Earth Syst. Sci. Data Discuss., author comment AC1
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Reply to RC1

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Author comment on "Meteorological and hydrological data from the Alder Creek watershed, SW Ontario" by Andrew J. Wiebe and David L. Rudolph, Earth Syst. Sci. Data Discuss., https://doi.org/10.5194/essd-2022-46-AC1, 2022

The authors would like to thank Anonymous Referee #1 for the comments and questions. In the following, the reviewer's comments are in bold, and the authors' responses are in Italics. All line numbers refer to the original, preprint manuscript. As this is the Open Discussion phase, changes to the manuscript have not yet been made, and the responses indicate what changes the authors propose to make.

Author's responses to comments by: **RC1, Anonymous Referee #1, 19 Mar 2022**

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This study provides meteorological and hydrological datasets in the Alder Creek watershed by monitoring precipitation, air temperature, solar radiation, groundwater levels, soil texture, soil moisture, soil temperature, streamflow, and geochemistry. This comprehensive dataset can be useful for systematically studying hydrological processes in the Alder Creek watershed. However, there still exist some issues in this stage.

1. My major concern for this study is how typical or special is the Alder Creek watershed, and is this region interesting enough to attract audiences of ESSD to use this dataset. What kinds of unique studies can be conducted in this small watershed rather than any other watersheds?

The Alder Creek watershed represents many small watersheds where there are competing pressures related to groundwater. The watershed has multiple types of land use, including agriculture, aggregate/sand and gravel extraction, and urban areas. These land use types each have their own groundwater quality concerns. Expanding urban development within the watershed is a major concern and a potential influence on groundwater recharge rates. Multiple public well fields are located within the watershed or capture water recharged within it, and these rely on maintaining groundwater recharge quantity and quality. There are ecological concerns regarding groundwater baseflow to the creek and how the public wells may influence this. Surficial geology data, stratigraphic data, and land use data are available for the watershed. Thus, the watershed is useful for assessing various critical issues related to groundwater management due to the many important issues related to the watershed, and the amount of data available.

The Introduction and Site Description sections will be updated to include this information, and the available datasets from other organizations will be listed in a new table.

2. This manuscript is more like a report to list all the hydrological data one by one. The measurements and characteristics of each hydrological data were described in detail, but these hydrological data were not connected together to provide any new knowledge and understanding. There are no clear result and discussion parts in this manuscript. Analysis of these data is lacked. Based on this dataset, can you provide any interesting characteristics of the hydrological processes, such as the interaction between climate and groundwater, at the site level or watershed level?

The goal of this data article was to present the available hydrological data and provide examples of how the data may be used. This format has been used by other researchers in their data articles regarding Canadian watersheds (e.g., Rasouli et al., 2019, ESSD, https://doi.org/10.5194/essd-11-89-2019; Fang et al., 2019, ESSD, https://doi.org/10.5194/essd-11-455-2019; Gibson et al., 2020, Data in Brief, https://doi.org/10.1016/j.dib.2020.105308; and Spence and Hedstrom, 2018, ESSD, https://doi.org/10.5194/essd-10-1753-2018). The work of connecting the data and generating new understanding is briefly included in the manuscript (new temperature modelling work to estimate recharge rates) but is more prominent in the theses and publications that have employed the data. The intention here is that future studies related to similar watershed environments will be better able to use these data as a result of the descriptions in this manuscript. Results and Discussion sections were not included, in keeping with the format precedence interpreted from the other studies. References to studies that have used various aspects of the presented data for specific scientific research have been listed in the document (Lines 380-381) and some have been referred to directly. For example, the data have been used (Wiebe, 2020) to study the spatial correlation of rainfall across the watershed (mentioned on Line 132). The spatial correlation of rainfall at this scale could not be evaluated without the data from the multiple weather stations installed in the watershed.

The interaction between climate and groundwater could be modelled based on the data. Wiebe (2020) provides an example of a Monte Carlo analysis. Other analyses would be possible.

