Planar electromagnetic sensor based estimation of nitrate contamination in water sources using independent component analysis

Abstract :

The main advantages of electromagnetic sensors can be listed as low-cost, convenient, suitable for in-situ measurement system, rapid response, and high durability. In this paper, the output parameters of the planar electromagnetic sensor have been observed with different kind of water samples at different concentrations. The output parameters have been derived and tested to be incorporated with independent component analysis (ICA) and used as inputs for an analysis model. The analysis model targeted to estimate the amount of nitrate contamination in water samples with the assistance of ICA based on FastICA fixed point algorithm under the contrast functions of pow3, tanh, gauss, and skew. Nitrates sample in the form of ammonium nitrates (NH_4NO_3), each of different concentration between 5 mg and 20 mg dissolved in 1 litre of deionized water (Milli-Q) was used as one of the main references. The analysis model was tested with eight sets of mixed NH_4NO_3 and $(NH_4)_2HPO_4$ water samples. It is seen from the results that the model can acceptably detect the presence of nitrate added in Milli-Q water and capable of distinguishing the concentration level in the presence of other type of contamination. The system and approach presented in this paper has the potential to be used as a useful low-cost tool for water sources monitoring.