



GEOCARE : Development of GEOphysics methods for ChAracterizing and REhabilitating contaminated sites

INTERSOL 2020

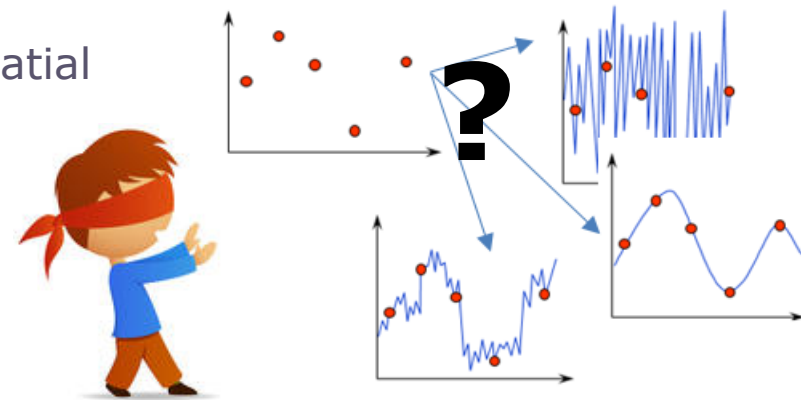
Théo De Clercq

A photograph of a large, teal-colored industrial tank, likely a storage vessel for oil or gas. A yellow metal staircase with a handrail leads up the side of the tank. A light fixture is mounted on the wall above the stairs. The image is used as a background for a presentation slide.

Why this project ?

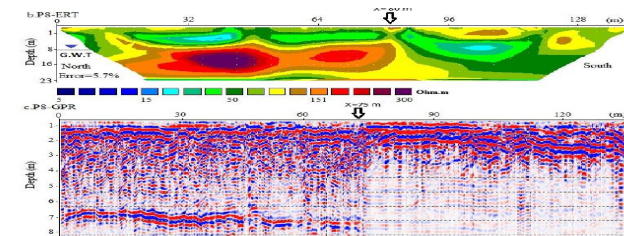
❑ Subsurface :

- Partial vision of the phenomena with spatial and temporal variability
- Uncertainties about :
 - Pollution characterization
 - Monitoring remediation



❑ GEOCARE :

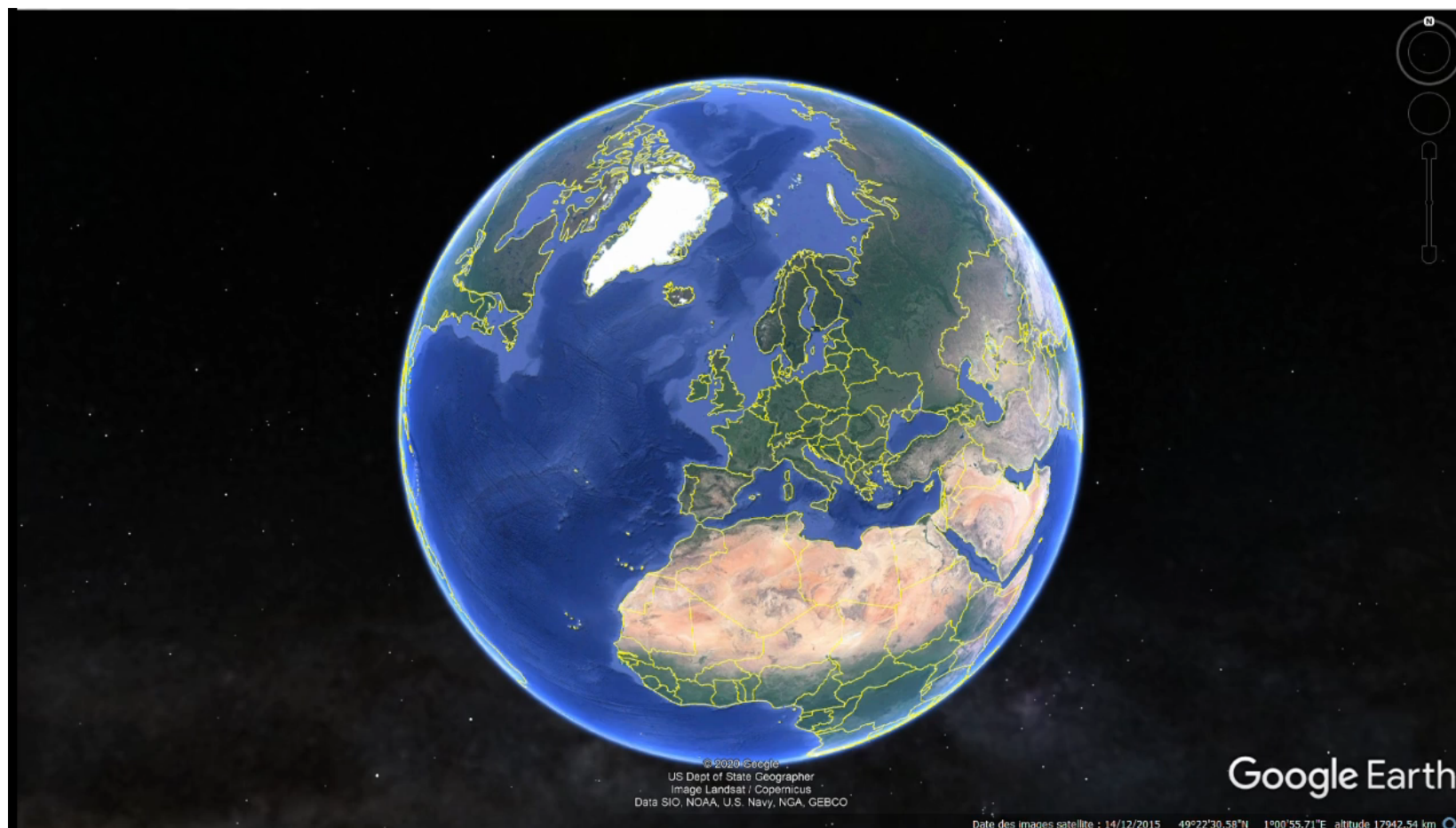
- Application of geophysical methods for Polluted Sites and Soils
- Benchmark with classical intrusive (MACAOH) or innovative methods(OIP probe)



⇒ **Hydrological characterization (groundwater and LNAPL behavior)**
⇒ **Geophysical measurement for LNAPL characterization**

A photograph of a large, teal-colored industrial tank, likely a storage tank for oil or gas. A yellow metal staircase with a handrail is attached to the side of the tank, leading up to a platform. A long, thin light fixture is mounted on the wall above the staircase. The tank's surface has a vertical corrugated texture.

