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Control of seasonal variation on spatial pattern of nitrate and important water quality parameters in agricultural region of Korea

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Seasonal fluctuation in groundwater level (below the ground surface) and water quality variables are mainly attributed to climatic conditions, soil characteristic, drainage method, and management practices. Groundwater degradations and high nitrate values have taken considerable attention in the Republic of Korea. Water management practices needs to be based on results of monitoring of groundwater level and water quality variables. We studied spatial variations based on temporal fluctuations of groundwater level (GWL), and water quality parameters including pH, electrical conductivity (EC), and nitrate (NO_3). These contents were monitored from year 2011 to 2014 in 70 groundwater wells of an agricultural region in Korea. The monitoring of contents was done in field and collected data after laboratory analysis, was analyzed by using geostatistical modeling and mapping techniques. Seasonal variations in GWL during the period of four years of monitoring were ranged 2.91–5.17 m and 2.80–4.08 m in wet and dry seasons, respectively. The variations in pH value for the same period ranged 6.55–7.50 and 6.69–7.82 in wet and dry seasons, respectively. The fluctuations in EC values ranged 125–604 μg/cm and 80–272 μg/cm in wet and dry seasons, respectively. The values for NO_3 in groundwater ranged 12.87–34.40 mg/L and 9.46–38.80 mg/L during the wet and dry seasons. The GWL shows strong spatial dependence, while pH and EC show strong to weak spatial dependence. The groundwater NO_3 shows partial spatial dependence with decreased values in 2014 compared to the values in 2011. This finding is attributed to improved agricultural practices and change in land use pattern from white radish and cabbage to orchards and ginseng fields. This work was supported by the National Research Foundation of Korea (NRF) grant, funded by the Korean government (MSIT) (NRF-2015R1A4A1041105) and Basic Science Research Program through the National Research Foundation of Korea (NRF) funded by the Ministry of Education (NRF-2018R1D1A1B07047200).