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Comment on egusphere-2022-79

David Dunkerley (Editor)

Editor comment on "Delineating the distribution of mineral and peat soils at the landscape scale in northern boreal regions" by Anneli M. Ågren et al., EGUsphere, https://doi.org/10.5194/egusphere-2022-79-EC1, 2022

This paper presents a study that sought to revise the mapping of peat soils at national scale across Sweden.

The 'Methods' section reports that the primary data used are detailed elevation data from airborne laser scanning (at 2 m resolution), and a computed soil moisture map previously developed by A□gren et al. The soil moisture map in turn relied on unspecified 'digital terrain indices' (ms. line 143-144), together with "ancillary data on quaternary deposits, soil depth, annual and seasonal runoff etc " (ms. line 145) that were used as input for a machine learning model, to predict soil moisture across Sweden. This section of the Methods presentation seemed inadequate to me. What were the topographic indices? How and at what scale were they derived? How were annual and seasonal runoff quantified, and what was the resolution and quality of these data? Runoff data can surely have been at no finer scale than that of catchment level, in most cases. If so, how can it assist in mapping peat at 2 m resolution? The authors need to explain much more thoroughly the data used and the methods used in the machine learning model. In turn, more commentary was needed on the resolution and quality of the soil moisture maps. What, for instance, is the extent of seasonal variability? Is the parameter calculated perhaps an annual mean or median value?

The predicted soil moisture data were then related to field-mapped peat depths collected from forestry surveys in which pits were excavated, and a regression model was fitted to the data. This is then used to predict peat thicknesses elsewhere across Sweden. However, the relationship between predicted organic layer thickness and measured thickness from the field survey data (Figure 4 in the ms.) shows enormous scatter. The bulk of the data points appear to be for quite thin organic layers (bottom left-hand corner of Fig 4), with relatively few observations > 60 cm (right hand part of Fig 4).

The authors do not actually describe the process of producing their predicted organic layer maps from the soil moisture data, but rather simply jump from Fig 3 to a discussion of the resulting maps. This needs to be corrected.

Given the enormous scatter in Fig 4, the authors at several places say that their thickness maps should not be 'taken literally' (e.g. line 460, line 466) and yet there is no real quantification of the probable magnitude of error at any location. This could have been done by comparing with the field data acquired from pits. The RMSE was reported as 19 cm (line 306) but this is a huge uncertainty given that most of the organic layers appear

to be less than 20-30 cm in thickness. Is this level of uncertainty actually acceptable, and are the predicted depths sufficiently reliable for the estimation of carbon stocks, for instance?

Overall, I was left unsure about how much confidence could be placed in the thickness maps generated by the authors. I think that a fuller discussion of actual thicknesses and the likely uncertainty (surely varying with topographic position, and perhaps areal extent of particular organic or peat deposits) in the predictions is required. The authors claim excellent resolution in mapping peat deposits covering just 4 m^2 (e.g. line 405) - i.e., just a single pixel in data at 2 m resolution. Do such tiny peat deposits actually exist? If so, what accounts for their isolated accumulation? The authors need to comment.

There are minor errors scattered throughout the ms. In particular, I would suggest that as a formal geological Period, 'Quaternary' should be capitalised. This is written 'quaternary' at many places in the ms., and all instances need correcting. The authors are occasionally inconsistent with this, such that Table 2 for instance contains 'Quaternary' as does the heading for Section 2.4, but elsewhere, mostly lower-case letters are used.