

Referee #1

The manuscript presents a technical setup for nitrate measurements in soil and open water in field conditions. Obviously, the subject is super important and critical in many scientific and environmental aspects. On one hand nitrogen pollution that is attributed to excess fertilization in agriculture is one of the main reasons for freshwater disqualification. On the hand the mechanisms related to the dynamic of nitrogen uptake and transport in the soil are also far from being well understood to achieve optimal fertilization. Therefore, any attempt to develop tools for field measurement of nitrate in soil and water is important and should be published.

In general, the presented methodology involves a sophisticated setup which includes a set of 6 mini peristaltic pumps that synchronize several steps which are managed by an open-source controller. Essentially the main steps include soil porewater sampling into a sampling tank where a reagent (that needs to be refrigerated in the field) is added to the sampled water until equilibrium is achieved (hours). Then the mixed sample is delivered into a cuvette for spectral analysis through synchronized automated process. In spite of its complexity and non-trivial field applicability the authors prove that it is doable and show reasonable results. Nevertheless, I have a major concern regarding the presented context and applicability of the proposed methodology.

The main rationale for developing the system is measuring soil nitrate concentration in agricultural setups. However, the measurement concentration range of the method presented here is inherently very low, limited to 10 ppm N-NO<sub>3</sub> (which is the max allowed concentration in drinking water). Nevertheless, soil nitrate concentration in fertilized agriculture is mostly far above that concentration, ranging between tens to hundreds ppm. Indeed, throughout their final chapter the author acknowledges this concentration limit. Nevertheless, I think that this limitation should be stated upfront in a clear manner, from the title and abstract to the objectives. Beyond this comment I want to state again that it is an elegant method that merit publication after revision that put in context the limited applicability.

We want to thank the reviewer for the positive feedback. Following the main comment on the measurement range, we revised the text in the following sections:

(1) The title was changed to emphasize the system's low range of nitrate:

“Technical note: An open-source, low-cost system for continuous monitoring of low-concentration nitrate in soil and open water”.

(2) We added the range of our system at the end of the introduction:

“For validation, three field tests with a concentration range of 0-10 ppm  $\text{NO}_3^-$ -N were conducted over five weeks.”

(3) The discussion on this limitation was extended in section 3.2 (System limitations and modifications):

”The system, considering our sample to reagent ratio, can accurately measure nitrate concentrations up to ~10 ppm  $\text{NO}_3^-$ -N. This is a well-known limitation (Doane and Horwath, 2003) of using the Vanadium III Chloride reagent, which also exists in the lab. It would be possible to increase the range with the current system by either increasing the amount of reagent, decreasing the amount of sample, or both. However, further experiments would be necessary to implement and test this extended range. When analyzing samples with higher concentrations (70-80 ppm  $\text{NO}_3^-$ -N), adding the reagent results in unusual colors (salmon, orange, and yellow) that cannot be accurately measured and calibrated using known concentration standards and the spectrophotometer. For example, a sample with a high concentration (e.g., approximately 120 ppm  $\text{NO}_3^-$ -N) will turn yellow and the spectrophotometer will register absorbance corresponding to concentrations lower than 1 ppm  $\text{NO}_3^-$ -N, indicating a false reading. A possible solution could be the addition of a visual color sensor to notify the user when the color is exceeding the concentration range covered by the standard (i.e., high nitrate concentrations) to then dilute the sample accordingly. This will require changing the design of the system and adding a dilution mechanism.”

(4) We added the applicability limitation to the conclusion section:

“This nitrate range is suitable for soils with low nitrate concentrations or open water”