



THE ABSOLUTE GRAVITY NETWORK OF HAITI

Status Report 2021

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Introduction

The establishment of the absolute gravity network of Haiti started in November 2016 in the framework of a “Protocole d’Accord” between the Faculty of Sciences, Technology and Communication of the University of Luxembourg and the “Unité de Recherche en Géophysique” (URGéo) from the Faculty of Sciences of the State University of Haiti. The agreement stipulates that the Geophysics Laboratory of the UL is providing the equipment and the expertise at no cost. On the other hand, the URGéo and the Centre National de l’Information Géo-Spatiale (CNIGS) are responsible for all the logistic in Haiti.

The objective is to determine the absolute gravity value at all the sites of the permanent GPS network in Haiti (Figure 1). During the construction of the GPS sites, concrete pillars of 1m x 1m were built to accommodate the absolute gravimeter inside the stations enclosure. All the measurements were carried out with the FG5X-216 from the University of Luxembourg. The FG5X is a free-fall gravimeter: an object is dropped inside a vacuum chamber and its successive positions during the fall are measured with a laser beam. The accuracy is about 2 microgal and the precision varies from 1 to 2 microgal depending on the distance to the sea, the nature of the soil and the human activities around the sites.

In addition to the determination of the g -values, we also measured the vertical gravity gradients. This information is essential to solve the trajectory of the free-fallen object and to transfer the absolute gravity value from the instrumental height (around 138 cm) to the benchmark on the floor.



Figure 1. Locations of the 16 permanent GPS stations (yellow) of the CNIGS and of the 10 established absolute gravity stations (red).

This report contains the results of absolute gravity measurements carried out in January 2019. Two previous campaigns were organized in November 2016 and January 2018. In 2016,

only three stations (Port-Au-Prince, Jacmel and Fond des Blancs) were measured. In 2018, these stations were re-measured at the same time as 5 new stations (Camp Perrin, Moron, Mirebalais, Hinche and Plaisance). Finally, in 2019, all the stations were re-measured and two more stations (Pont Sondé and Thiotte) were added which represents a total of 10 stations.

The absolute gravity data can be used in conjunction with leveling or GNSS data to detect deformations associated with geodynamical or tectonics motions. The combination of both types of measurements allows investigating the origin and cause of these deformations; in addition, the absolute gravity stations formed the backbone of relative gravity networks. It provides reference station that can be used to anchor relative gravity survey. They also provide reference stations to estimate the drift of the relative gravimeters as well as to determine their calibration factor. Relative gravity networks would provide the necessary data to build the geoid of Haiti as well as the orthonometric heights mapping to convert ellipsoidal heights provided by GNSS into altimetric heights.

The Permanent GPS network in Haiti

Since 2010, the Haitian government, through the National Center for Geo-Spatial Information (CNIGS) and the Technical Secretariat of the Inter-ministerial Committee for Territorial Planning (CIAT), with the support of the Inter-American Development Bank (IDB) has embarked on a process of modernizing its geodetic infrastructures, until now materialized by several marks on the ground. Thus, the project was born to install and set up a network of sixteen (16) permanent reference Global Navigation Satellite System (GNSS) stations. The realization of this network was entrusted to the American firm Trimble and was managed for the Haitian State by the CNIGS and the CIAT. The primary objective of this network, which will serve as the basis of the country modern geodetic network, is to facilitate the implementation of the Land Security Program in Rural Areas (PSFMR). This program is coordinated by the CIAT aiming at reforming the land registry of the country. It will also serve as a national reference for civil engineering, topographic, geomatics, etc.

Beyond technical applications of the network, several research projects are conducted. They are mainly concentrated on the gravity changes over medium and long-term: (a) monitoring of the crust deformations related to tectonic motions; (b) determination of the geophysical process by comparing the rates of the gravity and vertical displacements variations, and; (c) monitoring of the vertical displacements at the tide gauge stations in parallel with continuous GPS observations.

Vertical Gravity Gradient

The Vertical Gravity Gradient (VGG) is needed to linearize the equation of motion but also to transfer the measured absolute gravity value from the reference height around 1.38 m to the floor. Its determination requires relative measurements using a small portable relative gravimeter. The VGG were measured at all the stations with the Scintrex CG5-008 from the University of Luxembourg. Their values are listed in Table 1 and have been used for the absolute gravity data processing.

Table 1. Vertical gravity gradient at the absolute gravity stations in Haiti.

Site	Date	Vertical gravity gradient /microgal.cm ⁻¹	Uncertainty /microgal.cm ⁻¹
Port-au-Prince	27/01/2018	3.034	0.008
Camp Perrin	11/01/2018	3.139	0.009
Fond des Blancs	10/01/2018	3.507	0.007
Hinche	17/01/2018	3.439	0.007
Jacmel	14/01/2018	3.211	0.008
Mirebalais	16/01/2018	3.371	0.007
Moron	12/01/2018	3.868	0.011
Plaisance	18/01/2019	4.551	0.008
Pont Sondé	17/01/2019	3.175	0.007
Thiotte	14/01/2019	3.647	0.008

Data processing

Raw data from the absolute gravimeters consist of vectors of time and position of the falling object during the drops. To obtain the gravity value, a linear equation representing the equation of motion is fit to the raw data including the VGG.

The data processing follows the protocol adopted during absolute gravimeters comparisons at the BIPM in Sèvres (Francis and van Dam, 2003). Geophysical corrections are applied to the raw gravity data: Earth tides using modelled tidal parameters, atmospheric pressure effect using a constant admittance, and the polar motion effect using pole positions from the International Earth Rotation Service (<http://hpiers.obspm.fr>).

The g-soft version 9.120423 software from Microg-LaCoste Inc. was used for the processing.

Results of the absolute gravity measurements

The g-values of the absolute gravity measurements performed during the 2019 campaign are given in Table 2. Those are the reference values that should be used until the stations could be re-measured in the future. The g-values are provided at the floor level, exactly at the top of the marker. The final precision is given in the last column. It also includes the uncertainty related to the data transfer from the top of the drop (around 1.38 m) to the ground level.

Last part of the document contains station descriptions (location, geological environment, pillar/benchmark particularities, ...) and more detailed reports on the gravity measurements.

Table 2. Absolute gravity values at 10 of the 16 permanent GPS stations in Haiti. The g-values are given at the floor level, i.e. at the top of the benchmark. The uncertainty at the floor level is always larger than at the top of the drop (i.e. mean seat standard deviation). To obtain the value at the floor level, the value of the vertical gravity gradient is determined with a spring relative gravimeter. The precision of the gradient being around 1-2 microgal per meter, it introduced a contribution of 2-3 microgal in the final error budget.

Site	Date	Gravity value @ 0 m /microgal	Mean Set Standard Deviation /microgal	Uncertainty /microgal
Port-au-Prince	07/01/2019	978 565 461.06	0.54	1.23
Camp Perrin	10/01/2019	978 597 560.97	1.09	1.65
Fond des Blancs	09/01/2019	978 574 658.49	1.32	1.64
Hinche	16/01/2019	978 546 386.02	1.14	1.58
Jacmel	10/01/2019	978 632 698.39	1.12	1.57
Mirebalais	15/01/2019	978 558 399.26	1.82	2.06
Moron	11/01/2019	978 641 660.86	0.76	1.70
Plaisance	18/01/2019	978 613 795.93	0.46	1.20
Pont Sondé	17/01/2019	978 660 025.26	1.36	1.67
Thiotte	14/01/2019	978 292 347.27	1.12	1.57

Acknowledgments

The project benefited from the strong support and collaboration of Prof. Dominique Boisson (URGéo) as well as from Bobby Emmanuel Piard (Director of the CNIGS). We are grateful to all the people (drivers, technicians, ...) from the different Institutes who assisted us in our field campaigns.

Reference

Francis O., van Dam T.M., Processing of the Absolute data of the ICAG01, Cahiers du Centre Européen de Géodynamique et de Séismologie, vol.22, 45-48, 2003.

PORT-AU-PRINCE



Station description

Location: Indoor, new building of the CNIGS – Fundamental Absolute Gravity Station.

