Measurement Of Land Subsidence Based On GPS And Historical Geodetic Data

Stathis Stiros » Dept of Civil Engineering, Patras University, Greece  
Panos Psimoulis » Dept of Civil Engineering, Patras University, Greece

Ground subsidence is a major problem in many areas, leading to serious damage in infrastructure (Kontogianni et al., in press) and loss of land in Greece (Figure 1; Stiros, 2001) and other countries including the U.S. A main problem in some cases is to identify the extent and causes of the effect and separate anthropogenic contributions (mainly due to pumping) from natural effects. For this reason data covering greater than 30 to 40 year time periods are necessary. Comparison of historical leveling and triangulation data with GPS data, corrected for geoid undulations, appears to be the most promising way. Figure 2 summarizes the results of such a comparison in the Thessaloniki plain where subsidence rates up to 10 cm/yr have been measured (Stiros, 2001; Psimoulis et al., in press). These data indicate that subsidence is a basin-wide, long-term natural effect, and only locally subsidence due to pumping is superimposed. This result is extremely important, especially since pumping by the Water Authority is blamed for all damage observed. Except for the Thessaloniki Plain, measurements have also been made in the Thessaly Plain, central Greece. A future task is to refine and extend measurements with the support of UNAVCO.

Figure 1: Electricity poles offshore indicate loss of land due to land subsidence in the Kalochori area (Thessaloniki, Northern Greece)

Figure 2: Contours of subsidence (in m) in the wider Thessaloniki (Northern Greece) plain in the last 50 years based on a comparison of historical leveling and GPS data (triangles). Amount of subsidence is maximum, >4m in the Kalochori area partly due to water pumping (after Psimoulis et al., in press).

References:
Kontogianni, V., Pytharouli, S. and Stiros, S. Ground subsidence, Quaternary faults and vulnerability of utilities and transportation networks in Thessaly, Greece, Environmental Geology, in press.
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This work was supported by Patras University and the Greek Secretariat for Research and Technology.