UNIVERSITÉ de la NOUVELLE-CALÉDONIE

CNEP Centre des Nouvelles Études sur le Pacifique

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Using UAV and very high resolution photogrammetry to assess shoreline evolution. Example in Ouvea, Loyalty Islands, New Caledonia.

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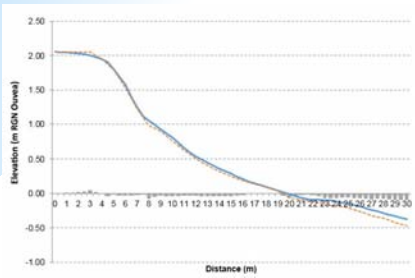
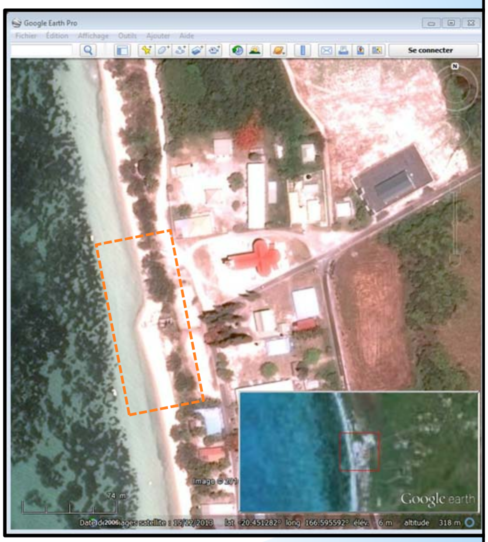


- Beach profiles are cross-shore graphical descriptions of elevation changes along an axis perpendicular to the shoreline (in this example, data was collected with a frame).

- DEM are precise elevation contour maps showing variation in elevation on the ground. They are interpolated from data (in this example, data was measured with a GNSS).
- DSM are precise elevation contour maps showing variation in elevation of all objects (buildings, vegetation).

- Study site:
  - ✓ Beach of St-Joseph, in the north part of Ouvea, a low–lying atoll, Loyalty Islands, New-Caledonia.
  - ✓ Suffers from coastal erosion.
  - ✓ Monitored in the field for one year using beach profiles and DEM.
- A research funded by:
  - ✓ French Overseas Ministry (MOM project)
  - ✓ European Union (INTEGRE project)
- Objectives
  - ✓ Build very precise maps of the beach.
  - ✓ Compare the maps to assess mild changes.
  - ✓ Determine the impacts of collapsed infrastructures on sediment transport.
  - ✓ Estimate how precise and reliable the result of the photogrammetry are.



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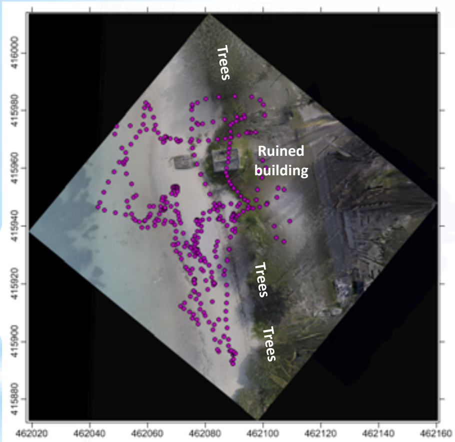

