

## ***Interactive comment on “Sources and fate of nitrate in groundwater at agricultural operations overlying glacial sediments” by Sarah A. Bourke et al.***

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Received and published: 6 May 2018

1. General comments It is interesting to assess the sources and fate of agriculturally derived  $\text{NO}_3\text{-N}$  by the concentration of  $\text{NO}_3\text{-N}$  and  $\text{Cl}^-$ . The idea of using  $f_d$  and  $f_m$  to quantify the impact of denitrification and dispersion are good. The tables and figures were displayed clearly and easy to understand.

2. Specific comments However, some specific scientific questions should be answered in this manuscript. Although the error in  $f_m$  introduced by neglecting  $\text{Cl}_b$  was discussed by authors, however, the error range may be underestimated. The largest error (calculated as 23% by authors) may be double as the  $\text{Cl}_b$  (assumed as 10 mg/L by authors)

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increased to 20 mg/L. The suggestion to improve this part in manuscript is to use an equation related to the ratio of  $\text{Cl}_b / \text{Cl}_i$ .

I would also suggest to share the Excel sheet or program used by this manuscript. (page 6, line 35 to line 38).

3. Technical corrections There are several technical corrections should be done before it can be published. 1) I notice that, the last paragraph of “introduction” belongs to “experimental site description” of “methodology”. (page 3, line 7 to line 20). 2) This manuscript didn't mention what is the sampling depth for the “water table wells” in the “methodology” section. To my understanding, there were little difference between groundwater monitor well and groundwater sampling well. Normally, the groundwater sampling well take water samples in a specific range of depths. 3) Sampling frequency. I'm not sure if the sample frequency of the chloride and N species were high enough to draw the conclusion, since the sample sizes was less than 30 and standard deviation seems not low. 4) Text clarity. Section 3.1 and 3.2 mentioned several “water table wells” labeled as DMW11, DMW14, etc. However, it's not easy for reader to look for those wells from figure 1 (the site description map). So, it seems that improvement of the structure of the sections might be needed.

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Interactive comment on Hydrol. Earth Syst. Sci. Discuss., <https://doi.org/10.5194/hess-2018-31>, 2018.

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