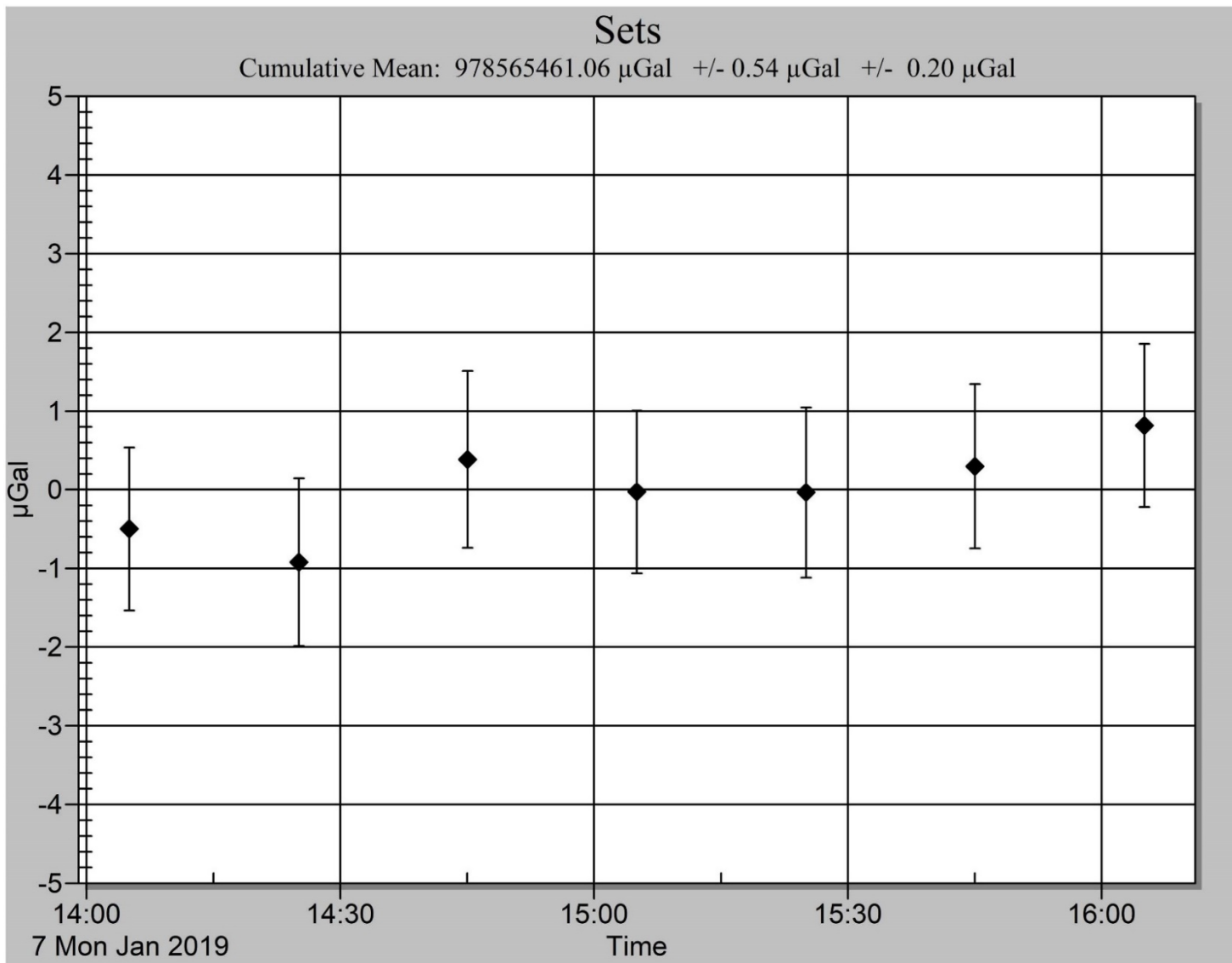
Responsible organization: CNIGS.

Geological context: Well-rounded calcium carbonate cobbles in a semi-consolidated red marlstone/mudstone matrix that contains a mixture of clays and silts.

Data quality: Excellent, very stable platform in the basement of the building.



STATION: PORT-AU-PRINCE												
City:	Port-au-Prince					Country:	Haiti					
Location:	CNIGS					Particularity:						
Situation:	New building					Remarks:	Lowest floor next to the stairs					
Date:	January 7, 2019											
Code number:												
Latitude:	18.52962					Degrees						
Longitude:	-72.32357					Degrees						
Elevation:	127					m						
Gradient:	-3.034					µgal/cm						
Reference height:	1.3868					m						
Meter:	FG5X											
S/N:	216											
Ocean loading correction (µgal, -Greenwich degree)												
Wave	M ₂	S ₂	K ₁	O ₁	N ₂	P ₁	K ₂	Q ₁	M _f	M _m	S _{sa}	
Ampl. :	1.728	0.556	0.883	0.716	0.321	0.266	0.157	0.169	0.0	0.0	0.0	
Phase:	11.9	-27.1	30.2	33.2	34.8	26.9	-23.1	41.1	0.0	0.0	0.0	
Polar motion correction						Air pressure correction						
X-coordinate:	0.0722			Arc seconds			Nominal air pressure:			998.09 mbar		
Y-coordinate:	0.2734			Arc seconds			Barometric admittance factor:			0.3 µgal/mbar		
Gravity												
Set gravity mean:	978 564 461.06					microgal						
Set std. dev.:	0.54					microgal						
Number of sets:	7											
Number of drops per set:	100											
Drop interval:	10					second						
Set interval:	20					minute						
Nominal/datum height:	0.00					m						
Author: O. Francis	University of Luxembourg											
Date: August 18, 2019												



Port-au-Prince - Plot of the set gravity values (1 set = 200 drops)

Camp Perrin



Station description

Location: Ferme Agricole Levi.

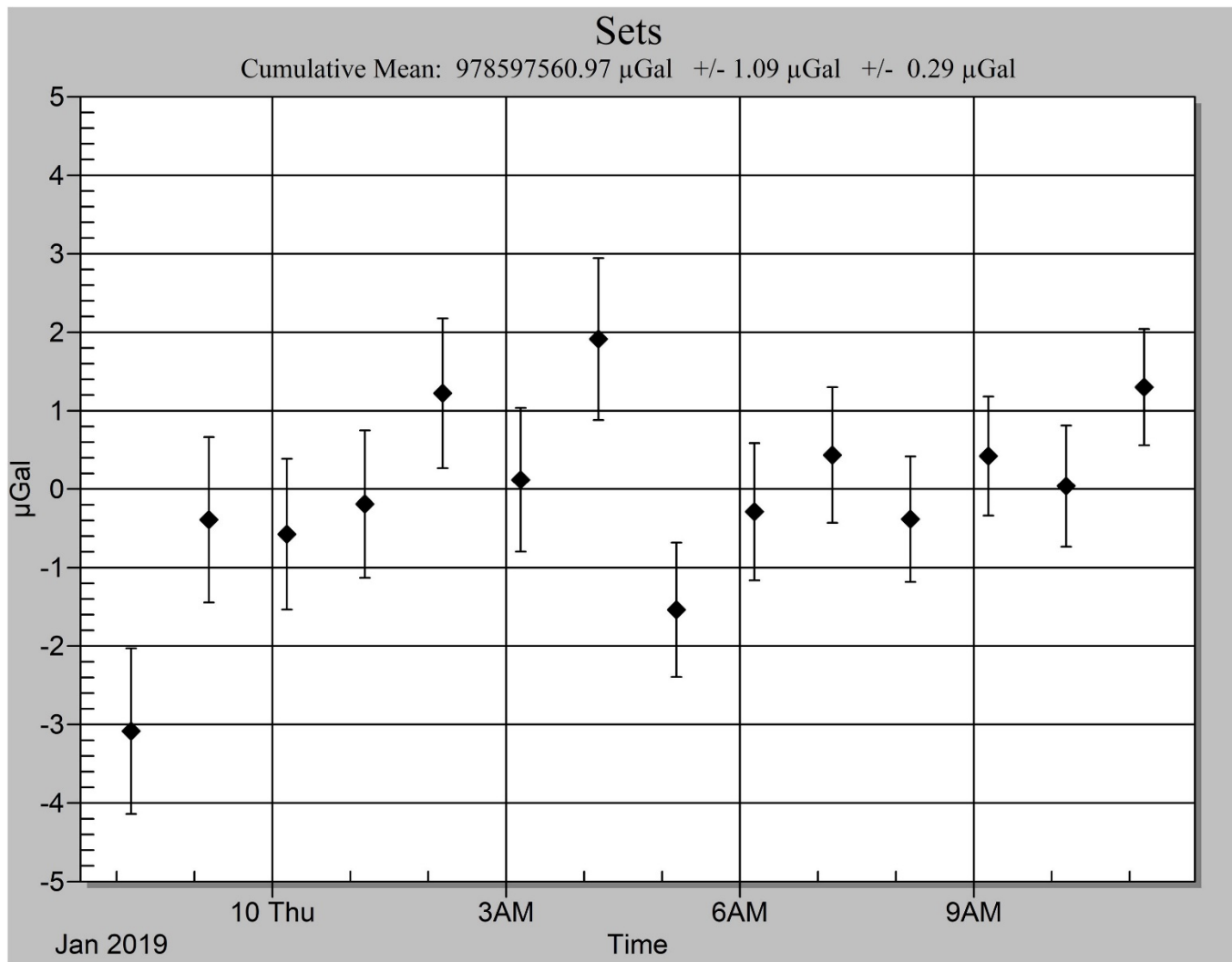
Responsible organization: CNIGS.