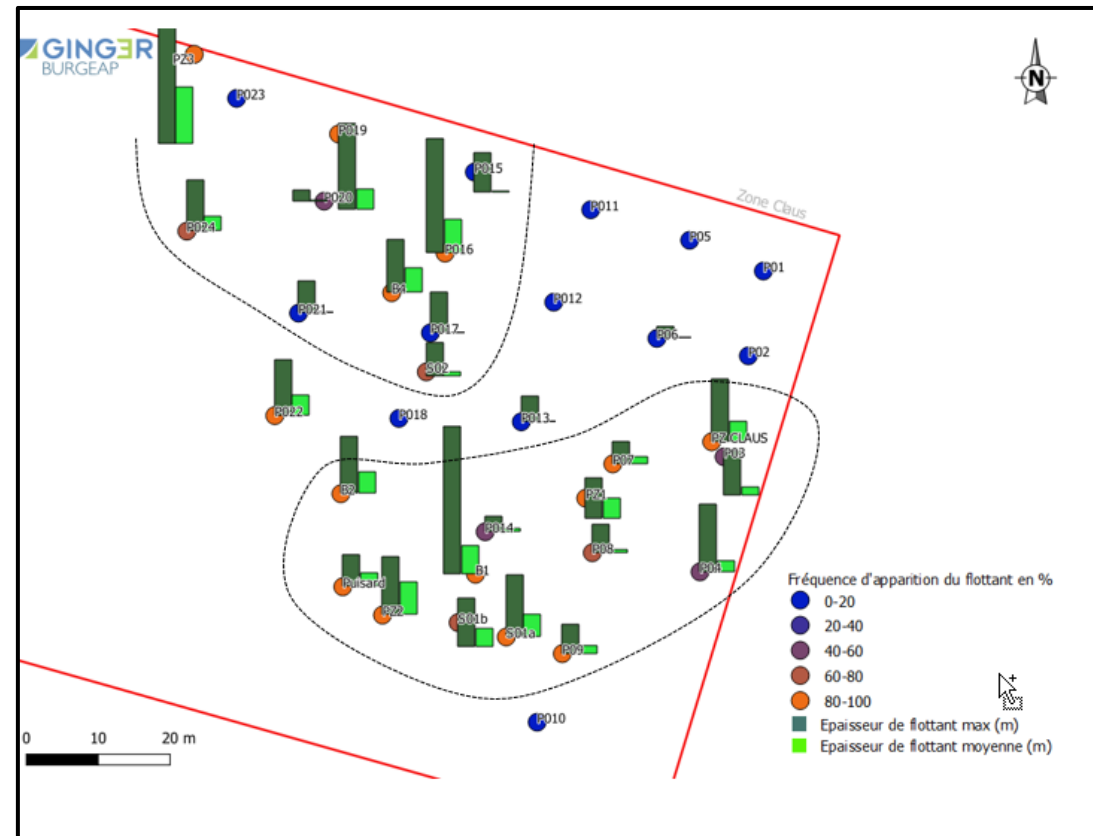
Study site



□ Surface : 1 Hectare

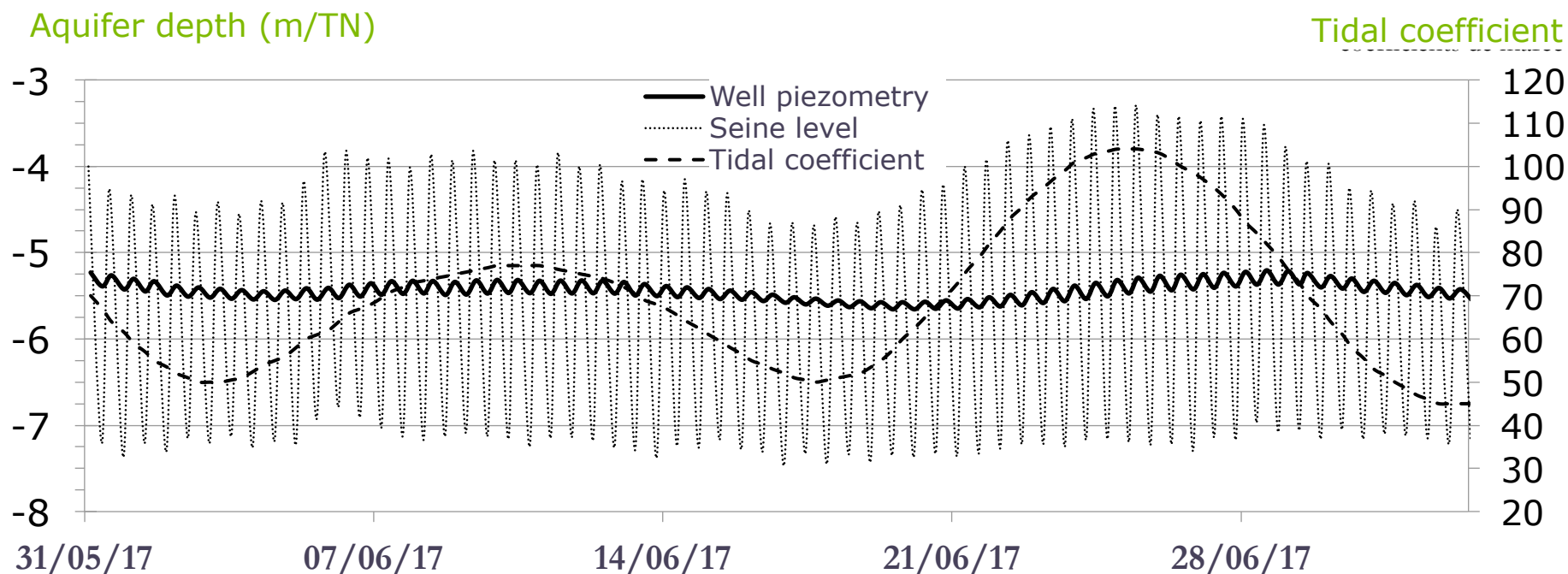
□ 32 access to water
devided into :

- 27 wells(Ø 200 mm)
- 4 piezometers (Ø 60 mm)
- 1 puisard (Ø 1000 mm)