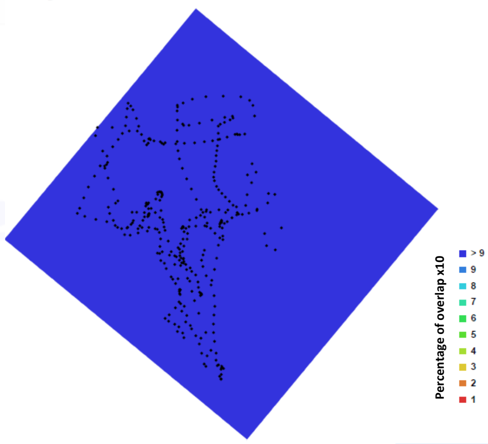

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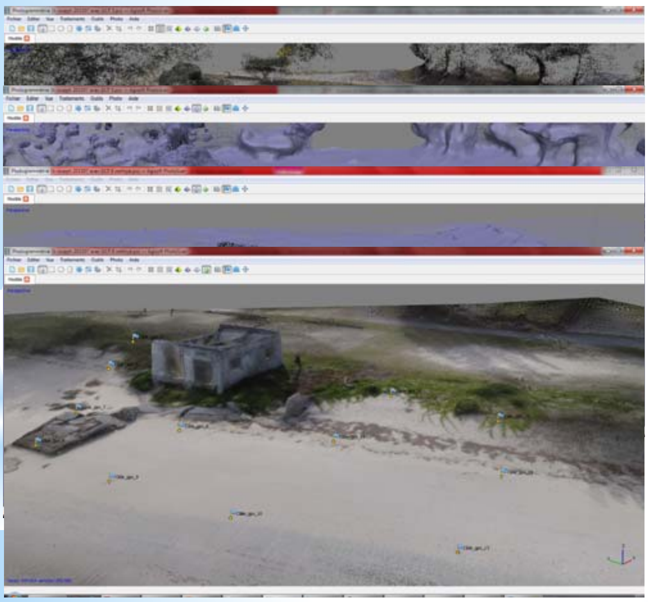

Workflow

Building a dense point cloud Model using the photographs

↓

Building a mesh (triangles)

↓

“Cleaning”of the DSM

↓

Applying a texture on the mesh

↓

Exporting elevation data into a regular grid (5 x 5 cm)

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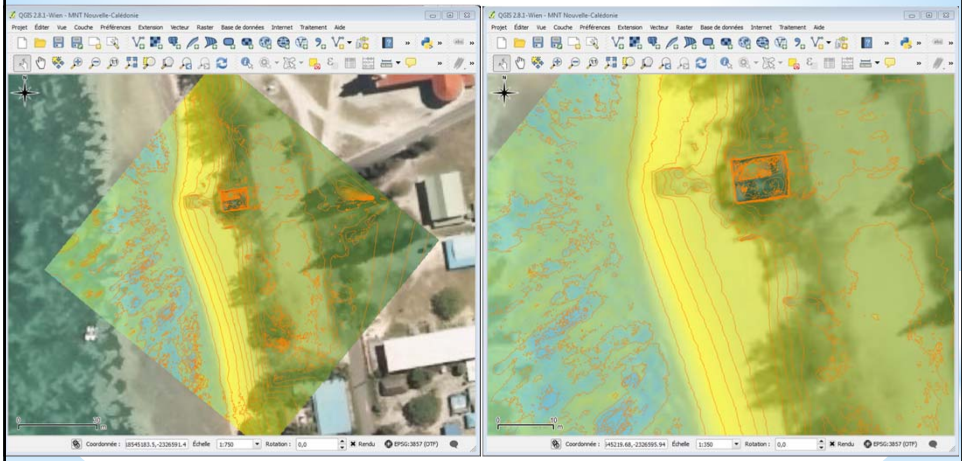

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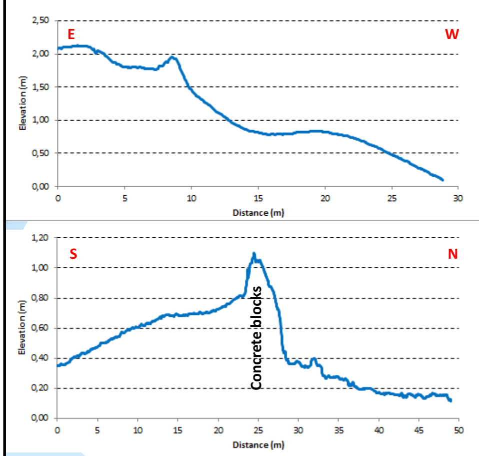