Specific issues:

Introduction

1. Line 18-19: "Comprehensive meteorological and hydrological data from multiple field stations within small to mid-sized watersheds are seldom publicly available." The USGS provides hydrological data across the country and there may exist many sites located in small to mid-sized watershed.

The unique part of the Alder Creek dataset is that there are data from multiple weather stations installed in and around a small to mid-sized watershed. There are indeed some watersheds with multiple weather stations within a small area that have been reported in the scientific literature (e.g., Walnut Creek, Iowa – Chaplot et al., 2005, J. Hydrol., https://doi.org/10.1016/j.jhydrol.2005.02.019), but this does not appear to be common. Characteristics of different watersheds can be highly variable and it is anticipated that there is value in having these types of dense meteorological data provided for multiple *watershed settings.*

2. Line 30. There is an extra “a”.

This will be revised, thanks.

3. Line 33. The Alder Creek watershed is important for local supply. Aside from this local importance, are there any other characteristics that make this small watershed be an interesting place to conduct hydrological studies that have broad influence in science.

Please see the response to Comment (1.) in the General Comments section at the top.

Site description

4. Are all the datasets first monitored and published in this study? The Water Survey of Canada is mentioned, so is the stream data collected from this source. If so, a table that lists all the data features and sources (collect, simulate, or monitor) may be helpful for audience to have an overview of these datasets.

This is a good idea. Most of the data discussed were first published in the cited Wiebe et al. (2019) dataset. Streamflow data (Water Survey of Canada), temperature and precipitation data (Environment Canada), and other weather data (University of Waterloo weather station) are mentioned in the text. These sources of information will be listed in a new table, along with the datasets mentioned in response to Comment (1.) in the General Comments section at the top.

Groundwater data

5. Figure 9. The label of this figure is missing.

We're not sure what is missing here. Would you be able to clarify? The figure is referenced in the text on Line 167, the caption appears to be present in Lines 177-180, and the two axes are labelled.

Vadose zone data

6. Does soil texture in different sites have any impacts on soil temperature and moisture?

Yes, soil texture has an impact on soil moisture at the Mannheim and Bethel Road Farm sites. Soil moisture readings at the Mannheim site (for both the TDR and CS655 sensors) are higher than the readings at the Bethel Road Farm site. This aligns with soil texture differences between the fine-grained upper soil layers at the Mannheim site, and the sandy soil in which the sensors are installed at the Bethel Road Farm site. The maximum and minimum soil temperatures are generally similar at both sites.

Soil moisture

7. Why there is no figure to show the soil moisture data.

Good catch. An example of these data will be added.

Soil temperature

8. Figure 14. The simulated results seem underestimate peak values, especially

in T109_2 and T109_3, what is the potential reason?

The results minimized the combined sum of squared errors from all five temperature observation depths (only three curves are shown for the sake of clarity). There is somewhat of a trade-off between increasing the flux to match the peaks of the shallower sensors, and decreasing the flux to match the deepest sensor. This may indicate a slight mismatch of the assumptions of 1D flux with the actual field conditions.

Creek data

9. Is discharge monitored or just estimated according to stream water level?

Only stream water level was monitored on a regular basis. Rating curves developed from temporal spot measurements (stream gauging) were used to estimate the streamflow.

Geochemistry data

10. Figure 18. There are few samples during May and Jun. The variations of P concentrations can be significant in a short time period according to the data around April.

The peaks in the total P and SRP in March and April coincide with the melting of the snowpack, and likely with the process of overland flow over frozen soils. After the snowpack melts and the ground thaws around the end of March, there would likely be less variation in the total P and SRP runoff. A comment to this effect will be added to the text.

11. L360-365. What conclusions can be made according to the isotopes data?

Thanks for the suggestion - the following will be added to the manuscript:

"The creek and groundwater isotopes align closely, reflecting the role of groundwater discharge in maintaining baseflow in winter. The groundwater isotopes are more enriched in the heavier isotopes than the snowpack samples, illustrating the greater contribution of rainfall to groundwater recharge."