

# GPS dans le contexte de l'arc antillais : expérience offshore & exploitation des données à terre



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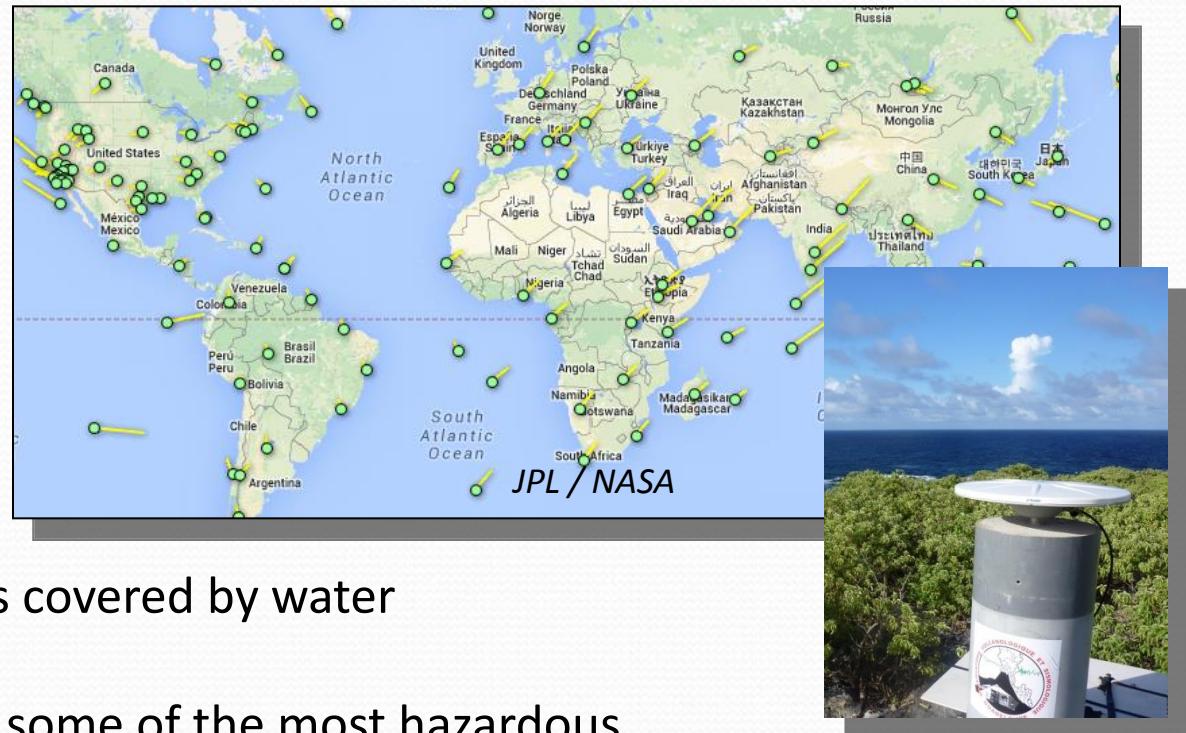
*Littoral ENvironnement et Sociétés - UMR 7266 –  
Université de La Rochelle*

