28	980489495.7	65.057	6.506	7.791	-40.054	-1.118	0.717	34.567	997.75
19	16:07:29	28	980489486	57.905	5.849	7.252	-15.762	1.106	0.752	34.49	997.866
20	17:07:34	28	980489477.9	76.647	7.665	8.786	11.792	3.023	0.776	34.478	997.947
21	18:07:34	28	980489490.8	67.391	6.739	7.997	38.669	4.153	0.785	34.395	997.976
22	19:07:34	28	980489476.9	68.192	6.819	8.065	60.896	4.233	0.97	34.228	998.592
23	20:07:34	28	980489497.1	70.316	7.032	8.241	75.019	3.256	1.146	34.294	999.179
24	21:07:34	28	980489493.1	77.989	7.799	8.9	78.804	1.483	1.182	34.183	999.299

A1.2 GODLEY HEAD (AABJ) FOR 100 CM TRANSFER HEIGHT AND -3.600 μ GAL/CM GRADIENT

Micro-g LaCoste g Processing Report
File Created: 05/15/15, 11:43:12

Project Name: Godley_Head_20150128
g Acquisition Version: 3.102100
g Processing Version: 9.120423

Company/Institution:
Operator: Nick Dando

Station Data

Name: Godley Head
Site Code: AAJB
Lat: -43.58820 Long: 172.80400 Elev: 150.00 m
Setup Height: 12.95 cm
Transfer Height: 100.00 cm
Actual Height: 129.56 cm
Gradient: -3.600 μ Gal/cm
Nominal Air Pressure: 995.36 mBar
Barometric Admittance Factor: 0.30
Polar Motion Coord: 0.0023 " 0.3044 "
Earth Tide (ETGTAB) Selected
Potential Filename: C:\gData\gWavefiles\ETCPOT.DAT
Delta Factor Filename: C:\gData\NZ_Data\WD_Bodytide.dff
Delta Factors

Start	Stop	Amplitude	Phase Term
0.000000	0.000001	1.000000	0.0000 DC
0.000002	0.249951	1.160000	0.0000 Long
0.721500	0.906315	1.154250	0.0000 Q1
0.921941	0.974188	1.154240	0.0000 O1
0.989049	0.998028	1.149150	0.0000 P1
0.999853	1.216397	1.134890	0.0000 K1
1.719381	1.906462	1.161720	0.0000 N2
1.923766	1.976926	1.161720	0.0000 M2
1.991787	2.002885	1.161720	0.0000 S2
2.003032	2.182843	1.161720	0.0000 K2
2.753244	3.081254	1.07338	0.0000 M3
3.791964	3.937897	1.03900	0.0000

Ocean Load ON, Filename: C:\gData\NZ_Data\NZ_Godley_Head\g8_TPX072_GDHD-OceanLoad.olf

Waves: M2 S2 K1 O1 N2 P1 K2 Q1 Mf Mm Ssa
Amplitude (μ Gal): 3.034 0.672 0.440 0.612 0.756 0.160 0.253 0.191 0.268 0.122 0.000
Phase (deg): 40.5 -155.3 66.4 153.3 91.8 83.0 -164.1 164.7 -5.4 3.1 0.0

Instrument Data

Meter Type: FG5
Meter S/N: 237
Factory Height: 116.61 cm
Rubidium Frequency: 10000000.00300 Hz
Laser: WEO100 (229)
ID: 632.99117754 nm (0.78 V)
IE: 632.99119473 nm (0.33 V)
IF: 632.99121259 nm (-0.02 V)
IG: 632.99123023 nm (-0.42 V)
IH: 632.99136890 nm (0.00 V)
II: 632.99139822 nm (0.00 V)
IJ: 632.99142704 nm (0.00 V)
Modulation Frequency: 8333.350 Hz

Processing Results

Date: 01/28/15
Time: 09:37:34
DOY: 028
Year: 2015
Time Offset (D h:m:s): 0 0:0:0
Gravity: 980489146.79 μGal
Set Scatter: 9.09 μGal
Measurement Precision: 1.86 μGal
Total Uncertainty: 2.75 μGal
Number of Sets Collected: 24
Number of Sets Processed: 24
Set #s Processed: 1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,21,22,23,24
Number of Sets NOT Processed: 0
Set #s NOT Processed:
Number of Drops/Set: 100
Total Drops Accepted: 2393
Total Drops Rejected: 7
Total Fringes Acquired: 700
Fringe Start: 19
Processed Fringes: 601
GuideCard Multiplex: 4
GuideCard Scale Factor: 250

Acquisition Settings

Set Interval: 60 min
Drop Interval: 10 sec
Number of Sets: 48
Number of Drops: 100

Gravity Corrections

Earth Tide (ETGTAB): -15.38 μGal
Ocean Load: -0.06 μGal
Polar Motion: -0.77 μGal
Barometric Pressure: 0.60 μGal
Transfer Height: 106.42 μGal
Reference Xo: -0.00 μGal

Uncertainties

Sigma Reject: 3.00
Earth Tide Factor: 0.001
Average Earth Tide Uncertainty: 0.02 μGal

Ocean Load Factor: 0.10
Average Ocean Load Uncertainty: 0.01 μGal
Barometric: 1.00 μGal
Polar Motion: 0.05 μGal
Laser: 0.01 μGal
Clock: 0.50 μGal
System Type: 1.00 μGal
Tidal Swell: 0.00 μGal
Water Table: 0.00 μGal
Unmodeled: 0.00 μGal
System Setup: 1.00 μGal
Gradient: 0.887 μGal (0.030 $\mu\text{Gal}/\text{cm}$)

A1.3 DUNEDIN - OTAGO UNIVERSITY (OUGG)

Micro-g LaCoste g Processing Report
File Created: 05/18/15, 16:47:08

Project Name: Otago_Uni_20150130_merged
g Acquisition Version: 3.102100
g Processing Version: 9.120423

Company/Institution:
Operator: Nick Dando

Station Data

Name: Dunedin Otago Uni
Site Code: OUGG
Lat: -45.86490 Long: 170.51520 Elev: 10.00 m
Setup Height: 12.95 cm
Transfer Height: 0.00 cm
Actual Height: 129.56 cm
Gradient: -2.748 $\mu\text{Gal}/\text{cm}$
Nominal Air Pressure: 1012.05 mBar
Barometric Admittance Factor: 0.30
Polar Motion Coord: 0.0029 " 0.3084 "
Earth Tide (ETGTAB) Selected
Potential Filename: C:\gData\gWavefiles\ETCPOT.DAT
Delta Factor Filename: C:\gData\NZ_Data\WD_Bodytide.dff
Delta Factors

Start	Stop	Amplitude	Phase Term
0.000000	0.000001	1.000000	0.0000 DC
0.000002	0.249951	1.160000	0.0000 Long
0.721500	0.906315	1.154250	0.0000 Q1
0.921941	0.974188	1.154240	0.0000 O1
0.989049	0.998028	1.149150	0.0000 P1
0.999853	1.216397	1.134890	0.0000 K1
1.719381	1.906462	1.161720	0.0000 N2
1.923766	1.976926	1.161720	0.0000 M2
1.991787	2.002885	1.161720	0.0000 S2
2.003032	2.182843	1.161720	0.0000 K2
2.753244	3.081254	1.07338	0.0000 M3
3.791964	3.937897	1.03900	0.0000 M4

Ocean Load ON, Filename:

C:\gData\NZ_Data\NZ_Dunedin_Otago_Uni\g8_TPX072_DUND-OceanLoad.olf
Waves: M2 S2 K1 O1 N2 P1 K2 Q1 Mf Mm Ssa
Amplitude (μGal): 1.614 0.889 0.415 0.747 0.607 0.172 0.321 0.225 0.285 0.134 0.000
Phase (deg): 134.3 -179.3 103.0 159.8 160.4 113.2 -174.9 169.5 -6.0 1.7 0.0

Instrument Data

Meter Type: FG5

Meter S/N: 237
Factory Height: 116.61 cm
Rubidium Frequency: 10000000.00300 Hz
Laser: WEO100 (229)
ID: 632.99117754 nm (0.84 V)
IE: 632.99119473 nm (0.41 V)
IF: 632.99121259 nm (-0.06 V)
IG: 632.99123023 nm (-0.45 V)
IH: 632.99136890 nm (0.00 V)
II: 632.99139822 nm (0.00 V)
IJ: 632.99142704 nm (0.00 V)
Modulation Frequency: 8333.350 Hz

