

## ***Interactive comment on* “Development of a harmonized soil profile analytical database for Europe: A resource for supporting regional soil management” by Jeppe Aagaard Kristensen et al.**

### **Anonymous Referee #2**

Received and published: 3 July 2019

MS: soil-2019-18 Title: Development of a harmonized soil profile analytical database for Europe: A 2 resource for supporting regional soil management

General comments This MS is informative on how SPADE was developed and evolved over the years. Unfortunately, the descriptions are not detailed enough so that potential users are convinced to use SPADE for their research endeavors. Many questions that raised my mind are mentioned below. The two examples for application of the SPADE 18 at EU level were not very convincing. Regarding the Root zone capacity I presume an error in the equation applied (hopefully it is just a typing error so that calculated results are all right) and for the SOC stock estimation no coarse fragments

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are taken into account, not even mentioned. More references could have been made to recent papers and studies and to the applied methods. Over all, this MS can be still be improved substantially, starting by considering my suggestions and corrections seriously. I look forward to a next revision and a proper answer to my questions.

Specific comments L36-37. In the lack of systematic cross-European soil analysis schemes, . . . Several cross and pan-European soil analysis schemes exist already for decades. Examples are the UN-ECE ICP Forests soil manual with sampling schemes for forest soils in the systematic 16x16 km Level I forest soil network. Freely accessible though this link. For agricultural soils mainly, a manual and sampling scheme was developed for the LUCAS monitoring grid. Reference: Fernández-Ugalde O., Orgiazzi A., Jones A., Lugato E., Panagos P., LUCAS 2018 – SOIL COMPONENT: Sampling Instructions for Surveyors, EUR 28501 EN, doi 10.2760/023673. Strange it is not mentioned in this manuscript, since different coauthors are involved. Also in World Reference Base, soil analytical methods required for soil description and classification are well described (see IUSS Working Group WRB (2014) among other FAO reports)

L55-57. A recent assessment . . . This phrase is unclear and difficult to understand, unless you read the referenced article. Please rephrase

L64-L66. I expect some critical evaluation in this MS concerning the mapping-unit approach, especially the practical problems in GIS processing since soil-types are not spatially explicit defined this way. Maybe state some alternative (better) soil mapping approaches from literature.

L87-96. Overall, this section is not very clear in describing the various database products and how they are linked to each other, and what they effectively contain (which countries, number of soil profiles, measured vs. estimated/derived profile data, etc). I suggest to use Table 2 earlier in the text to describe the SPADE versions and their evolution.

L98. I would replace “Root zone capacity” here with “volumetric water content” since

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the first term is not used frequently and should be defined first along with a proper reference.

L106. Why “preferable on arable land” ? Would have been more logical to provide analytical data for the dominant STU and for the dominant land-use in each SMU in Level 1, while in Level 3 you then have the differentiation among land-uses for all soil-types.

L115. What do you exactly mean by “established analytical procedures” ? Do you refer to international procedures like ISO methods, EN, etc ? Or do you mean specific ‘established manuals’ ?

L115-116. I would expect the inverse: established procedures (understood as internationally accepted conventional methods) are more comparable across country borders than national methods (Proforma I).

L122-123. Why is the database limited to assessments of agricultural land management if one-third of the EU land area are forests ? Considering also that soil profiles under forest are well suited as a reference and to better evaluate the impact of agricultural management on soil development and quality.

L132-133. Can you provide any reason explaining the limited response from national stakeholders ? Was there any questionnaire or evaluation study dealing with this issue ?

L144. Was there any information on coarse fragments (stoniness) in each horizon ?

L149&L151. Versioning for SPADE databases is quite confusing. So you have SPADE2v11 (11th version of SPADE 2 ?), but also a SPADE version released in 2014, being SPADE14. I presume there is some simplification possible here ?

L167-168. If implausible values were adjusted, was this documented in the database. If so, how ?