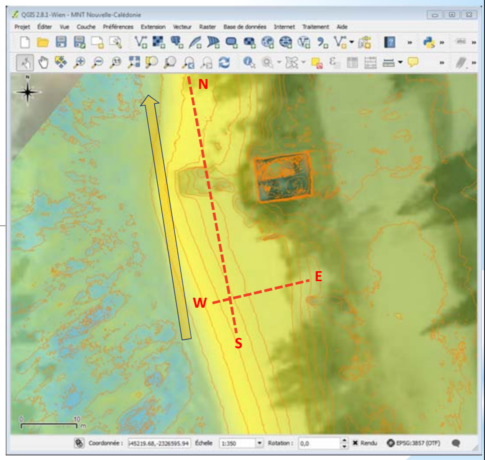

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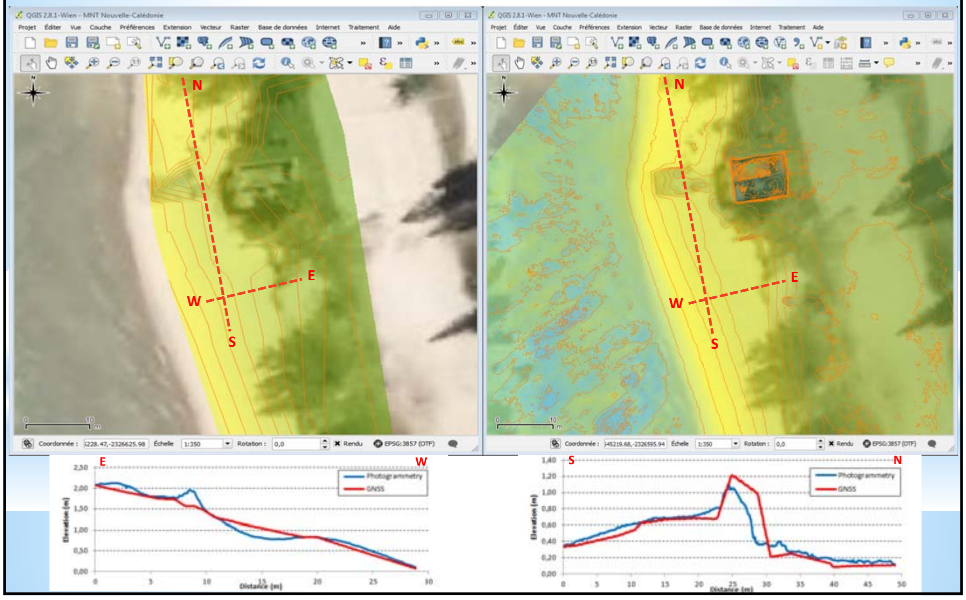

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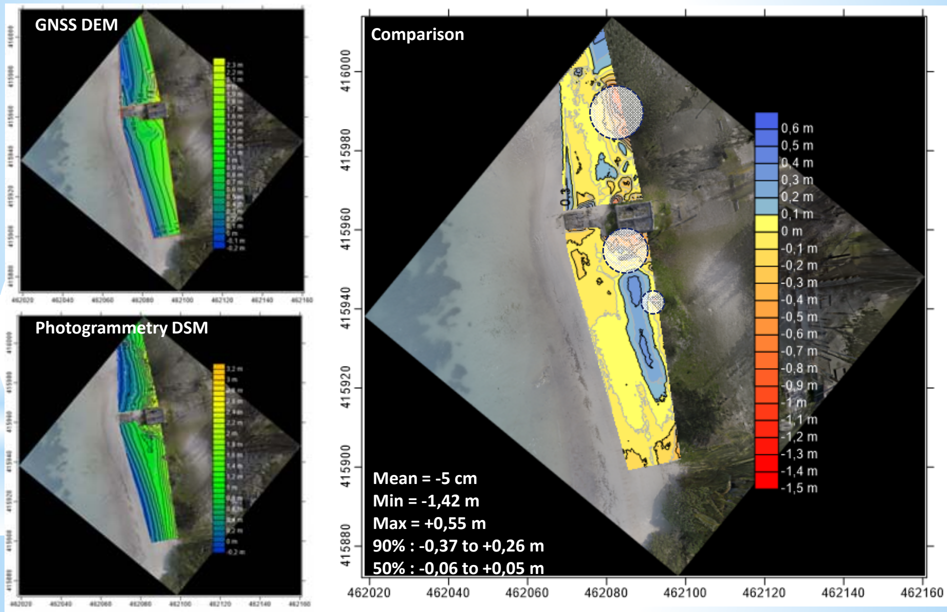
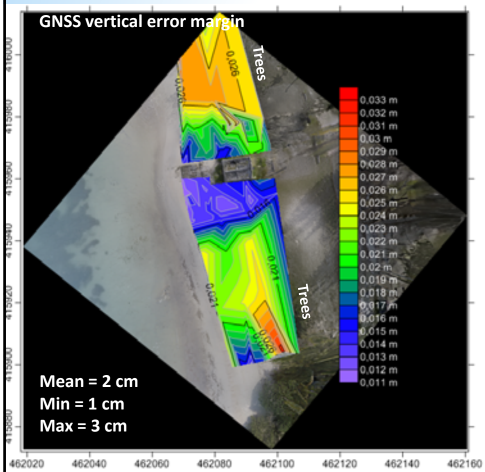
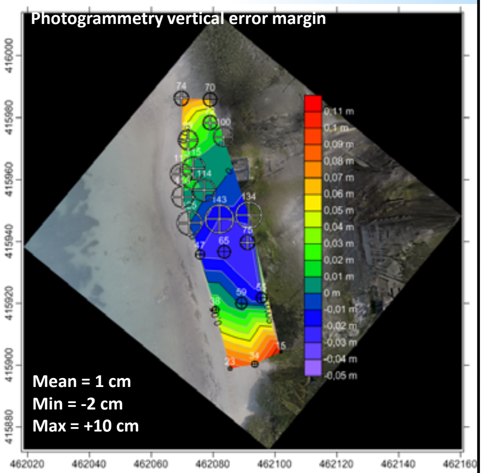
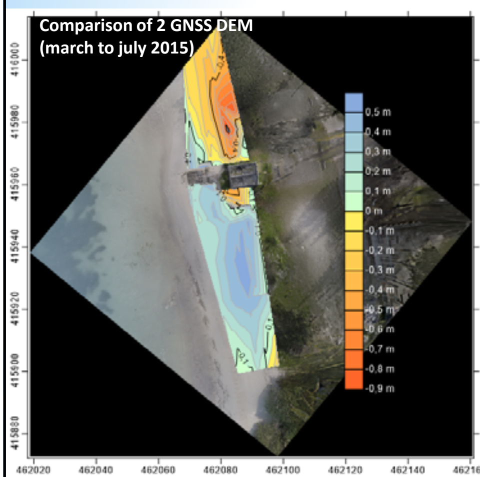
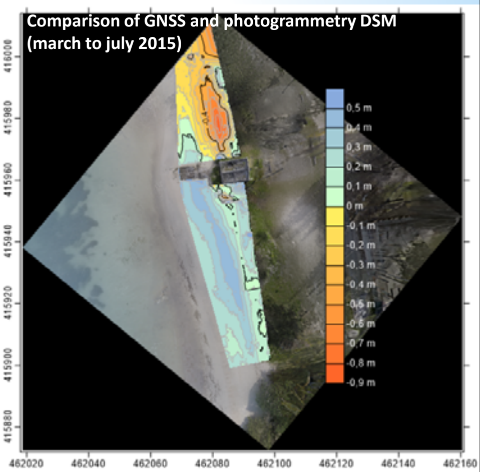



