6.6 INVESTIGATION OF THE RELATIONSHIP BETWEEN THE TOPOGRAPHY AND THE FLUID CIRCULATION DEPTH ON THE GEOTHERMAL SYSTEMS OF CENTRAL ANATOLIA REGION

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ABSTRACT

Geothermal energy is renewable, has a nearly zero carbon footprint, and is a strong baseload resource alternative to fossil fuel-based energy resources. Geothermal systems are developed in complex geologic settings involving various factors, including topography. Modeling studies of geothermal systems around the world demonstrated that topography is an effective factor in the geothermal fluid cycle, depending on the basal heat flow. This study explores the intricate dynamics of basal heat flow and topography in geothermal systems, focusing on the Central Anatolia region. The geothermal source temperatures and circulation depth are parametrically analysed using the finite element method. The data is retrieved from existing MTA inventory borehole data in combination with the updates from the literature, accordingly. The models are produced in 2-D by insulating the transfer of heat and fluid on the side boundary, employing a constant hydraulic permeability and fault depth. Initially, the produced models are validated by comparing them to similar studies published previously. According to the numerical results obtained through simulations, topography has a significant effect on the fault zone temperatures in geothermal systems, generally. Using the model results and 37 geothermal sites of the Central Anatolia region, the temperature-depth profiles were produced. Subsequently, a correlation was observed between the fault in the models and the borehole data of the Central Anatolia region. The mean height in the Central Anatolia region is approximately 1053 m. When the elevation difference of the topography is high, the geothermal fluid cycle is higher. Although a constant fault depth is used in all models, the temperature increase due to convection along the fault zone is calculated to be higher with topography. When the basal heat flow is high, heating in the fault zone is higher, ultimately due to the mutual development of natural and forced convection processes.

KEY WORDS: geothermal energy, topography, fluid circulation, Central Anatolia, numerical.