



Symposium SIRGAS 2015

Dominican Republic
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Universidad Nacional Pedro Henríquez Ureña

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Advance and Prospects on Geodetic Infrastructure of the Republic of Haïti

Centre National de l'Information Géo-Spatiale
CNIGS

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Plan

- Geodetic and leveling Network
- GNSS/CORS station Network
- Gravimetric measurement
- Tide Gauge Network
- Conclusion



Geodetic and Leveling networks History

Geodetic Network

The current (or old) geodetic network was the result of various work from 1920 to 1960 mainly under the auspices of the US Army, scientific Institutions(USGS, IAGS...) and the Department of Public Works of Haïti.

Some specifications:

- **Référentiel géodésique** : North American Datum 1927 (NAD27)

Coordinate System :

tridimensional :

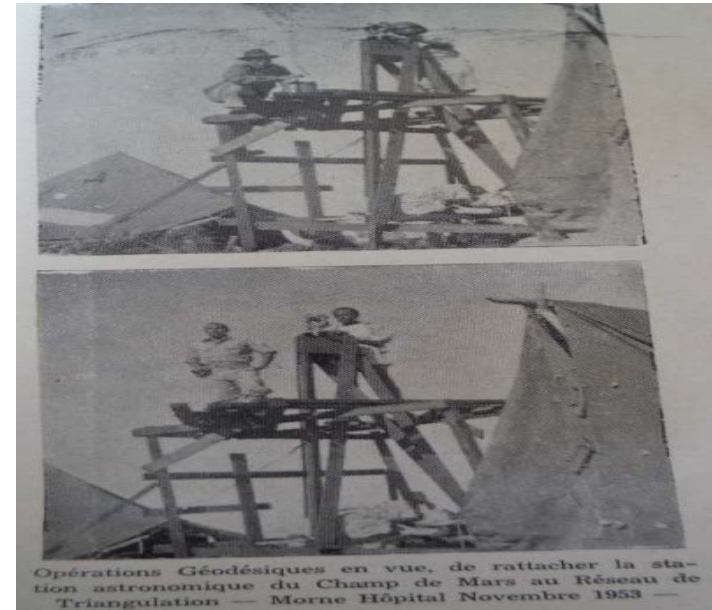
horizontal :

- latitude, longitude Greenwich, ellipsoïde CLARKE1866, degré sex.
- projection : UTM Nord fuseaux 18/19, mètre.

vertical : altitude / mean sea level, mètre.

A few notes:

- Old network of more than 55 years without any maintenance
- Several benchmarks are lost
- Some benchmark access time is measured in hours or days
- Coverage is regional and not national



Geodetic Observation, Port au prince, 1953



Geodetic and Leveling networks History

Leveling Network

The current (or old) leveling network was the result of various work from 1947 to 1957 mainly under the auspices of the US Army, Cartographic and Geodetic Service of Haïti and the IAGS.

Some specifications:

- Vertical Reference: average sea level of Port-au-Prince, 1949-1950.
- Fundamental point: Benchmark M5 1,1355m (Port au prince)
- Orthometric system (no gravimetric measurement)

A few notes:

- Many open line, not enough loop
- Old network of more than 55 years without any maintenance
- Several benchmarks are lost
- Coverage is regional and not national

NB :

A partial inventory of the geodetic and leveling network was done in 1997 and the geodetic and leveling network is almost unusable.