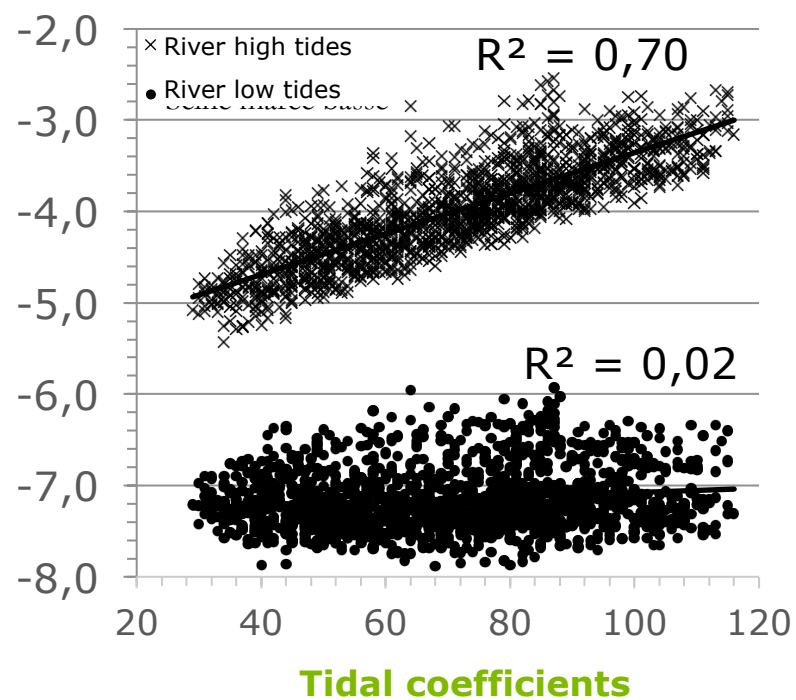




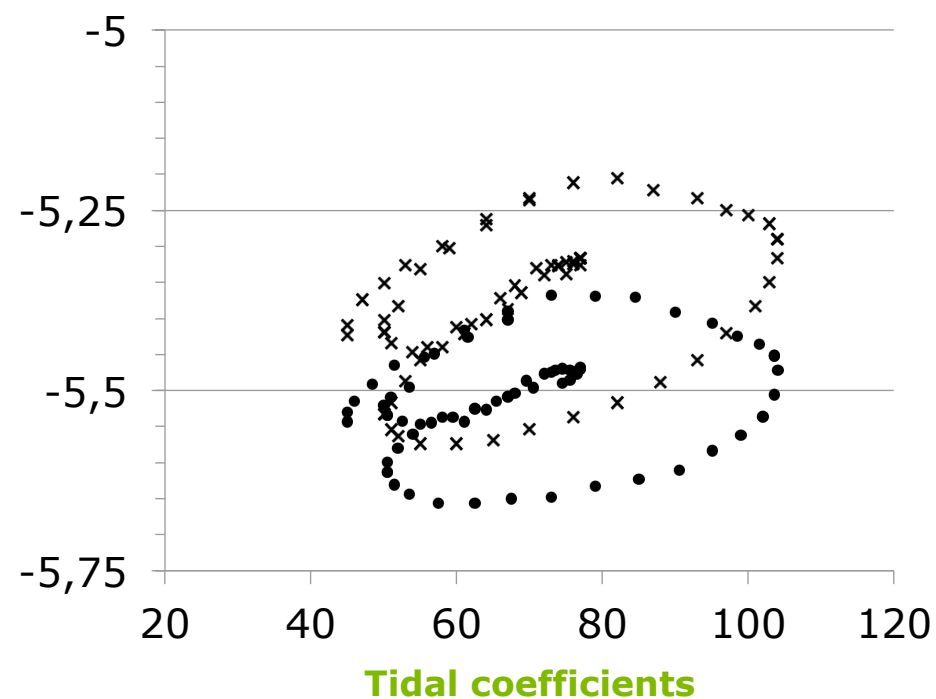
Hydrological specific behavior



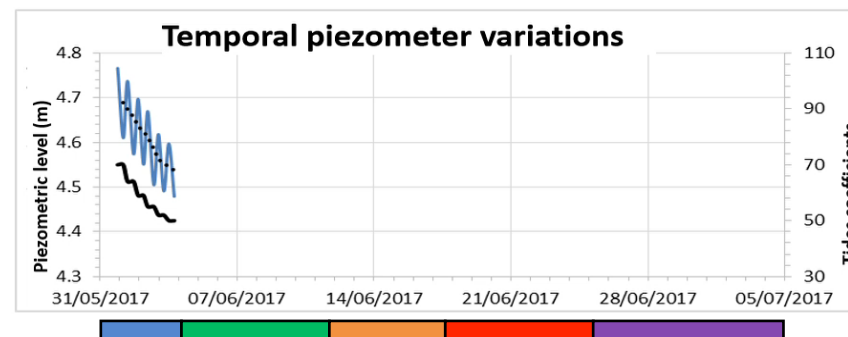
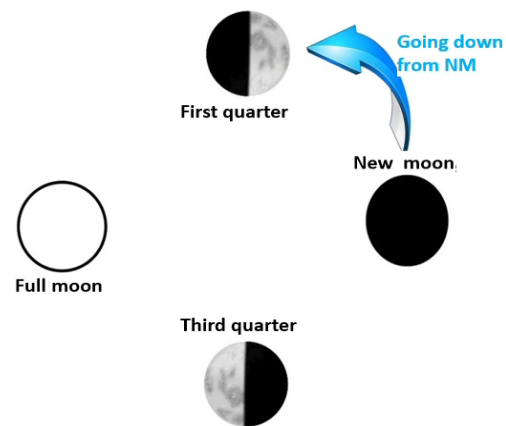
Water level (m)



Water level (m)



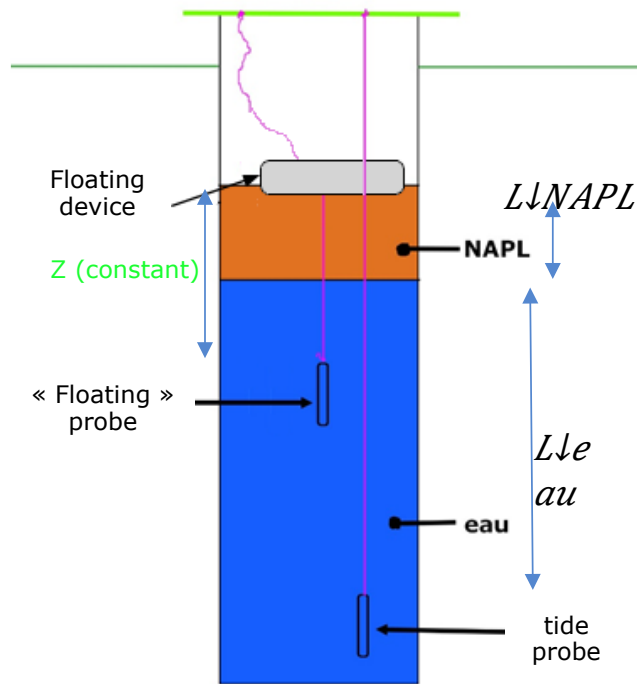
Diaporama PowerPoint - CSME 2018 Hydrogeological tidal effect and LNAPL behavior.pptx - PowerPoint



