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Interactive comment on “Spatial distribution of soil organic carbon stocks in France” by M. P. Martin et al.

Anonymous Referee #1

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General comments The paper discusses an original approach for the estimation of national soil organic carbon (SOC) stocks based on extrapolation of soil monitoring data using a boosted regression tree approach. The subject is timely and important. Many countries are now setting up soil monitoring networks, and examples of extrapolation of monitoring results to an entire country are still lacking (in most cases) rigorous spatially explicit statistical foundations. However, the paper is poorly written and lacks rigorous description of the variables. I would not recommend publication in its present form and advise a major revision. I would like to see some more reference to approaches of country wide assessments of SOC stocks in the Introduction. The variables used for the empirical modelling are poorly explained in some cases : The three levels of land use are not discussed (lines 65-68), although they are explicitly referred to in the results (lines 305-306). The variables for the water budget are not defined and

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it is not clear how a spatial coverage of these variables was obtained (lines 69-73). There should be a short explanation on how the NPP is derived from MODIS imagery (lines 75-76). The mineralization modifiers in the RothC model should be explained and again it is not clear how a spatial cover of these variables was obtained (lines 102-105). I am not sure what the authors mean by soil surface data (section 2.2.1). Are these the state of the soil surface (eg crusting ?) or the areas of each land use class ? I fully appreciate that the technique of boosted regression trees is quite complex, and I leave it to the experts to judge whether the description is comprehensive. However, the parameter settings for the models (section 2.3.2) is quite difficult to read, mainly because the different values are given in the text, whereas a table would be easier to read. Finally, I am not sure that the paper needs a long discussion on the effects of each variable on the empirical outcomes. Section 4.2 is quite long, the graphs 7 and 8 are not clear and the axes lack units. After all, it is very hard to describe the mechanisms of mineralization based on an empirical model at the national scale. Most of the effects of variables (that are not clearly defined, see above) are not even shown in graphs (eg the RothC mineralization modifiers or the water budget variables). I would reduce this section to the discussion of one or two key variables. In general there are many abbreviations. Some of them are not particularly common/useful. Why use 'SOCS' instead of the commonly used SOC stock? Please take care that abbreviations can only be used when the term is spelled in full for the first time. Some examples: JRC line 28 (by the way, I would be more specific and refer to Jones et al 2005), GHG line 31, line 32: use the term in full first and then (BRT) in brackets. Line 42C SOC stocks can be used directly as SOC was already defined (line 14)

Specific comments Abstract line 3 : The statement that the course of climate change will be influenced by soil carbon appears to me a bit strong. Abstract, first paragraph : The 2200 measurements do not correspond with the 1974 measurements used in the remainder (eg line 35). Abstract and further in the text e.g. Line 34. I have looked up the word 'metropolitan' in the New Oxford Dictionary. It means 'related to a metropolis'. I guess that you meant to use it for mainland France (without overseas departments).

I would not use 'the whole' and 'mainland' in the same sentence. Line 9 suggestion: Accurate estimates of this pool are required, however ... Line 15 and further in the text (eg line 60): I prefer the term 'rock fragments'. This term is well defined (see eg the special issue of Catena edited by Poesen (1994?). Coarse elements are confusing as sometimes there is also coarse organic debris. Lines 26-28 I do not see the point of this example. The fit between the JRC and national estimates seems quite well. Please give the reader your opinion on this fit (good, reasonable ...). An example of a poor fit would also be welcome. Lines 28-31 Please be more specific on how measured SOC stocks are used. Are they the initial values SOC values in simulation models? Are they used to calibrate/validate models? Line 43: Figure 1 does not give any added information. Please remove. Instead it would be useful to define the abbreviation RMQS here, as it not described in line 77, where it first appears. Lines 62-64: I do not understand this complex sentence. Do you mean that byou also used land use data from field observations? Line 76 Describe the principle of the NPP product from MODIS in one sentence. Line 84 Replace 'soil usage' by 'land use' Line 93 Please use 'precipitation' instead of 'rain'. Line 95 Please check the sequence of the reference to the Figures. You cannot refer to Fig 5 after only Fig 1 has been used. Line 95 Why do you refer to Fig 5? This is a SOC map, not a P or T map. If it is to demonstrate a 12 by 12 km grid, I do not think that it is useful. Lines 107 and 108 The term 'soil surface data' is ambiguous. It could also mean data on the state of the soil surface such as roughness, vegetation cover or crusting. Please be more precise. Lines 109, 110, 119 and 120 Please define 'TERUTI', 'SCEES', 'MART' and 'GBM'. Line 137 Fitting the algorithm is ... Lines 188-193: The land cover levels 'lu1' etc and the minderalization modifiers 'A and b' have not been explained in the Materials and methods section (see major remarks). Lines 224-225/ It is obvious that the statistics such as MPE etc are used for validation. Please delete the sentence. Line 229 Why is MPE squared? Line 231: Please check sequence of the figures. If I am not mistaken you have so far referred to Figs 1, 2 and 5. Line 234 please add '(eq. 2)' at the end of the sentence. Section 2.3.3 See also major remarks. The

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section is difficult to read because of the frequent use of ‘respectively’ sometimes with even two levels. I would suggest constructing a small table for the model parameters. Line 270 Please use ‘MPE’ instead of ‘bias’. Line 271: Are you sure that you mean ‘validated’ not calibrated? Line 272 and further. Please mention the units for RMSE and MPE etc. Lines 281, 287: Please do not forget the units Line 317-318 Not clear. Please re-formulate. Line 320 Please refer to equation 2 for the uncertainty. Line 329: Please use another formulation for ‘sharp pattern’. Line 358 Please define ‘ecd’ Line 362 ...values were not predicted correctly by the model. Line 374 ... between both methodologies. Line 382 What do you mean by ‘multiplicative’? Line 387-394 These sentences are not very clear. Please describe in one sentence how SMNs can be used to refine their own performance, and specify more precisely how SMN’s can contribute to continental scale SOC dynamics modeling. Lines 405 and 406 The difference between ‘global’ and ‘elementary’ is not entirely clear. Line 425. Please re-formulate in order to avoid using the plural of rainfall. Line 455.may imply that on average. ... Section 4.2.3 Difficult to follow without reference to figures. Where is the relation NPP/SOCS shown for instance? See also major remarks. Line 511 delete ‘for whom ...surfaces’. Lines 552-562 Please delete this section. You do not show any data on mineralogy. See also major remarks. Line 583 What are ‘octop bulk density maps’? Line 587 Please check. I think you mean ‘former’ Line 593 Avoid using references in the conclusions Table 1: Please give the units where applicable. Fig. 3 caption: Please refer the reader to the M&M section for the definition of the variables. Are you sure that you defined all of them, also ‘ce’? Fig. 7 caption: I cannot see the bars on the lower axis. Fig. 8 I am not sure that I understand this figure. Please explain in the caption more clearly.

Technical corrections Abstract, last line on page 1: These relationshipS Line 7: CO2 Line 94 (Å°C) Line 276 the same AS Line 277 develoPed Line 280 ON average Line 281: bias Line 301 typo: ..the the... Line 312 Variable should be in italicstransformed a variable..... Line 349 ...because of itS systematic Line 354 unbiased Line 356 ...values below the SOC.... Line 368argued that the

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resolution... Line 481: ...that the importance of pet was always Line 584 laTter
Line 636 I believe this paper is now printed. Please update

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