Journées GINS / Juin 2015



# Context

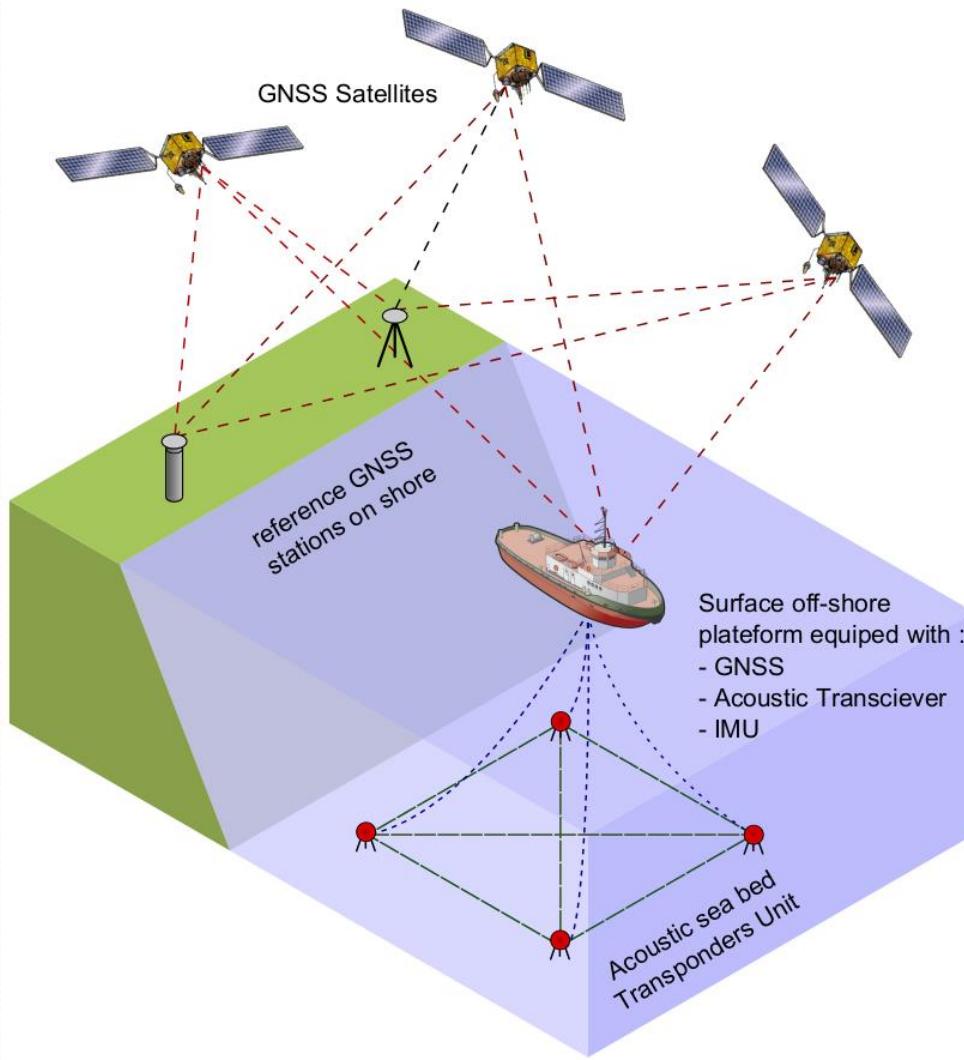
Observations of movements and deformations on the Earth surface using Global Navigation Systems



- 70 % of the Earth Surface is covered by water
- Oceans are the theaters of some of the most hazardous tectonic phenomena

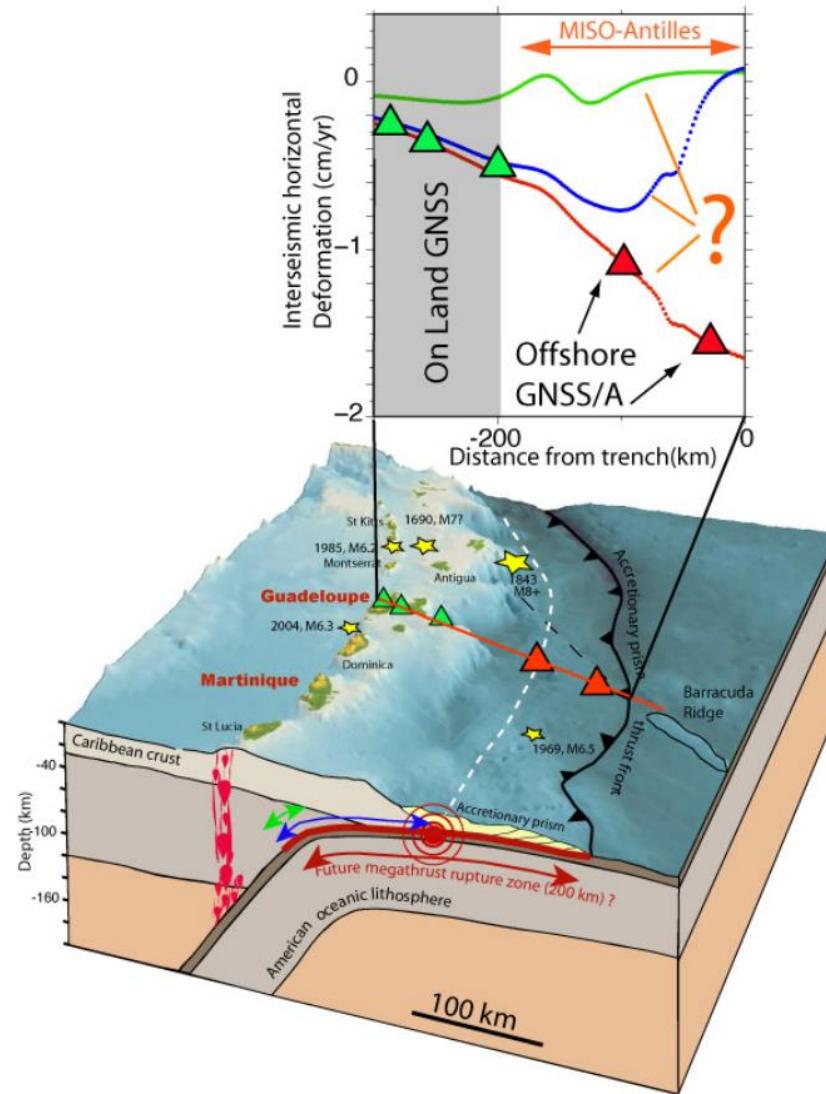
**How to extend land observation networks offshore and perform precise geodetic measurements under the seas ?**