Geological context: Cemented and coarse alluvial sediments (cobbles, gravel, sand).

Data quality: Medium, perturbations due to the electrical generator providing the power to the absolute gravimeter.



STATION: CAMP PERRIN												
City:	Camp Perrin					Country:	Haiti					
Location:	Permanent GPS CNIGS					Particularity:						
Situation:	Ferme Agricole Levi					Remarks:						
Date:	January 10, 2019											
Code number:												
Latitude:	18.29972					degrees						
Longitude:	-73.85908					degrees						
Elevation:	130.0					m						
Gradient:	-3.0					µgal/cm						
Reference height:	1.3853					m						
Meter:	FG5X											
S/N:	216											
Ocean loading correction (µgal, -Greenwich degree)												
Wave	M ₂	S ₂	K ₁	O ₁	N ₂	P ₁	K ₂	Q ₁	M _f	M _m	S _{sa}	
Ampl. :	1.325	0.578	0.955	0.758	0.207	0.314	0.165	0.156	0.0	0.0	0.0	
Phase:	17.9	-8.0	29.8	34.0	40.0	30.3	-7.3	54.1	0.0	0.0	0.0	
Polar motion correction						Air pressure correction						
X-coordinate:	0.0698			Arc seconds			Nominal air pressure:			991.34 mbar		
Y-coordinate:	0.2758			Arc seconds			Barometric admittance factor:			0.3 µgal/mbar		
Gravity												
Set gravity mean:	978 597 560.97					microgal						
Set std. dev.:	1.09					microgal						
Number of sets:	14											
Number of drops per set:	100											
Drop interval:	10					second						
Set interval:	60					minute						
Nominal/datum height:	0.00					m						
Author: O. Francis	University of Luxembourg											
Date: August 19, 2019												



Camp Perrin - Plot of the set gravity values (1 set = 200 drops)

FOND DES BLANCS



Station description

Location: Top of a hill next to an isolated farm.

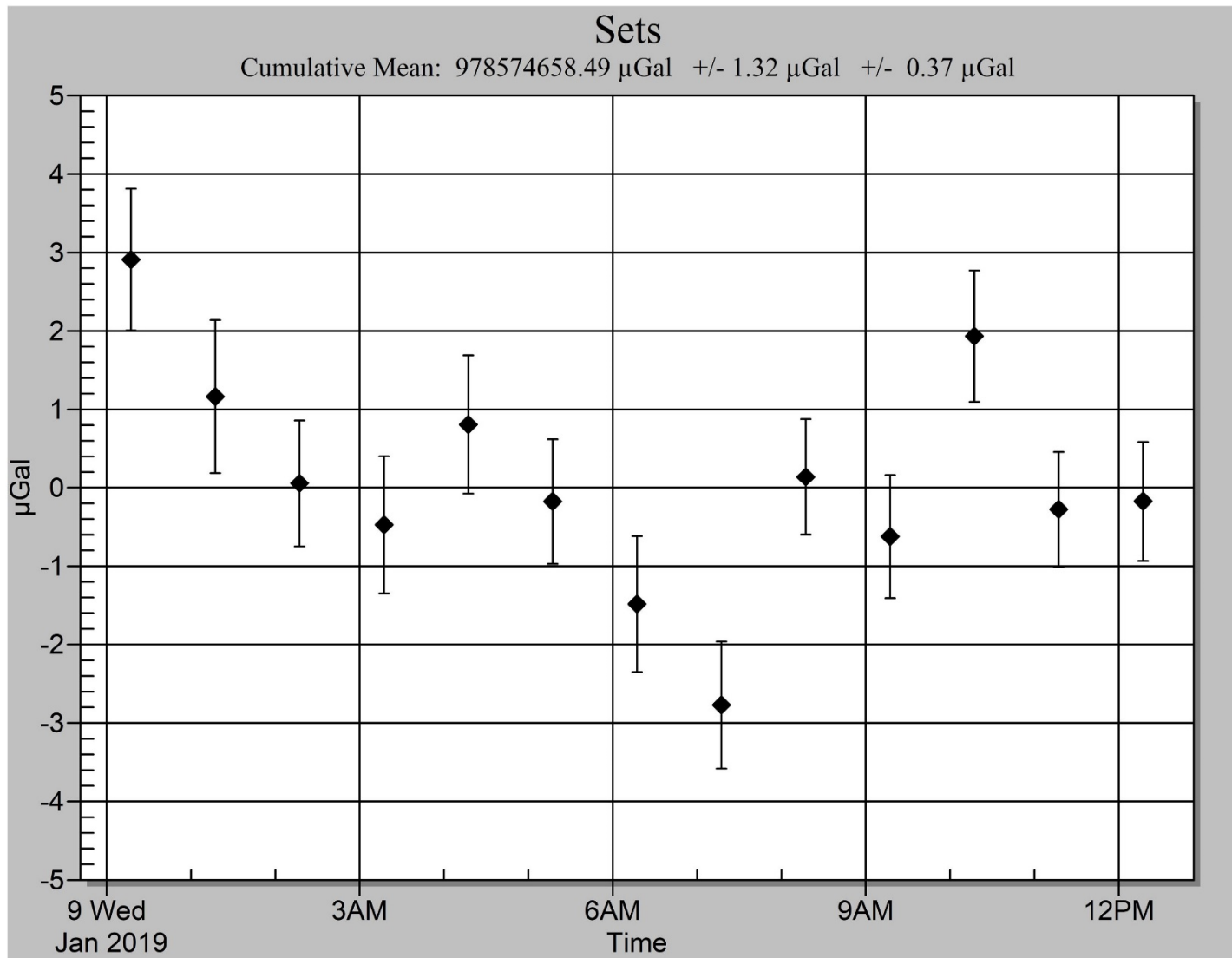
Responsible organization: CNIGS

Geological context: Sedimentary and fractured limestone.

Data quality: Excellent, very stable pier.