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L168-179. It seems that response of stakeholders for reviewing SPADE databases was repeatedly low or absent. Could it be that EC asked for responses and reviews on a voluntary basis, while only by (co) financing serious and adequate expert responses may be expected ? In this MS it seems that often the national stakeholders are blamed. Maybe the approach and strategy of responsible institutions like DG JRC is inadequate and does not promote fruitful cooperation between EC and member states on European soil databases?

L192. Matching of similar soil types in neighbouring countries is quite tricky. Thorough validation and evaluation of such a process is needed to avoid systematical bias in the SPADE database. Estimated records need a clear flag in the database so that they can be omitted by evaluators if they do not trust the estimated/imputed records.

L196. Replace 'final' by 'resulting'. Is there any further versioning of the SPADE14 database ?

L199. 'passivity' – There might be several reasons for not cooperating. See comment for L168-179

L201-L203. This all seems tricky to me. Is this process clearly documented and traceable ? Please inform the reader on this.

L206-208. Please provide a reference or URL to such a detailed description of the methodology

L210-211. Can you inform the reader how many stakeholders responded and how their response was processed before publication ?

L214 “weredeveloped” add space between words

L218. SPADE 2 (table 1), ... please add “depending on their OM content and depth”

L223. BD estimated a value in the range 1.1-1.2 g cm<sup>-3</sup>. Why not using 1.15 g cm<sup>-3</sup>, making gap filling more reproducible ?

L229. Root zone capacities. Please refer to a definition or paper for this term (e.g. Jensen et al. 1998)

L233. Why using  $50\mu$  in 20-50  $\mu\text{m}$  and 50-200 $\mu\text{m}$  fractions while  $63\mu$  is recommended by FAO and USDA soil texture classes ?

L234. "Complete estimated datasets" Does it mean completed using estimated data ? So, for instance estimated bulk density using PTF functions instead of measured bulk density ?

L240 VWC1000 not mentioned in line 231. VWC1500 in stead ?

L243 In all these equations BD is used twice, so this is a high impact predictor. Is only measured BD applied here or also predicted BD ?

L250 please explain predictors in the regression equations: "where TEXT2 = 0-2  $\mu\text{m}$  fraction in mass %, ...

L261-262. Again, when adjusted, how is this documented in the database ?

L274-275. It would be helpful to provide an EU map showing the profile locations of SPADE 14 and SPADE 18 across Europe, so that the geographical distribution across Europe may be evaluated

L288. ... assigned by estimated analytical data

L322 will be published. ... so without any national validation then. Is it indicated in the SPADE 18 database if the data has been nationally validated or not ?

L326 currently only the SPADE 14 can be downloaded through this link; and also SPADE/M and SPADE/M2 but these are not explained in this manuscript

L314& L345. Can you provide a reference for this equation ? It seems to me that VWC100i, which needs to be VWC at Field capacity is far too high at -100 kPa. Conventionally it should be for FC between -10, -20 or -32 kPa depending on soil texture,

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respectively sand, silt or clayey soils. Can you check this ?

L350. I presume there is also a fraction 200-300mm considered “High”

L360. For the SOC stock estimation volumetric proportion of coarse fragments are not taken into account while these are usually considered for accurate SOC stock estimation (see De Vos et al. 2015 you are referring to) ? Why is this ? Because SPADE has no coarse fragments data ? Neglecting coarse fragments content will lead to an overestimation of the SOC stock.

L379-380. You cannot simply sum the estimates by De Vos et al. 2015 and Lugato et al. 2014 because the latter is only the 0-30 cm stock. According to the first referene, assuming a 60% proportion of SOC in the upper 30 cm, the total 1-m SOC stock in EU27 agricultural and forest soils would amount to ~51.3 Gt, which is about 68% of the SPADE 18 estimated stock. As said before, since coarse fragments are neglected in the calculation the SPADE 18 estimate is presumably an over-estimate. Recently the GSOC map was developed by the Global soil partnership. Please compare these results for Europe also with the SPADE 18 data, if necessary only for 0-30 cm topsoil SOC stocks.

L402. Indeed. This is a very important factor. Carbon hotspots are often smaller SMU's and often underrepresented in soil databases or masked by generalization of soil maps.

L436. Refer to figure please for Danish-German border example. . .

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