INITIAL REVIEW 26th October 2024

General comments

Overall, the paper is based on good background research, sufficient detail of the methods and techniques and a reasonably clear structure of the document. Additionally, the English is well written. However, there are some debatable interpretations of the data, which I am confident can be improved with some extra analysis and interpretation. Additionally, there are some illogical orderings of the methods and techniques, giving low priority to the key measurements of infiltration and conductivity; these shortcomings are easily curable. With sufficient improvements it should be relatively easy to revise the MS to a suitable publishable condition. The authors should be congratulated on assembling and reporting such a wide range of data to help improve predictions of drainage and flooding in the Thames catchment area.

Specific comments

1. The principal shortcoming of this study is the inadequate identification and interpretation of the role that drainable macroporosity has on infiltration and permeability; essentially the more efficient transit of fluids through a system of channels or fissures than a macropore system dominated by vughs. Vughs are more isolated volumes of pores than channels and fissures in soils of moderate to high clay content and are only relatively efficient in very sandy soils where the main mineral particles meet at small contact points and allow general rapid transfers of fluids between them, i.e. sands generally drain faster than most heavier textured soil in the same drainable landscape position.

This figure from Blackwell et al. graphically summarises these concepts of relative macropore organisation.

224 *P. S. Blackwell et al.*

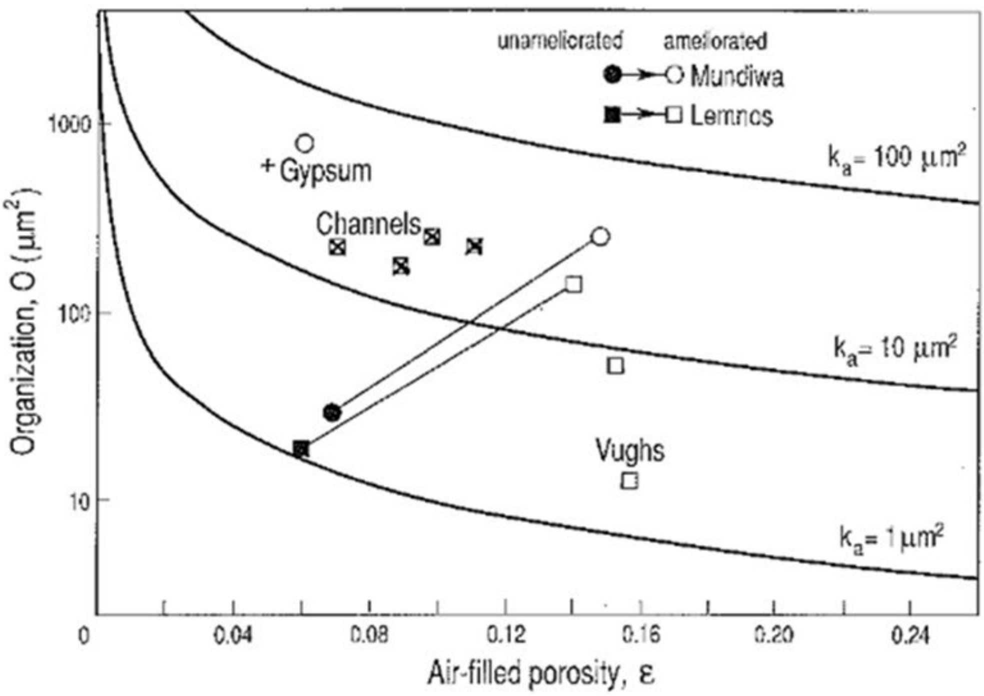

Fig. 4. The O:ε characteristic for individual samples of ameliorated Lemnos loam with channels from old lucerne roots (☒) or many coarse occluded vughs (☐) and for Mundiwa clay loam B horizon ameliorated only by surface gypsum applications (+gypsum). Mean values (from Fig. 3) for Lemnos loam and Mundiwa clay loam of unameliorated soil and ameliorated soil without large channels or vughs are also shown together with intrinsic permeability (k_a) isolines.

Thus, as seen from Fig. 4, the occurrence of channel and fissure type macroporosity (fissures are often a feature of gypsum treated sodic soils) instead of vughs can easily lead to ten-fold or more increase in intrinsic permeability (a definition independent of fluid viscosity that can be applied to water or gas). Further details can be found in the full paper (European Journal of Soil Science 41(2):215 – 228)).

“A well prep brush attachment was used to lightly roughen the walls of the well hole and to remove any soil smearing that may have occurred during the augering process” (quote from line 240 of the ms), thus access to the local microporosity for the well permeameters should have been adequate at each site.