Leveling Measurement, North West , 1947

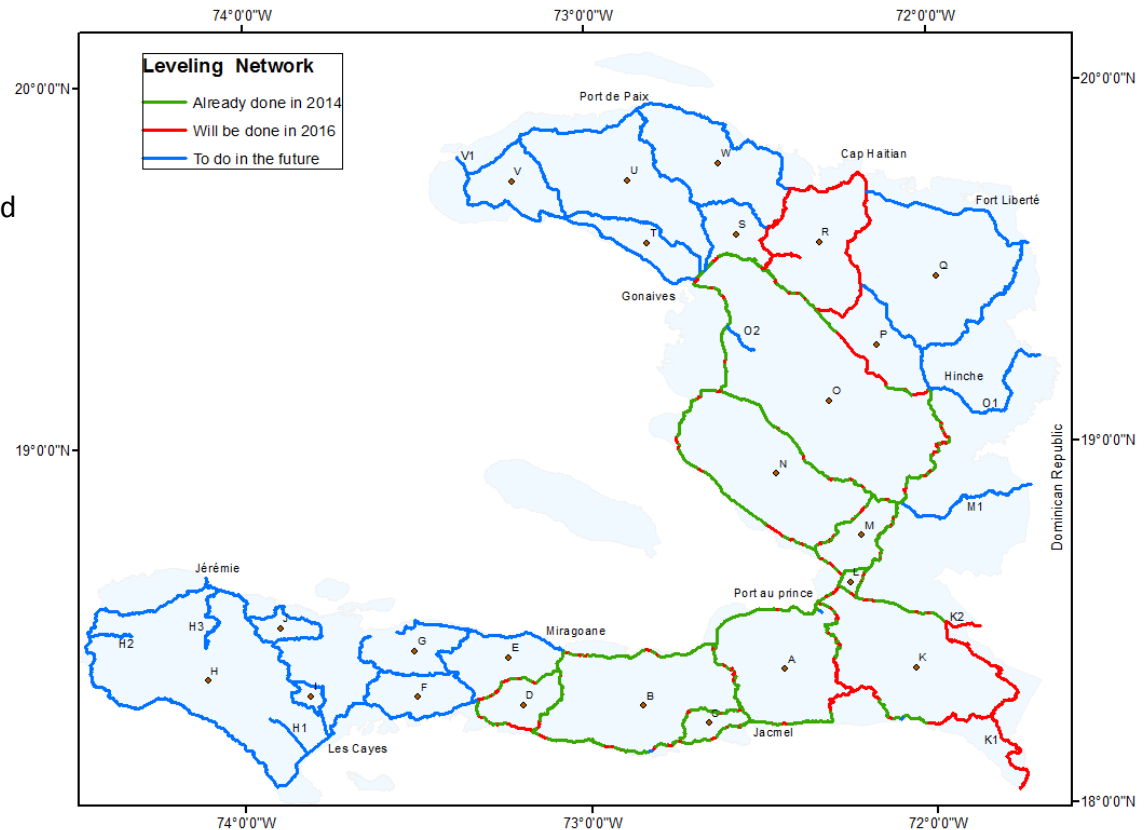


Geodetic and leveling networks advance and prospect

Establishment of a new Geodetic and leveling Network since 2013

Network specifications :

- A network of about 3000 Km length
- Leveling benchmarks (BM) placed along the roads every 1km (3000 leveling BM)
- 1000 leveling benchmarks will be also measured by GPS (one every 3 km)
- Precision of measurements : $2\sqrt{L}$
(L distance between two BM)
- Approximately 1100 km already leveled
- Approximately 400km will be leveled in 2016





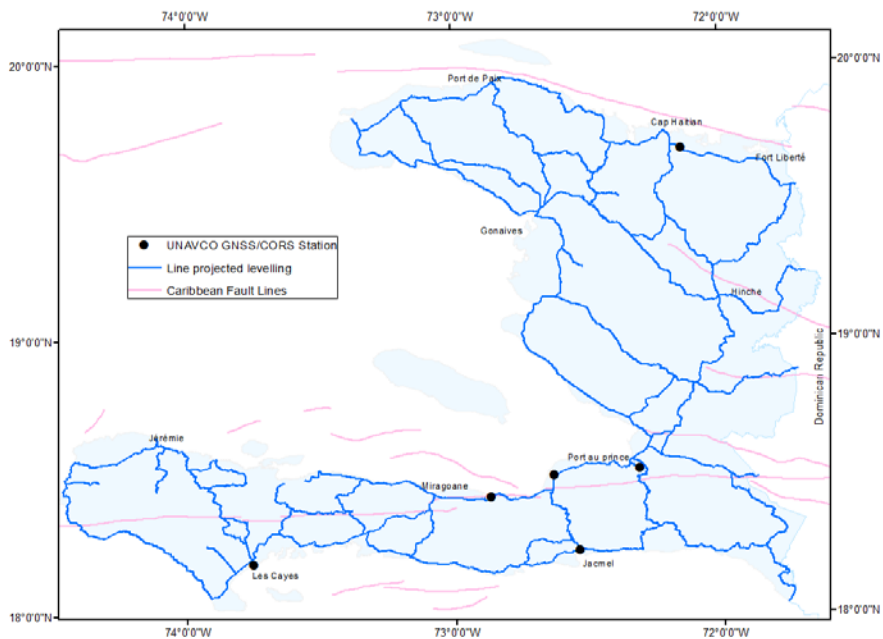
Geodetic and leveling networks advance and prospect

- 15 Surveyors and 5 Engineers were trained specially in the field for leveling measurements.





