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## **An integrated hydrogeophysical approach for karst water assessment and management in humanitarian context - Mahafaly Plateau in Madagascar**

Simon Damien Carriere, Konstantinos Chalikakis, Nicolas Guibert, Karl Lellouche, Marie Mangin, Jean Kempf, Jean Lapègue

### ► **To cite this version:**

Simon Damien Carriere, Konstantinos Chalikakis, Nicolas Guibert, Karl Lellouche, Marie Mangin, et al.. An integrated hydrogeophysical approach for karst water assessment and management in humanitarian context - Mahafaly Plateau in Madagascar. 43rd IAH international congress, Sep 2016, Montpellier, France. hal-02446402

**HAL Id: hal-02446402**

**<https://hal.science/hal-02446402>**

Submitted on 20 Jan 2020

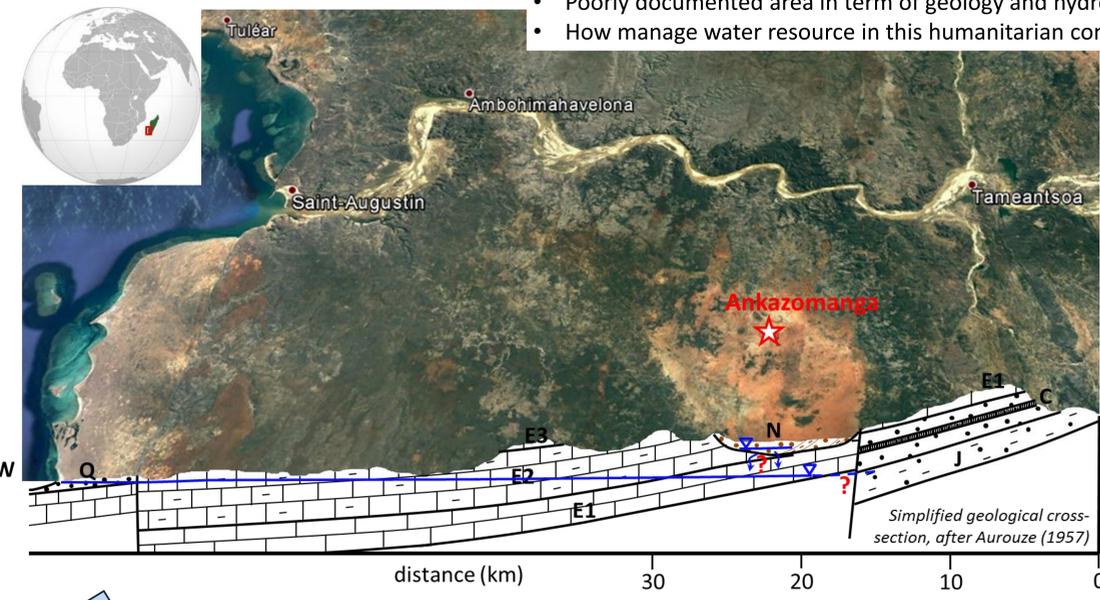
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Carrière S.D.<sup>(1)</sup>, Chalikakis K.<sup>(1)</sup>, Guibert N.<sup>(2)</sup>, Lellouche K.<sup>(2)</sup>, Mangin M.<sup>(2)</sup>, Kempf J.<sup>(2)</sup>, Lapegue J.<sup>(2)</sup>

**Hydrogeological and humanitarian issues**

- What water resource can we exploit?
  - Where dug boreholes?
  - Complex and discontinuous geology.
  - Poorly documented area in term of geology and hydrogeology.
  - How manage water resource in this humanitarian context?
- 11 target villages → 15 000 inhabitants
  - traditional water points  
 → unsustainable  
 → undrinkable  
 → low productivity