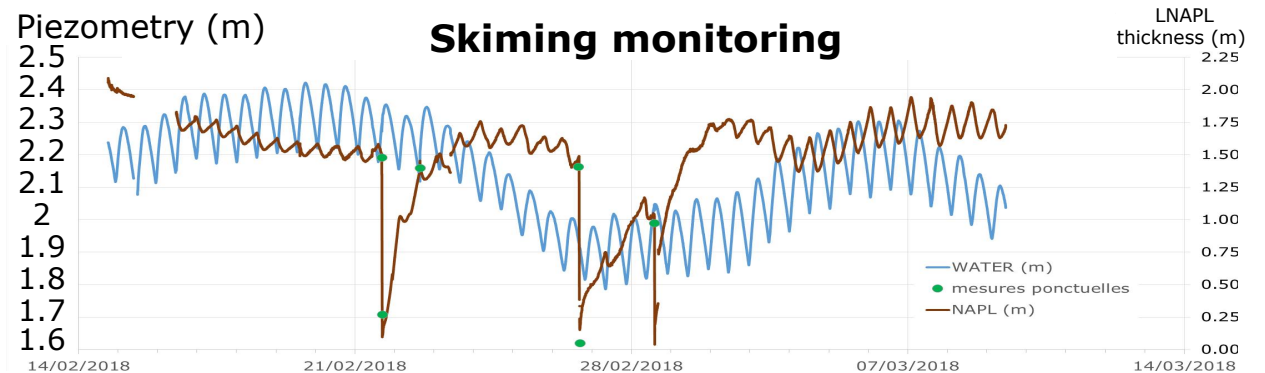
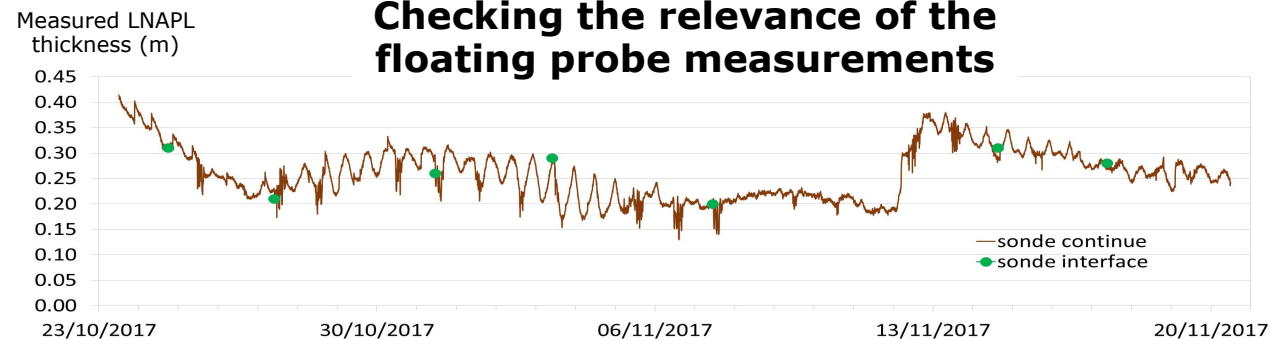
A photograph of a large, teal-colored industrial tank, likely a storage vessel for liquids or gases. A yellow metal staircase with black steps and railings spirals up the side of the tank. A long, thin light fixture is mounted on the tank's surface near the staircase. The background is a clear, light blue sky.

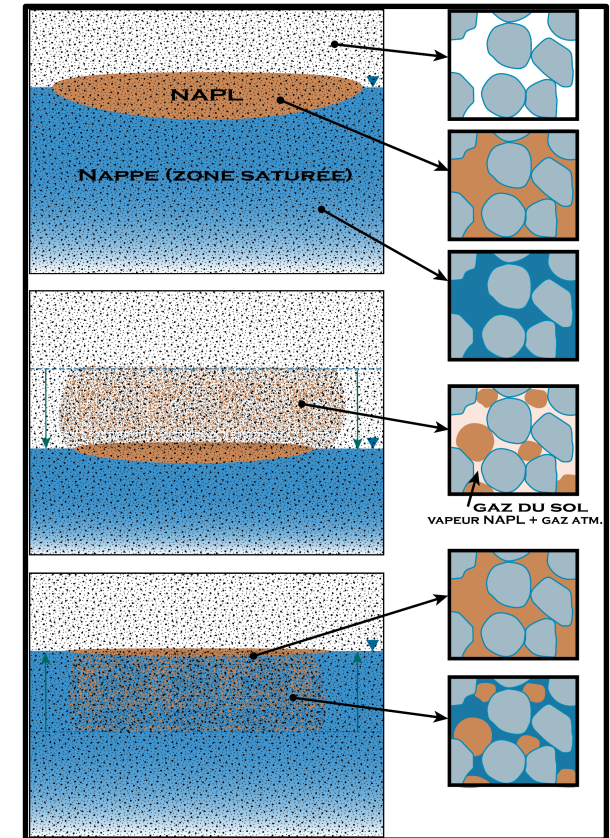
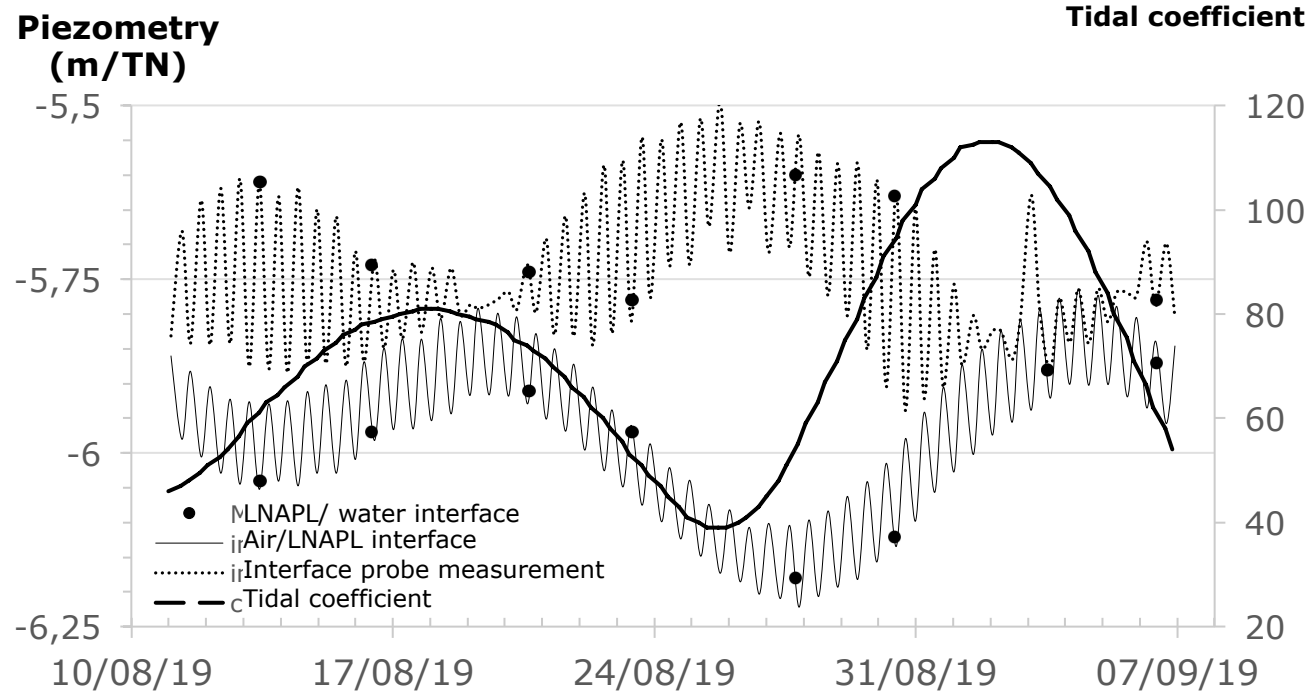
LNAPL specific behavior