# GPS/Acoustics [Spiess et al. 1998]



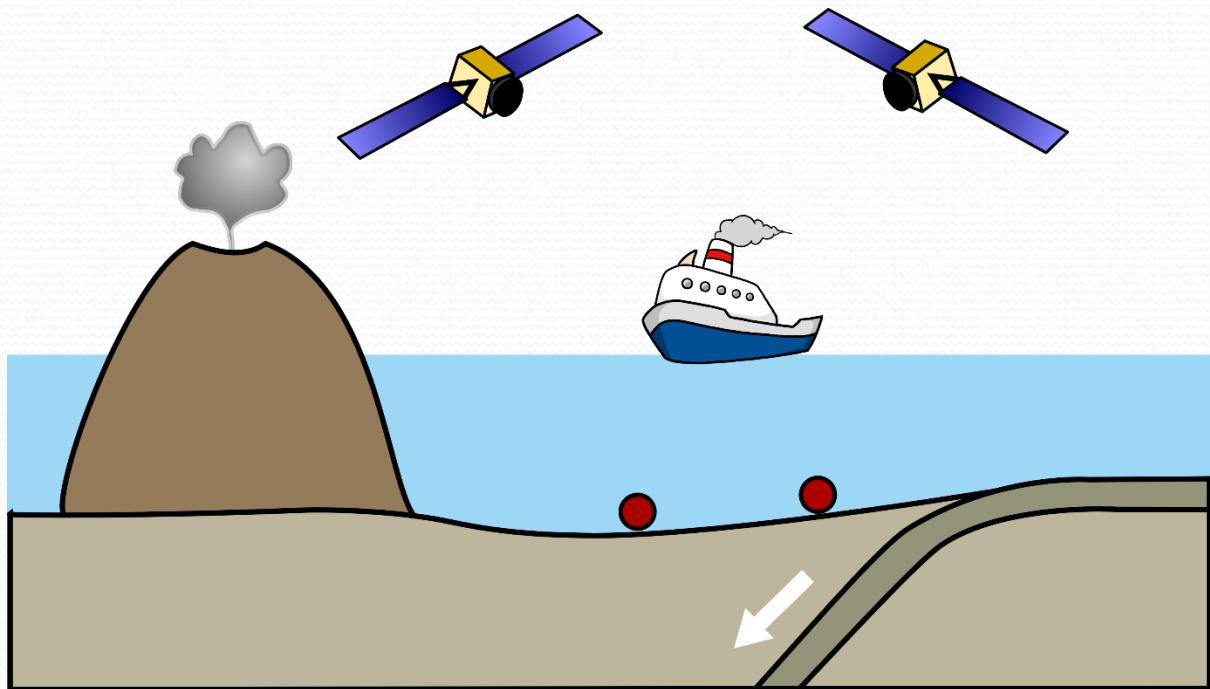
# The case of Lesser Antilles

- Can a tsunamigenic earthquake occur ?
  - No tsunami during 1843 event (VII Intensity)
- No significant signal with on shore GNSS
  - Trench is 300km far from the islands
  - ~ 5000m water depth



# Problematics

1. Estimating the quality of the underwater ranging in by numerical simulations
2. Evaluating positioning accuracy of the surface platform
3. Searching for a optimal deployment site using finite-element modification and onshore GNSS data