Processing Results

Date: 01/30/15
Time: 12:08:09
DOY: 030
Year: 2015
Time Offset (D h:m:s): 0 0:0:0
Gravity: 980727527.36 μ Gal
Set Scatter: 5.63 μ Gal
Measurement Precision: 1.10 μ Gal
Total Uncertainty: 4.43 μ Gal
Number of Sets Collected: 27
Number of Sets Processed: 26
Set #s Processed: 1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,21,22,23,24,25,26,27
Number of Sets NOT Processed: 1
Set #s NOT Processed: 20
Number of Drops/Set: 100
Total Drops Accepted: 2596
Total Drops Rejected: 4
Total Fringes Acquired: 700
Fringe Start: 19
Processed Fringes: 601
GuideCard Multiplex: 4
GuideCard Scale Factor: 250

Acquisition Settings

Set Interval: 60 min
Drop Interval: 10 sec
Number of Sets: 27
Number of Drops: 100

Gravity Corrections

Earth Tide (ETGTAB): -7.53 μ Gal
Ocean Load: -0.52 μ Gal
Polar Motion: -1.03 μ Gal
Barometric Pressure: 0.94 μ Gal
Transfer Height: 356.03 μ Gal
Reference Xo: -0.00 μ Gal

Uncertainties

Sigma Reject: 3.00
Earth Tide Factor: 0.001
Average Earth Tide Uncertainty: 0.01 μ Gal

Ocean Load Factor: 0.10
 Average Ocean Load Uncertainty: 0.05 μGal
 Barometric: 1.00 μGal
 Polar Motion: 0.05 μGal
 Laser: 0.01 μGal
 Clock: 0.50 μGal
 System Type: 1.00 μGal
 Tidal Swell: 0.00 μGal
 Water Table: 0.00 μGal
 Unmodeled: 0.00 μGal
 System Setup: 1.00 μGal
 Gradient: 3.887 μGal (0.030 $\mu\text{Gal}/\text{cm}$)

g Acquisition Version: 3.102100
 g Processing Version: 9.120423

Set	Time	DOY	Gravity	Sigma	Error	Uncert.	Tide	Load	Baro.	Temp.	Press.
1	23:22:58	29	980727522.3	46.707	4.671	6.341	76.017	-1.7	1.28	30.496	1016.317
2	0:22:54	30	980727527.3	40.704	4.07	5.912	54.093	-1.585	1.132	32.43	1015.823
3	1:21:51	30	980727523	52.217	5.222	6.755	25.785	-0.964	1.122	32.774	1015.791
4	2:21:51	30	980727531.4	44.464	4.446	6.175	-4.935	0.026	1.12	33.511	1015.785
5	3:21:51	30	980727523.8	45.104	4.51	6.222	-32.518	1.115	1.152	33.325	1015.891
6	4:21:56	30	980727531.8	45.39	4.539	6.245	-52.979	2.001	1.138	33.24	1015.843
7	5:21:52	30	980727532.8	37.687	3.788	5.724	-64.225	2.421	1.159	33.17	1015.913
8	6:21:56	30	980727527.3	46.748	4.675	6.346	-66.646	2.226	1.253	33.12	1016.226
9	7:21:56	30	980727534.3	41.752	4.175	5.985	-62.667	1.414	1.264	33.058	1016.265
10	8:21:56	30	980727518.5	48.746	4.875	6.49	-56.028	0.143	1.483	33.026	1016.994
11	9:21:56	30	980727514.4	44.701	4.47	6.194	-50.584	-1.314	1.588	32.959	1017.344
12	10:21:56	30	980727530.4	54.397	5.44	6.93	-49.144	-2.627	1.64	32.921	1017.518
13	11:21:56	30	980727527.5	46.911	4.691	6.363	-52.629	-3.496	1.527	32.88	1017.139
14	12:21:56	30	980727527.5	44.98	4.498	6.224	-59.793	-3.725	1.36	32.872	1016.582
15	13:21:56	30	980727521.1	41.134	4.113	5.949	-67.583	-3.268	1.084	32.87	1015.664
16	14:21:53	30	980727531.5	44.172	4.439	6.174	-72.008	-2.245	0.987	32.849	1015.339
17	15:21:56	30	980727531.6	49.811	4.981	6.571	-69.285	-0.903	0.944	32.843	1015.197
18	16:21:56	30	980727531.1	49.373	4.937	6.538	-56.938	0.432	0.925	32.826	1015.132
19	17:21:56	30	980727525.1	45.432	4.543	6.247	-34.618	1.448	0.802	32.804	1014.722
21	19:21:54	30	980727519.2	41.605	4.181	5.99	29.519	1.776	0.585	32.831	1013.999
22	20:21:59	30	980727537.2	43.842	4.406	6.147	61.654	1.09	0.545	32.846	1013.867
23	21:21:56	30	980727528.2	45.819	4.582	6.274	86.136	0.089	0.336	32.882	1013.169
24	22:21:56	30	980727533.6	45.142	4.514	6.225	98.394	-0.928	0.214	32.895	1012.764
25	23:21:56	30	980727534.4	44.154	4.415	6.156	95.879	-1.659	0.118	32.928	1012.444
26	0:21:56	31	980727530.2	41.948	4.195	6	78.851	-1.883	-0.035	32.953	1011.932
27	1:21:56	31	980727533.5	37.846	3.785	5.719	50.372	-1.519	-0.307	32.96	1011.028

A1.4 MT JOHN (MTJG)

Micro-g LaCoste g Processing Report
File Created: 05/18/15, 17:00:10

Project Name: Mt_John_20150201
g Acquisition Version: 3.102100
g Processing Version: 9.120423

Company/Institution:
Operator: Nick Dando

Station Data

Name: Mt John Observatory
Site Code: MTJG
Lat: -43.98550 Long: 170.46410 Elev: 1025.00 m
Setup Height: 13.30 cm
Transfer Height: 0.00 cm
Actual Height: 129.91 cm
Gradient: -3.878 $\mu\text{Gal}/\text{cm}$
Nominal Air Pressure: 896.02 mBar
Barometric Admittance Factor: 0.30
Polar Motion Coord: 0.0045 " 0.3131 "
Earth Tide (ETGTAB) Selected
Potential Filename: C:\gData\gWavefiles\ETCPOT.DAT
Delta Factor Filename: C:\gData\NZ_Data\WD_Bodytide.dff
Delta Factors

Start	Stop	Amplitude	Phase Term
0.000000	0.000001	1.000000	0.0000 DC
0.000002	0.249951	1.160000	0.0000 Long
0.721500	0.906315	1.154250	0.0000 Q1
0.921941	0.974188	1.154240	0.0000 O1
0.989049	0.998028	1.149150	0.0000 P1
0.999853	1.216397	1.134890	0.0000 K1
1.719381	1.906462	1.161720	0.0000 N2
1.923766	1.976926	1.161720	0.0000 M2
1.991787	2.002885	1.161720	0.0000 S2
2.003032	2.182843	1.161720	0.0000 K2
2.753244	3.081254	1.07338	0.0000 M3
3.791964	3.937897	1.03900	0.0000 M4

Ocean Load ON, Filename: C:\gData\NZ_Data\NZ_Mt_John\g8_TPX072_MTJN-OceanLoad.olf

Waves: M2 S2 K1 O1 N2 P1 K2 Q1 Mf Mm Ssa

Amplitude (μGal): 1.754 1.122 0.354 0.597 0.380 0.128 0.358 0.189 0.238 0.110 0.000

Phase (deg): -110.5 -151.4 67.3 154.8 -130.4 87.7 -149.1 166.6 -5.2 3.9 0.0

Instrument Data

Meter Type: FG5

Meter S/N: 237
Factory Height: 116.61 cm
Rubidium Frequency: 10000000.00300 Hz
Laser: WEO100 (229)
ID: 632.99117754 nm (0.55 V)
IE: 632.99119473 nm (0.05 V)
IF: 632.99121259 nm (-0.33 V)
IG: 632.99123023 nm (-0.72 V)
IH: 632.99136890 nm (0.00 V)
II: 632.99139822 nm (0.00 V)
IJ: 632.99142704 nm (0.00 V)
Modulation Frequency: 8333.350 Hz