2. However, the data quality analysis reveals some strategies that could exclude some very high and very low real values, which could reflect the relative influence of extremes of macropore organisation. Possible problems are in **red text**.

Infiltration measurements underwent Quality Control to categorise each measurement using the following data flags which are stored as “Infiltration_1_QC_Flag” and “Infiltration_2_QC_Flag” in the dataset:

• *“Good” = Where no apparent issues with the measurement were identified.*

• *“Invalid” = Where the measurement gave values that were not physically plausible (e.g. negative values). These values have been removed from the dataset.* **(this is sensible)**

• ***“A”* = Where the change in infiltration rate over time was observed to be notably unsteady (e.g. where plots of cumulative infiltration over time showed sudden/rapid changes). This may have excluded some real effects of the interaction between the soil chemistry and the ionic strength of the infiltrating water.**

“B” = Where < 15 ml water infiltrated during the measurement (the Mini Disk infiltrometer 280 manual states that **accurate calculation requires at least 15 ml of water to be infiltrated during each measurement)**. **(This may exclude some real but very low values.)**

• **“C” = Where calculated *Kunsat* values were unusually high. This was determined by comparing the measured value against typical values + 3 SD (i.e. the 99.7% upper bound of the distribution) from Carsel and Parrish (1988). It is important to note that datapoints with this QC flag may in fact be correct and potentially reflect the novel soil state/structure/management at the time of measurement**. This may exclude some real and very high values and is recognised by the authors in the underlined text.

Saturated hydraulic conductivity measurements underwent QC to categorise each measurement using the following flags which are stored in the “Guelph_Permeameter_QC_Flag” column of the dataset:

• “Good” = Where no apparent issues with the measurement were identified.

• “Invalid” = Where measurements gave values that were not physically plausible, e.g. negative values or “**alpha”values outside of the valid range of 0.01-0.5 cm-1** (Soilmoisture Equipment Corp., 2012). These values have been removed from the dataset. **(This may exclude some real but very low or high values.)**

In addition, the “Guelph_Permeameter_notes” column indicates whether the double head method or the mean of two single head measurements was used for deriving *Kfs* for each measurement. The double head method is more accurate and is therefore provided in preference. However, **sometimes the data generated physically inadmissible values when using the double head method** and in this case the data was instead used in two separate single head measurement calculations. The results of the two single head measurements were then averaged. Further details are given in the Guelph Permeameter operating instructions (Soilmoisture Equipment Corp., 2012). **This needs a more detailed explanation to clarify the ‘physical inadmissibility’.**

I strongly suggest the authors review the excluded values of permeability & conductivity and seek empirical reasons for their inclusion as they may be a consequence of extreme types of macroporosity and the ionic interactions with the tap water being used in the infiltrometers. It may also be feasible to enable an experienced soil surveyor to inspect the sites to enable a macropore identification method to be used. Such as by Graham Shepherds visual field techniques (https://www.bioagrinomics.com/visual-soil-assessment)**.**

3. There are some possible shortcomings of using a standard particle density to calculate total air-filled porosity. Line 180 assumed to be 2.65 g cm-3 , as commonly used in soil science.

For example, from the Nigerian Journal of Soil Science. SOME PHYSICAL PROPERTIES OF SOILS OVERLYING LIMESTONE PARENT MATERIAL IN SOUTHEASTERN NIGERIA, Aki, E. E. and Antigha, N.R.B. The bulk density of the topsoils ranged between 1.20 and 1.62g/cm3' for subsoils 1.33 and 1.82g/cm3 **Particle densities ranged between 2.42 and 3.10g/cm3 respectively** and total porosity for the surface and subsurface ranged between 49.7 and 50% respectively for all the soils.

I have tried to translate the data and possible errors of calculating total porosity with a standard value. Here is a summary of the analysis.

Soil porosity was estimated using total porosity = 1- (dry bulk density/particle density)							
	from paper	from range in literature	only limestone				
	g/cm3	g/cm3	g/cm3	uniform p density	possible p density		
example parent material	**dry bulk density @ 50cm dep**	**uniform particle density**	**possible particle density**	**estimated total porosity cm3/cm3**	**estimated total porosity cm3/cm3**	**porosity error cm3/cm3**	**porotity error %age**
mudstone	1.4	2.65	3.10	0.472	0.548	-0.077	**-16.3**
	1.4	2.65	3.10	0.472	0.548	-0.077	**-16.3**
	1.4	2.65	2.42	0.472	0.421	0.050	**10.6**
	1.4	2.65	2.42	0.472	0.421	0.050	**10.6**
limestone	1.4	2.65	3.10	0.472	0.548	-0.077	**-16.3**
	1.4	2.65	3.10	0.472	0.548	-0.077	**-16.3**
	1.4	2.65	2.42	0.472	0.421	0.050	**10.6**
	1.4	2.65	2.42	0.472	0.421	0.050	**10.6**
	1.4	2.65	2.42	0.472	0.421	0.050	**10.6**
sand	1.8	2.65	3.10	0.321	0.419	-0.099	**-30.7**
	1.8	2.65	3.10	0.321	0.419	-0.099	**-30.7**
	1.8	2.65	2.42	0.321	0.256	0.065	**20.1**
	1.8	2.65	2.42	0.321	0.256	0.065	**20.1**
	1.8	2.65	2.42	0.321	0.256	0.065	**20.1**
						max	**20.1**
						min	**-30.7**

