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Comment on soil-2021-80

Dylan Beaudette

Community comment on "How well does digital soil mapping represent soil geography? An investigation from the USA" by David G. Rossiter et al., SOIL Discuss., https://doi.org/10.5194/soil-2021-80-CC2, 2021

Posted on behalf of a colleague who would like to remain anonymous

I think this paper is a noble attempt to make qualitative and numeric cross-product comparisons of PSM/DSM products. I believe a distillation of examples would be useful with more contextual background to explain what the reader should be specifically looking for in the visual comparison outputs. Many articulate and powerful examples of where these products are lacking could be described for any given soilscape within the CONUS area. I feel there is better articulation of the examples in the long form version of the ISRIC report, but that this background context was largely neglected in the shorter form version of this paper.

Explanation of PSM/DSM
"A principal attraction of PSM is that it produces consistent, geometrically-correct and reproducible gridded maps over large
areas, given training data ("point" observations of soil classes, properties or conditions), a set of environmental covariates
covering the entire area to be mapped at some fixed grid resolution, and a set of algorithms implemented in computer code."

"This (the above attractions of PSM/DSM) removes the need for expertise in discovering and interpreting the soil-landscape relations, also known as the "paradigm" of soil survey (Hudson, 1992), which is vital for traditional soil survey and difficult to acquire and harmonize among surveyors."

As one who regularly "actually examines the soil and landscape" of my area, I take great issue with the above statement. It needs to be clarified that it is really only possible to evaluate the PSM/DSM results if one has the expertise derived from the traditional "paradigm" of soil survey.

A dirty little secret concerning PSM/DSM products is that in spite of their assumed superiority and 'explicitly multifactorial' approach as previously described by esteemed commentators, these products are not 'intelligent' in how they parse soil topographic/soil geomorphic/soil geographic relationships.

No matter how you slice it understanding local geomorphic relationships and their relevance to the distribution of soil parent materials is an extremely important and high

cut in the process of mapping soils. These complex soil geomorphic relationships live in conventional soil survey products and are largely absent in PSM/DSM products making them substandard in how they capture the reality of soil distributions. You pick the area (any area) and a soil scientist with the ability to read and understand soil geomorphic relationships (the quote traditional paradigm of soil survey) will show you numerous shortcomings.

Computer vision of the soilscape is essentially metadata of the real thing but it is not the 'real thing' only a representation that is largely bias based on what went into it. Simply because PSM/DSM methods are new and powerful, it is wrong to automatically accept them as being superior to the nuance of what a soil scientists trained senses (eyes, ears, nose, legs, arms, hands, fingers) take in they analyze and walk a landscape. At this point in time PSM/DSM products are like looking through a blurry lens at something that I could be observing directly.

They are useful, yes – but they don't replace the invaluable skills, intelligence and perspective of the soil resource acquired in understanding a landscape in detail via observations grounded in the soil survey paradigm thru 'traditional' soil survey, at least not yet.

The paper should postulate on why the PSM/DSM products don't measure up to conventional survey. The intent is not to replicate earlier products, but one would hope that PSM/DSM products would reflect a similar lineage in larger structures and spatial patterns expressed within the soilscape. We know these patterns are there so why do we deny them in these new products.

I think the more pressing and important question is how do we build the intelligence and paradigm from traditional mapping into PSM/DSM approaches so that the strengths of the hierarchical relationships of geomorphology, superposition, fluvial downcutting/cross-cutting, geologic discontinuities of materials are added back into these models to further inform the outputs.
More inputs do not make better models, higher quality inputs make better models.

I applaud the authors for taking this comparison on and for attempting to shed some light on the touch points of inadequacy that exist in these products.