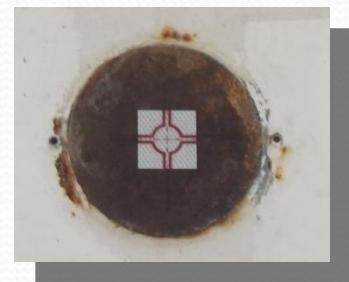
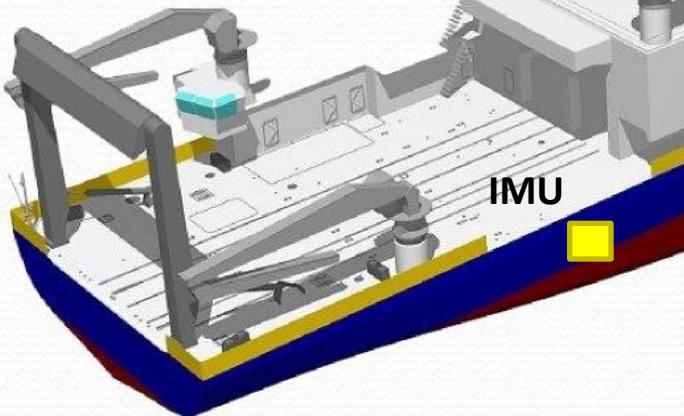
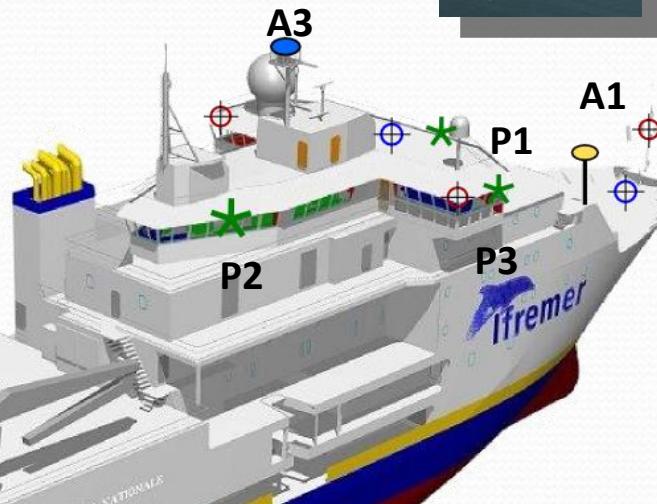
**Proposing the best  
measurement scenario for  
a GPS/A experiment in the  
Caribbean Context**

# Precise Positioning Experiment

Temporary GNSS configuration on R/V *Pourquoi Pas ?*

Surveys on 2 points (P1 & P2), sighting reflectors on antennas, reference points of the ship & controls points

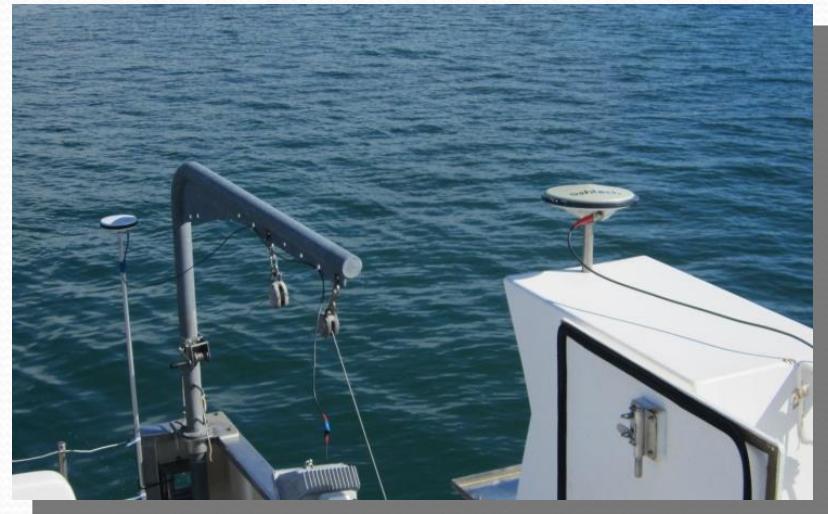
Cumulative observations of each points,  
in order to reduce noise  
(12 stations on P1 and P2,  
10 shoots on each point)