Processing Results

Date: 02/01/15
Time: 15:09:06
DOY: 032
Year: 2015
Time Offset (D h:m:s): 0 0:0:0
Gravity: 980248931.02 μ Gal
Set Scatter: 1.54 μ Gal
Measurement Precision: 0.31 μ Gal
Total Uncertainty: 4.90 μ Gal
Number of Sets Collected: 24
Number of Sets Processed: 24
Set #s Processed: 1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,21,22,23,24
Number of Sets NOT Processed: 0
Set #s NOT Processed:
Number of Drops/Set: 100
Total Drops Accepted: 2393
Total Drops Rejected: 7
Total Fringes Acquired: 700
Fringe Start: 19
Processed Fringes: 601
GuideCard Multiplex: 4
GuideCard Scale Factor: 250

Acquisition Settings

Set Interval: 60 min
Drop Interval: 10 sec
Number of Sets: 48
Number of Drops: 100

Gravity Corrections

Earth Tide (ETGTAB): -13.01 μ Gal
Ocean Load: -0.36 μ Gal
Polar Motion: -1.08 μ Gal
Barometric Pressure: -2.38 μ Gal
Transfer Height: 503.79 μ Gal
Reference Xo: -0.00 μ Gal

Uncertainties

Sigma Reject: 3.00
Earth Tide Factor: 0.001
Average Earth Tide Uncertainty: 0.01 μ Gal
Ocean Load Factor: 0.10

Average Ocean Load Uncertainty: 0.04 μGal
 Barometric: 1.00 μGal
 Polar Motion: 0.05 μGal
 Laser: 0.01 μGal
 Clock: 0.50 μGal
 System Type: 1.00 μGal
 Tidal Swell: 0.00 μGal
 Water Table: 0.00 μGal
 Unmodeled: 0.00 μGal
 System Setup: 1.00 μGal
 Gradient: 4.547 μGal (0.035 $\mu\text{Gal}/\text{cm}$)

g Acquisition Version: 3.102100
 g Processing Version: 9.120423

Set	Time	DOY	Gravity	Sigma	Error	Uncert.	Tide	Load	Baro.	Temp.	Press.
1	3:39:11	32	980248929.7	19.802	1.99	5.285	-11.681	1.966	-1.499	33.225	891.023
2	4:39:14	32	980248930.5	19.118	1.921	5.259	-45.97	1.972	-1.66	36.043	890.485
3	5:39:06	32	980248928.6	17.3	1.73	5.191	-68.838	1.555	-1.732	36.56	890.246
4	6:39:05	32	980248927.9	16.966	1.697	5.179	-77.868	0.802	-1.781	36.588	890.085
5	7:39:05	32	980248927.5	19.596	1.96	5.27	-73.999	-0.116	-1.703	36.463	890.344
6	8:39:05	32	980248928.6	17.144	1.714	5.185	-61.376	-0.992	-1.636	36.069	890.567
7	9:39:10	32	980248928.3	16.118	1.62	5.156	-46.005	-1.635	-1.597	35.746	890.698
8	10:39:05	32	980248928.9	18.353	1.835	5.228	-34.075	-1.91	-1.687	35.512	890.398
9	11:39:05	32	980248930.8	18.745	1.875	5.241	-29.994	-1.782	-1.782	35.284	890.081
10	12:39:05	32	980248928.1	21.924	2.192	5.362	-35.299	-1.319	-1.884	35.089	889.738
11	13:39:02	32	980248927.4	23.172	2.329	5.418	-48.118	-0.672	-1.977	34.957	889.431
12	14:39:05	32	980248925	22.706	2.271	5.393	-63.787	-0.039	-2.103	34.797	889.01
13	15:39:05	32	980248931.2	21.671	2.167	5.351	-76.068	0.39	-2.242	34.624	888.548
14	16:39:09	32	980248930.9	19.08	1.918	5.255	-79.031	0.486	-2.411	34.413	887.982
15	17:39:03	32	980248930.4	21.994	2.21	5.368	-68.721	0.213	-2.522	34.262	887.613
16	18:39:05	32	980248926.9	21.162	2.116	5.33	-44.297	-0.359	-2.62	34.175	887.288
17	19:39:05	32	980248927.7	21.561	2.156	5.347	-8.56	-1.068	-2.741	34.318	886.882
18	20:39:05	32	980248928.3	20.876	2.088	5.321	32.654	-1.706	-2.844	34.531	886.538
19	21:39:05	32	980248930.9	20.654	2.065	5.314	71.689	-2.072	-3.09	34.872	885.719
20	22:39:05	32	980248930.7	16.578	1.658	5.17	100.813	-2.026	-3.247	35.066	885.197
21	23:39:05	32	980248931	19.006	1.901	5.251	114.018	-1.531	-3.342	35.236	884.879
22	0:39:05	33	980248926.4	17.877	1.788	5.209	108.439	-0.665	-3.523	35.282	884.278
23	1:39:01	33	980248928.8	18.003	1.809	5.216	85.12	0.392	-3.476	34.963	884.432
24	2:39:05	33	980248929.3	17.624	1.762	5.201	48.639	1.407	-3.93	34.939	882.919

A1.5 MT JOHN (MTJG) FOR 100 CM TRANSFER HEIGHT AND -3.910 μ GAL/CM GRADIENT

Micro-g LaCoste g Processing Report
File Created: 05/15/15, 11:53:30

Project Name: Mt_John_20150201
g Acquisition Version: 3.102100
g Processing Version: 9.120423

Company/Institution:
Operator: Nick Dando

Station Data

Name: Mt John Observatory
Site Code: MTJG
Lat: -43.98550 Long: 170.46410 Elev: 1025.00 m
Setup Height: 13.30 cm
Transfer Height: 100.00 cm
Actual Height: 129.91 cm
Gradient: -3.910 μ Gal/cm
Nominal Air Pressure: 896.02 mBar
Barometric Admittance Factor: 0.30
Polar Motion Coord: 0.0045 " 0.3131 "
Earth Tide (ETGTAB) Selected
Potential Filename: C:\gData\gWavefiles\ETCPOT.DAT
Delta Factor Filename: C:\gData\NZ_Data\WD_Bodytide.dff
Delta Factors

Start	Stop	Amplitude	Phase Term
0.000000	0.000001	1.000000	0.0000 DC
0.000002	0.249951	1.160000	0.0000 Long
0.721500	0.906315	1.154250	0.0000 Q1
0.921941	0.974188	1.154240	0.0000 O1
0.989049	0.998028	1.149150	0.0000 P1
0.999853	1.216397	1.134890	0.0000 K1
1.719381	1.906462	1.161720	0.0000 N2
1.923766	1.976926	1.161720	0.0000 M2
1.991787	2.002885	1.161720	0.0000 S2
2.003032	2.182843	1.161720	0.0000 K2
2.753244	3.081254	1.07338	0.0000 M3
3.791964	3.937897	1.03900	0.0000 M4

Ocean Load ON, Filename: C:\gData\NZ_Data\NZ_Mt_John\g8_TPX072_MTJN-OceanLoad.olf

Waves: M2 S2 K1 O1 N2 P1 K2 Q1 Mf Mm Ssa
Amplitude (μ Gal): 1.754 1.122 0.354 0.597 0.380 0.128 0.358 0.189 0.238 0.110 0.000
Phase (deg): -110.5 -151.4 67.3 154.8 -130.4 87.7 -149.1 166.6 -5.2 3.9 0.0

Instrument Data
Meter Type: FG5

Meter S/N: 237
Factory Height: 116.61 cm
Rubidium Frequency: 10000000.00300 Hz
Laser: WEO100 (229)
ID: 632.99117754 nm (0.55 V)
IE: 632.99119473 nm (0.05 V)
IF: 632.99121259 nm (-0.33 V)
IG: 632.99123023 nm (-0.72 V)
IH: 632.99136890 nm (0.00 V)
II: 632.99139822 nm (0.00 V)
IJ: 632.99142704 nm (0.00 V)
Modulation Frequency: 8333.350 Hz

Processing Results

Date: 02/01/15
Time: 15:09:06
DOY: 032
Year: 2015
Time Offset (D h:m:s): 0 0:0:0
Gravity: 980248543.93 μ Gal
Set Scatter: 1.54 μ Gal
Measurement Precision: 0.31 μ Gal
Total Uncertainty: 2.11 μ Gal
Number of Sets Collected: 24
Number of Sets Processed: 24
Set #s Processed: 1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,21,22,23,24
Number of Sets NOT Processed: 0
Set #s NOT Processed:
Number of Drops/Set: 100
Total Drops Accepted: 2393
Total Drops Rejected: 7
Total Fringes Acquired: 700
Fringe Start: 19
Processed Fringes: 601
GuideCard Multiplex: 4
GuideCard Scale Factor: 250

Acquisition Settings

Set Interval: 60 min
Drop Interval: 10 sec
Number of Sets: 48
Number of Drops: 100