STATION: FOND DES BLANCS											
City:	Fond des Blancs					Country:	Haiti				
Location:	Permanent GPS CNIGS					Particularity:					
Situation:						Remarks:					
Date:	January 9, 2019										
Code number:											
Latitude:	18.29792					degrees					
Longitude:	-73.10386					degrees					
Elevation:	353					m					
Gradient:	-3.507					µgal/cm					
Reference height:	1.3783					m					
Meter:	FG5X										
S/N:	216										
Ocean loading correction (µgal, -Greenwich degree)											
Wave	M ₂	S ₂	K ₁	O ₁	N ₂	P ₁	K ₂	Q ₁	M _f	M _m	S _{sa}
Ampl. :	1.363	0.577	1.002	0.801	0.220	0.330	0.164	0.165	0.0	0.0	0.0
Phase:	15.0	-9.3	29.3	33.7	37.1	29.8	-8.3	54.4	0.0	0.0	0.0
Polar motion correction						Air pressure correction					
X-coordinate:	0.0706		Arc seconds			Nominal air pressure:			971.56 mbar		
Y-coordinate:	0.2748		Arc seconds			Barometric admittance factor:			0.3 µgal/mbar		
Gravity											
Set gravity mean:	978 574 658.49					Microgal					
Set std. dev.:	1.32					microgal					
Number of sets:	14										
Number of drops per set:	100										
Drop interval:	10					second					
Set interval:	60					minute					
Nominal/datum height:	0.00					m					
Author: O. Francis	University of Luxembourg										
Date: August 19, 2019											



Fond des Blancs - Plot of the set gravity values (1 set = 100 drops)

HINCHE



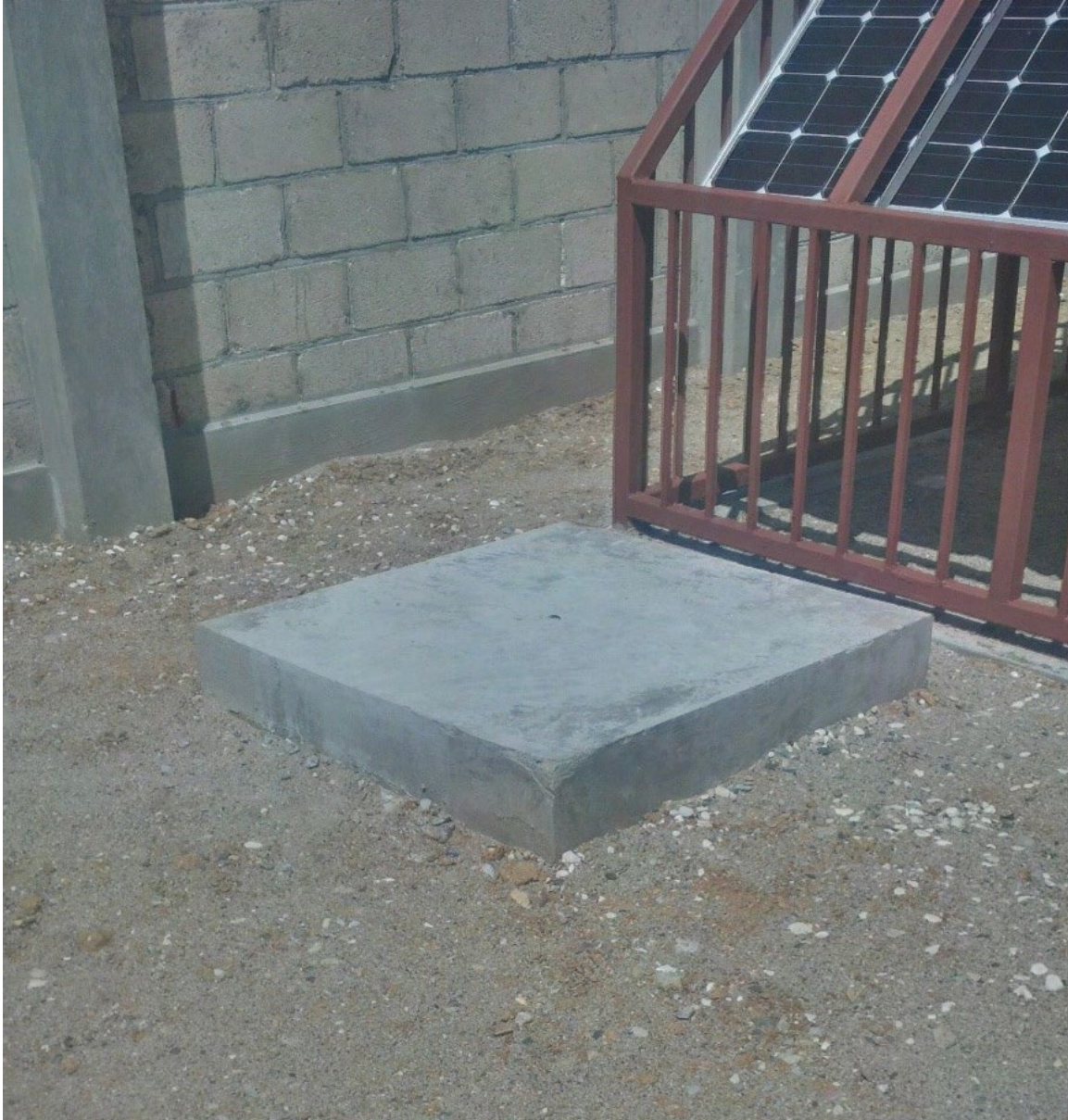
Station description

Location: Papaye.

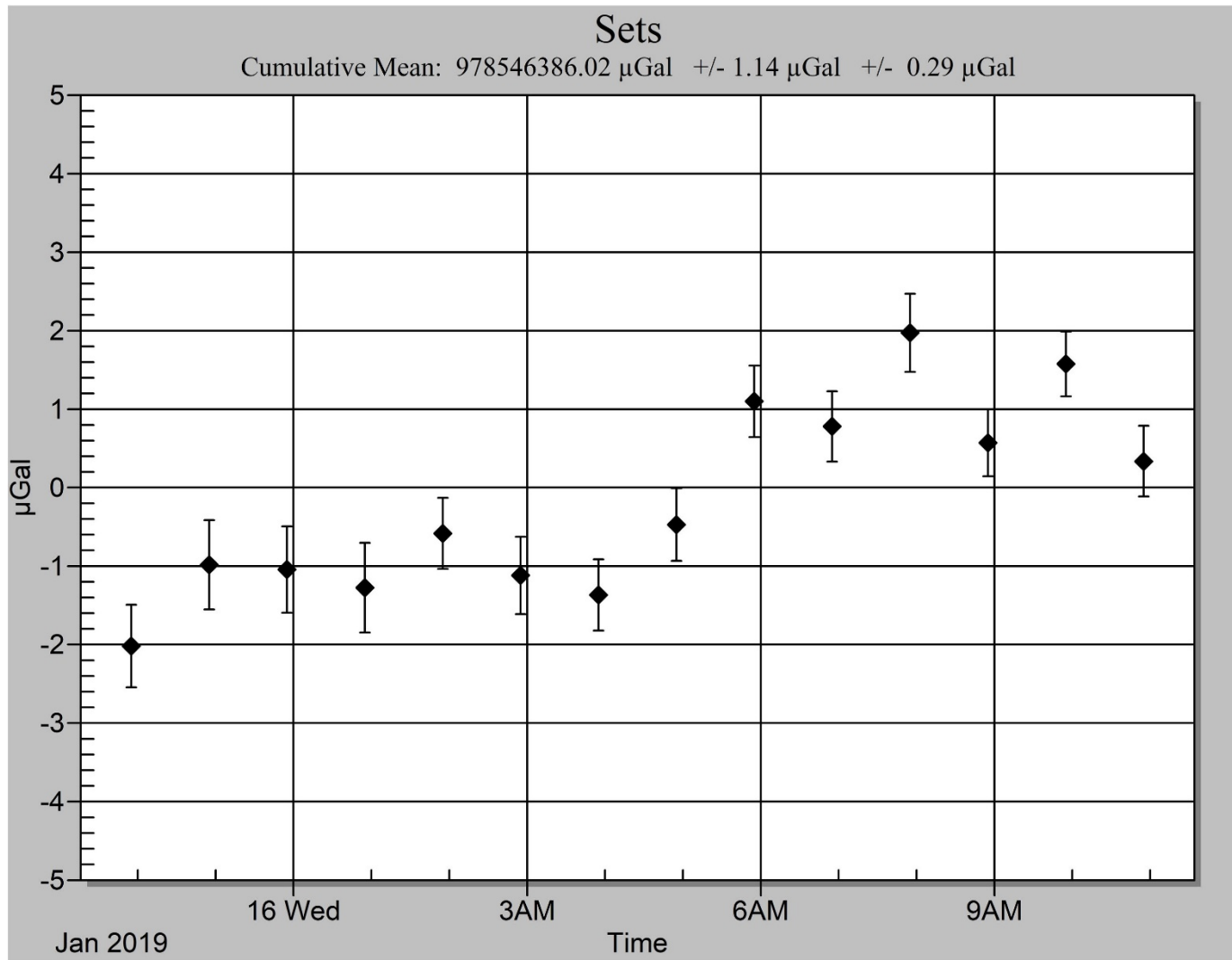
Responsible organisation: CNIGS.