GNSS/CORS Station Network COCONet



Cap Haitian Station



Leogane Station



Jacmel Station



Les Cayes Stations

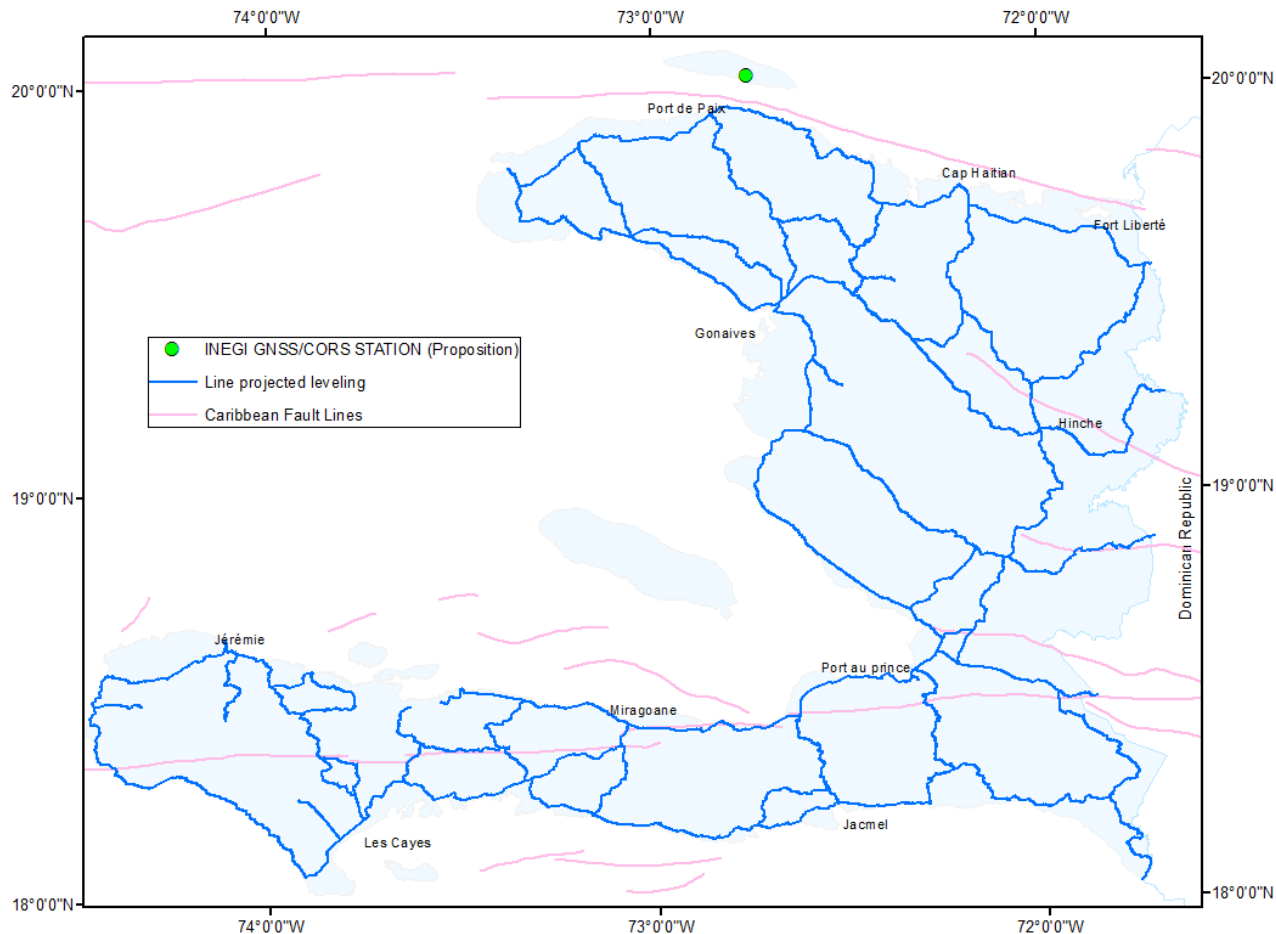


GNSS/CORS Station Network

INEGI

- A INEGI station will be installed in Haïti in December 2015. Currently, there are three sites that are proposed for the installation of this station. Taking into account the presence of the northern fault line, we prefer the site of the island of la Tortue to the other two.

