Tropical peatlands has been drained in the past decades, causing in low water-table conditions, peat decomposition and subsidence, and also greenhouse gases emissions. Drained tropical peatlands are susceptible to fire and smoke, which might lead to health problems.

In order to mitigate environmental issues caused by tropical peatland drainages, massive efforts have been allocated to restore the drained peatlands. Canal blockings are commonly implemented to increase the water table of drained peatlands, but studies evaluating the performance of those structures are limited.

This study simulates the effectiveness of canal blockings in raising the water table of tropical peatlands over large areas, and the estimation of CO_2 emission reductions resulted by canal blockings. In this study, a process-based hydrological model was developed to simulate the effect of canal blocks in a 22000 ha of tropical peatlands in Sumatra, Indonesia. The water-table dynamics were modelled in two blocks scenarios (with and without blocks), two El Niño–Southern Oscillation (ENSO) scenarios, and four peat hydraulic properties scenarios. The specific yields and the transmissivity of peat were calculated based on literatures and assumed to be varied with depth, following some empirically generated logarithmic equations.

The simulations were performed using two modules, the canal water flow module (CNM) and the peat water flow module (PHM). The canal water flow module (CNM) was using a diffusive wave approximation of the open channel flow equations. The flow through a canal block was modelled using a coefficient that regulates the flow rate and based on canal water-level state. The peat water flow module (PHM) was using a two dimensional groundwater flow equation. Field water-table data are reported and used to check the model results, though the authors recognized that the variation of peatland topography within the modelling cells (50 m × 50 m) does not allow one-to-one comparison between the modelled and the measured water tables to be done.

The authors have done a novel job. This study accommodated the canal and the peatland water-level interaction in a time step basis, which has not been studied and reported before. I find that this study provides meaningful contribution to tropical peatland studies as it provides efficient approach for analysing tropical peatland water management schemes that involve canal blocks.

Nonetheless, I feel the authors could improve this paper by clarifying some issues as highlighted in this review report.

General comments:

1. The time attribute differences between the field data and the model input data must be more clearly summarized and justified in the methodology. For an example, it was mentioned that the simulations were using the data of 1997 (dry year) and 2013 (wet year) (see L214) but the reality check water-table data were using the data of 2020 (see L265).
2. It will be clearer if the author can summarize the canal block performances during dry and wet periods (seasons) in a table, rather than only showing the profile of dry and wet years. Presenting the yearly average of water-table of all modelled scenarios might hide the seasonal performance of canal blocks. The seasonal water-table summary might support the authors' claim that "canal blocks are most effective during dry periods" (see L10).
3. In my opinion, it must be also mentioned and justified that this study has not consider the structured canal distribution density of the study area. The direction and arrangement of the canals were given. Therefore, claims about the limit of canal blocks' effect in refers to the distance from the canal (for example the one in L10) might need to be refocussed. Authors might either ensure that there was only one dominant canal that govern water table behaviour at some transects or admit that several canals might affect the water-table behaviours at some transects.

Minor issues:

1. L1-L2: "… among other negative environmental impacts." It needs to be explained or deleted.
2. L2-L3: "These effects can be mitigated by raising the water table depth (WTD) using canal or ditch blocks." Please mention the limit of raising WTD. The statement in L2-L3 is contrast to the statement in L450-L451, which is "In fact, having shallower WTD as the only optimization goal may not be desirable due to increased methane emissions".
3. L7-L8: "The study was performed across two El-Niño Southern Oscillation (ENSO) scenarios, and four different peat hydraulic properties." Please clarify the scenarios. The 1997-Dry year and the 2013-Wet year? Heavily degraded to moderately degraded peatlands?
4. L16: Please put a sentence that summarize the plausibility of the developed model to be implemented by the peatland manager in peatland restoration planning.
5. L21: "…enhancing site productivity…". Please add citations on this if any. Otherwise, please consider to remove it as drainage might not enhance peatland productivity.
6. L30-31: "As a result of the decomposition process, CO_2 is emitted, peat subsides, and nutrients are released." It has been mentioned in L23-L27. Consider to combine and simplify the information to avoid redundancy.
7. L44: "Process based models offer a different, complementary approach …" Different than what approach? Please explain.
8. L55-L56: "… a large tropical peatland area …" Please mention the area, 22000 ha?
9. L64-L67: Please add coordinates, for example the lower left corner and the upper right corner coordinates.
10. L74-L76: Please provides the monitoring period of the instruments. Starting on January 22nd, 2020?
11. Figure 1: Please use different shapes for Dipwells and Canal blocks. The sentences "Each patrol posts … with monthly frequency." seem redundant (has been mentioned in the text). Delete?
12. Figure 2: Please reformat the symbols (italics).
13. L165: I think Table 2 must be moved here as the specific yield parameterization is discussed here.
14. L176: Do you think that the fixed head Dirichlet boundary of -0.2 m may cause the overall water table conditions never be deeper than -1.5 m (consider that the peat thickness is 5 m)? Please discuss this matter in the discussion section.
15. L212: "… the Sultan Thaha Airport …" Please add coordinates.
16. Figure 3: Legends are incomplete in the first review pdf. Please fix and improve the legends. Mention the used symbols (e.g., c m and m (d)) in the figure's caption.
17. Table 2: The column "Name" can be replaced with "Parameter Scenario", can not it?
18. L230-L233: What is the common height of the blocks? Will it be better if a picture of a block in the field be presented?
19. Figure 4: Please bring it close to Table 2. Some legends of Figure 4 do not complete (some texts are missing). For (b), (c), (d) please use similar range of *x* axis if it is possible, so that the reader can read it clearer and not being confined in a distortion. Please use different line styles for each parameter scenario.
20. L269-L272: Please move or combine this subsection (2.4 Notation) to be under Subsection 2.3 Modelled scenarios.
21. Figure 5: Some legends are not clearly shown. It is better to show some example of modelled scenarios instead of presenting so many lines. It might be better to choose some

output points that are representative to be discussed. Please explain symbols (e.g., m(d), m as d, and m d d) in the figure's caption.

22. Figure 6: The modelling domain needs to be noticeable to the readers. What is the unit of the colour bar? The symbol "Δ¯ζ(m) av eraged ov er all scenario s " were not clearly seen/written in this review pdf.
23. Figure 7: Please use different line styles for each scenarios (all 4 of the scenarios). Please make sure that the line styles are noticeable to the readers.
24. L201: Please provides some explanation in Subsection 2.3 about the different perspectives between the distance to canal and the distance to the nearest block. When will each parameter be used to interpret the results?
25. Figure 8: Figures are too small. Please provide some justification in the discussion section about the use of the distance to the nearest block in this spatial study. Please consider that this spatial study involved many canal blocks.
26. Figure 9: Please use different line styles for each scenarios (all 4 of the scenarios). Some axis labels are not completely written.
27. Line 460: The readme file in Urzainki (2022) - Txart block_effectiveness: v1.0.2 was not clear enough in describing the data. It might be better to separate the weather data (P and ET) from the model files/ codes.