Gravity Corrections

Earth Tide (ETGTAB): -13.01 μ Gal
Ocean Load: -0.36 μ Gal
Polar Motion: -1.08 μ Gal
Barometric Pressure: -2.38 μ Gal
Transfer Height: 116.95 μ Gal
Reference Xo: -0.00 μ Gal

Uncertainties

Sigma Reject: 3.00
Earth Tide Factor: 0.001
Average Earth Tide Uncertainty: 0.01 μ Gal
Ocean Load Factor: 0.10

Average Ocean Load Uncertainty: 0.04 μGal
Barometric: 1.00 μGal
Polar Motion: 0.05 μGal
Laser: 0.01 μGal
Clock: 0.50 μGal
System Type: 1.00 μGal
Tidal Swell: 0.00 μGal
Water Table: 0.00 μGal
Unmodeled: 0.00 μGal
System Setup: 1.00 μGal
Gradient: 1.047 μGal (0.035 $\mu\text{Gal}/\text{cm}$)

A1.6 WELLINGTON A (WELG)

Micro-g LaCoste g Processing Report
File Created: 05/18/15, 17:07:53

Project Name: Wellington_A_20150205B
g Acquisition Version: 3.102100
g Processing Version: 9.120423

Company/Institution:
Operator: Nick Dando

Station Data

Name: Wellington A
Site Code: WELG
Lat: -41.28420 Long: 174.76820 Elev: 122.00 m
Setup Height: 13.08 cm
Transfer Height: 0.00 cm
Actual Height: 129.69 cm
Gradient: -2.922 $\mu\text{Gal}/\text{cm}$
Nominal Air Pressure: 998.68 mBar
Barometric Admittance Factor: 0.30
Polar Motion Coord: 0.0032 " 0.3213 "
Earth Tide (ETGTAB) Selected
Potential Filename: C:\gData\gWavefiles\ETCPOT.DAT
Delta Factor Filename: C:\gData\NZ_Data\WD_Bodytide.dff
Delta Factors

Start	Stop	Amplitude	Phase Term
0.000000	0.000001	1.000000	0.0000 DC
0.000002	0.249951	1.160000	0.0000 Long
0.721500	0.906315	1.154250	0.0000 Q1
0.921941	0.974188	1.154240	0.0000 O1
0.989049	0.998028	1.149150	0.0000 P1
0.999853	1.216397	1.134890	0.0000 K1
1.719381	1.906462	1.161720	0.0000 N2
1.923766	1.976926	1.161720	0.0000 M2
1.991787	2.002885	1.161720	0.0000 S2
2.003032	2.182843	1.161720	0.0000 K2
2.753244	3.081254	1.07338	0.0000 M3
3.791964	3.937897	1.03900	0.0000 M4

Ocean Load ON, Filename: C:\gData\NZ_Data\NZ_Wellington_Alg8_TPX072_WELA-OceanLoad.olf

Waves: M2 S2 K1 O1 N2 P1 K2 Q1 Mf Mm Ssa

Amplitude (μGal): 3.483 1.256 0.442 0.417 0.476 0.125 0.371 0.142 0.215 0.093 0.000

Phase (deg): -29.1 -132.5 20.6 154.1 15.1 38.6 -135.4 167.2 -4.7 5.7 0.0

Instrument Data

Meter Type: FG5

Meter S/N: 237
Factory Height: 116.61 cm
Rubidium Frequency: 10000000.00300 Hz
Laser: WEO100 (229)
ID: 632.99117754 nm (0.65 V)
IE: 632.99119473 nm (0.20 V)
IF: 632.99121259 nm (-0.25 V)
IG: 632.99123023 nm (-0.64 V)
IH: 632.99136890 nm (0.00 V)
II: 632.99139822 nm (0.00 V)
IJ: 632.99142704 nm (0.00 V)
Modulation Frequency: 8333.350 Hz

Processing Results

Date: 02/05/15
Time: 13:39:15
DOY: 036
Year: 2015
Time Offset (D h:m:s): 0 0:0:0
Gravity: 980251004.49 μ Gal
Set Scatter: 2.94 μ Gal
Measurement Precision: 0.54 μ Gal
Total Uncertainty: 4.33 μ Gal
Number of Sets Collected: 30
Number of Sets Processed: 30
Set #s Processed:
1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,21,22,23,24,25,26,27,28,29,30
Number of Sets NOT Processed: 0
Set #s NOT Processed:
Number of Drops/Set: 100
Total Drops Accepted: 2994
Total Drops Rejected: 6
Total Fringes Acquired: 700
Fringe Start: 19
Processed Fringes: 601
GuideCard Multiplex: 4
GuideCard Scale Factor: 250

Acquisition Settings

Set Interval: 60 min
Drop Interval: 10 sec
Number of Sets: 48
Number of Drops: 100

Gravity Corrections

Earth Tide (ETGTAB): 5.78 μ Gal
Ocean Load: 0.27 μ Gal
Polar Motion: -0.62 μ Gal
Barometric Pressure: -4.20 μ Gal
Transfer Height: 378.95 μ Gal
Reference Xo: -0.00 μ Gal

Uncertainties

Sigma Reject: 3.00
Earth Tide Factor: 0.001
Average Earth Tide Uncertainty: 0.01 μ Gal

Ocean Load Factor: 0.10
 Average Ocean Load Uncertainty: 0.03 μGal
 Barometric: 1.00 μGal
 Polar Motion: 0.05 μGal
 Laser: 0.01 μGal
 Clock: 0.50 μGal
 System Type: 1.00 μGal
 Tidal Swell: 0.00 μGal
 Water Table: 0.00 μGal
 Unmodeled: 0.00 μGal
 System Setup: 1.00 μGal
 Gradient: 3.891 μGal (0.030 $\mu\text{Gal}/\text{cm}$)

g Acquisition Version: 3.102100
 g Processing Version: 9.120423

Set	Time	DOY	Gravity	Sigma	Error	Uncert.	Tide	Load	Baro.	Temp.	Press.
1	23:09:25	35	980251005.8	20.811	2.092	4.777	73.217	-2.209	-3.531	30.813	986.909
2	0:09:13	36	980251009.3	24.324	2.432	4.931	98.759	-0.363	-3.636	30.374	986.561
3	1:09:15	36	980251003.8	26.652	2.665	5.052	105.668	1.513	-3.848	30.369	985.853
4	2:09:13	36	980251003.4	26.117	2.625	5.037	92.306	2.963	-4.22	30.457	984.612
5	3:09:15	36	980251003.5	28.999	2.9	5.19	61.639	3.655	-4.424	30.507	983.932
6	4:09:15	36	980251012	29.007	2.901	5.189	20.502	3.44	-4.511	30.791	983.643
7	5:09:15	36	980251002.3	25.786	2.579	5.01	-22.15	2.402	-4.713	30.848	982.971
8	6:09:17	36	980251005.2	23.607	2.373	4.902	-57.332	0.832	-4.983	30.844	982.069
9	7:09:15	36	980251006.8	27.174	2.717	5.078	-78.104	-0.844	-5.031	30.81	981.909
10	8:09:15	36	980251012.6	24.549	2.455	4.947	-81.373	-2.181	-5.004	30.772	981.999
11	9:09:15	36	980251007.5	26.948	2.695	5.073	-68.432	-2.823	-5.041	30.798	981.876
12	10:09:15	36	980251005.2	25.08	2.508	4.975	-44.62	-2.6	-5.457	30.787	980.491
13	11:09:16	36	980251005.2	19.326	1.942	4.71	-17.83	-1.571	-5.916	30.799	978.962
14	12:09:15	36	980251006	28.838	2.884	5.168	3.614	-0.012	-6.069	30.827	978.451
15	13:09:15	36	980251007.2	24.736	2.474	4.953	13.301	1.656	-5.834	30.861	979.233
16	14:09:15	36	980251007.7	27.192	2.719	5.087	8.439	2.974	-5.891	30.969	979.042
17	15:09:15	36	980251003.3	30.701	3.07	5.286	-9.343	3.565	-5.135	30.979	981.564
18	16:09:15	36	980251009.7	31.278	3.128	5.318	-34.47	3.235	-4.664	31.072	983.133
19	17:09:15	36	980251003.1	34.499	3.45	5.508	-58.987	2.026	-4.335	30.968	984.229
20	18:09:15	36	980251003.6	31.691	3.169	5.333	-74.804	0.21	-3.938	30.873	985.553
21	19:09:15	36	980251006.9	31.454	3.145	5.322	-75.948	-1.779	-3.755	30.947	986.162
22	20:09:25	36	980251005.6	30.638	3.064	5.282	-60.171	-3.452	-3.446	30.898	987.192
23	21:09:15	36	980251010.3	29.508	2.951	5.224	-29.913	-4.377	-3.24	30.964	987.88
24	22:09:15	36	980251001.8	29.388	2.939	5.217	8.889	-4.322	-2.905	30.953	988.997
25	23:09:15	36	980251003.4	35.952	3.595	5.606	47.678	-3.28	-2.826	30.906	989.261
26	0:09:15	37	980251008.4	27.609	2.775	5.111	77.712	-1.495	-2.835	30.83	989.231
27	1:09:15	37	980251003.9	32.951	3.295	5.409	92.143	0.607	-2.804	30.773	989.334
28	2:09:15	37	980250999.9	31.112	3.111	5.305	87.656	2.52	-2.678	30.75	989.754