Geological context: At the surface are fine clayey soils. The subsoil is made up of materials of various sizes ranging from fine sand to coarse gravel.

Data quality: Good site but vibration due to the portable electric generator.



STATION: HINCHE												
City:	Hinche					Country:	Haiti					
Location:	Permanent GPS CNIGS					Particularity:						
Situation:	Papaye					Remarks:						
Date:	January 16, 2019											
Code number:												
Latitude:	19.17548					degrees						
Longitude:	-72.71.98434					degrees						
Elevation:	298					m						
Gradient:	-3.439					µgal/cm						
Reference height:	1.3738					m						
Meter:	FG5X											
S/N:	216											
Ocean loading correction (µgal, -Greenwich degree)												
Wave	M ₂	S ₂	K ₁	O ₁	N ₂	P ₁	K ₂	Q ₁	M _F	M _m	S _{sa}	
Ampl. :	1.659	0.569	0.928	0.780	0.319	0.306	0.157	0.165	0.0	0.0	0.0	
Phase:	4.6	-14.3	33.5	36.3	25.4	33.9	-11.4	58.4	0.0	0.0	0.0	
Polar motion correction						Air pressure correction						
X-coordinate:	0.0630			Arc seconds			Nominal air pressure:			977.96 mbar		
Y-coordinate:	0.2868			Arc seconds			Barometric admittance factor:			0.3 µgal/mbar		
Gravity												
Set gravity mean:	978 546 386.02					microgal						
Set std. dev.:	1.14					microgal						
Number of sets:	16											
Number of drops per set:	200											
Drop interval:	5					second						
Set interval:	60					minute						
Nominal/datum height:	0.00					m						
Author: O. Francis	University of Luxembourg											
Date: April 8, 2021												



Hinche - Plot of the set gravity values (1 set = 100 drops)

JACMEL



Station description

Location: Airport.

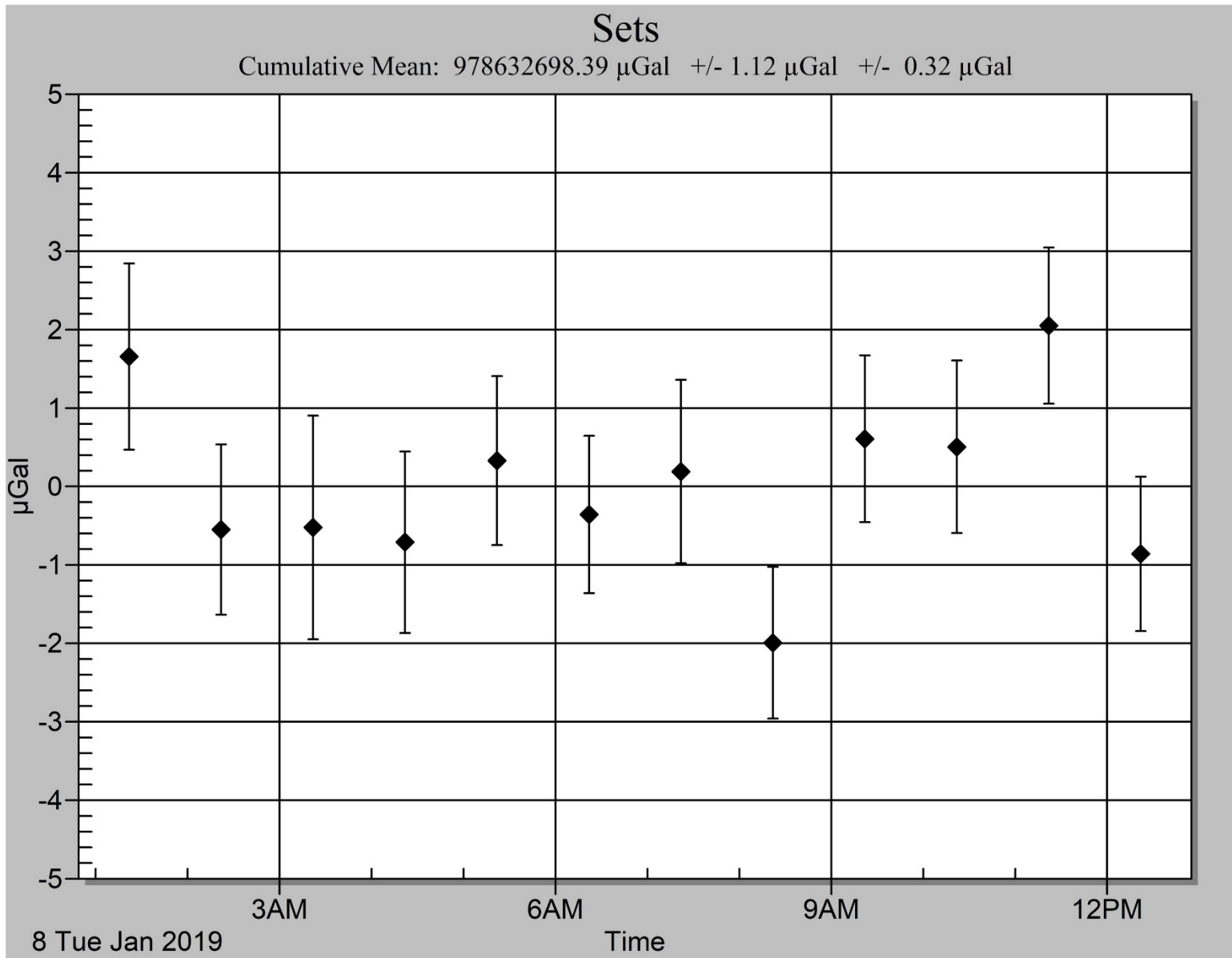
Responsible organization: CNIGS.

Geological context: Sedimentary dark-brown, clayey loam over weathered and soft limestone.

Data quality: Moderate, swamp area.



STATION: JACMEL											
City:	Jacmel					Country:	Haiti				
Location:	Permanent GPS CNIGS					Particularity:					
Situation:	Airport					Remarks:					
Date:	January 8, 2019										
Code number:											
Latitude:	18.23780					degrees					
Longitude:	-72.51780					degrees					
Elevation:	45.0					m					
Gradient:	-3.211					µgal/cm					
Reference height:	1.3738					m					
Meter:	FG5X										
S/N:	216										
Ocean loading correction (µgal, -Greenwich degree)											
Wave	M ₂	S ₂	K ₁	O ₁	N ₂	P ₁	K ₂	Q ₁	M _f	M _m	S _{sa}
Ampl. :	1.372	0.560	0.973	0.792	0.231	0.320	0.159	0.165	0.0	0.0	0.0
Phase:	17.8	-7.5	29.3	33.6	41.5	29.8	-6.6	54.8	0.0	0.0	0.0
Polar motion correction						Air pressure correction					
X-coordinate:	0.0711		Arc seconds			Nominal air pressure:			1007.86 mbar		
Y-coordinate:	0.2738		Arc seconds			Barometric admittance factor:			0.3 µgal/mbar		
Gravity											
Set gravity mean:	978 632 698.39					microgal					
Set std. dev.:	1.12					microgal					
Number of sets:	12										
Number of drops per set:	100										
Drop interval:	10					second					
Set interval:	60					minute					
Nominal/datum height:	0.00					m					
Author: O. Francis	University of Luxembourg										
Date: August 20, 2019											



Jacmel - Plot of the set gravity values (1 set = 100 drops)

MIREBALAIS



Station description

Location: North of Mirebalais.

