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The monitoring of land subsidence and groundwater level in the southeast Kanto groundwater basin, Japan

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The Kanto Plain is underlain by the Kanto Groundwater Basin, Central Japan. The maximum depth of the basin ranges from about –3000m to –2500m. The groundwater basin is composed of Pleistocene marine sediments of the Kazusa group and Shimosa group. Chiba Prefecture is located in the southeastern part of the Kanto groundwater basin; and as of 2015 land subsidence has been monitored by 150 observation wells and 1142 benchmarks. Based on continuous monitoring, the mechanism of land subsidence is now reasonably well understood [1].

The lower groundwater basin contains brine groundwater (fossil sea water) including natural gas and iodine. Maximum land subsidence of 247mm/year occurred in 1971 and was due to natural gas production. Since that time, groundwater-pumping regulations have been strictly enforced in the Tokyo Bay area. Consequently, groundwater levels have recovered and the surface has been slightly uplifted. Therefore, the pumping is now limited to the area of hills and the Kujukuri Plain in the marginal area of the basin.

The upper groundwater basin has been extensively pumped, mainly for drinking water supply, agricultural and industrial use. Groundwater in the aquifer fell to its lowest level in the early 1970s. Many local governments then regulated groundwater pumping and surface water has since been used in the industrial district. Accordingly, the groundwater level recovered by 20–30 m in the southern Kanto groundwater basin. Water in the lower aquifer has now stabilized to near historic levels. However, the upper aquifer has not recovered enough yet because the pumping continues.

The extreme upper part of the basin is subject to compaction of “alluvial” sediments, a phenomenon particularly found in the lower, delta area of the Kanto Plain. It is now widely confirmed that the amount of ground subsidence is affected by the thickness of Holocene deposits.

Our hydraulic models and general hydrogeological investigations now show that we can reasonably pump groundwater in the Kanto basin without causing undue land subsidence. Nevertheless, groundwater pumping requires constant monitoring for sustained use.

References:

[1] Furuno, K., Kagawa, A., Kazaoka, O., Kusuda, T. and Nirei, H. (2015) Groundwater management based on monitoring of land subsidence and groundwater levels in the Kanto Groundwater Basin, Central Japan. Proceedings of the Ninth International Symposium on Land Subsidence