(Project for the Strengthening of Spatial Data Infrastructures in the Caribbean region)





GNSS/CORS Station Network CNIGS

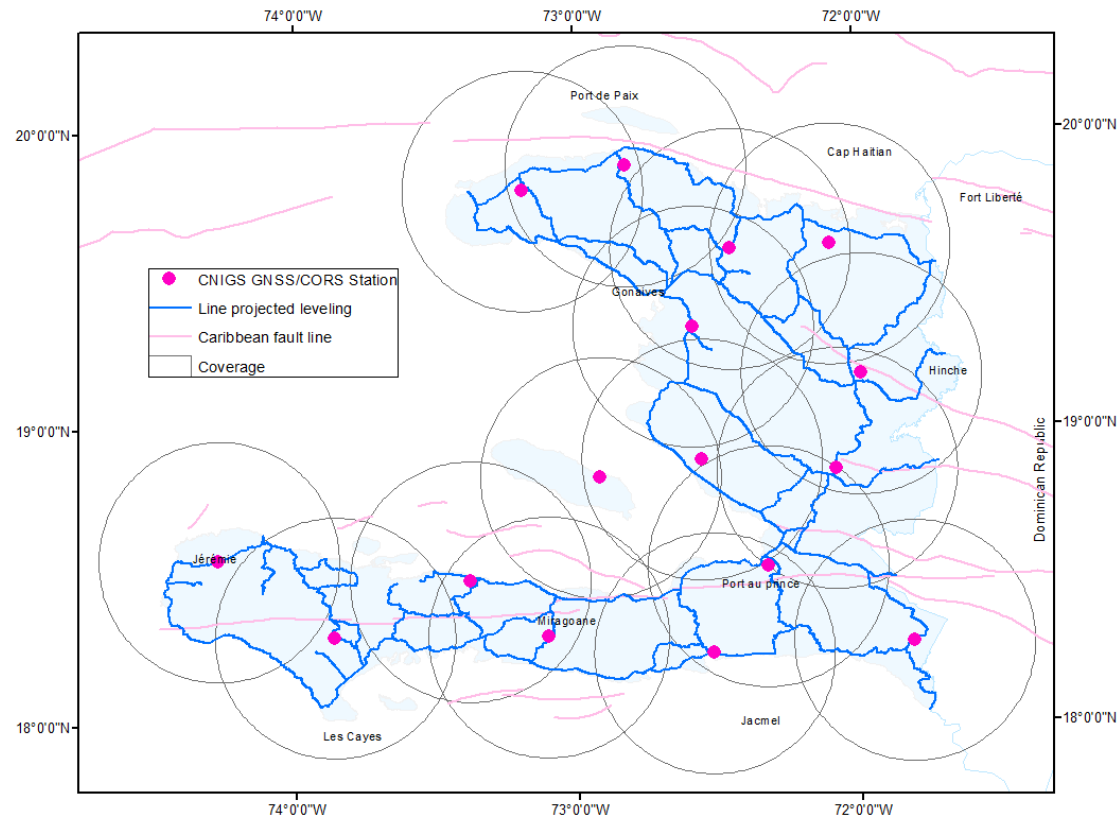


Specifications :

- A network of 16 stations connected to a data center
- VRS System (Virtual Reference Station)
- 45 km coverage radius
- Pivot software for network management
- Port au prince station will be registered on the IGS (International GNSS Service) network
- All stations are to be built in the ground except the Port-au-Prince Station that will be on top of building

NB :

- all prospective positions are already measured during 24h , MP1 and MP2 values are generally less than 0.3m.
- The network should be operational end of 2016