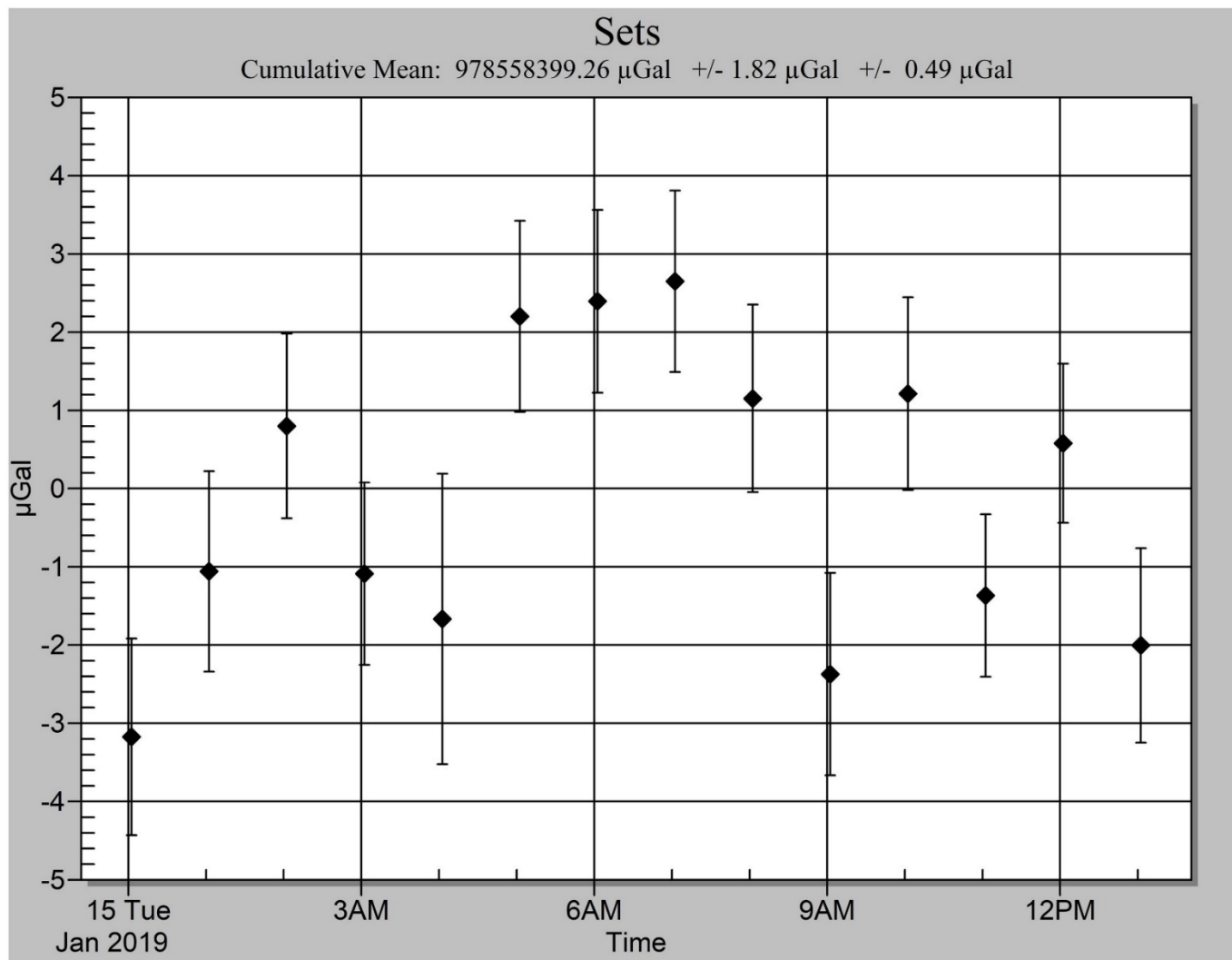
Responsible organization: CNIGS.

Geological context: Sedimentary moderately indurated limestone and marl outcrops.

Data quality: Good but vibration due to the portable electric generator.



STATION: MIREBALAIS											
City:	Mirebalais					Country:	Haiti				
Location:	Permanent GPS CNIGS					Particularity:					
Situation:						Remarks:					
Date:	January 15, 2019										
Code number:											
Latitude:	18.86770					degrees					
Longitude:	-72.08042					degrees					
Elevation:	151					m					
Gradient:	-3.371					µgal/cm					
Reference height:	1.3731					m					
Meter:	FG5X										
S/N:	216										
Ocean loading correction (µgal, -Greenwich degree)											
Wave	M ₂	S ₂	K ₁	O ₁	N ₂	P ₁	K ₂	Q ₁	M _f	M _m	S _{sa}
Ampl. :	0.804	0.298	0.294	0.205	0.205	0.097	0.084	0.060	0.0	0.0	0.0
Phase:	75.1	69.7	-170.8	-71.3	79.5	-170.4	68.7	-14.2	0.0	0.0	0.0
Polar motion correction						Air pressure correction					
X-coordinate:	0.0663		Arc seconds			Nominal air pressure:			995.24 mbar		
Y-coordinate:	0.2820		Arc seconds			Barometric admittance factor:			0.3 µgal/mbar		
Gravity											
Set gravity mean:	978 558 399.26					microgal					
Set std. dev.:	1.82					microgal					
Number of sets:	14										
Number of drops per set:	100										
Drop interval:	10					second					
Set interval:	60					minute					
Nominal/datum height:	0.00					m					
Author: O. Francis	University of Luxembourg										
Date: August 21, 2019											



Mirebalais - Plot of the set gravity values (1 set = 100 drops)

MORON



Station description

Location: Close to the “Ecole Nationale”.

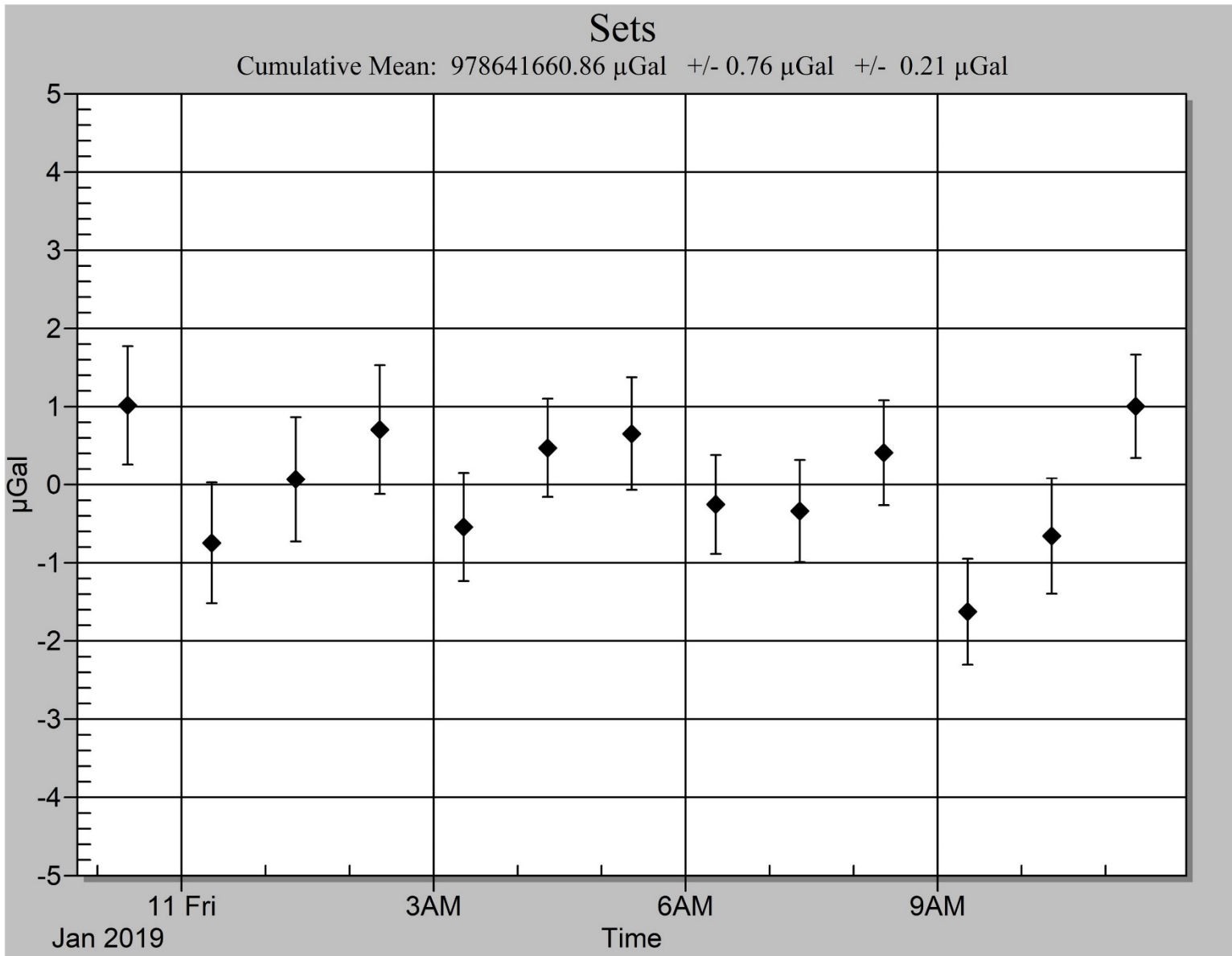
Responsible organisation: CNIGS.