# Precise Positioning Experiment

## GNSS post-processing :

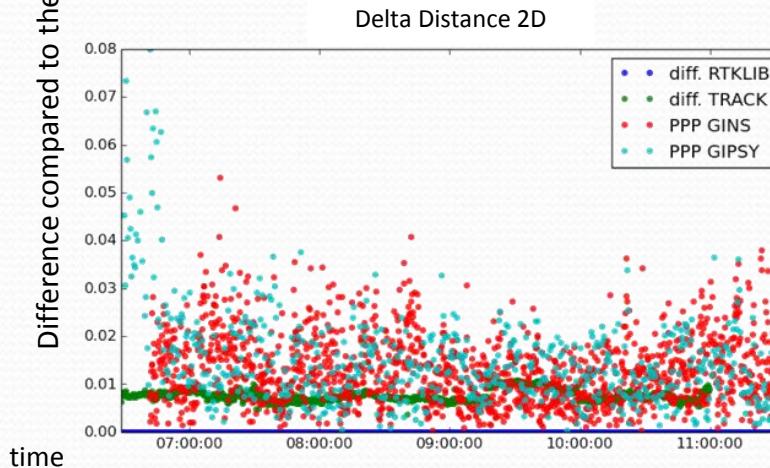
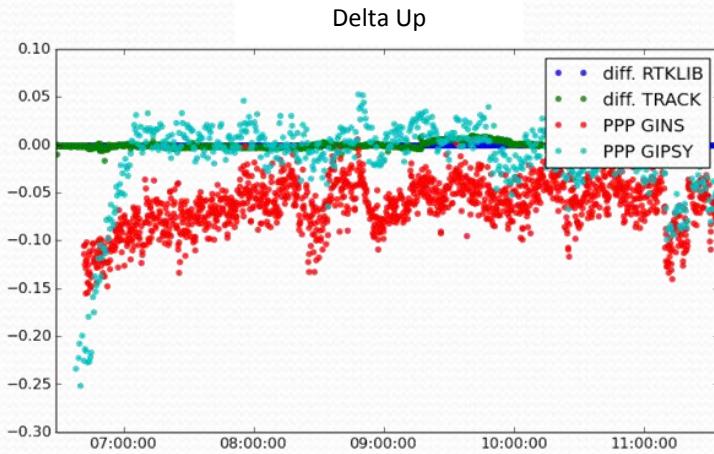
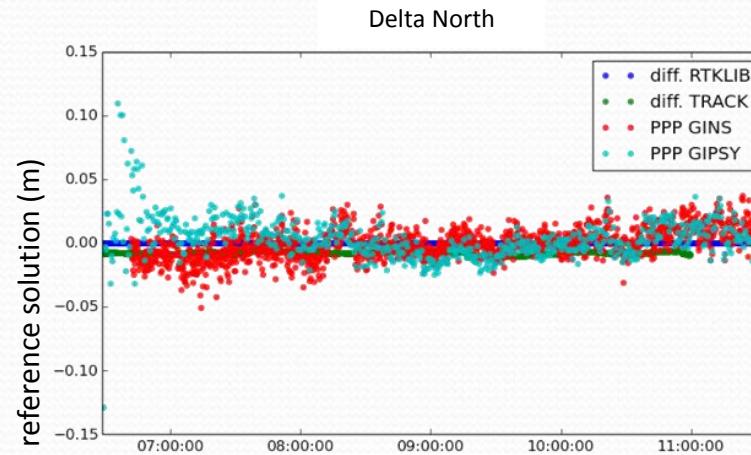
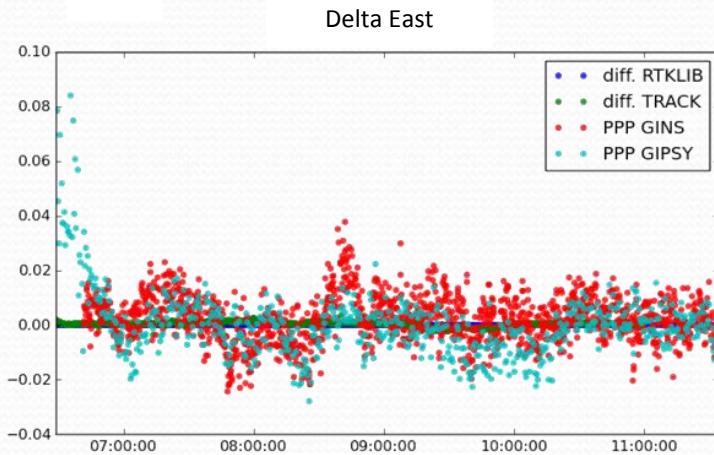
- Differential approach :
  - *Track*
  - *RTKLIB*
  - IGS BRST station as reference
- PPP approach :
  - *GINS* (CNES)
  - *GIPSY* (JPL/NASA)
- 1 Hz acquisition rate
- Tropospheric model GPT2/GMF2
- Antex IGS week 1798
- IGS/CLS/JPL final orbits



# Precise Positioning Experiment

results on *Albert Lucas* : **GAV1 (GNSS « Avant » / Bow ) results**

Difference compared to the reference solution (m)



