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Interactive comment on "A novel analytical approach for the simultaneous measurement of nitrate and DOC in soil water" *by* Elad Yeshno et al.

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Interactive comment on "A novel analytical approach for the simultaneous measurement of nitrate and DOC in soil water" by Elad Yeshno et al.

Anonymous Referee #1 Received and published: 2 October 2020

General Comments: This is a very well written and well done study that should be of broad international interest. The methods were clear and the Results and Discussion nicely done on the whole. I believe that this paper is suitable for publication after minor revision.

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Discussion paper

Reply to general comments: We would like to thank the reviewer for the encouraging words, both on the importance of the research and the quality of the reported article.

Specific Comments: Comment 1: Concentrations of nitrate and DOC are expressed as ppm, which is not a SI unit. My preference would be to change concentrations to units of mg/l throughout the paper (including tables and figures) and supplementary material. Such units are also better for flux calculation in case one was so inclined. Reply to specific comment 1: We accept the reviewer comment and have revised the manuscript, figures and supporting information files accordingly.

Comment 2: In the Methods, I wonder if iron caused any interference in the UV absorption measurements. If not, please state as such. If so, please explain how this was handled. Reply to specific comment 2: It is indeed correct that dissolved iron absorbs UV light at a similar wavelengths region to nitrate and can potentially cause interference when applying UV absorption spectroscopy techniques. However, iron has very low absorbance around the examined area of the UV spectrum in this research (300 nm), even at relatively high concentrations. For example, Shaw et al., (2014) showed that Fe2+ at a concentration of 250 mg/L has an absorbance intensity of less than 0.1. additionally, during their research, Shaw et al., (2014) had analyzed the chemical composition of water samples obtained at 27 different sites, and found that Fe2+ was exhibit in the samples at very low concentrations (<0.29 mg/L). We therefore deduced that iron interference on the UV absorption spectrum at the sample analyzed in this research would be negligible.

Comment 3: In the Methods, I also think that a photograph or diagram of the experimental set-up would be useful for readers. Please add. Reply to comment 3: The research presented in this article is merely a proof of concept and was therefore conducted solely on benchmark laboratory apparatus. The new concept can indeed perform as the analytical basis onto which a LED-based nitrate sensor can be developed. However, a LED-based analytical system was not yet developed in the framework of this research.

Comment 4: I understand that this paper is about soilwater. However, it struck me as I was reading this paper, if it was worth mentioning in the Introduction and/or Discussion how such techniques have been used to measure DOC and nitrate concentrations in streamwater. Otherwise, one might not know that such techniques have been used elsewhere in hydrology. I think it is important to provide the reader with some context on other measurements of DOC and nitrate for sake of completeness and context. I am only asking for a nod to such work. A paper by Vaughan et al (2017) shows streamflow DOC and nitrate concentrations in streamwater for forested, agricultural, and urban watershed (see: https://agupubs.onlinelibrary.wiley.com/doi/full/10.1002/2017WR020491). Such a paper might be worth mentioning with regard to the above but there are many other options.

Reply to comment 4: We accept the reviewer's comment and revise the manuscript accordingly to add more extensive and clarifying details on additional techniques for aqueous nitrate and DOC estimation (lines 76-85). Indeed, past research has already shown the ability to measure nitrate and DOC at surface and stream water using spectral methods. However, the work presented by Vaughan et al (2017) and additional references cited in their paper shows calibration methods which are based on Partial Least Squares Regression (PLSR) (Avagyan et al., 2014; Etheridge et al., 2014; Rieger et al., 2006). PLSR has shown excellent results predicting both nitrate and DOC using absorbance spectroscopy at the UV-VIS range. Yet the method presented in their research required the absorbance data at a broad spectrum on the UV-VIS to obtain a calibration and perform turbidity noise reduction (220-750nm). However, the newly developed concept presented in this paper focuses on a robust method that would merely require a single wavelength for each chemical component (DOC/nitrate) so that the method could be used as the base for an affordable LED-Based sensor for agricultural soils. Moreover, by applying further engineering know-how, a practical optical apparatus can be developed to utilize the same methods presented in this research on surface water or streamwater as well.

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