Set	Time	DOY	Gravity	Sigma	Error	Uncert.	Tide	Load	Baro.	Temp.	Press.
29	3:09:11	37	980251004.3	31.583	3.174	5.349	65.288	3.785	-2.744	30.735	989.533
30	4:09:15	37	980251002.5	26.752	2.675	5.071	29.987	4.114	-2.671	30.771	989.776

A1.7 CALLAGHAN (GCAG)

Micro-g LaCoste g Processing Report
File Created: 05/18/15, 16:41:44

Project Name: Callaghan_20150207
g Acquisition Version: 3.102100
g Processing Version: 9.120423

Company/Institution:
Operator: Nick Dando

Station Data

Name: Callaghan
Site Code: GCAG
Lat: -41.23420 Long: 174.91730 Elev: 2.00 m
Setup Height: 12.38 cm
Transfer Height: -0.70 cm
Actual Height: 128.99 cm
Gradient: -2.765 $\mu\text{Gal}/\text{cm}$
Nominal Air Pressure: 1013.01 mBar
Barometric Admittance Factor: 0.30
Polar Motion Coord: 0.0021 " 0.3244 "
Earth Tide (ETGTAB) Selected
Potential Filename: C:\gData\gWavefiles\ETCPOT.DAT
Delta Factor Filename: C:\gData\NZ_Data\WD_Bodytide.dff
Delta Factors

Start	Stop	Amplitude	Phase Term
0.000000	0.000001	1.000000	0.0000 DC
0.000002	0.249951	1.160000	0.0000 Long
0.721500	0.906315	1.154250	0.0000 Q1
0.921941	0.974188	1.154240	0.0000 O1
0.989049	0.998028	1.149150	0.0000 P1
0.999853	1.216397	1.134890	0.0000 K1
1.719381	1.906462	1.161720	0.0000 N2
1.923766	1.976926	1.161720	0.0000 M2
1.991787	2.002885	1.161720	0.0000 S2
2.003032	2.182843	1.161720	0.0000 K2
2.753244	3.081254	1.07338	0.0000 M3
3.791964	3.937897	1.03900	0.0000 M4

Ocean Load ON, Filename: C:\gData\NZ_Data\NZ_Callaghan\g8_TPX072_CALL-OceanLoad.olf

Waves: M2 S2 K1 O1 N2 P1 K2 Q1 Mf Mm Ssa

Amplitude (μGal): 3.379 1.198 0.420 0.384 0.456 0.116 0.355 0.136 0.207 0.089 0.000

Phase (deg): -32.4 -131.9 17.2 156.2 8.8 35.1 -134.2 168.1 -4.6 5.9 0.0

Instrument Data

Meter Type: FG5

Meter S/N: 237
Factory Height: 116.61 cm
Rubidium Frequency: 10000000.00300 Hz
Laser: WEO100 (229)
ID: 632.99117754 nm (0.75 V)
IE: 632.99119473 nm (0.40 V)
IF: 632.99121259 nm (-0.01 V)
IG: 632.99123023 nm (-0.40 V)
IH: 632.99136890 nm (0.00 V)
II: 632.99139822 nm (0.00 V)
IJ: 632.99142704 nm (0.00 V)
Modulation Frequency: 8333.350 Hz

Processing Results

Date: 02/07/15
Time: 13:00:09
DOY: 038
Year: 2015
Time Offset (D h:m:s): 0 0:0:0
Gravity: 980279233.31 μ Gal
Set Scatter: 1.90 μ Gal
Measurement Precision: 0.38 μ Gal
Total Uncertainty: 33.90 μ Gal
Number of Sets Collected: 25
Number of Sets Processed: 25
Set #s Processed: 1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,21,22,23,24,25
Number of Sets NOT Processed: 0
Set #s NOT Processed:
Number of Drops/Set: 100
Total Drops Accepted: 2486
Total Drops Rejected: 14
Total Fringes Acquired: 700
Fringe Start: 19
Processed Fringes: 601
GuideCard Multiplex: 4
GuideCard Scale Factor: 250

Acquisition Settings

Set Interval: 60 min
Drop Interval: 10 sec
Number of Sets: 48
Number of Drops: 100

Gravity Corrections

Earth Tide (ETGTAB): -7.33 μ Gal
Ocean Load: 0.08 μ Gal
Polar Motion: -0.59 μ Gal
Barometric Pressure: 1.12 μ Gal
Transfer Height: 358.59 μ Gal
Reference Xo: -0.00 μ Gal

Uncertainties

Sigma Reject: 3.00
Earth Tide Factor: 0.001
Average Earth Tide Uncertainty: 0.01 μ Gal
Ocean Load Factor: 0.10

Average Ocean Load Uncertainty: 0.01 μGal
 Barometric: 1.00 μGal
 Polar Motion: 0.05 μGal
 Laser: 0.01 μGal
 Clock: 0.50 μGal
 System Type: 1.00 μGal
 Tidal Swell: 0.00 μGal
 Water Table: 0.00 μGal
 Unmodeled: 0.00 μGal
 System Setup: 1.00 μGal
 Gradient: 33.849 μGal (0.261 $\mu\text{Gal}/\text{cm}$)

g Acquisition Version: 3.102100
 g Processing Version: 9.120423

Set	Time	DOY	Gravity	Sigma	Error	Uncert.	Tide	Load	Baro.	Temp.	Press.
1	1:00:42	38	980279231	24.684	2.481	33.988	71.427	-0.845	0.481	31.42	1014.615
2	2:00:16	38	980279232.7	20.564	2.056	33.96	76.893	1.315	0.503	33.007	1014.686
3	3:00:12	38	980279233.1	23.932	2.393	33.983	65.264	3.143	0.395	33.125	1014.326
4	4:00:06	38	980279232.2	21.235	2.123	33.966	39.049	4.188	0.336	33.212	1014.13
5	5:00:06	38	980279235.6	21.487	2.149	33.968	4.076	4.214	0.36	33.331	1014.209
6	6:00:07	38	980279230.3	21.473	2.158	33.967	-31.794	3.239	0.286	33.306	1013.964
7	7:00:06	38	980279233.6	23.126	2.313	33.976	-60.658	1.543	0.497	33.283	1014.667
8	8:00:08	38	980279236.5	19.766	1.997	33.956	-76.515	-0.419	0.62	33.252	1015.075
9	9:00:06	38	980279235.6	22.37	2.237	33.972	-76.549	-2.122	0.761	33.251	1015.545
10	10:00:04	38	980279234.6	19.895	2	33.958	-61.886	-3.119	0.883	33.239	1015.955
11	11:00:06	38	980279232.2	20.864	2.086	33.963	-37.144	-3.153	1.164	33.201	1016.89
12	12:00:09	38	980279235.7	21.956	2.207	33.97	-9.363	-2.218	1.134	33.195	1016.789
13	13:00:06	38	980279233.3	21.58	2.158	33.966	13.859	-0.573	1.148	33.174	1016.836
14	14:00:06	38	980279234.1	23.335	2.333	33.978	26.505	1.336	1.18	33.147	1016.944
15	15:00:06	38	980279234.3	21.607	2.161	33.967	25.54	2.989	1.342	33.105	1017.483
16	16:00:06	38	980279232.7	24.395	2.44	33.987	11.822	3.922	1.295	33.079	1017.327
17	17:00:06	38	980279232.1	22.569	2.257	33.974	-10.191	3.861	1.473	32.995	1017.922
18	18:00:06	38	980279234.3	21.407	2.141	33.966	-33.709	2.783	1.572	33.181	1018.25
19	19:00:10	38	980279236.4	25.409	2.567	33.994	-51.536	0.932	1.682	33.212	1018.616
20	20:00:02	38	980279234.9	28.011	2.815	34.014	-58.001	-1.23	1.816	33.158	1019.064
21	21:00:06	38	980279235.3	23.681	2.368	33.981	-50.652	-3.178	1.753	33.21	1018.855
22	22:00:08	38	980279235	36.172	3.654	34.096	-30.748	-4.408	1.861	33.299	1019.214
23	23:00:19	38	980279229	30.263	3.073	34.039	-2.928	-4.6	1.835	33.321	1019.127
24	0:00:06	39	980279235.5	25.746	2.575	33.997	25.694	-3.699	1.816	33.308	1019.065
25	1:00:06	39	980279237.2	24.961	2.496	33.989	48.242	-1.914	1.879	33.303	1019.275