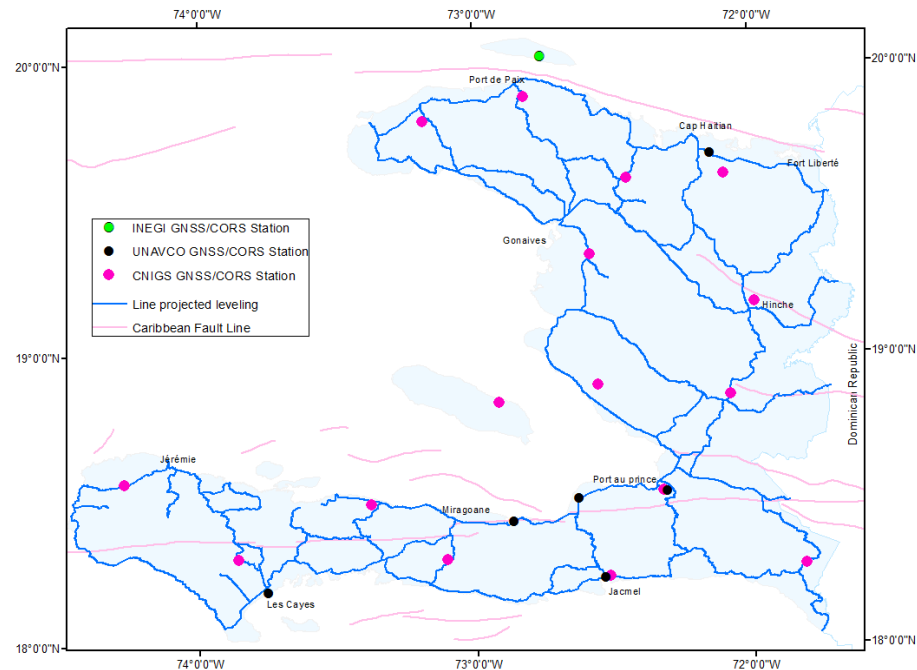




GNSS/CORS Station Network Haïti

End 2016, 23 operational stations in Haïti :

Haïti CORS Stations				
Network	Receiver model	Antenna model	Company	Station Number
CNIGS	NETR9	Zephyr Geodetic	Trimble	16
INEGI	GR10	AR10	LEICA	1
UNAVCO	NETR9 (2) / NETRS (4)	Zephyr Geodetic(4) / Choke Ring (2)	Trimble	6