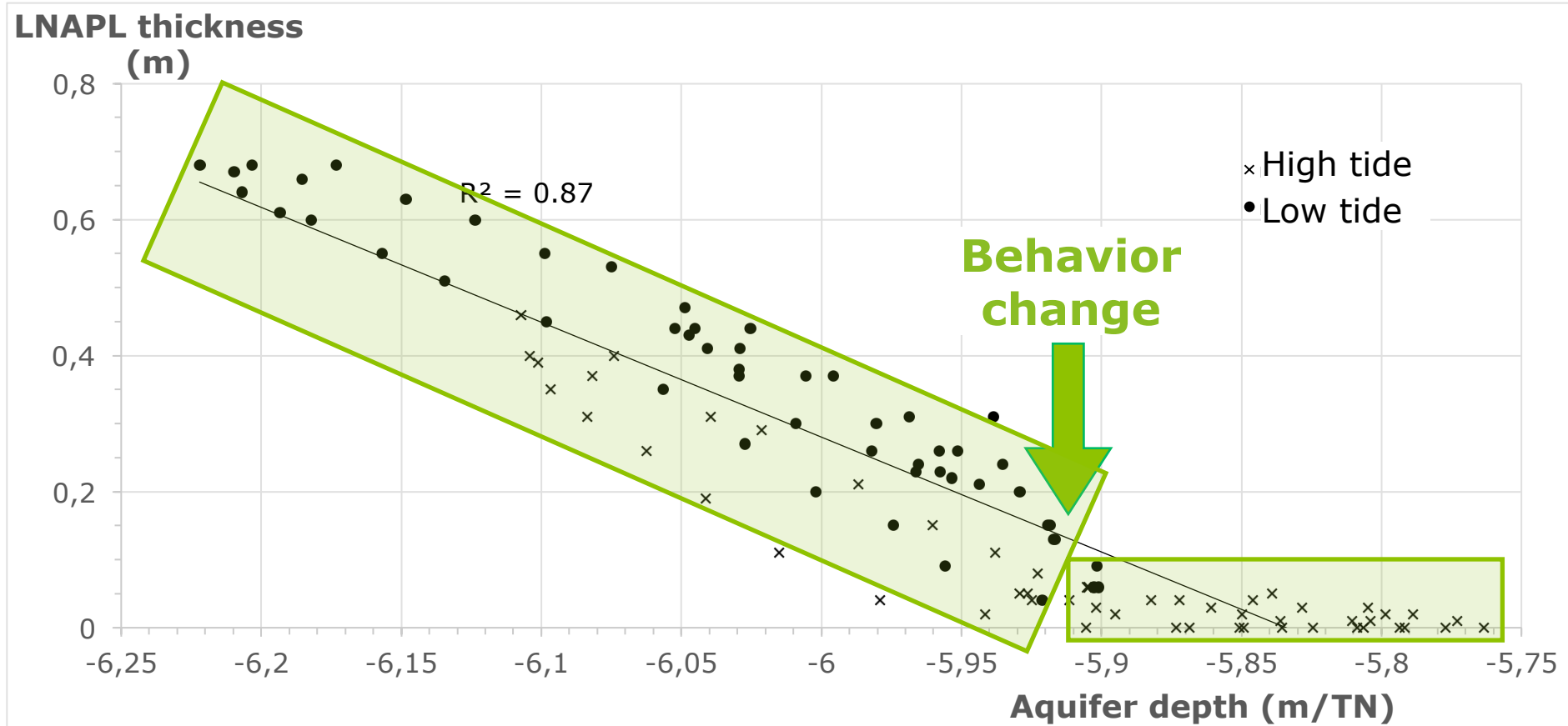
$$\{ \begin{aligned} Z &= L_{eau} + L_{NAPL} \\ P_a &= -\rho_{eau} * g * L_{eau} - \rho_{NAPL} * g * L_{NAPL} \end{aligned}$$



Checking the relevance of the floating probe measurements





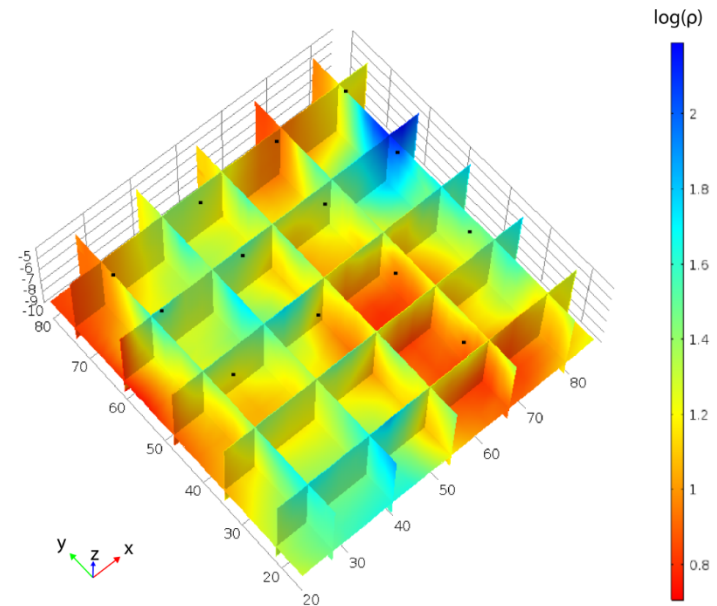


A photograph of a large, teal-colored industrial storage tank. A yellow metal staircase with black steps and railings spirals up the side of the tank. A long, thin light fixture is mounted on the tank's surface. The background is a clear, light blue sky.

