

Water resource management in the Valley of Cochabamba – A geophysical survey

Background

The demand of Earth's resources has increased with the world's growth in population. Fresh water is one of the most important natural resources, needed for many disciplines within society. Water is naturally occurring in so-called aquifers, porous sediments within the ground that store water. It can be extracted with the use of wells. However, the demand for drinking water in overpopulated areas can result in unsustainable overexploitation on local aquifers. This is the case for the population of Cochabamba in Bolivia. The use of geophysical investigations can help provide information about the subsurface, without needing to dig or mine the area and can thus be used to study aquifers.

Method

Electrical Resistivity Tomography (ERT)

Measures the resistivity of the ground, i.e. the ability to resist the flow of electrical current. A current is sent through two current electrodes (C) into the ground. Two potential electrodes (P) measure the emerging potential difference. The potential difference depends on the resistivity of the materials in the ground.

Transient Electromagnetic Method (TEM)

A current is sent into the ground and creates a primary electromagnetic wave. The current is quickly turned off and an electromotive force is created. This induces a current into conductors in the ground that are proportional to the resistivity. As the current passes through the conductor it fades and creates a secondary wave. Equipment at the surface registers these waves and the obtained data can be used to create resistivity models.

Results

The survey fulfilled one of two aims. Determining the geometry of the potential aquifer was accomplished, while the depth of the bedrock could not be concluded. Fig. 1 shows a 3D model consisting of several TEM profiles. The upper parts of the subsurface (in red) show the potential aquifer. The layer mainly consists of sand and gravel. These sediments allow water to infiltrate easily and to be stored. This potential aquifer is an important source for drinking water for the population of Cochabamba in the future. It is therefore important that the area stays free from buildings or other structures that otherwise would affect the infiltration negatively.

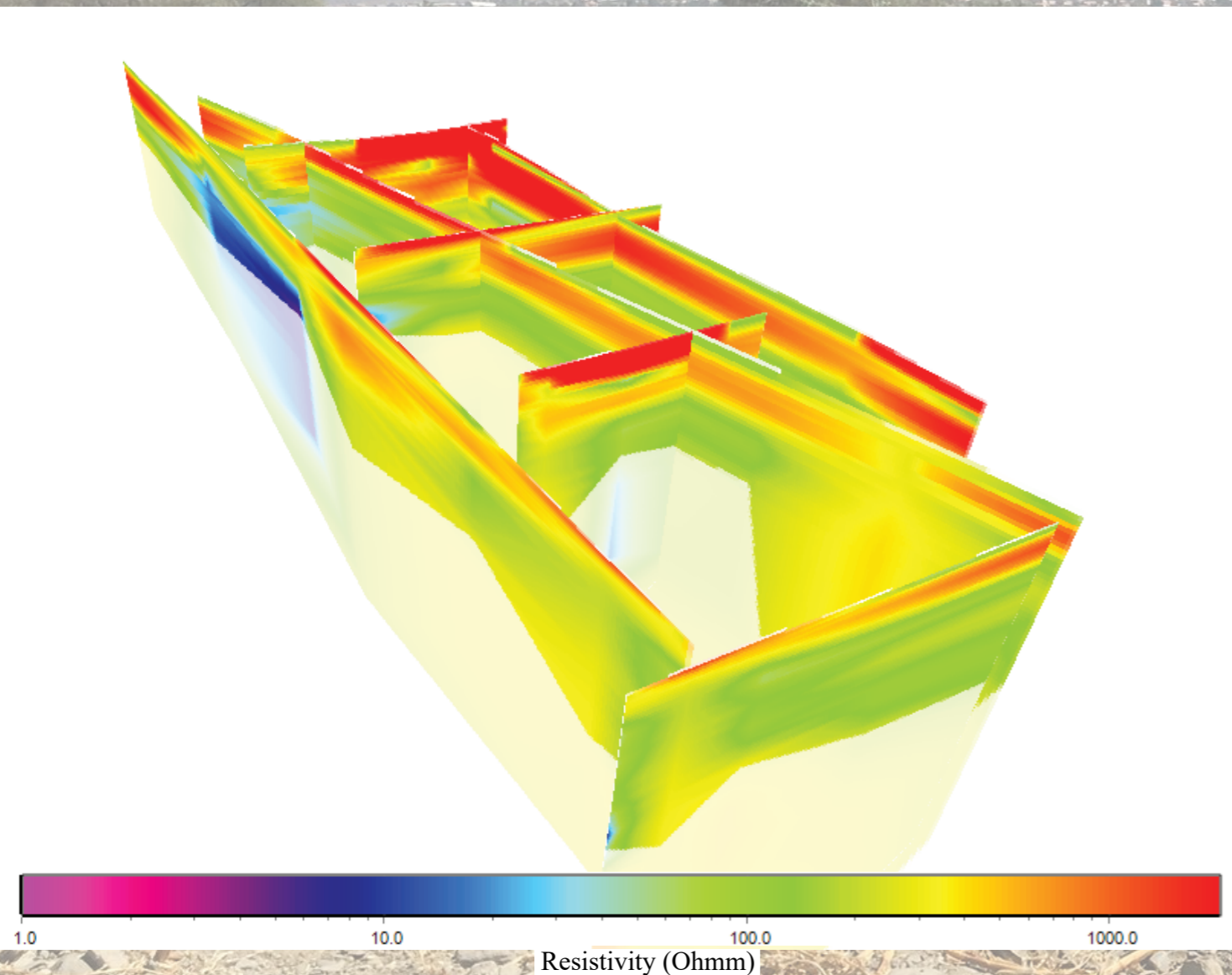


Figure 1. A 3D model consisting of TEM line 1, 2, 6, 7, 8, 9 and 10. The model shows the variations in resistivity within the study area.