Preliminary local numerical modeling of the Acoculco area

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ABSTRACT

A preliminary local numerical model was developed by integrating thermal and pressure logs, geological, structural and topographical information of the Acoculco local surface area as defined by the GEMex WP3 team. First, the stratigraphic model developed by the T3.1 group was implemented on the *RockWorks 16* software, adding the lito-stratigraphic information from the EAC-1 and EAC-2 boreholes as interpreted by the T6.2 team at the local area nearby the wells. Then a preliminary numerical model aimed at running on the *TOUGH2* simulator was set up on the graphical user interface *PetraSim* based on the Rockworks model. The numerical model was implemented with rock property data measured and distributed by the T6.1 & T6.2 groups as well as generic rock properties available elsewhere. The numerical simulation work is currently on progress.

INTRODUCTION

The Acoculco area has been selected as a potential *Enhanced Geothermal System* (EGS) development site because it is characterized by high temperatures (300°C) at a depth of about 2 km; the zone shows a conductive gradient resulting from the presence of very low permeability rocks [1]. Acoculco is located 130 km northeast of Mexico City, the eastern sector of the Trans Mexican Volcanic Belt (TMVB) and the Sierra Madre Oriental [1,2,3] (Figure 1).

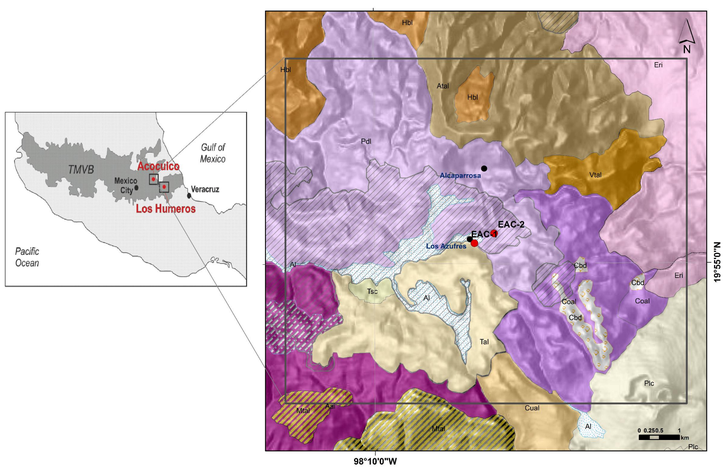

Figure 1. *Location of the Acoculco area and geologic map of the Acoculco Caldera Complex [4].*

DATA

Two exploratory wells (EAC-1 and EAC-2) were drilled by CFE near the Los Azufres bubbling pond [2]. The main objective of the wells was to determine if high temperatures and permeabilities existed at depth. At the end of the drilling operations, a series of temperature logs were obtained [1,5] as shown in Figure 2.

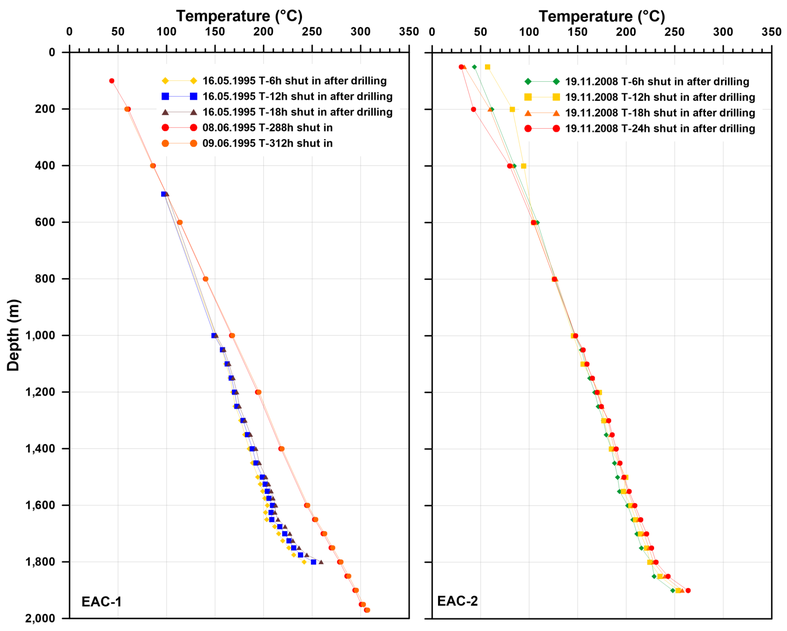

Figure 2. *Temperature logs for the EAC-1 and EAC-2 as exploratory wells; provided by CFE [1,5].*

Additional data are: the lithology structure of wells was provided by the T6.2 team [6], the preliminary regional model of geological formations (basement, granite, skarn, limestone and volcanic rocks) defined by the WP3 team [7], in addition to digital elevation model (DEM) [8].

METHODOLOGY

The present work integrates the geological, structural, topographical and bottom downhole data that is available for the Acoculco area, through the use of *Geographic Information System* (GIS) tools. In addition, a stratigraphic model was implemented on *RockWorks 16*. Then a preliminary local numerical model was implemented on the interface *PetraSim*. A simplified diagram of the methodology used is shown in Figure 3.