Geophysical LNAPL characterization

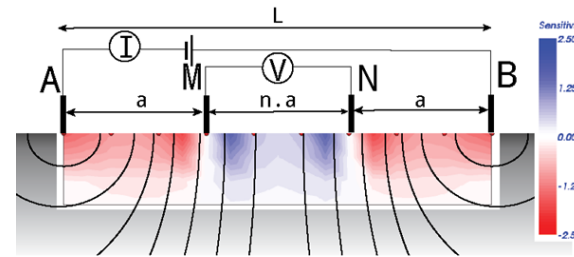
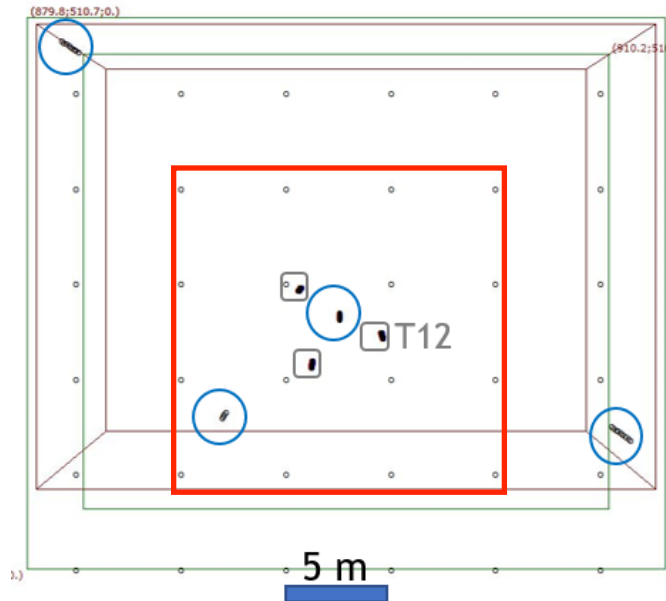
- ❑ Diverses méthodes testées
- ❑ Résistivité électrique en surface
 - modèle 3D de conductivité hydraulique

❑ Résistivité électrique 3D



Modèle 3D (inversé de 12 profils ERT réalisé en surface) de la résistivité de la zone d'étude

Modélisation volume : 450 m³
 Surface : **225m²** (15m*15m)
 Z=2m (between -5 et -7m)



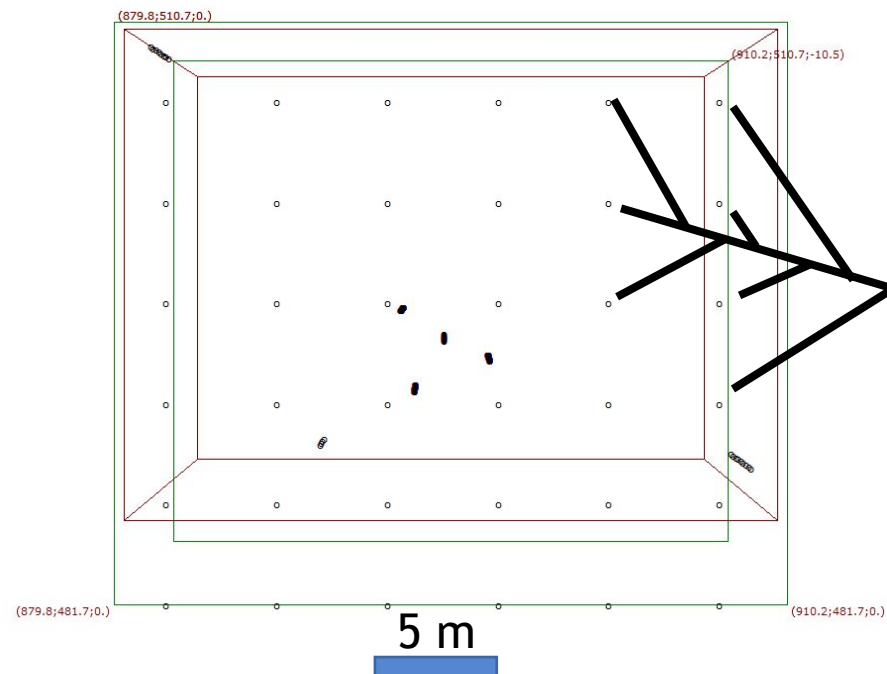
$$\rho_a = k \cdot \frac{V_M - V_N}{I_{AB}}$$

□ Measuring devices :

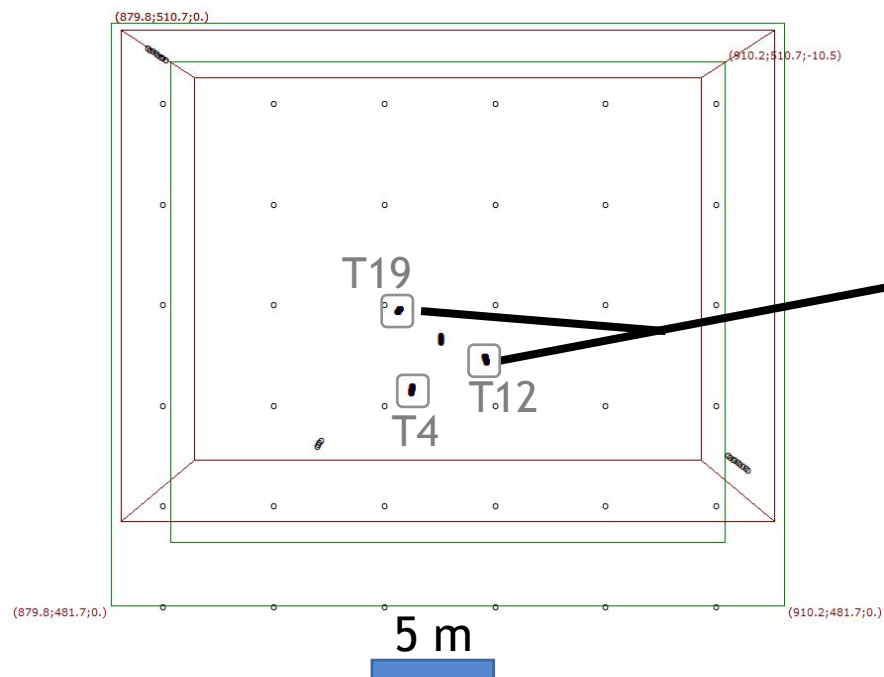
- 3 electrodes rods (T19, T12 et T4) + one well
- 3 electrodes rods (T19, T12 et T4) + surface electrodes