A1.8 PALMERSTON NORTH – MASSEY (MASG)

Micro-g LaCoste g Processing Report
File Created: 05/18/15, 16:57:32

Project Name: Massey_20150209
g Acquisition Version: 3.102100
g Processing Version: 9.120423

Company/Institution:
Operator: Nick Dando

Station Data

Name: Massey_University
Site Code: MASG
Lat: -40.38010 Long: 175.61380 Elev: 29.00 m
Setup Height: 12.78 cm
Transfer Height: 0.00 cm
Actual Height: 129.39 cm
Gradient: -2.983 $\mu\text{Gal}/\text{cm}$
Nominal Air Pressure: 1009.77 mBar
Barometric Admittance Factor: 0.30
Polar Motion Coord: 0.0020 " 0.3270 "
Earth Tide (ETGTAB) Selected
Potential Filename: C:\gData\gWavefiles\ETCPOT.DAT
Delta Factor Filename: C:\gData\NZ_Data\WD_Bodytide.dff
Delta Factors

Start	Stop	Amplitude	Phase Term
0.000000	0.000001	1.000000	0.0000 DC
0.000002	0.249951	1.160000	0.0000 Long
0.721500	0.906315	1.154250	0.0000 Q1
0.921941	0.974188	1.154240	0.0000 O1
0.989049	0.998028	1.149150	0.0000 P1
0.999853	1.216397	1.134890	0.0000 K1
1.719381	1.906462	1.161720	0.0000 N2
1.923766	1.976926	1.161720	0.0000 M2
1.991787	2.002885	1.161720	0.0000 S2
2.003032	2.182843	1.161720	0.0000 K2
2.753244	3.081254	1.07338	0.0000 M3
3.791964	3.937897	1.03900	0.0000 M4

Ocean Load ON, Filename:

C:\gData\NZ_Data\NZ_Massey_University\g8_TPX072_PALM-OceanLoad.olf

Waves: M2 S2 K1 O1 N2 P1 K2 Q1 Mf Mm Ssa

Amplitude (μGal): 3.882 1.206 0.472 0.295 0.570 0.125 0.349 0.114 0.186 0.079
0.000

Phase (deg): -37.4 -127.7 5.3 158.2 -2.4 19.2 -129.0 169.0 -4.1 7.5 0.0

Instrument Data

Meter Type: FG5

Meter S/N: 237
Factory Height: 116.61 cm
Rubidium Frequency: 10000000.00300 Hz
Laser: WEO100 (229)
ID: 632.99117754 nm (0.95 V)
IE: 632.99119473 nm (0.45 V)
IF: 632.99121259 nm (0.09 V)
IG: 632.99123023 nm (-0.30 V)
IH: 632.99136890 nm (0.00 V)
II: 632.99139822 nm (0.00 V)
IJ: 632.99142704 nm (0.00 V)
Modulation Frequency: 8333.350 Hz

Processing Results

Date: 02/09/15
Time: 11:19:36
DOY: 040
Year: 2015
Time Offset (D h:m:s): 0 0:0:0
Gravity: 980107409.55 μGal
Set Scatter: 4.09 μGal
Measurement Precision: 0.89 μGal
Total Uncertainty: 13.61 μGal
Number of Sets Collected: 21
Number of Sets Processed: 21
Set #s Processed: 1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,21
Number of Sets NOT Processed: 0
Set #s NOT Processed:
Number of Drops/Set: 100
Total Drops Accepted: 2084
Total Drops Rejected: 16
Total Fringes Acquired: 700
Fringe Start: 19
Processed Fringes: 601
GuideCard Multiplex: 4
GuideCard Scale Factor: 250

Acquisition Settings

Set Interval: 60 min
Drop Interval: 10 sec
Number of Sets: 48
Number of Drops: 100

Gravity Corrections

Earth Tide (ETGTAB): -5.09 μGal
Ocean Load: 0.87 μGal
Polar Motion: -0.51 μGal
Barometric Pressure: 2.78 μGal
Transfer Height: 385.97 μGal
Reference Xo: -0.00 μGal

Uncertainties

Sigma Reject: 3.00
Earth Tide Factor: 0.001
Average Earth Tide Uncertainty: 0.01 μGal
Ocean Load Factor: 0.10

Average Ocean Load Uncertainty: 0.09 μGal
 Barometric: 1.00 μGal
 Polar Motion: 0.05 μGal
 Laser: 0.01 μGal
 Clock: 0.50 μGal
 System Type: 1.00 μGal
 Tidal Swell: 0.00 μGal
 Water Table: 0.00 μGal
 Unmodeled: 0.00 μGal
 System Setup: 1.00 μGal
 Gradient: 13.457 μGal (0.104 $\mu\text{Gal}/\text{cm}$)

g Acquisition Version: 3.102100
 g Processing Version: 9.120423

Set	Time	DOY	Gravity	Sigma	Error	Uncert.	Tide	Load	Baro.	Temp.	Press.
1	1:19:47	40	980107403.7	57.235	6	14.846	33.088	-2.465	1.197	31.673	1013.761
2	2:19:41	40	980107406.7	47.072	4.731	14.378	42.213	-0.042	0.919	35.074	1012.832
3	3:19:35	40	980107407.2	40.286	4.049	14.17	39.24	2.357	1.08	35.692	1013.369
4	4:19:33	40	980107410.2	45.442	4.567	14.33	24.357	4.151	1.215	35.791	1013.821
5	5:19:35	40	980107411.6	54.63	5.463	14.643	0.654	4.906	1.163	35.943	1013.646
6	6:19:36	40	980107414.1	47.74	4.798	14.407	-26.592	4.46	1.353	35.85	1014.281
7	7:19:35	40	980107416.8	58.797	5.88	14.798	-51.252	2.959	1.594	35.758	1015.083
8	8:19:35	40	980107403.6	90.499	9.05	16.317	-67.781	0.816	1.735	35.632	1015.553
9	9:19:35	40	980107413.1	112.75	11.275	17.649	-72.46	-1.397	2.092	35.554	1016.742
10	10:19:35	40	980107404.9	100.421	10.042	16.89	-64.27	-3.097	2.298	35.684	1017.43
11	11:19:35	40	980107415.3	75.112	7.511	15.521	-45.125	-3.844	2.573	35.343	1018.348
12	12:19:35	40	980107415.7	62.454	6.245	14.948	-19.423	-3.45	3.012	34.838	1019.81
13	13:19:35	40	980107404.7	63.213	6.321	14.978	6.997	-2.031	3.2	34.644	1020.435
14	14:19:35	40	980107415.8	64.684	6.468	15.039	28.268	0.026	3.321	34.585	1020.84
15	15:19:32	40	980107404.3	61.457	6.177	14.917	39.932	2.163	3.593	34.376	1021.747
16	16:19:33	40	980107405.4	61.106	6.141	14.906	40.074	3.801	3.857	34.264	1022.626
17	17:19:35	40	980107411.8	66.874	6.687	15.141	29.701	4.485	4.288	34.232	1024.063
18	18:19:35	40	980107408.9	63.844	6.384	15.008	12.485	4.005	4.536	33.956	1024.892
19	19:19:35	40	980107411.2	57.994	5.799	14.766	-6.361	2.458	4.888	33.8	1026.063
20	20:19:35	40	980107412.1	67.279	6.728	15.152	-21.524	0.215	5.128	33.838	1026.865
21	21:19:38	40	980107406.2	58.892	5.919	14.813	-29.063	-2.167	5.418	33.833	1027.828

A1.9 TARAWERA (TAAG)

Micro-g LaCoste g Processing Report
File Created: 05/18/15, 17:05:29

Project Name: Tarawera_20150212
g Acquisition Version: 3.102100
g Processing Version: 9.120423