Geological context: Sedimentary and hard limestone bedding.

Data quality: Excellent data.



STATION: MORON											
City:	Moron					Country:	Haiti				
Location:	Permanent GPS CNIGS					Particularity:					
Situation:						Remarks:					
Date:	January 11, 2019										
Code number:											
Latitude:	18.55831					degrees					
Longitude:	-74.27020					degrees					
Elevation:	141					m					
Gradient:	-3.868					µgal/cm					
Reference height:	1.3818					m					
Meter:	FG5X										
S/N:	216										
Ocean loading correction (µgal, -Greenwich degree)											
Wave	M ₂	S ₂	K ₁	O ₁	N ₂	P ₁	K ₂	Q ₁	M _f	M _m	S _{sa}
Ampl. :	1.361	0.591	0.955	0.751	0.215	0.314	0.168	0.154	0.0	0.0	0.0
Phase:	13.2	-10.4	30.5	34.4	32.4	30.9	-9.3	54.2	0.0	0.0	0.0
Polar motion correction						Air pressure correction					
X-coordinate:	0.0688		Arc seconds			Nominal air pressure:			996.43 mbar		
Y-coordinate:	0.2760		Arc seconds			Barometric admittance factor:			0.3 µgal/mbar		
Gravity											
Set gravity mean:	978 641 660.86					microgal					
Set std. dev.:	0.76					microgal					
Number of sets:	13										
Number of drops per set:	100										
Drop interval:	10					second					
Set interval:	60					minute					
Nominal/datum height:	0.00					m					
Author: O. Francis	University of Luxembourg										
Date: August 21, 2019											



Moron - Plot of the set gravity values (1 set = 100 drops)

PLAISANCE



Station description

Location: Bedoret.

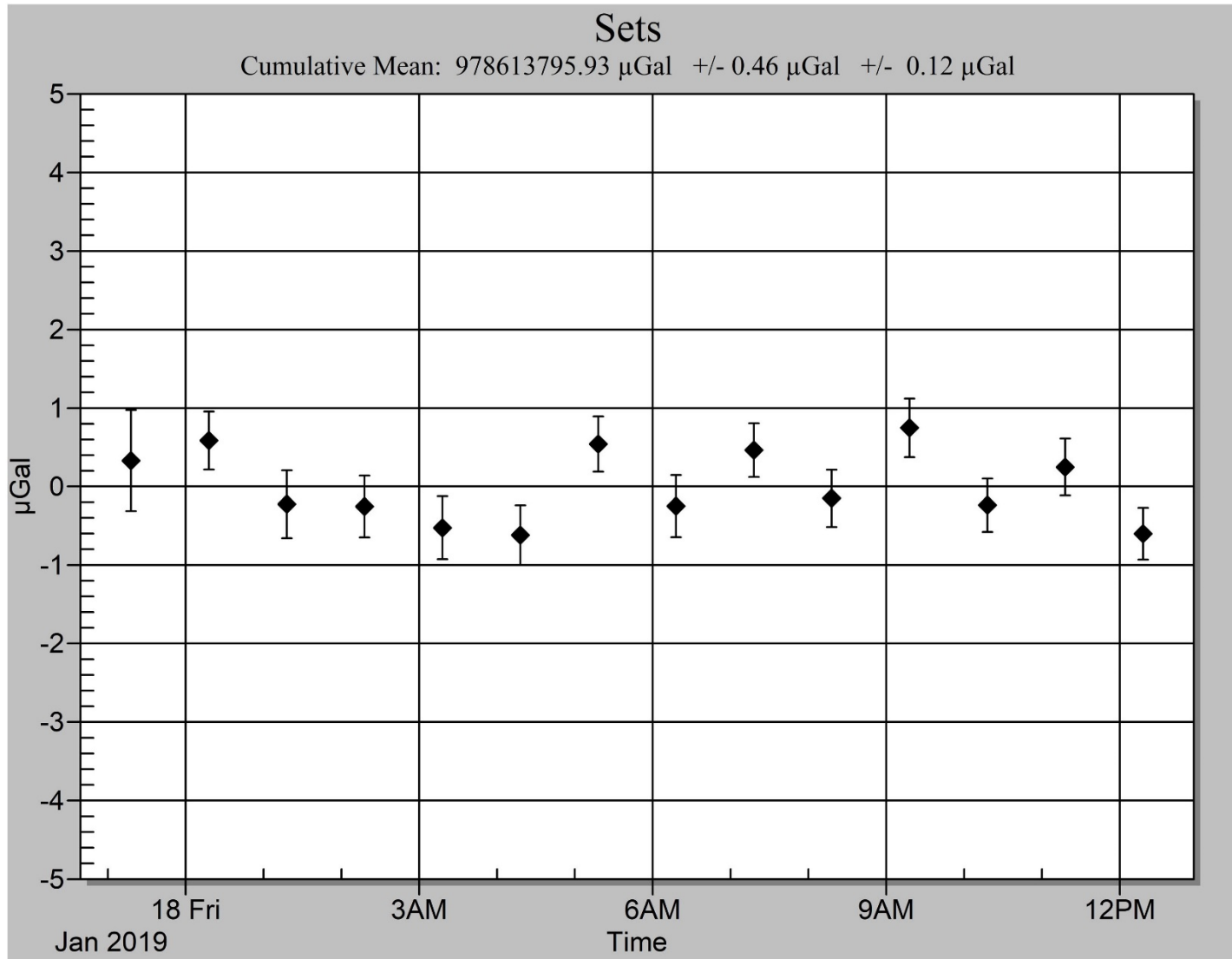
Responsible organisation: CNIGS.

Geological context: At the boundary between lightly metamorphosed marine sediments to the northwest and igneous andesites/dacites/rhyo-dacites to the east with consolidated rock that is friable in certain areas.

Data quality: Excellent data.



STATION: PLAISANCE											
City:	Plaisance					Country:	Haiti				
Location:	Permanent GPS CNIGS					Particularity:					
Situation:	Bedoret					Remarks:					
Date:	January 18, 2019										
Code number:											
Latitude:	19.60218					degrees					
Longitude:	-72.44486					degrees					
Elevation:	545					m					
Gradient:	-4.551					µgal/cm					
Reference height:	1.3793					m					
Meter:	FG5X										
S/N:	216										
Ocean loading correction (µgal, -Greenwich degree)											
Wave	M ₂	S ₂	K ₁	O ₁	N ₂	P ₁	K ₂	Q ₁	M _f	M _m	S _{sa}
Ampl. :	1.856	0.602	0.982	0.814	0.367	0.323	0.164	0.171	0.0	0.0	0.0
Phase:	-3.0	-1.9.2	35.2	37.5	16.6	35.5	-15.4	59.7	0.0	0.0	0.0
Polar motion correction						Air pressure correction					
X-coordinate:	0.0630		Arc seconds			Nominal air pressure:			949.47 mbar		
Y-coordinate:	0.2868		Arc seconds			Barometric admittance factor:			0.3 µgal/mbar		
Gravity											
Set gravity mean:	978 613 795.93					microgal					
Set std. dev.:	0.46					microgal					
Number of sets:	17										
Number of drops per set:	200										
Drop interval:	5					second					
Set interval:	60					minute					
Nominal/datum height:	0.00					m					
Author: O. Francis	University of Luxembourg										
Date: April 8, 2021											



Plaisance - Plot of the set gravity values (1 set = 100 drops)

PONT SONDE



Station description

Location: ODVA site.

