Review 2 for EGUSPHERE-2025-4567 (for Hydrology and Earth System Sciences)

Editor decision: Publish subject to minor revisions (review by editor)
Dear authors,

My apologies for not being able to get back to you sooner. Several weeks ago, as one of the reviewers was unresponsive, I had to invite a third person to evaluate your revised manuscript. In the end, the reviewer did reply, but a third referee had already agreed and started to review your revised manuscript, and I needed to give them their full 4-6 weeks to finish their work. Based on the comments received, I am returning your manuscript for minor revision.

With best wishes,

Genevieve Ali

- Thank you for your feedback and updates regarding the timeline for the three manuscript reviews. Below, you will find the minor revisions addressed as requested for publication in the HESS journal.

Referee 1: Eric Rosa, 29 Apr 2026

(No Additional Comments in Report, Suggested to be "Accepted As Is")

Referee 2: Efemena Emmanuel, 17 Mar 2026

Comment: Thank you for the clarification in Figure 7 and 8a regarding the use of the vegetation mask. While the rationale for highlighting localized zones of advective heat transport is appreciated, the current presentation still makes it difficult to directly relate the zoomed-in sections to the broader thermal context shown in panel (a). In particular, the application of the vegetation mask and the apparent change in color scaling reduce visual consistency and may introduce ambiguity in interpretation.

To improve clarity, I recommend that the authors (i) explicitly delineate the masked versus unmasked regions in the figure or caption, and (ii) clarify whether a consistent temperature scale is used between the overview and zoomed panels. Providing an additional unmasked zoomed panel or a clearer linkage between the inset and the background image would further strengthen the interpretation of the figures.

Addressing these points would enhance the transparency and reproducibility of the analysis and improve the reader's ability to interpret the spatial relationship between the observed thermal anomalies and the broader landscape.

- Clarification regarding the masked versus unmasked zones and temperature scales has been added to the figure captions of the UAS and handheld TIR imagery presented in

Figure 7, Figure 8, Figure S10, Figure S11, and Figure S12 to improve the clarity, transparency, and reproducibility of the analysis presented.

Referee 3: Anonymous, 15 Jun 2026

Comment: The manuscript titled "Proposing Sources for Discrete Groundwater Discharges to Patterned Pools in Three Regional Raised Northern Peat Bogs" offers new hydrological evidence on how minerogenous groundwater discharges and influences ombrotrophic patterned pools of peatlands in Maine, USA. Using multiple geophysical and geochemical techniques, the authors were able to show how groundwater discharges from peatland edges through glaciofluvial aquifers outflowing to the center of the northern peat bogs. There were multiple lines of evidence that were used 1) ground-penetrating radar, 2) transient electromagnetic induction surveys, 3) uncrewed aerial systems and handheld thermal imaging, and 4) in situ measurements of temperature, specific conductivity, and trace metal concentrations. Although groundwater discharge was not quantified, these multiple lines of evidence suggest the occurrence of groundwater discharge. I recommend publication after the below comments have been addressed to improve scientific clarity.

- Thank you for your time providing this peer review, below you will find the comments and suggestions addressed.

Comment: The results should be re-organized, specifically the presentation of the figures. For example, the GPR results from each of the three northern bogs can be presented in one figure. Furthermore, the GPR images should be annotated or marked both in the manuscript and in the supplementary. Similarly, the TEM inversion images from the three bogs may be presented in one figure. This will reduce the total number of figures.

- After reviewing the options to present the GPR data from the three bogs, the current presentation has been retained for two main reasons: 1) to keep spatial reference to the transect locations across the three bogs and reinforce the similarities in bedrock architecture for GPR transects from different peatland systems; and 2) most GPR figures are not part of the main manuscript and are included under supplemental material.
- Additional annotations have been made to the transitions in the mineral sediment interface response in Figure S1, Figure S2, Figure S3, and Figure S4.
- The presentation of the TEM inversion images has been retained in separate figures to 1) maintain the spatial reference to the transect locations relative to the pools and 2) to underscore the novelty of the use of this method in northern peatlands.