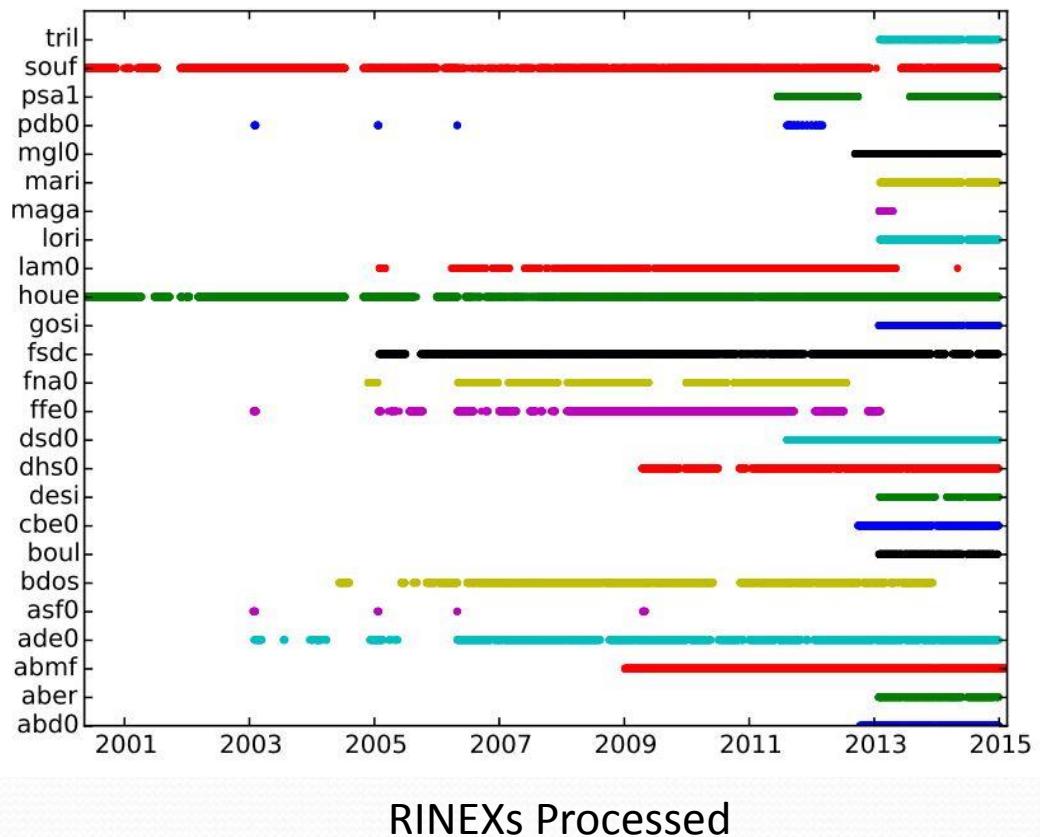
Using RTKLIB  
solution as  
reference  
2) Surface positioning

(m)	RMS 3D	RMS 2D	$\sigma$ 3D
<b>TRACK</b>	0,0050	0,0059	0,0013
<b>GINS</b>	0,0443	0,0098	0,0196
<b>GIPSY</b>	0,0303	0,0144	0,0255