- Number of quadripoles : 12 603
- Total duration of the measurements : 7h

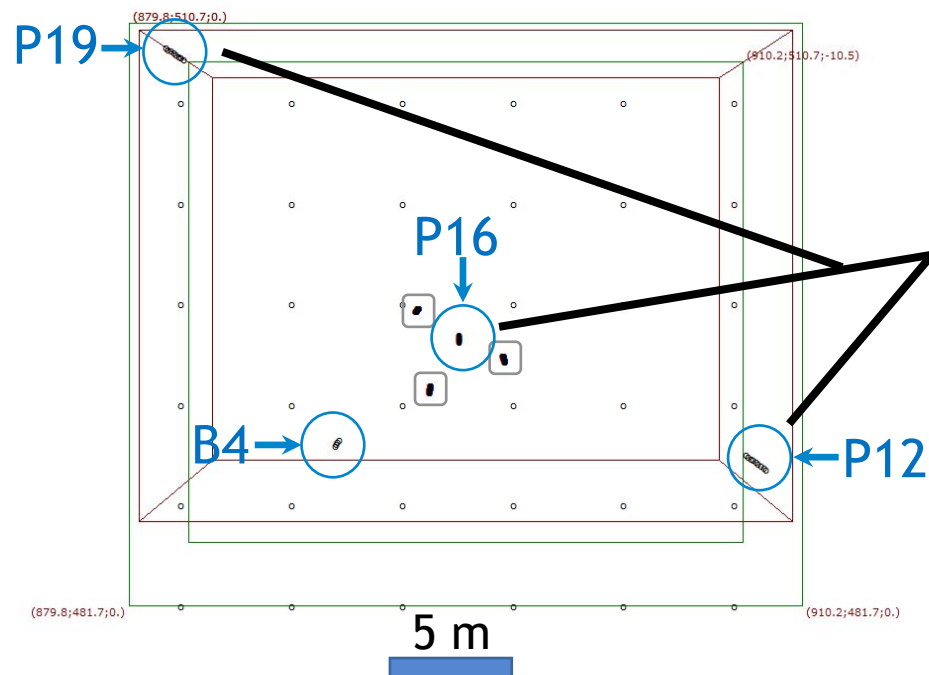
- Surface : 36 électrodes mesh (6 by 6) spaced by 5m



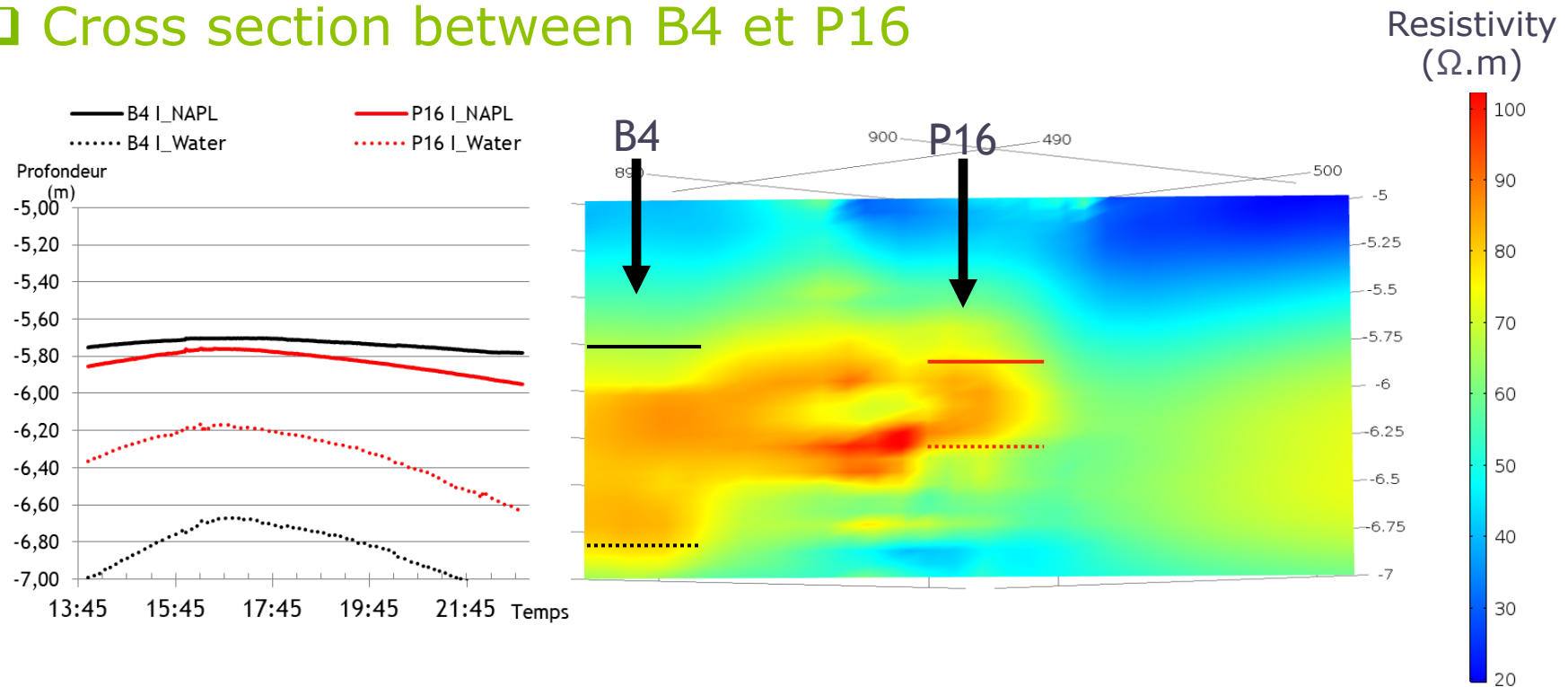
- ❑ Tige : tube $\varnothing 32\text{mm}$ avec 12 électrodes de -4,25 à -7 mètres (tous les 0.25 m)



