

# ***Interactive comment on “Determination of vadose and saturated-zone nitrate lag times using long-term groundwater monitoring data and statistical machine learning” by Martin J. Wells et al.***

**Scott Gardner (Referee)**

sgardner@uoguelph.ca

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This paper utilizes a very interesting statistical methodology for evaluating nitrate transit times across saturated and unsaturated zones. General comments - The study presents the environmental setting well in terms of soil, climate, and land use, however, more specific information (cross-sections or maps) on the geologic setting would be useful in evaluating spatial variability in lag times. - The distance between the monitoring wells evaluated and the screens that are sampled to the sources of nitrate (probably fields) are not touched on in the manuscript and might be useful in explaining

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variance in lag times. - Perhaps land use might also be important to consider nearby the wells, as interception, evapotranspiration, and other land use specific processes could be relevant to nitrate lag times.

Specific comments line 17 - I am not sure you need to include the part about it not being common to have unsaturated velocities slower than saturated, this has been the case in other studies and is not out of the ordinary (fractured bedrock aquifers, karst, etc.) line 79 - perhaps provide a reference explaining the importance of canals in the region for readers that are not familiar with the study area. line 107 - here and everywhere after it is not clear what is meant by screen length, is this the depth bgs that the screen begins, or the size of the screen? please clarify line 157 - what is meant by 'bootstrapped' readers which are unfamiliar with computer science jargon may have trouble with this please clarify. line 234 - what was the reasoning behind selecting 1 standard deviation for an acceptable range of results? If this selection was arbitrary then it should be made clear.

figure s1 please change the colours on the nitrate concentrations to better contrast the results

Conclusion The paper is well written and presents a great analysis using a interesting statistical modeling approach. The long term nature of the study data gives observations strong credence. Adding more specific spatial analyses between different well locations in the region might help explain the high variance in model results. My recommendation is acceptance after major revisions.

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