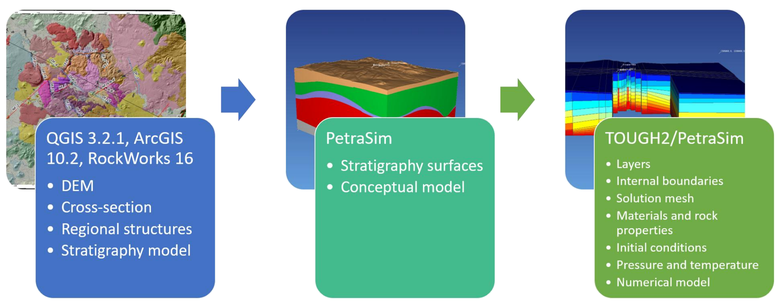

Figure 3. *Methodology diagram.*

In this study, we selected the EOS1 module of the *TOUGH2* simulator for simulating our numerical model.

Two static numerical models were created using different solution meshes, A and B, in the X-Y planes. Both meshes share the same discretization along the Z-direction. The dimensions of the Acoculco numerical model are 11.6, 10.2, and 2.2 km in the X (East), Y (North), and Z (vertical) directions, respectively. Meshes A and B are discretized into 2,464 and 37,600 grid blocks, respectively (Figure 4).

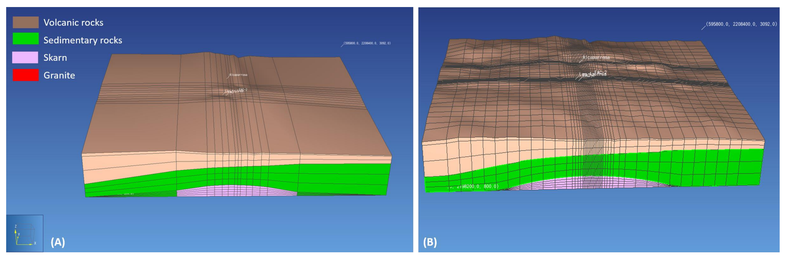

Figure 4. *Regular solution meshes for the Acoculco area.*

The thermal- and petro-physical properties for the volcanic, sedimentary, skarn and granite layers were provided by the T6.1 [9] and T6.2 [6] groups and assimilated into the numerical model.

Fixed boundary conditions of temperature and pressure were assigned at the surface (15°C, 1 bar) uppermost block layer representing the atmosphere. Whereas most of the inner blocks were assigned initial conditions having a temperature gradient condition of 140 °C/km [2] and a hydrostatic pressure gradient (Figure 5-6). The heat source was located at the bottom of the model.

SIMULATION

The numerical model was run to reach a steady state condition.

The temperature and pressure logs for both wells are currently being calibrated.

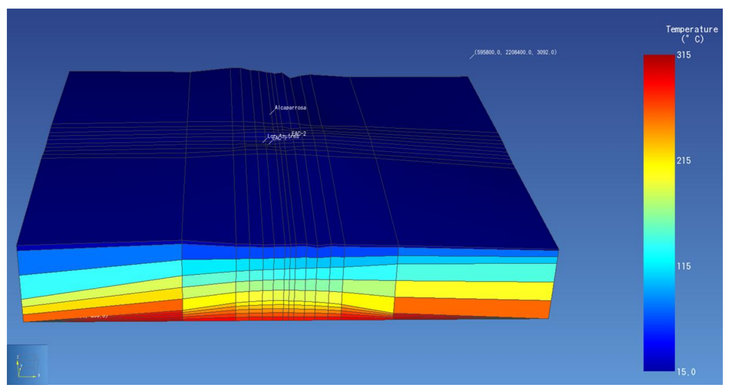

Figure 5. *Temperature initial conditions.*

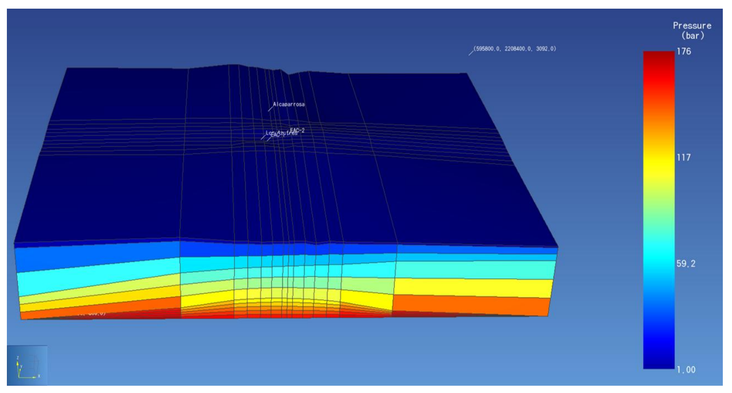

Figure 6. *Pressure initial conditions.*

Our work is still on progress. Once further data on Acoculco become available from the GEMex WPs, our conceptual and numerical models should become more valid.

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