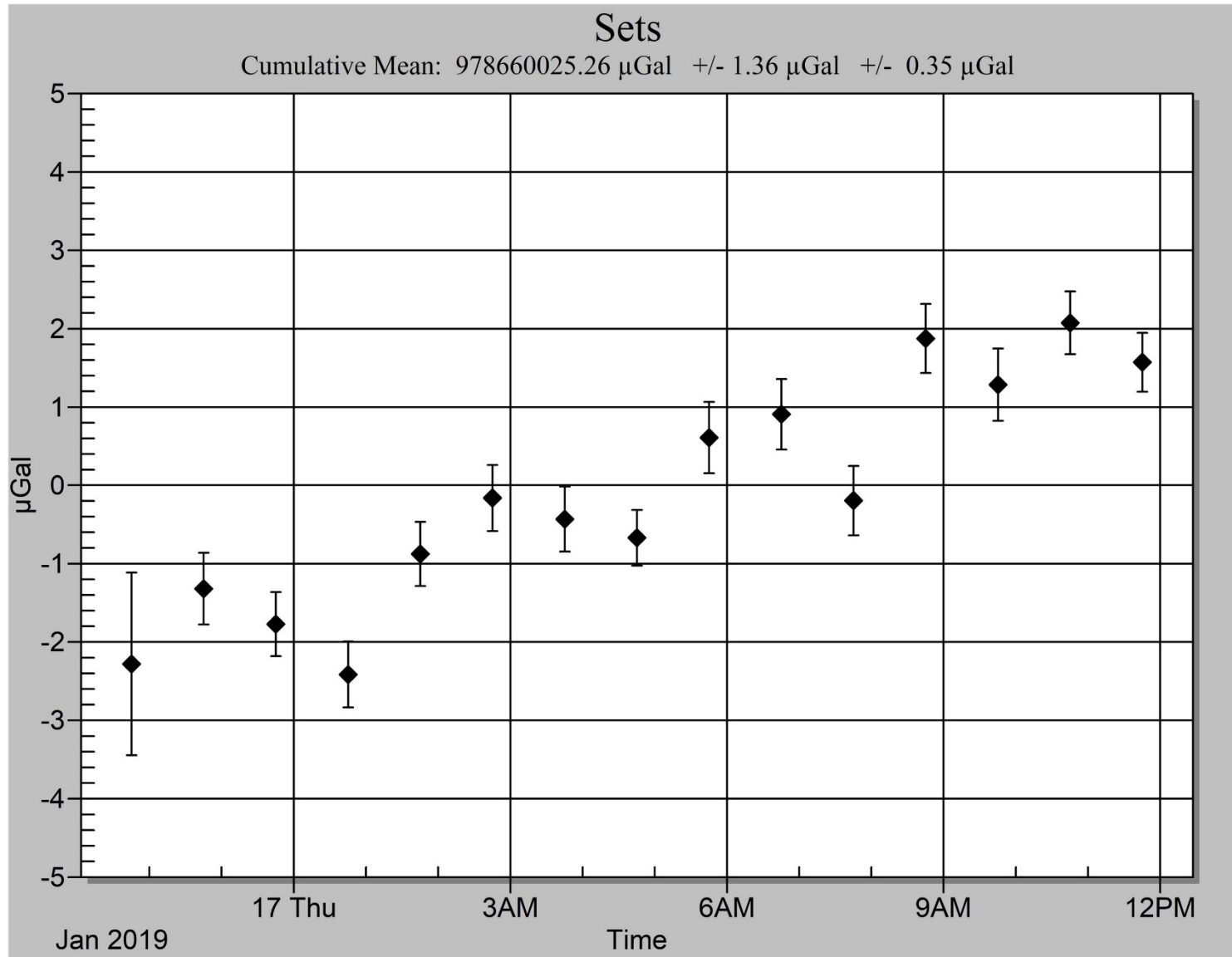
Responsible organisation: CNIGS

Geological context: The site geology is composed of sedimentary limestone.

Data quality: good.



STATION: PONT SONDE											
City:	Pont Sondé					Country:	Haiti				
Location:	Permanent GPS CNIGS					Particularity:					
Situation:	ODVA					Remarks:					
Date:	January 17, 2019										
Code number:											
Latitude:	19.14326					degrees					
Longitude:	-2.61190					degrees					
Elevation:	9					m					
Gradient:	-3.175					µgal/cm					
Reference height:	1.3826					m					
Meter:	FG5X										
S/N:	216										
Ocean loading correction (µgal, -Greenwich degree)											
Wave	M ₂	S ₂	K ₁	O ₁	N ₂	P ₁	K ₂	Q ₁	M _f	M _m	S _{sa}
Ampl. :	1.885	0.573	0.892	0.724	0.347	0.269	0.161	0.172	0.0	0.0	0.0
Phase:	3.9	-31.3	32.4	34.8	24.8	29.7	-27.1	41.8	0.0	0.0	0.0
Polar motion correction						Air pressure correction					
X-coordinate:	0.0644		Arc seconds			Nominal air pressure:				1006.18 mbar	
Y-coordinate:	0.2855		Arc seconds			Barometric admittance factor:				0.3 µgal/mbar	
Gravity											
Set gravity mean:	978 660 025.26					microgal					
Set std. dev.:	1.36					microgal					
Number of sets:	15										
Number of drops per set:	200										
Drop interval:	5					second					
Set interval:	60					minute					
Nominal/datum height:	0.00					m					
Author: O. Francis	University of Luxembourg										
Date: April 8, 2021											



Pont Sondé - Plot of the set gravity values (1 set = 200 drops)

THIOTTE



Station description

Location: Ferme agricole Savane Zombi.

Responsible organization: CNIGS.

Geological context: Sedimentary limestone.

Data quality: Medium disturbed by the portable electric generator.



STATION: THIOTTE											
City:	Thiotte					Country:	Haiti				
Location:	Permanent GPS CNIGS					Particularity:					
Situation:	Savane Zombi					Remarks:					
Date:	January 14, 2019										
Code number:											
Latitude:	18.55833					Degrees					
Longitude:	-74.27021					Degrees					
Elevation:	1458					m					
Gradient:	-3.647					µgal/cm					
Reference height:	1.3758					m					
Meter:	FG5X										
S/N:	216										
Ocean loading correction (µgal, -Greenwich degree)											
Wave	M ₂	S ₂	K ₁	O ₁	N ₂	P ₁	K ₂	Q ₁	M _f	M _m	S _{sa}
Ampl. :	2.012	0.863	1.472	1.147	0.314	0.498	0.232	0.284	0.0	0.0	0.0
Phase:	-29.0	315.4	33.1	36.1	-9.9	21.1	318.8	36.7	0.0	0.0	0.0
Polar motion correction						Air pressure correction					
X-coordinate:	0.0676		Arc seconds			Nominal air pressure:				849.93 mbar	
Y-coordinate:	0.2784		Arc seconds			Barometric admittance factor:				0.3 µgal/mbar	
Gravity											
Set gravity mean:	978 292 347.27					microgal					
Set std. dev.:	1.12					microgal					
Number of sets:	18										
Number of drops per set:	100										
Drop interval:	10					second					
Set interval:	60					minute					
Nominal/datum height:	0.00					m					
Author: O. Francis	University of Luxembourg										
Date: April 8, 2021											