- ❑ Wells : 9 electrodes (every 0.5m) into the aquifer (from -6 to -10m)

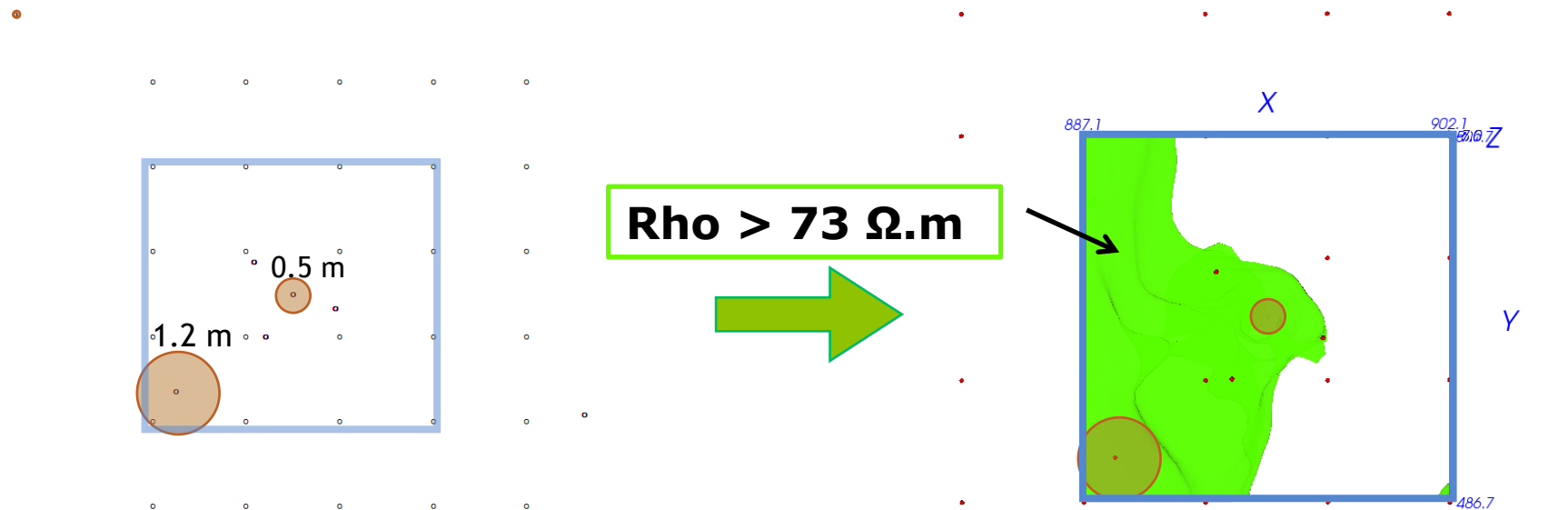


□ Cross section between B4 et P16



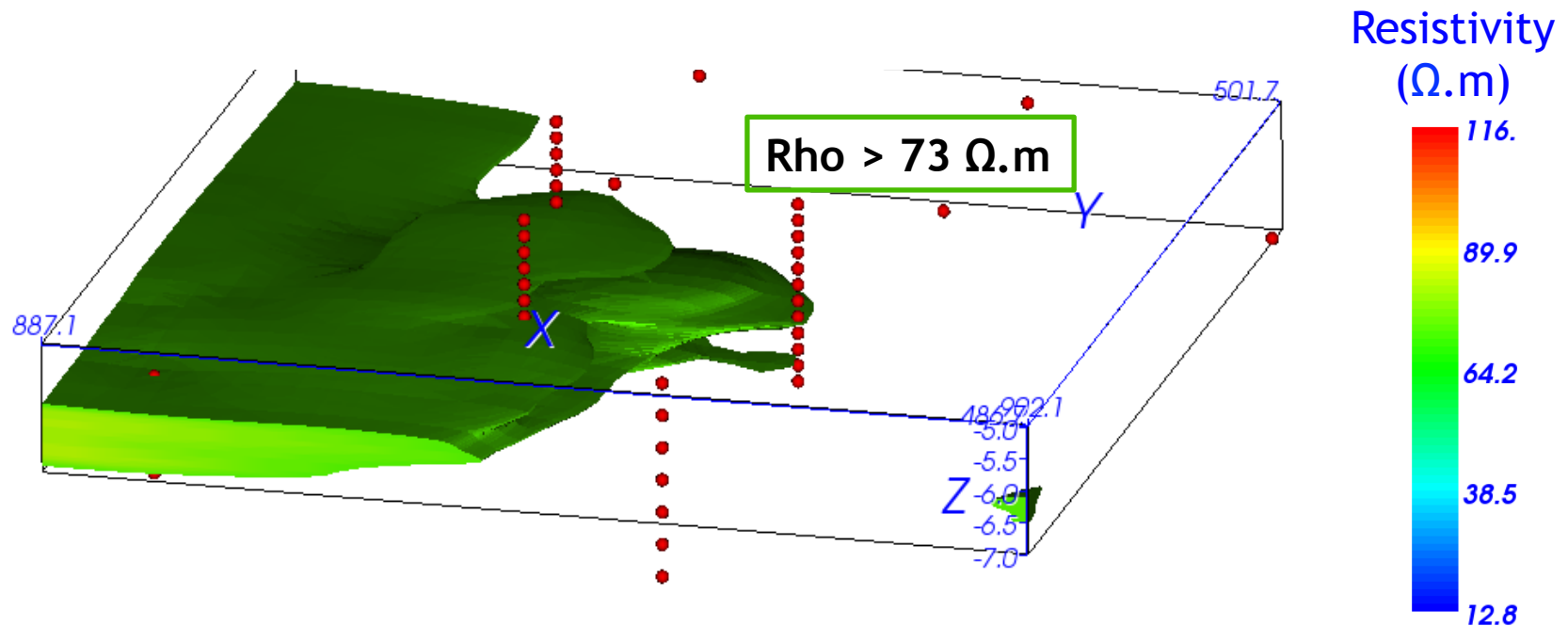
➔ **Vertical link between electrical resistivity and thickness variation of mobile LNAPL in wells**

□ 2D-Map view



➡ **Horizontal link between high electrical resistivity and repartition of mobile LNAPL in the wells**

3D view



➔ 3D isolation of a highly resistive zone where LNAPL is observed into the wells



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