Company/Institution:
Operator: Nick Dando

Station Data

Name: Tarawera
Site Code: TAAG
Lat: -39.02650 Long: 176.57360 Elev: 470.00 m
Setup Height: 13.08 cm
Transfer Height: 0.00 cm
Actual Height: 129.69 cm
Gradient: -2.870 $\mu\text{Gal}/\text{cm}$
Nominal Air Pressure: 958.05 mBar
Barometric Admittance Factor: 0.30
Polar Motion Coord: 0.0023 " 0.3311 "
Earth Tide (ETGTAB) Selected
Potential Filename: C:\gData\gWavefiles\ETCPOT.DAT
Delta Factor Filename: C:\gData\NZ_Data\WD_Bodytide.dff
Delta Factors

Start	Stop	Amplitude	Phase Term
0.000000	0.000001	1.000000	0.0000 DC
0.000002	0.249951	1.160000	0.0000 Long
0.721500	0.906315	1.154250	0.0000 Q1
0.921941	0.974188	1.154240	0.0000 O1
0.989049	0.998028	1.149150	0.0000 P1
0.999853	1.216397	1.134890	0.0000 K1
1.719381	1.906462	1.161720	0.0000 N2
1.923766	1.976926	1.161720	0.0000 M2
1.991787	2.002885	1.161720	0.0000 S2
2.003032	2.182843	1.161720	0.0000 K2
2.753244	3.081254	1.07338	0.0000 M3
3.791964	3.937897	1.03900	0.0000 M4

Ocean Load ON, Filename: C:\gData\NZ_Data\NZ_Tarawera\g8_TPX072_TARA-OceanLoad.olf

Waves: M2 S2 K1 O1 N2 P1 K2 Q1 Mf Mm Ssa

Amplitude (μGal): 4.873 1.136 0.572 0.183 0.840 0.154 0.318 0.087 0.164 0.067 0.000

Phase (deg): -30.7 -117.7 -4.0 159.9 2.5 5.7 -119.7 169.6 -3.1 10.5 0.0

Instrument Data

Meter Type: FG5
Meter S/N: 237

Factory Height: 116.61 cm
Rubidium Frequency: 10000000.00300 Hz
Laser: WEO100 (229)
ID: 632.99117754 nm (0.55 V)
IE: 632.99119473 nm (0.07 V)
IF: 632.99121259 nm (-0.35 V)
IG: 632.99123023 nm (-0.77 V)
IH: 632.99136890 nm (0.00 V)
II: 632.99139822 nm (0.00 V)
IJ: 632.99142704 nm (0.00 V)
Modulation Frequency: 8333.350 Hz

Processing Results

Date: 02/12/15
Time: 01:02:55
DOY: 043
Year: 2015
Time Offset (D h:m:s): 0 0:0:0
Gravity: 979922338.20 μ Gal
Set Scatter: 3.69 μ Gal
Measurement Precision: 1.17 μ Gal
Total Uncertainty: 18.16 μ Gal
Number of Sets Collected: 10
Number of Sets Processed: 10
Set #s Processed: 1,2,3,4,5,6,7,8,9,10
Number of Sets NOT Processed: 0
Set #s NOT Processed:
Number of Drops/Set: 100
Total Drops Accepted: 976
Total Drops Rejected: 24
Total Fringes Acquired: 700
Fringe Start: 19
Processed Fringes: 601
GuideCard Multiplex: 4
GuideCard Scale Factor: 250

Acquisition Settings

Set Interval: 20 min
Drop Interval: 10 sec
Number of Sets: 12
Number of Drops: 100

Gravity Corrections

Earth Tide (ETGTAB): -15.27 μ Gal
Ocean Load: -4.72 μ Gal
Polar Motion: -0.41 μ Gal
Barometric Pressure: 4.78 μ Gal
Transfer Height: 372.21 μ Gal
Reference Xo: -0.00 μ Gal

Uncertainties

Sigma Reject: 3.00
Earth Tide Factor: 0.001
Average Earth Tide Uncertainty: 0.02 μ Gal
Ocean Load Factor: 0.10
Average Ocean Load Uncertainty: 0.47 μ Gal

Barometric: 1.00 μGal
 Polar Motion: 0.05 μGal
 Laser: 0.01 μGal
 Clock: 0.50 μGal
 System Type: 1.00 μGal
 Tidal Swell: 0.00 μGal
 Water Table: 0.00 μGal
 Unmodeled: 0.00 μGal
 System Setup: 1.00 μGal
 Gradient: 18.027 μGal (0.139 $\mu\text{Gal}/\text{cm}$)

g Acquisition Version: 3.102100
 g Processing Version: 9.120423

Set	Time	DOY	Gravity	Sigma	Error	Uncert.	Tide	Load	Baro.	Temp.	Press.
1	23:33:09	42	979922328.3	38.91	3.93	18.545	-7.873	-4.956	5.26	27.055	975.585
2	23:53:00	42	979922337.3	45.499	4.596	18.698	-10.808	-5.271	5.099	29.05	975.048
3	0:12:52	43	979922337.6	29.612	3.007	18.373	-13.209	-5.449	4.971	30.358	974.622
4	0:32:57	43	979922342.4	38.852	3.986	18.558	-15.105	-5.486	4.853	31.269	974.226
5	0:52:49	43	979922336.4	36.355	3.654	18.49	-16.48	-5.379	4.793	31.911	974.028
6	1:12:45	43	979922339.6	31.589	3.207	18.406	-17.404	-5.131	4.756	32.311	973.902
7	1:32:50	43	979922343.6	42.613	4.283	18.622	-17.927	-4.745	4.654	32.635	973.563
8	1:53:00	43	979922338.8	31.504	3.249	18.411	-18.11	-4.232	4.586	32.958	973.336
9	2:12:51	43	979922338.9	30.015	3.002	18.367	-18.028	-3.617	4.474	33.419	972.963
10	2:32:54	43	979922334	35.486	3.567	18.467	-17.76	-2.904	4.384	33.661	972.664

A1.10 WARKWORTH (WARG)

Micro-g LaCoste g Processing Report
File Created: 05/18/15, 17:10:51

Project Name: Warworth_20150213
g Acquisition Version: 3.102100
g Processing Version: 9.120423

Company/Institution:
Operator: Nick Dando

Station Data

Name: Warkworth
Site Code: WARG
Lat: -36.43450 Long: 174.66300 Elev: 74.00 m
Setup Height: 13.25 cm
Transfer Height: -0.70 cm
Actual Height: 129.86 cm
Gradient: -3.348 $\mu\text{Gal}/\text{cm}$
Nominal Air Pressure: 1004.39 mBar
Barometric Admittance Factor: 0.30
Polar Motion Coord: 0.0027 " 0.3335 "
Earth Tide (ETGTAB) Selected
Potential Filename: C:\gData\gWavefiles\ETCPOT.DAT
Delta Factor Filename: C:\gData\NZ_Data\WD_Bodytide.dff
Delta Factors

Start	Stop	Amplitude	Phase Term
0.000000	0.000001	1.000000	0.0000 DC
0.000002	0.249951	1.160000	0.0000 Long
0.721500	0.906315	1.154250	0.0000 Q1
0.921941	0.974188	1.154240	0.0000 O1
0.989049	0.998028	1.149150	0.0000 P1
0.999853	1.216397	1.134890	0.0000 K1
1.719381	1.906462	1.161720	0.0000 N2
1.923766	1.976926	1.161720	0.0000 M2
1.991787	2.002885	1.161720	0.0000 S2
2.003032	2.182843	1.161720	0.0000 K2
2.753244	3.081254	1.07338	0.0000 M3
3.791964	3.937897	1.03900	0.0000 M4

Ocean Load ON, Filename: C:\gData\NZ_Data\NZ_Warkworth\g8_TPX072_WARK-OceanLoad.olf

Waves: M2 S2 K1 O1 N2 P1 K2 Q1 Mf Mm Ssa

Amplitude (μGal): 7.619 1.820 1.017 0.122 1.324 0.284 0.504 0.065 0.129 0.048 0.000

Phase (deg): -47.5 -110.2 -6.2 71.1 -22.1 -0.6 -107.8 148.4 -0.6 20.5 0.0

Instrument Data

Meter Type: FG5

Meter S/N: 237

Factory Height: 116.61 cm

Rubidium Frequency: 10000000.00300 Hz

Laser: WEO100 (229)

ID: 632.99117754 nm (0.75 V)

IE: 632.99119473 nm (0.40 V)

IF: 632.99121259 nm (-0.01 V)

