

# Characterization of the aquifer system of the up basin of the Chambo river: recharge processes and sustainable resource management

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## ABSTRACT

The water resources management is crucial and implies the knowledge of dynamics, hydrochemistry and the interaction between the surface water and groundwater, as well as the relations among the urbanization, weather changes and environment impacts in cities where the main drinkable water supply comes from the subsoil. This is the case of Riobamba and Guano (Ecuador), cities whose surface and underground water resources have been monitored for decades, but without planning. Such planning is essential for a better exploitation of the hydrological cycle, taking into account the influence of the recharge and water quality on the aquifers that underlay the populations. The aim of this project is to evaluate the water resource interrelations, their complementarity, hydrodynamics, hydrochemistry and the benefits in order to create strategies for exploitation of water in these cities.

### Introduction / Objectives

Groundwater from the aquifer of the Upper Basin of Chambo river, is considered as the main source of drinking water for the cities of Riobamba and Guano, and a tool for the development of agriculture and animal raising<sup>1</sup>. The use and benefit of the aquifer influences recharge and water quality, so it is important to characterize it considering that, the volcano-sedimentary aquifers can be very complex both in geology and dynamics, due to its anisotropy and heterogeneity.

During last decades, the aquifer of the Upper Basin of Chambo river has been monitored at random in groundwater level and hydrochemical analysis, emphasizing water quality<sup>3</sup>. The objective of this study is to characterize the aquifer hydrodynamics and geochemistry, and evaluate potential interactions between surface and groundwater, and the interactions with the volcanoes next to the study area.

The integration of data will result in: I) the preliminary conceptual model of the aquifer, ii) identification of potential areas of contamination related to the use and cover land, iii) determination of a model of effective management of water resources, which will establish criteria and recommendations that could help public authorities and the community for the development of protection and water usage policies.

### Methodology

Existing and Generating Data Sets

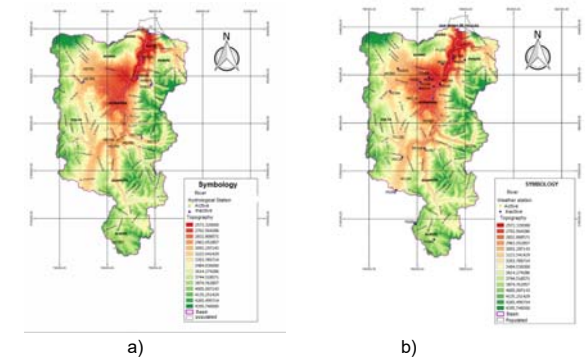
- > Registration of wells<sup>1</sup>
- > Cartographical collection<sup>2</sup>
- > Treatment of hidrological data<sup>3</sup>
- > Treatment of geologycal, geophysical, hidrologycal data and chemical analysis preexisting<sup>1,3</sup>

Field Work

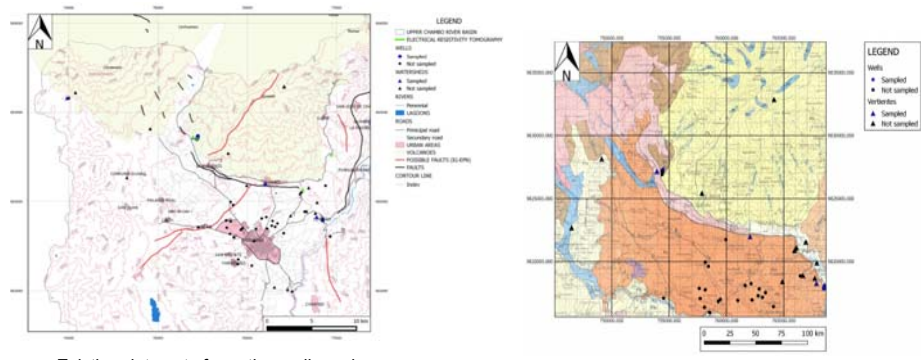
- > Geological mapping (1:25.000)
- > Geophysical (5 electrical tomography)
- > Sampling campaigns
- > Isotopes data

Data Analysis

- > Characterize the aquifer hydrodynamics and geochemistry,
- > Evaluate potential interactions between surface and groundwater (WEAP<sup>5</sup>), and the interactions with the volcanoes next to the study area (Isotopic methods).

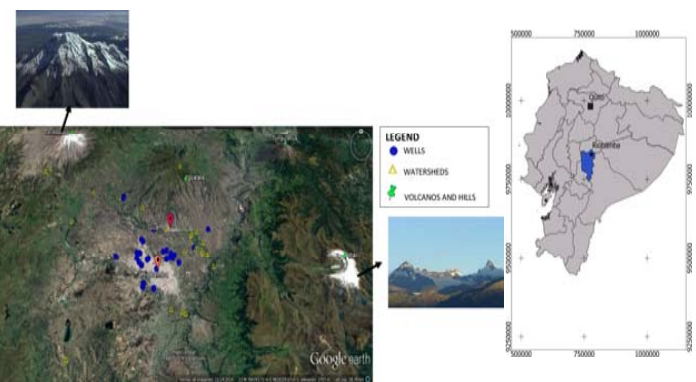


Delimitation of the basin  
 a) hydrological stations  
 b) weather stations



Existing data sets for active wells and watersheds were gathered. We have 27 watersheds and 35 wells.

Location of the wells and watersheds in the geological map.



## FUTURE WORK

Define the conceptual model of the down basin of Chambo river aquifer system. Modeling the integrated management of water resources, including the interaction between surface and groundwater.

References:  
 [1]EMAPAR (2008).-Estudios de los Planes Maestros de Agua Potable Alcantarillado de la ciudad de Riobamba. Anexo 1.4: Estudios Hidrogeológicos. 54 pp.  
 [2]SEMPLEDES.-Secretaría Nacional de Planificación y Desarrollo Ecuador.- Subsecretaría de Información. 2011  
 [3]Universidad San Francisco de Quito (USFQ, 2012). Producto 3: Plan de protección de fuentes de agua potable de la ciudad de Riobamba y manejo integrado de las fuentes de agua de San Pablo y Llífo. Preparado para: EP-EMAPAR. 160 pp.