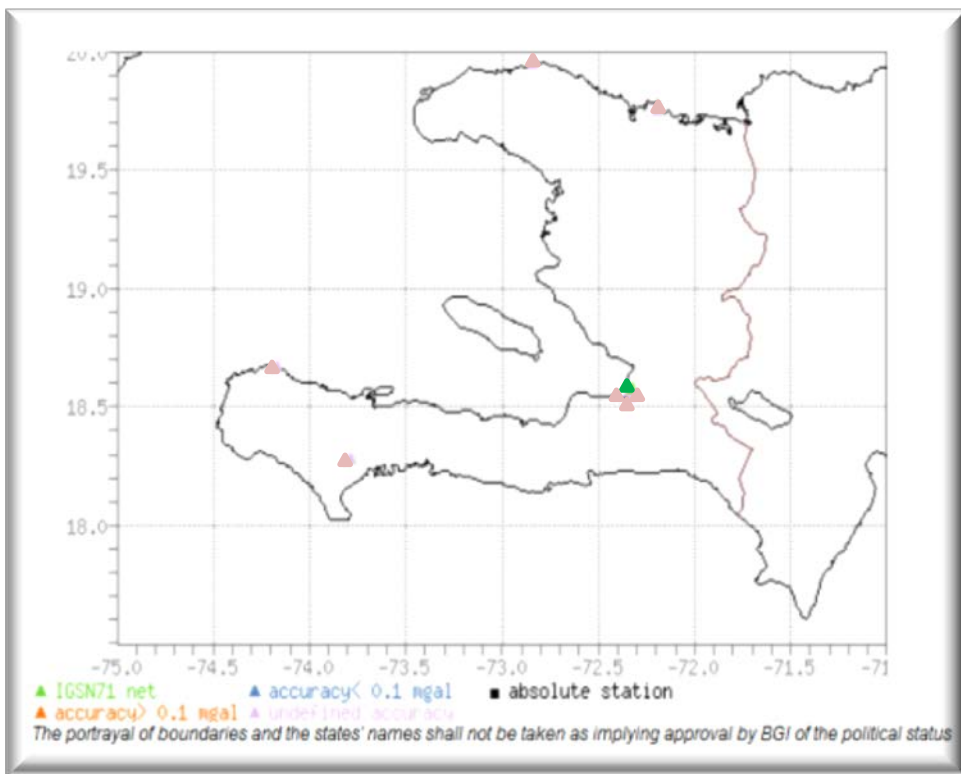


Gravimetric measurement History



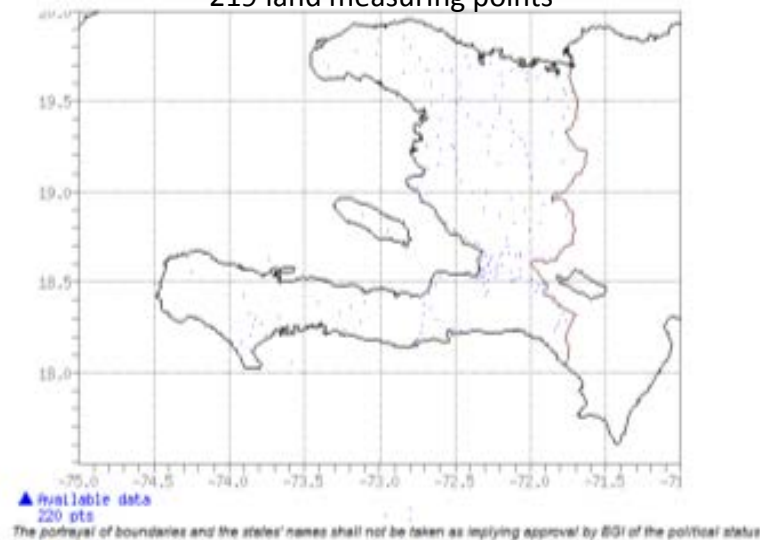
According to the archives of BGI (International Gravimetric Bureau) gravity measurements were carried out in Haiti between 1950 and 1971 as part of the implementation of the IGSN71 (International Gravity Standardization Net 1971)

8 reference points were measured and materialized, but does not exist today



- NB:**
- No absolute gravity reference measurement
 - Unusable data today

219 land measuring points



Monograph point of reference in Port-au-prince Airport

STATION NO.		IGSN STATION DESCRIPTION		QUAD. DEG. SQ.	
0482 K	010331			2	18072
Station Name		PORT AU PRINCE			
Country		HAITI			
Other Designation		EPS : 9124-16			
National Contact Agency					
Access Restrictions					
<p>The gravity station is in Port au Prince at the Sala Gate Jet Terminal (new airport 1965). The station is near the SW corner of the building on the concrete asphalt ramp 2 m. N and 1 m. E of the westernmost of eight large concrete pillars. The station is not monumented.</p>					