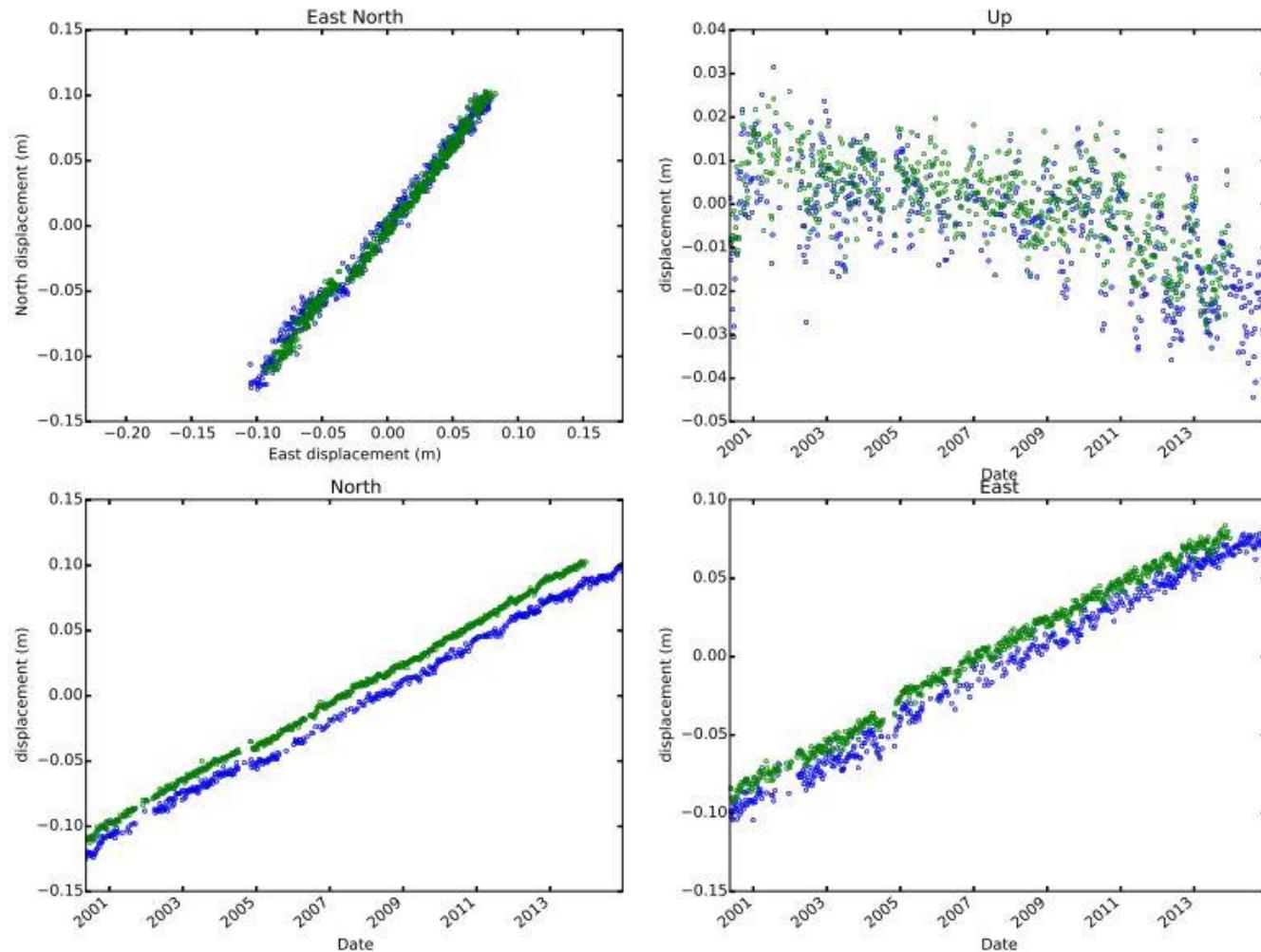
Thanks to P. Bosser –  
ENSTA/IGN for GIPSY run

# Onshore processing

- Using GINS in PPP mode with GRGS/CLS REPRO2 products
- Processing 28 stations : 13 IPGP + 7 RENAG + 8 IGS on the Guadeloupe Archipelago
- Noise and Trend Estimation with HECTOR [Bos et al. 2013]
- Caribbean plate motion determined using the velocities of IGS stations on land surfaces



