

# ***Interactive comment on “Hydrologic regimes drive nutrient export behavior in human impacted watersheds” by Galen Gorski and Margaret A. Zimmer***

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In this study, the authors examine nitrate c-Q relationships based on high-frequency data across 5 agricultural watersheds in Iowa. They separate their data into baseflow and stormflow by applying a set of objective criteria, although they describe that some subjective decisions are necessary to finalize the data separation process. The authors focus their analysis on seasonal patterns of variation. Intensity of artificial drainage is an important explanatory variable across the watersheds, as concluded by many past studies.

Overall, this is a good study that provides some new insights to nitrate behavior in agri-

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cultural catchments, but mainly reinforces conclusions from previous investigations. The paper is well written, the methods technically sound, and the authors demonstrate good awareness of previous related papers. The limitations of a c-Q study such as this is that it's not always clear to what extent the static vs. dynamic patterns are driven by c vs. Q. In other words, much of the reason why baseflow is more chemodynamic may be that Q varies less, so that any variation in c is amplified. So, it would be helpful for the authors to comment on the relative c vs. Q roles regarding their interpretation of seasonal differences, and inter-watershed comparisons, especially relative to comparing stormflow to baseflow. I am not necessarily questioning their broad interpretations of the drivers of c-Q patterns, just asking for some additional insight as to whether c or Q are driving some of the differences described in the paper.

Beyond this criticism, the study provides limited insight to inter-annual variation. Studies of stream nitrate in the agricultural Midwest have highlighted strong year-to-year variation in c-Q patterns. For example, Jones et al., 2017 (cited by the authors) and Davis et al., 2014 (JEQ, 43: 1494-1503) provide examples of the strong role of dry periods followed by re-wetting. The authors do discuss relative wet-dry conditions on a seasonal basis, but the study provides little perspective on inter-annual patterns and the role these may have played in the study results. At least some quantitative insight would be helpful especially at it may have affected the baseflow vs. stormflow conclusions.

Below are some specifics comments and criticisms referred to line number, and these range from minor editorial suggestions to more substantive comments:

Title – should change “nutrient” to “nitrate” in title since nitrate is the only nutrient that was analyzed

Line 48 – suggest adding “excess” before applied

Line 194 – rather than refer to Student's t-test whenever paired comparison results are discussed, would be better to state this approach in the methods section and then just

describe whether results are significant or not given criteria described in methods.

Line 205 – in the paragraph that begins on this line, there is discussion of correlations, but no reference to quantitative values. It would be best to define how correlations were determined—Pearson Product Moment or another approach? Also, should provide p value to reinforce terms such as “well correlated”. Was this done just visually, or were tests performed and significance determined?

Line 291 – the authors mention the possibility of biofouling affecting nitrate concentrations during one baseflow period. Was this based on evidence from a technician that serviced the site or was it based on anomalous values or rapid unexplained shifts? Would be good to provide basis for this statement. And this does raise the question as to whether biofouling may have affected other periods of observation.

Line 323 – higher export than what? Comparative here is incomplete.

Line 375 – change “that” to “than”

Figure 3 – the color contrasts in the figure panels are not as strong as those shown in the color key. For example, the blue and green patterns for fall and winter show poor contrast in the figure. This is also true for spring in 3a and summer in 3b.

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