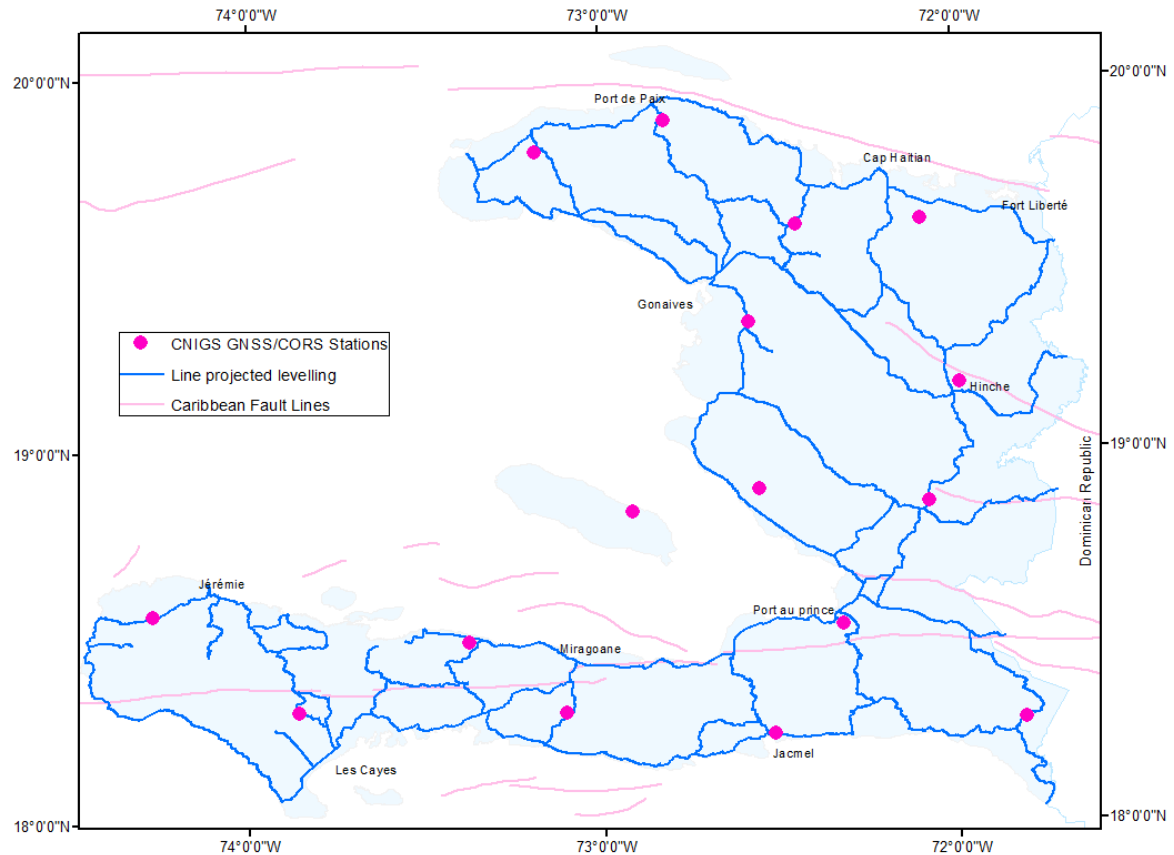


Gravimetric measurement prospect



Objective :

- Achieve absolute gravimetric measurements at 10 of the 16 CNIGS GNSS/CORS stations during 2016 in partnership with the Faculty of Science of the University of Haiti State and the Faculty of Science, Technology and Communication the University of Luxembourg.
- Establishing a zero network as a basic reference and calibration for all future measures relating gravimetric.

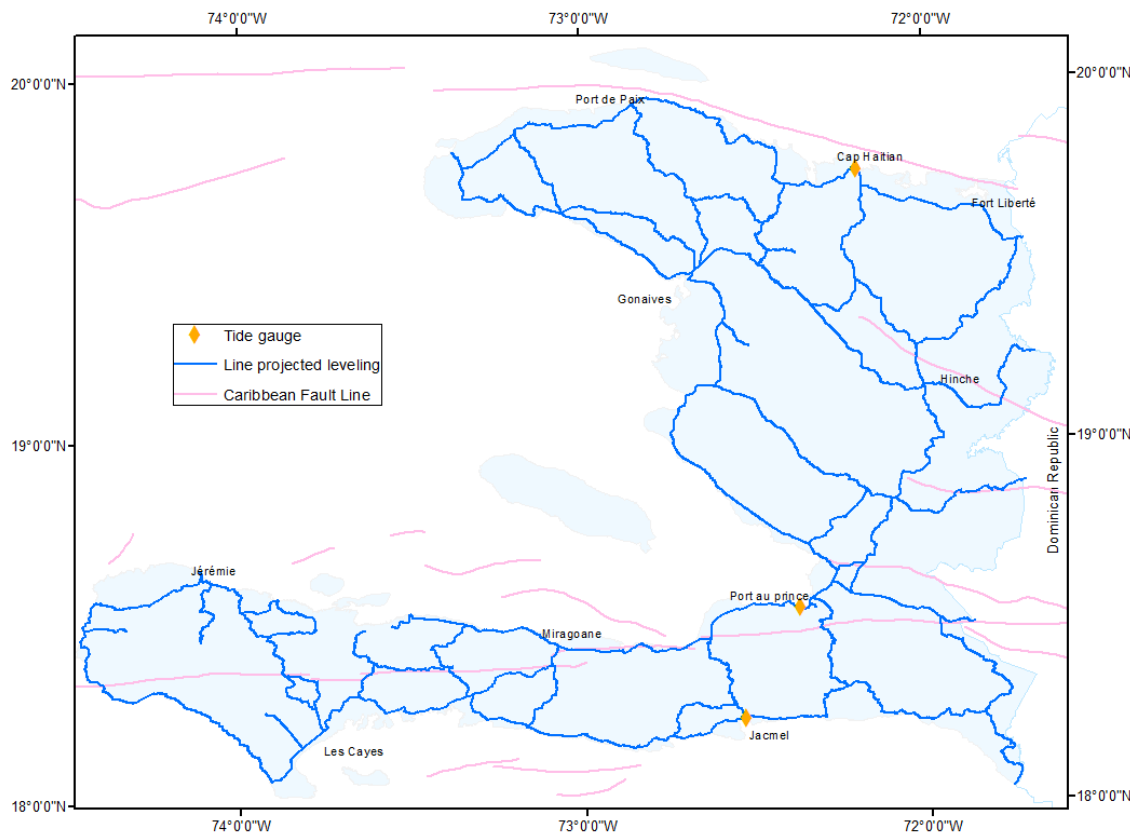




Tide Gauge Network

There are currently three tide gauges in operation and have been installed by the SEMANAH (Maritime and Navigation Service of Haïti) with support from UNESCO and NOAA.

