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New Data on Land Subsidence Phenomena Due to Excessive Ground Water Withdrawal in the Western Thessaly Basin, Central Greece

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The Western Thessaly basin is a major plain which is located in Central Greece. During the last decades this area exhibits an intensive development, mainly based on the agricultural economy. Due to that agricultural development, several thousand boreholes have been drilled for irrigation purposes.
The overexploitation of the ground water, in the wider area, has triggered the manifestation of land subsidence phenomena. These phenomena were firstly observed in 2002 in the Stavros and Farsala sites (southeast part of the Western Thessaly basin), in the form of various surface ruptures. In 2009 similar phenomena appeared in Agios Georgios village and in 2011 in Anohori and Katohori villages, which are located between Farsala and Stavros towns.
The geological environment of the research area consists of terrestrial sands and gravels horizons Pleistocene in age, with brown and grey clayey silt to silty clay intercalations. These alternations of permeable coarse-grained deposits (aquifers) with impermeable to low permeability strata (aquitards) create a number of successive semi-confined to confined aquifers, sometimes artesians.
Land subsidence deformations were noticed both along the margins as well as in the inner part of the basin. Surface ruptures are observed along the margins of the basin where the bedrock outcrops and generally in areas where the thickness of the Pleistocene deposits appear to be small. On the contrary, in the parts of the basin with thick deposits, the subsidence of the Pleistocene formations can be noticed by the extraction of the water wells pipes.
During this research a detailed geotechnical and hydrogeological survey was carried out covering the study area. Several hundreds of boreholes, drilled in the frame of previous geological–geotechnical investigations, were analyzed and interpreted, along with previous data, referring to the stratigraphy of the study area. As a result, the highly compressible units, which may be responsible for subsidence phenomena below urban and agricultural sites, have been identified.
The mean piezometric level has been studied using a network of 311 water wells across the basin. The results indicate that during the last two decades, an especially along the regions where the surface ruptures were observed, the drawdown exceeds 40m. It is noticeable that the changes of the ground water level were not caused by a corresponding reduction of the mean annual rainfalls.
The purpose of this study is to point out the recent data and recordings on the manifestation of the land subsidence in the Western Thessaly, but also to highlight these phenomena as a geohazard that causes slow ground deformations and as a threat for the natural and urban environment.