Through the national project titled, “Implementation of the Geosciences to Construct the New Desert Urban, Site Management, and Distribute Resources; Pilot area: Moghra Oasis, Qattara Depression,” the magnetic field of the earth was measured on an area of 3,600 km² in the Egyptian desert, near the Qattara depression situated in the northeastern part of the great Sahara in North Africa. To achieve this, a very accurate magnetometer was employed to detect the minute variations in the Earth’s field, measured in nanoteslas (nT). The primary aim of this initiative was to use the magnetic properties of rocks to develop a model of the aquifer within this very arid environment.

Moreover, the project also involved the measurement of magnetic susceptibilities to provide mathematical constraints for the proposed model based on the magnetic field measurements. Furthermore, measurements of electromagnetic and electrical resistivities of rocks were conducted. These measurements were used to examine the geoelectric properties and establish the geoelectric layers of the aquifer.

The steering team for this work was formed by a total of 20 scientists hailing from the Cairo and Tanta Universities, and the National Research Institute of Astronomy and Geophysics (NRIAG) in Helwan, Cairo. The project entailed two years of fieldwork and an additional year of office work. We extend our gratitude for the financial support received from the STDF, the Science, Technology and Innovation Funding Authority within the Egyptian Ministry of Scientific Research. The results were awe-inspiring and demonstrated how geophysics played a crucial role in exploring the groundwater aquifer, site management, and distributing resources.
The achieved objectives of the project included:

1. Comprehend the general and detailed geology of eastern Qattara;

2. Locate natural resources (i.e., sand and dolomite) in the northern part of the research area;

3. Perform a detailed assessment of the possible aquifers, including their extent, water quality, and potential productivity using magnetic and electric measurements;

4. Determine the most suitable sites for water wells and the development of a production plan to maximize aquifer utilization. Additionally, evaluate the touristic attraction elements and provide suggestions for the future development of the region; and

5. Mitigation of natural hazards, including environmental pollution and earthquakes.

Figure 2: Measurement of the earth’s magnetic field using the GEM magnetometer. (Photo Credit: The authors)