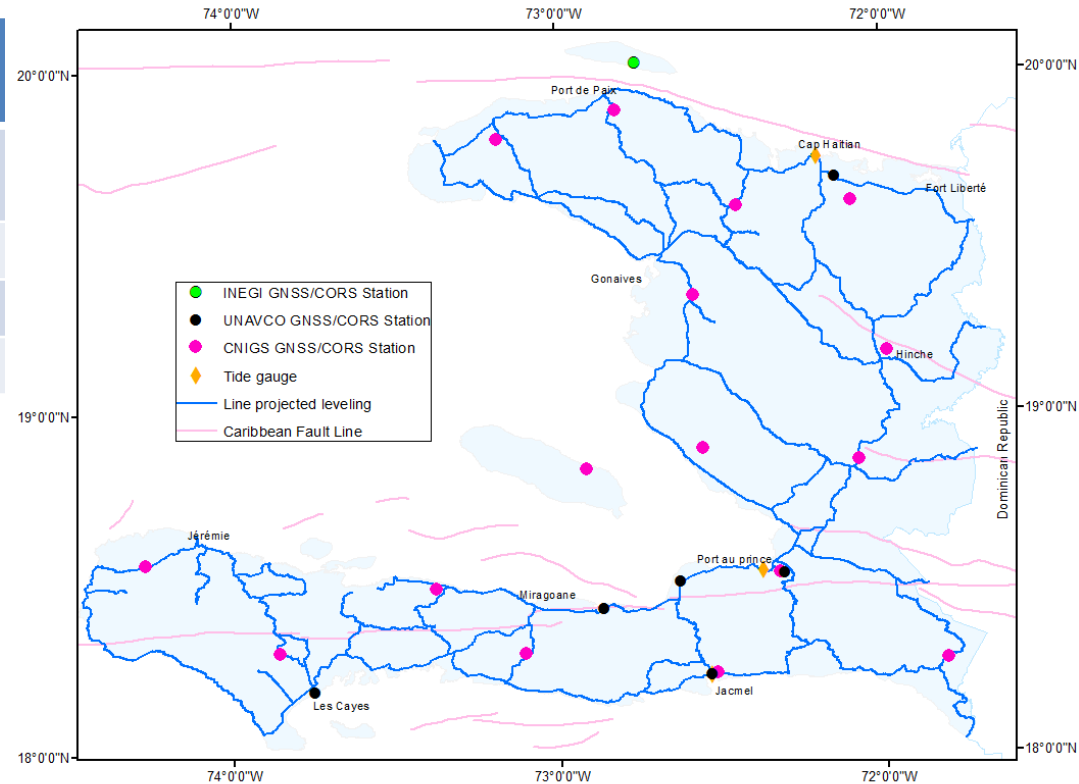
City	Installation Date	Statute
Cap Haitien	December 2011	operational
Port au prince	December 2013	operational
Jacmel	December 2013	operational





Tide Gauge Network

Tide gauge and CORS station approximate distance(km)		
Tide gauge	COCONet Station	CNIGS Station
Cap Haitien	10	20
Jacmel	0.5km	2 km
Port au prince	8km	6km



- Website for tide gauge data : <http://www.ioc-sealevelmonitoring.org/map.php>



Conclusion

- One goal is to get to combine all of these data (leveling, GNSS, tidal and Gravimetric) to adjust a geoid (global or regional) for Haïti.
- Align our work with the recommendations of SIRGAS in order to facilitate future data exchanges.



Thank You!





Definitions

- **CORS** (Continuously Operating Reference Station)
- **GNSS** (Global Navigation Satellite System)
- **INEGI** (Instituto Nacional de Estadística y Geografía)
- **CNIGS** (Centre National de l'Information Géo-Spatiale)
- **COCONet** (Continuously Operating Caribbean GPS Observational Network)
- **UNAVCO** (a non-profit university-governed consortium, facilitates geoscience research and education using geodesy)
- **IAGS** (Inter American Geodetic Survey)
- **USGS** (US Geological Survey)
- **UNESCO** (United Nations Educational, Scientific and Cultural Organization)
- **NOAA** (National Oceanic and Atmospheric Administration)
- **SIRGAS** (Geocentric Reference System for the Americas)