GNSS vertical error margin
Trees
Trees
Mean = 2 cm
Min = 1 cm
Max = 3 cm


Photogrammetry vertical error margin
Mean = 1 cm
Min = -2 cm
Max = +10 cm


Comparison of 2 GNSS DEM
(march to july 2015)


Comparison of GNSS and photogrammetry DSM
(march to july 2015)

Benefits	Inconveniences
✓ Affordable ✓ Easy and quick to operate ✓ A great density of measurements ✓ A high level of details ✓ Beautiful maps and pictures ✓ 3D model with texture that displays features invisible on GNSS survey (sand/vegetation limit) ✓ Textured models are convenient tools for scientific communication	✓ Sensitive to meteorological conditions (wind) ✓ A short time of flight (battery life = 20 minutes) and a short flight range ✓ Heavy photogrammetric processing. A long time of computation that needs a work station ✓ Needs GCP measured with a GNSS ✓ Vegetation have to be removed from the DSM ✓ More and more restrictive laws.

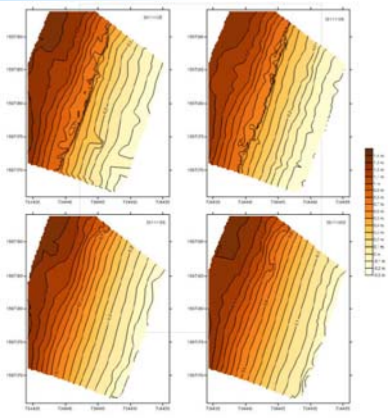


Figure 1 : MNT aux quatre dates de leve

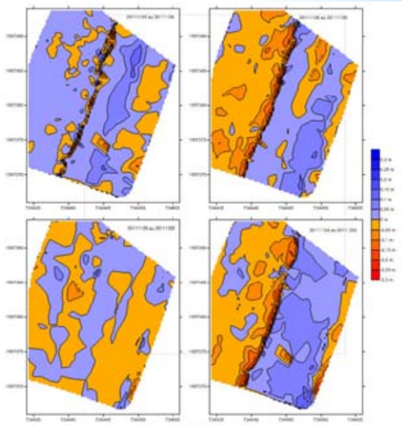


Figure 3 : MNT différentiels

- Perspectives:
  - ✓ Use a better camera to make point detection and photogrammetric processing more accurate.
  - ✓ Use a UAV carrying a high accuracy GNSS => the GCP should not be necessary.
  - ✓ Go on testing the method and now compare several photogrammetry DSM, compute volume changes (sediment budget) and detect beach fine morphological evolution.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Perspective
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