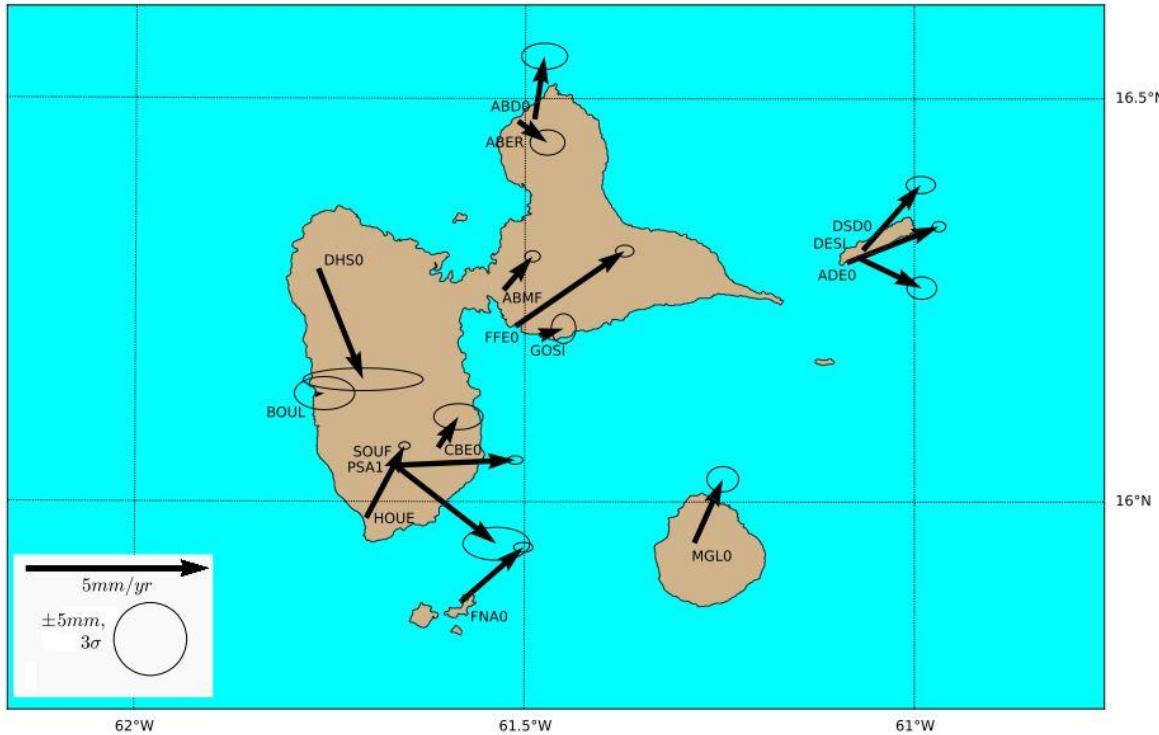
# Onshore processing – Time Series



**Consistency between our PPP and GAMIT differential processing  
of [Symithe et al., 2015] (HOU station)**

# Onshore processing

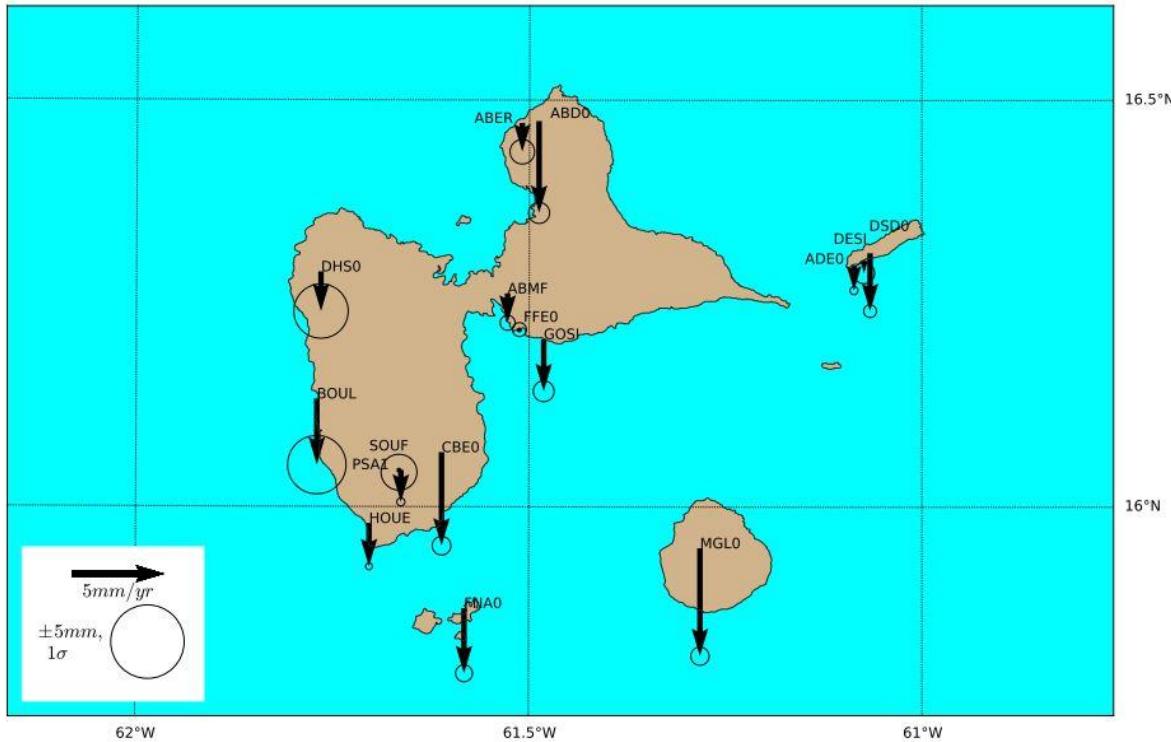
## Horizontal velocities with respect to Caribbean plate



Small horizontal deformation (<5mm/yr) & no general pattern

# Onshore processing

## Vertical velocities



**General subsidence of the Guadeloupe Archipelago**

# Desiderata :)

- Need of faster / longer period kinematic processing
- Export of correlations between components for variance propagation
- Interface with DYNAMO / GLOBK ?
- Multi-constellations orbits
- Allowing parallel runs
- GINS online ?

## Annex works made by the LIENSs team

- Python frontend for batch processing
- GINS quick start manual (may be converted into a wiki ?)