Thus, the net error variation is about 51%. Translating this to possible effects on infiltration (Fig 4 above) there are a range of possibilities with a range of 50% variation from values of about 0.12cm3/cm3 total porosity.

However, the relevance of this source of error in the data analysis is debateable since direct measurements of infiltration and permeability are used in the study which makes estimates of permeability from porosity relatively redundant. Additionally, the authors point out, below, other errors of estimating total porosity, adding further doubt to the need to calculate it at all.

"*It is important to note that the estimated porosity data are derived purely based on the assumed density of the soil mineral particles, without accounting for the proportion or density of any soil organic matter present. Therefore, estimated porosities for the soil surface samples are likely to be less accurate than the samples at greater depth due to the greater influence of organic matter in the topsoil. However, the LANDWISE Broadscale dataset provides adjusted estimates of soil surface porosities which also take organic matter content into account (Blake et al., 2022)*." I suggest the authors consider how much detail of total porosity estimation is required in the paper, unless such estimations are required in the overland flow models currently in use.

4. Benefits of Controlled Traffic Farming (CTF). The authors identify that "*The dataset highlights how trafficked arable field areas such as tramlines, in comparison to general infield areas, have a higher bulk density (and lower estimated porosity) near the soil surface and lower saturated hydraulic conductivity (both attributable to compaction). These trafficked areas, although forming a small proportion of the field area, will therefore have a disproportionate impact on the potential generation of surface runoff in response to storm events and likely provide rapid overland flow routes connecting runoff to the local watercourse network. This raises the challenge of how to represent such processes in hydrological models, particularly given the apparent disparity of scales*".

This is worth providing more emphasis in the conclusions since the introduction states "*There is evidence to suggest that applying such practices can help to restore soil structure, increase water holding capacity and macropore density, and reduce bulk density (McHugh et al., 2009)*". A common practical consequence of CTF in higher rainfall environments is soil erosion of the tramlines with sufficient downhill slope and length. (e.g. Saggau, P. Kuhwald, M. and Duttman, R. Effects of contour farming and tillage practices on soil erosion processes in a hummocky watershed. A model-based case study highlighting the role of tramline tracks. Catena, vol 228). Such tramline erosion has been a major concern for CTF adoption by some farmers, even leading to dis-adoption in extreme cases. Thus strong reference to these issues by the authors in this paper may help to encourage and justify further modelling of such effects to minimise the problem by developing improved future modelling.

5. The value of soil moisture retention curves. These allow *“comparisons to be made between the different agricultural management practices and their potential influence on soil hydraulic properties”*. Further analysis of the differences in the moisture retention curves comparing trafficked and untrafficked zones would be beneficial to draw out more value from the data, as well as suggestions on how this difference can be applied to overland flow models.

Technical corrections (typing errors etc)

1. The sequence of explanation of methods in the abstract and methods could be improved. In the title the information is presented as “*Soil hydraulic and hydrological data*”, but in the methods section ‘*Measurements (n = 1300) included soil bulk density, estimated porosity, soil moisture and soil moisture retention, surface infiltration rate, and saturated hydraulic conductivity*.’ hydraulic properties (Infiltration and conductivity) are explained after other methods. The order should be in reverse to match the priorities in the title. It should be relatively easy to re-order the text re methods in the Abstracts and the main materials and methods sections.
2. The original data, accessed from the link, is in an excel spreadsheet and should be understandable to most students and researchers. The overview of the data, locations and methods etc, is well explained both in adobe format and Word format. However, the spreadsheet itself could be less clumsy to use if the row of column headings and the first column were locked to make the location of the data much easier to understand.
3. Reference to footnote g in table 1 shows no explanation of HCl manual methodology.
4. land-based Natural Flood Management (NFM measures). NFM is not defined in the beginning of the Conclusions section and is advisable to be clarified for ease of reading the paper.