9th FTSES 2024 Penghu, Taiwan

9th France-Taiwan Symposium in Earth Sciences
Session: General Session

Heterogeneous Hydrogeological Characteristics in Choushui River Alluvial Fan: Insights from Multi-Layer Compaction Monitoring Well

Reyhan Azeriansyah[1], Kuo-En Ching[1], Pei-Ching Tsai[1], Kuo-Chin Hsu[2], Cheng-Wei Lin[3], Chao-Lung Yeh[3], Ruey-Juin Rau[4]

[1] Department of Geomatics, National Cheng Kung University, Taiwan
[2] Department of Resources Engineering, National Cheng Kung University, Taiwan
[3] Tainan Hydraulics Laboratory, National Cheng Kung University, Taiwan
[4] Department of Earth Sciences, National Cheng Kung University, Taiwan

This research explores the phenomenon of land subsidence within the Choushui River alluvial fan, situated in central Taiwan, emphasizing the contrasting subsidence patterns in the northern (Changhua) and southern (Yunlin) regions. Commencing in 1985, there has been a notable decrease in subsidence in Changhua, while significant subsidence continues unabated in Yunlin. Our methodology involved analyzing data gathered from a comprehensive network consisting of 35 multi-layer compaction monitoring wells (MLCWs), 83 wells monitoring groundwater levels, and 4 extensometers to delineate the subsidence trends. Recognizing the direct correlation between the fluctuations in compacted layers and groundwater levels, we employed the degree of similarity in layer fluctuations as a metric to gauge the sensitivity of layer compaction due to groundwater extraction. The study incorporates the normalized cross-correlation method to evaluate the similarity of layer fluctuations in both horizontal and vertical dimensions, utilizing data from the MLCWs. A pronounced sensitivity among the hydrogeological layers in the Yunlin region is revealed, contrasted by a lower sensitivity in the Changhua area, indicating a higher degree of layer isolation. This suggests that while the groundwater extraction-induced compaction in Yunlin may have wider regional effects, in Changhua, such impacts are likely to remain more localized. Furthermore, our findings challenge the efficacy of traditional methods that classify groundwater systems based on core material for comprehending the intricate dynamics of land subsidence. This innovative approach offers another insight for developing more effective strategies to mitigate subsidence, applicable not only in central Taiwan but also in other similar global contexts.

Keywords: Choushui River Alluvial Fan, Groundwater Systems, Hydrogeological Characteristics, Land Subsidence, Multi-Layer Compaction Monitoring Well