IG: 632.99123023 nm (-0.40 V)

IH: 632.99136890 nm (0.00 V)

II: 632.99139822 nm (0.00 V)

IJ: 632.99142704 nm (0.00 V)

Modulation Frequency: 8333.350 Hz

Processing Results

Date: 02/14/15

Time: 04:05:50

DOY: 045

Year: 2015

Time Offset (D h:m:s): 0 0:0:0

Gravity: 979886253.49 μ Gal

Set Scatter: 1.97 μ Gal

Measurement Precision: 0.28 μ Gal

Total Uncertainty: 8.18 μ Gal

Number of Sets Collected: 48

Number of Sets Processed: 48

Set #s Processed:

1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,21,22,23,24,25,26,27,28,29,30,31,32,33,
34,35,36,37,38,39,40,41,42,43,44,45,46,47,48

Number of Sets NOT Processed: 0

Set #s NOT Processed:

Number of Drops/Set: 100

Total Drops Accepted: 4787

Total Drops Rejected: 13

Total Fringes Acquired: 700

Fringe Start: 19

Processed Fringes: 601

GuideCard Multiplex: 4

GuideCard Scale Factor: 250

Acquisition Settings

Set Interval: 60 min

Drop Interval: 10 sec

Number of Sets: 48

Number of Drops: 100

Gravity Corrections

Earth Tide (ETGTAB): 1.30 μ Gal

Ocean Load: 0.14 μ Gal

Polar Motion: -0.62 μ Gal

Barometric Pressure: 2.77 μ Gal

Transfer Height: 437.11 μ Gal

Reference Xo: -0.00 μ Gal

Uncertainties

Sigma Reject: 3.00

Earth Tide Factor: 0.001

Average Earth Tide Uncertainty: 0.00 μGal

Ocean Load Factor: 0.10

Average Ocean Load Uncertainty: 0.01 μGal

Barometric: 1.00 μGal

Polar Motion: 0.05 μGal

Laser: 0.01 μGal

Clock: 0.50 μGal

System Type: 1.00 μGal

Tidal Swell: 0.00 μGal

Water Table: 0.00 μGal

Unmodeled: 0.00 μGal

System Setup: 1.00 μGal

Gradient: 7.964 μGal (0.061 $\mu\text{Gal}/\text{cm}$)

g Acquisition Version: 3.102100

g Processing Version: 9.120423

Set	Time	DOY	Gravity	Sigma	Error	Uncert.	Tide	Load	Baro.	Temp.	Press.
1	4:36:16	44	979886252.5	20.392	2.05	8.42	-32.214	-1.212	1.911	34.34	1010.76
2	5:35:56	44	979886255.8	26.874	2.687	8.599	-28.777	2.173	1.851	39.342	1010.56
3	6:35:48	44	979886251.8	23.334	2.333	8.508	-25.652	5.049	1.983	40.97	1010.999
4	7:35:48	44	979886255.6	26.725	2.672	8.618	-25.061	6.739	2.042	40.818	1011.198
5	8:35:48	44	979886251	25.758	2.576	8.59	-28.273	6.858	2.184	40.002	1011.672
6	9:35:48	44	979886256.9	25.04	2.517	8.562	-35.173	5.411	2.36	39.293	1012.255
7	10:35:48	44	979886250.5	25.951	2.595	8.573	-44.158	2.782	2.363	38.721	1012.268
8	11:35:48	44	979886254.5	26.28	2.628	8.579	-52.384	-0.369	2.274	38.216	1011.971
9	12:35:48	44	979886253.7	28.15	2.815	8.644	-56.374	-3.27	2.216	37.746	1011.777
10	13:35:55	44	979886255.2	27.882	2.788	8.645	-52.889	-5.229	2.108	37.315	1011.417
11	14:35:48	44	979886253.8	24.721	2.472	8.552	-39.985	-5.795	2.084	36.831	1011.336
12	15:35:48	44	979886251.5	23.801	2.38	8.52	-17.625	-4.884	2.097	36.423	1011.381
13	16:35:48	44	979886251.7	23.112	2.311	8.491	11.811	-2.772	2.176	36.093	1011.645
14	17:35:48	44	979886251.9	25.325	2.533	8.55	43.899	-0.034	2.292	35.773	1012.031
15	18:35:48	44	979886252.6	22.462	2.246	8.473	73.032	2.607	2.538	35.5	1012.85
16	19:35:48	44	979886248.1	39.847	3.985	9.098	93.712	4.465	2.692	36.046	1013.364
17	20:35:55	44	979886248	140.359	14.036	16.247	101.885	5.057	2.699	37.96	1013.386
18	21:35:49	44	979886255.3	26.47	2.647	8.595	95.937	4.225	2.715	40.605	1013.441
19	22:35:48	44	979886251.9	23.318	2.332	8.495	77.096	2.174	2.729	42.301	1013.487
20	23:35:48	44	979886252.7	24.175	2.418	8.516	49.083	-0.584	2.642	43.669	1013.197
21	0:35:48	45	979886249.1	25.741	2.587	8.572	17.219	-3.356	2.573	44.505	1012.967
22	1:35:50	45	979886253.9	24.965	2.509	8.56	-12.83	-5.441	2.437	44.697	1012.515
23	2:35:48	45	979886253.2	21.256	2.126	8.461	-36.224	-6.298	2.272	44.806	1011.964
24	3:35:48	45	979886253.6	22.375	2.238	8.486	-50.07	-5.692	2.306	42.404	1012.078
25	4:35:47	45	979886253.4	21.366	2.158	8.455	-53.759	-3.739	2.25	42.604	1011.891

Set	Time	DOY	Gravity	Sigma	Error	Uncert.	Tide	Load	Baro.	Temp.	Press.
26	5:35:48	45	979886255	23.775	2.377	8.505	-49.018	-0.88	2.356	42.713	1012.242
27	6:35:48	45	979886254.8	19.749	1.975	8.404	-39.358	2.219	2.457	42.116	1012.581
28	7:35:48	45	979886253.7	18.181	1.818	8.38	-29.156	4.838	2.735	40.858	1013.505
29	8:35:48	45	979886254.1	20.148	2.015	8.435	-22.536	6.369	2.906	39.577	1014.078
30	9:35:47	45	979886253.9	20.46	2.056	8.446	-22.27	6.467	3.116	38.412	1014.775
31	10:35:49	45	979886249.7	21.055	2.106	8.449	-28.978	5.125	3.124	37.503	1014.802
32	11:35:48	45	979886249.2	19.047	1.905	8.389	-40.796	2.678	3.164	36.795	1014.936
33	12:35:48	45	979886250.9	20.617	2.062	8.422	-53.721	-0.286	3.209	36.343	1015.087
34	13:35:49	45	979886251.7	16.395	1.648	8.336	-62.532	-3.065	3.16	36.143	1014.924
35	14:35:48	45	979886248.3	19.861	1.986	8.419	-62.183	-5.015	3.205	35.907	1015.074
36	15:35:48	45	979886254.6	17.506	1.751	8.371	-49.307	-5.704	3.158	35.629	1014.916
37	16:35:48	45	979886255.3	18.757	1.876	8.393	-23.411	-5.011	3.278	35.479	1015.318
38	17:35:48	45	979886252.6	20.306	2.031	8.42	12.611	-3.153	3.408	35.535	1015.75
39	18:35:48	45	979886251.2	20.133	2.013	8.411	52.861	-0.626	3.544	35.493	1016.204
40	19:35:48	45	979886254	19.379	1.938	8.395	89.701	1.919	3.762	35.621	1016.931
41	20:35:51	45	979886250.9	24.217	2.459	8.537	115.586	3.837	3.876	35.211	1017.311
42	21:35:48	45	979886254.1	18.189	1.819	8.38	124.895	4.642	3.836	37.035	1017.178
43	22:35:56	45	979886254.5	19.278	1.928	8.401	115.445	4.133	3.733	38.879	1016.834
44	23:35:50	45	979886253.2	15.063	1.522	8.31	89.105	2.442	3.606	40.297	1016.411
45	0:36:01	46	979886249.5	16.229	1.623	8.326	50.951	-0.02	3.519	41.197	1016.121
46	1:35:48	46	979886251.4	16.364	1.636	8.332	8.954	-2.608	3.355	41.672	1015.572
47	2:35:48	46	979886250.7	14.157	1.416	8.301	-29.367	-4.688	3.267	42.089	1015.28
48	3:35:48	46	979886253.8	16.152	1.615	8.344	-57.271	-5.71	3.155	42.368	1014.905