**Hydrochemistry**

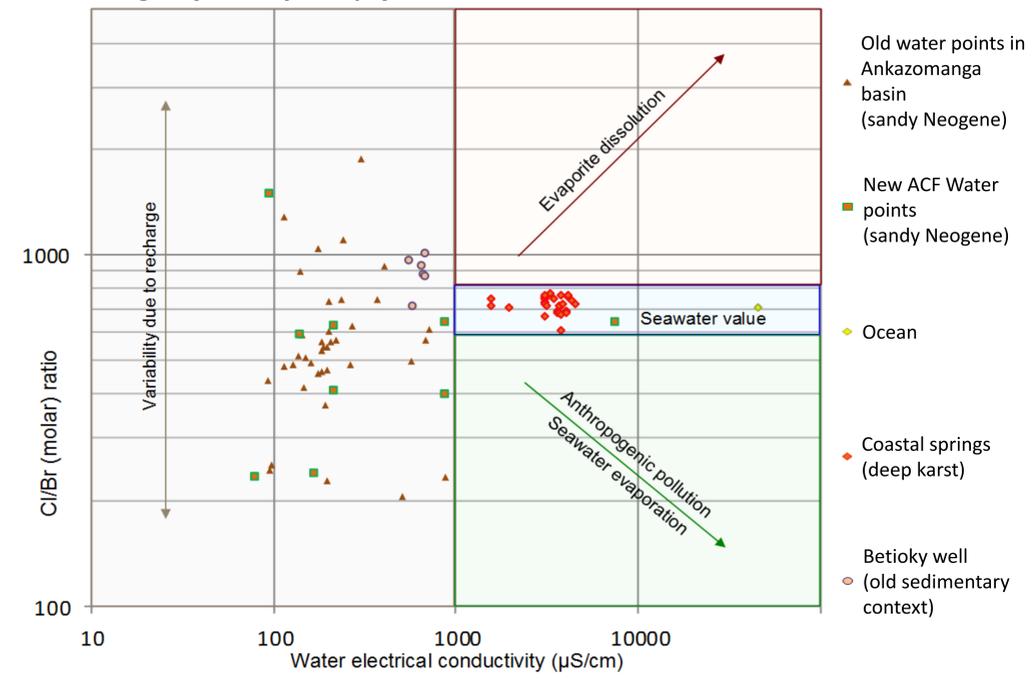
Method  
 • 7 surveys → 111 samples

Main results:  
 ➢ deep karst resource is probably salinized  
 ➢ 1 new ACF water point seems influenced by seawater → influence of cyclone?

**Drillings**

Main results:  
 ➢ 6 positive boreholes → 1 salinized borehole  
 ➢ 6 failures → 3 drilling "failures" replaced by wells  
 ➢ productive aquifer are sand and clayey sand  
 ➢ permeability from  $1.10^{-4}$  to  $1.10^{-7}$  m/s

**Origin of salinity in aquifers**



**Hydrogeology**

Method:  
 • 217 points with differential GPS survey

Main results:  
 ➢ general water table slope is West direction  
 ➢ at small scale, water table is very discontinuous

**Hydrogeophysics**

Method:  
 • 262 TDEM soundings  
 • 2588 EM34 points  
 • 35 electrical soundings

Main results:  
 ➢ understanding of the general geological structure  
 ➢ identification of drilling points  
 ➢ geology in Neogene in very heterogeneous and discontinuous

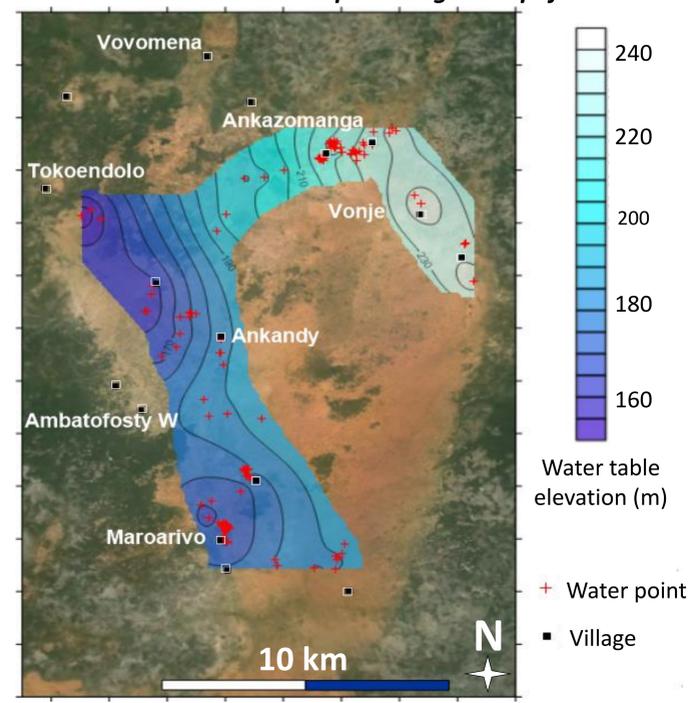
**Water management**

Method  
 • 1 meteorological station in the middle of the study area (installed in 2016)  
 • 10 automatic piezometric probes (installed in 2014 and 2016)  
 • a team of local partners was formed for data acquisition and maintenance of equipment