Comment: With the re-organization of the figures, the results section can be improved much further, and repetitive descriptions may be avoided.

- Thank you for this feedback, the suggestions for these figures have been addressed above.

Comment: While the groundwater index (Gi) metric appears to be a useful tool for groundwater discharge, can the authors provide further justification for using this metric? In addition, several other parameters could have also been considered. For example, pH or DIC concentration could be an additional indicator of groundwater influence. Furthermore, please expound why water samples were not taken from the bottom of the pools were groundwater influence could have been greater rather than at 0.25 m below surface.

- Line 706 to Line 707 have been added to describe the potential additions of other hydrological variables to the G_i variable developed in this study, stating that "While the use of temperature and SpC have been consistently used to track groundwater discharge as a snapshot in time (e.g., Hayashi, 2004; Anderson, 2005; Cox et al., 2007), additional hydrological parameters (such as pH, dissolved oxygen, dissolved inorganic carbon, etc.) could be considered to further develop the Gi variable in future studies with prolonged sampling periods.".
- Aqueous geochemistry samples were taken at 0.25m beneath the surface due to the ease of access and limited access to equipment for sampling from depth.

Comment: Figure 1: could be re-arranged to avoid confusion. Caribou Bog and Meddybemps Heath could go down while Thousand Acre Bog could go to the upper right area and the Main map goes to the upper left.

- Locations of the map subsections highlighting the patterned pools of each of the three select bogs has been retained after experimenting with the suggested approach. Attempts to rearrange the different elements from the figure, as suggested, were not feasible without overlapping elements interfering with the satellite basemap.

Comment: Subheadings can be further shortened.

- Subheadings in the Materials and Methods and Results sections have been shortened for brevity.

Comment: Line 366, 367: Table S2?

- Thank you for catching this missing table reference, Table S2 is now acknowledged in this line of the manuscript.

Comment: Please cite other papers on groundwater discharge in peatlands.

- Additional citations highlighting the parallels observed between this research and recent findings on glaciofluvial aquifer connectivity to peatlands has been included in Line 701 to Line 703: "Previous studies also suggest that the hydraulic interaction between peatlands and glaciofluvial aquifers locally alters vertical groundwater flow patterns in peatlands (e.g., Rossi et al., 2012; Ala-aho, 2014; Berthot et al., 2016; Quillet et al., 2017; Lambert et al., 2022)."

Comment: Line 557 – 560, sources?

- This line has been removed for clarity, and the paragraph has been restructured to ensure readability, now stating: “Previously, Siegel et al. (1995) suggested that precipitation events dampen minerogenous groundwater contributions from basin-scale groundwater mounds beneath raised bogs, with minerogenous groundwater only elevating towards, but never reaching, the surface during drought periods. However, further evidence of focused groundwater discharge to the patterned pools is highlighted in temperature data from UAS TIR mapping efforts occurring after major rainfall events. These surveys captured the effect of flow through the underlying aquifer (via precipitation recharge through the unsaturated zone) on the temperature signals at the surface of pools, with cooler temperature signals observed during the summer season and warmer temperature signals during the winter season. Previous estimates for the precipitation required to pressurize the underlying glaciofluvial aquifer and drive upwelling to isolated peatland pools yielded a minimum precipitation of 25.0 mm/d, with a response in vertical hydrological flux recorded between 24 to 48 hours afterwards (Moore et al., 2024). In this study, temperature responses in the TIR maps show evidence of precipitation enhancing discharge to the pools over a range of precipitation from 4.06 mm/d to a maximum of 29.0 mm/d, and similar temporal minerogenous groundwater flowpath response. Temperature maps generated from the UAS TIR illuminate localized points of cooler water during the summer and warmer water during the winter. Handheld TIR imagery further details temperature anomalies suggesting locations of focused groundwater discharge with clear temperature gradients from the point sources into the pool surface water (Fig. 8b).