

L10: 'discrete' – I would suggest to use something like 'low frequency', because even *in situ* sensors provide discrete measurements.

L12: 'continuous' – would not use this as adjective, as the sensor is not continuous. You could emphasise the high frequency data collection with 'measuring at xxx minute interval'. Or call them 'high-frequency sensors', as you do in L99 (and please use the same term consistently).

L16 and whole document: are concentration in mg NO<sub>3</sub> per L or mg N per L? Please clarify in the manuscript.

L19-20: 'larger average area' – What are the implications of a larger or smaller area (or more or less hysteresis)? What can we learn from this information? Might be too complicated to include in the abstract and needs to be explained properly in the main text.

L44: 'forestry ecosystems' – Does the description of processes in the following sentences refer to forestry ecosystems only (which, I presume, are plantation or intensively managed forests only?) or all forest ecosystems? If it applies to all forests, I would use the term 'forest ecosystems' instead.

Table 1: Include the abbreviation 'NO<sub>3</sub>-N' in the caption behind 'nitrate-nitrogen'. Interesting additional information for the table would be an indication of the time period over which each study was conducted and potentially even the method used to obtain the nitrate data.

L100-103: I presume that you mean that high frequency monitoring could be done in multiple places to understand the high variability in inorganic N movement? Or do you mean that one high-frequency sensor can help to better understand the spatial variability as well? It might be good to clarify this in the sentence.

L133-140: While the objective makes sense for a case study perspective, the 'bigger picture' is missing. Why is this study relevant for others than those working in the case study location? What can be learned from it, applied elsewhere?

Section 2: You could include some more background information on the climate in the study area, particularly rainfall amounts and seasonality (if applicable) and evapotranspiration.

L177: 'and telemetry' – Is this really described in this section? I could not identify it.

L207-208: 'were adjusted to concurrent validation measurement' – This sound to me like you calibrated the sensor using the validation sample measurements (and the annual/quarterly measurements?). Perhaps use the word 'calibration' instead of your current formulation?

Section 3.1: Did you do any data post-processing or quality control (other than comparison to grab samples) to the time series data? E.g. outlier detection, gap-filling, etc. If so, please describe.

Section 3.2: It is not clear on which information the choice of parameter values for soil water capacity, evaporation reduction function, crop factor and drainage threshold were based, nor where the data for precipitation (from the rain gauge next to the well?) and Penman PET were obtained. Please add this information.

Section 3.3 and 3.4: It is not entirely clear to me how these data will be used (i.e. related to the groundwater N data) based on the description. It would be helpful if this could be highlighted in a sentence in each of the sections.

L225-226: Was the sensor also adjusted using these monthly grab samples, like with the sensor installed in the well?

L235: This is probably the question you do not want to get, but how was the 1 mg/L threshold determined?

L235-237: What was the point of splitting up the time period? Was the rate of change determined for each of the five sections?

L241-243: Could you explain the relevance of the different metrics? What do they indicate?

L245-246: Since you mention how many events were identified in 2022 and 2023, it would be interesting to report in this paragraph as well, how many events were identified for 2020 and 2021.

L252: 'bore' – Should be 'borehole'?

L252-257: It is not entirely clear what you are describing here. I think you are not calculating the nitrate load yet, since you are only using the concentration data. The load calculation itself seems to be described in L265-267, where you multiply the concentration with the volume of groundwater discharged from the aquifer. Or how does the area under the curve represent the load?

L294-295: 'In November 2020, [...] flow and rainfall' – This comparison is a bit odd. What is the point of comparing the highest concentration in Nov. 2020 with the highest concentration in Feb. 2022? Unless you want to point something out (which you would have to specify), I would take it out or reformulate in a way that it does not become an odd comparison.

L298-299: 'Data was missing [...] and interference effects.' – This information could be included in the methods, including information on how much data (%) is missing. Were there no data gaps at all for the sensor deployed in the groundwater? Please specifically mention this (or the percentage of data missing) in the methods as well. I was wondering whether the sudden drops in nitrogen concentrations in the Hurunui River were also related to maintenance (e.g. cleaning), but since some of the increases are also reflected in the monthly nitrate data, I might be mistaken.

L306: I would refer to Fig. 5 in L307, following '[...] low rainfall recharge in Canterbury.'

L307: Where is Balmoral? How does this site relate to the sites included in Fig. 5?

Section 4.2: These sections seem a bit isolated from the rest of the manuscript. They could be embedded better by directly linking it to the groundwater nitrogen data (although that might require merging of result and discussion?) or they could be placed somewhere else than between the initial description of the groundwater nitrogen data and the hysteresis analysis, which is based on the same data.

Section 4.3/Fig. 7-8: Are these six the only hysteresis curves you analysed (i.e. the only identified events)? This could be clarified by including in the text how many events were identified and analysed.

L348-356: A lot of this information is difficult to interpret, because it is not clear what the relevance of the average area is and incomplete formulation. For example, in the methods you state 'the proportion of time into the event that the peak groundwater level and nitrate-nitrogen concentration [occurs]', which is a lot easier to understand than 'time to reach peak groundwater level and peak nitrate-nitrogen concentration' expressed in a percentage. Or 'The residual analysis indicated a return to pre-event conditions...', was this done for all events individually?

Fig. 9: Please include the unit (%) for the first two graphs and add 'of hysteresis curve' to the label of the y-axis of the third graph. Also include on how many events these boxplots are based.

L382-383, Table 3: If I understand correctly, these loads are based on the groundwater nitrate data and groundwater validation samples. Did you also compare these loads with export values calculated from the river nitrate data (at least for those periods for which there is data available for both sensors)?

L388-395: It would be interesting to see a time series plot of the load data to better visualise the pulses and their timing.

Section 5: Since the discussion is relatively short, I would recommend integrating it with the results. This avoids duplication of information and might make the interpretation of some of the data also more straightforward (see previous comment about interpretation of hysteresis metrics).

L404-407: Can you really fully attribute these differences to the harvesting? You point out in Section 4.2.1 that this period is also characterised by a change in weather (not climate!) from dry conditions to wetter conditions.

L426-428: 'Over consecutive recharge events [...] after successive recharge events.' – either remove the end or the beginning of the sentence to avoid duplication.

L437-438: I see how this approach could complement the more 'traditional' analysis of concentration-discharge relationships or hysteresis analysis, but I think the formulation that the approach you used can be applied to improve hysteresis analysis in streams and riverine environments is incorrect. It can only be applied in cases whereby groundwater data (concentrations and levels) is available.