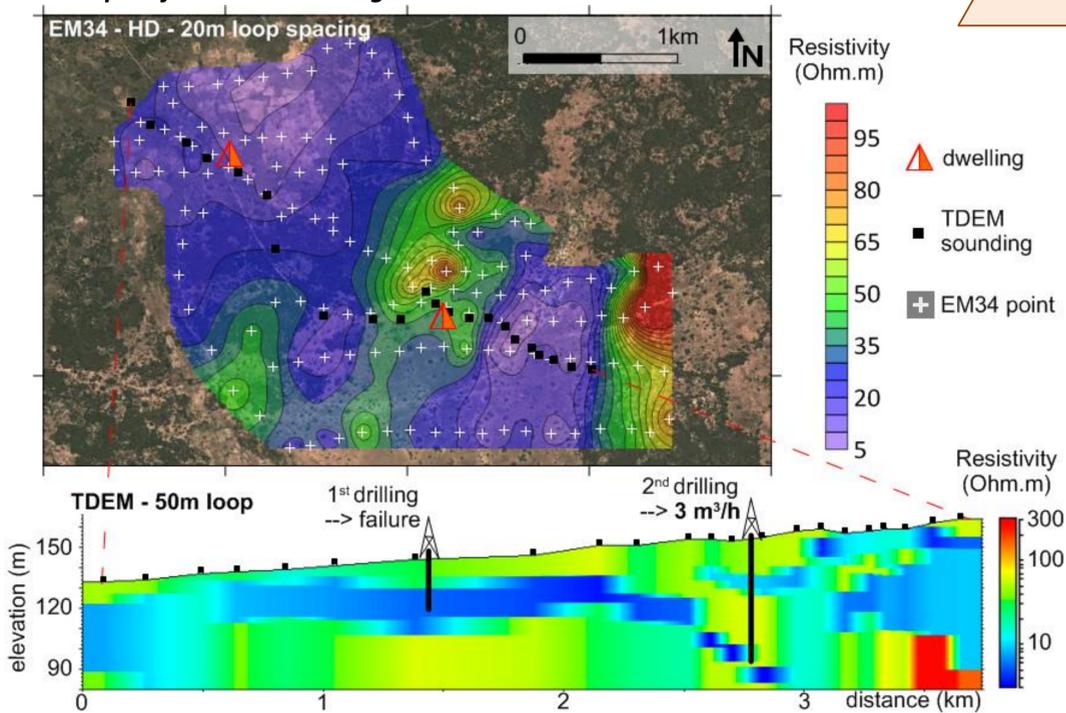
Main results:  
 ➢ very different water dynamic between two boreholes (separated by 450m)  
 ➢ delayed water table ascent at Well 06 → lateral transfer?  
 ➢ recharge of exploited aquifer seem dependent on intense rain events  
 ➢ low recharge in 2016 → following drought period will be very difficult!



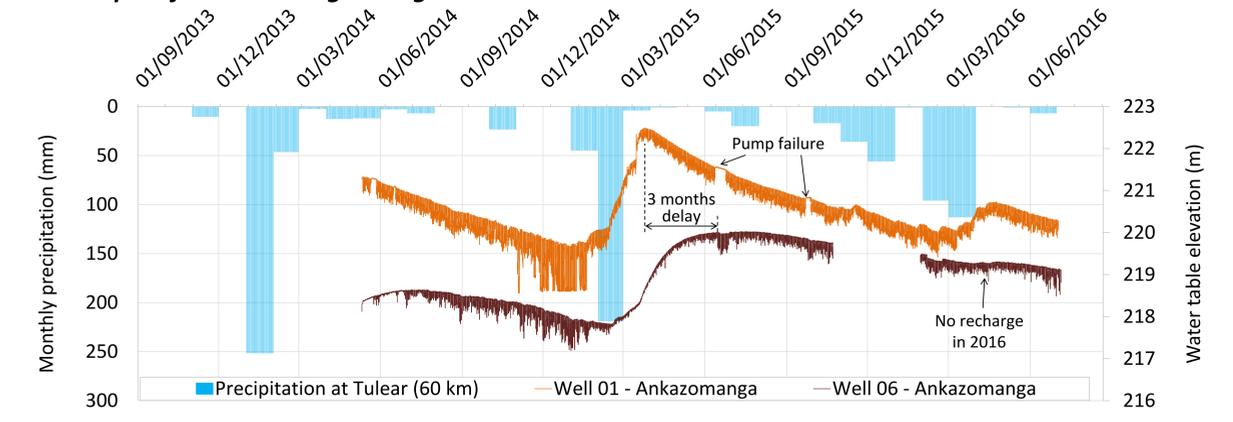
**General water table map in Neogene aquifer**



**Example of Tokoendolo village**



**Example of Ankazomanga village**



**Perspective**

• Meteorological and piezometric sensors and the team formed will allow to manage sustainably water resource  
 • This part of Mahafaly plateau is now a unique observatory for drought warning in one of the largest karst system of the southern hemisphere.

(1) UMR 1114 EMMAH INRA/UAPV, Avignon, France  
 (2) Action Contre la Faim, Paris, France