SOIL-2021-80
Reply to CC3: Dylan Beaudette, 21 Oct 2021
(Posted on behalf of a colleague who would like to remain anonymous)

The Authors

October 30, 2021

1   General comment

Comment: "My only critical comment in the pdf concerns what appears to be a mis-characterization of POLARIS uncertainty estimates. Otherwise the paper is well written and provides a thoughtful comparison on the differences amongst soil datasets."

Answer: The paper states "SG2 and PSP predict the 5% and 95% quantiles of the distribution of predictions using Quantile Regression Forests (QRF)".

Indeed this is not correct for PSP. It does provide these quantiles but using a more complex method, as described in §3.3.1 of the POLARIS soil properties paper (`DOI:10.1029/2018WR022797`). It is based on property data available for a given soil series, to create a depth-harmonized profile with uncertainty at each depth slice. We will change L242-3 accordingly. The important point for our paper is that the PSP method of DSM provides uncertainty, which we can compare with other measures of uncertainty, in this case with SG2.

2   Specific comments

Line 60: Does it? Domain expertise seems critical to know when these ML models are overfit.

Answer: this refers to the statement "This removes the need for expertise in discovering and interpreting the soil-landscape relations,..." What we meant here is that expertise is not needed in the same sense as the surveyor uses holistic,

expert knowledge of the soil-landscape relation. Indeed domain expertise should be used to (1) select relevant covariates, (2) check that the ML model output is reasonable.

In the revision we will clarify this point.

Line 242: PSP used a "classification" forest, thus how could it has also used a quantile "regression" forest? The PSP is based on a weighted average of soil components.

Answer: Correct, we answered this in the general comment above.

Line 405 / Table 1: What is with the units in this table? The RMSD is different by a pH of 4-6? You're multiplying by 10? Why?

Answer: Because of processing limitations, it is common in wide-area (e.g., global) DSM models to predict integer values. This is to reduce the size of the generated raster layers, using one-bit signed integers (range 0-255). Thus a single-precision pH 4.2 is represented as 42, etc. We created the table from these integers, to be consistent with the necessary use of integers in the raster maps, e.g., Fig. 4. We also decided that, given the imprecision of the ML models, a single-precision pH was sufficiently precise. We made similar decision in SoilGrids v2.0 for each property, as shown in the Case Studies ISRIC report.

Figure 3: I love visuals, but in this case a simple correlation matrix would be more informative.

Answer: This plot is quite common in related literature, and the exact values are of less interest (we think) than the visual impression given by the plot.

Table 2: I would have figured that gNATSGO would have had the highest nugget because it is the most detailed, but I suppose this is an artifact of the polygons.

Answer: We think this is indeed an effect of the polygons: adjacent grid cells are more likely to be within a polygon than between them. Notice also the short range, which reflects the typical width of a delineation.

Figure 11: Red-Green is a bad color scheme for folks (like me) whose vision is color deficient.

Answer: Yes, and we were thoughtless here. For the revised paper we intend to recompile the figures, consulting with experts in colour schemes appropriate for red-green colour "blindness"

Figure 12: Any thoughts on the use of a consistent color scheme across all thematic maps?

Answer: We purposely used different schemes for (1) property predictions, (2) property prediction differences, (3) uncertainty, (4) uncertainty differences (IQR), (5) classified maps – the red/green problem mentioned above, although

here we were not consistent in the regional vs. local class maps. We intend to rectify this last, along with the previous point, in the revised paper.

Figure 13: Shouldn't you have a legend for the gridded soil maps? Also, IMO I find the transparency and orientation distracting.

Answer: Here we were just trying to show the difference between gSSURGO and PSP, i.e., PSP's disaggregation, against a landscape with significant relief and composite map units. The actual values are not so important, the reader should concentrate on matching the colours, which do represent the same values.

The transparency and orientation are to highlight the landscape underneath the soil map.