

Impact of the Great East Japan Earthquake on the fluctuation patterns of groundwater levels in Tokyo

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Groundwater levels of 104 wells have been observed at 42 sites in Tokyo Metropolis since 1952. The Great East Japan Earthquake, most powerful earthquake ever recorded in Japan with a magnitude of 9.0 (Mw), occurred at 14:46 JST on Friday 11 March 2011. Although Tokyo is located around 400 km away from the epicenter, the earthquake brought a great impact on the groundwater levels in Tokyo with various fluctuation patterns.

In this study, taking full advantage of the unique rare case data from the dense groundwater monitoring network in Tokyo, we investigate the fluctuation patterns of unconfined and confined groundwater levels caused by the Great East Japan Earthquake. The groundwater level data used in this study consist of one month time series of 104 wells in March 2011 with 10-minute interval. The fluctuation patterns of the time series were analyzed and identified by the cardinal visual inspection method taking the time.

As for the results, interestingly opposite changes of both abrupt rise and drawdown of groundwater levels were observed right after the earthquake depending on the wells. No change pattern is also identified. In more detail, totally three and seven fluctuation patterns were identified for the unconfined and confined groundwater levels, respectively. The increase after short drawdown was a major pattern for the confined groundwater levels, whereas no change in pattern was observed for about 70% of the unconfined groundwater levels. The causes of those patterns were also investigated.