

## ***Interactive comment on “Comparison of high frequency, in-situ water quality analysers and sensors with conventional water sample collection and laboratory analyses: phosphorus and nitrogen species” by Steven J. Granger et al.***

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1) Reviewer 3 states that “the present paper offers only a very narrow view of the topic about investigated compounds, range and amount of analysed data and analytical devices” and then goes on to dismiss the Nitratax UV as “one with the lowest precision of devices currently on the market”, furthermore, “a discussion on other P analysers” is missing. However, their point and the general context of much of Review 3s criticism, is that more sensors should have either been used in the study, and/or a more in-depth review of available sensors should have been undertaken. We feel this reviewer

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misses the point of our study, which was not to review all the sensors available for every compound and circumstance but simply to compare, in a real setting, the sensors at our disposal with manually collected samples subject to standard laboratory analysis. Therefore, it is not our intention to give “a misleading assessment of optical nitrate sensors”, indeed we are currently using one so we are in no way dismissing them as a useful tool in scientific environmental studies. In our revised manuscript, we can direct readers to the reports and other assessments (e.g. the USGS work) suggested by Reviewer 3 within the introduction and expand upon the evidence for and against the trade-offs between high frequency measurements of low precision and low frequency measurements of high precision. We will also emphasize to readers that our study is in no way dismissing the use of sensors.

2) Reviewer 3 strongly defends the accuracy and validity of in situ sensors as “Studies using high frequency in situ data mostly validate the sensors with laboratory data. This is true for optical sensors, see e.g. Pellerin et al. 2015, Heffernan and Cohen 2010 as well as for Phosphax analysers (e.g. Halliday et al. 2014).” However, Reviewer 3 also indicates that “It is well known that other compounds like e.g. turbidity may interfere with nitrate sensor measurements and may affect the precision of measurement.” It is this degree of uncertainty between in situ and laboratory data, and the confounding features and trade-offs of both we sought to examine in our study. Indeed Reviewer 3 also states that we do “not include further compounds, even not in the discussion”. This is untrue as we do make mention of other compounds affecting the ISEs potentially leading to some of the trends we see although we could not confirm that it was the case. However, we will expand this issue in the discussion within a revised version of the manuscript and this expansion will place our results in the context of the findings of previous work comparing in situ sensors and laboratory analyses.

3) Reviewer 3, criticises the “amount of data presented in the manuscript is small. Only one runoff event of each catchment has been included in the analyses. Because all samples were taken on the same dates the range of data is narrow and very similar

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for all three catchments". This point is indeed a valid one. However, these instruments ARE being used in this environment, including NH4-N sensors, and therefore it is valid to examine them in this context, and to assess whether they are suitable. Such an assessment can be expanded upon in the revised manuscript to ensure we highlight potential limitations associated with the fact we only sampled a single storm. Likewise, expanded discussion can also include consideration of additional sensors including the one cited in the review comment here.

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Interactive comment on Hydrol. Earth Syst. Sci. Discuss., <https://doi.org/10.5194/hess-2017-684>, 2018.