**Review "Global patterns and drivers of soil total phosphorus concentration"
by He et al.**

General

The manuscript is very well written and presents very interesting and extremely useful data not only for a global soil science community but also for any related field interested in biogeochemical fluxes and pools. As the background, aim, methods and results are clearly and with high quality standards presented, I have only minor comments. One important request from my side would be, that the readme file of the presented data would be extended to make the data tables self explainable. E.g., looking at the rf.dat.csv file, units are not clear and BIOMES, BEDROCK, SOIL TYPE is not clear what the categorical numbers given represent. Same holds true for the covstack.dat.csv and the raw.data.csv files. The readme.txt does not explain units or legends (e.g. what is a "1" for BIOME or BEDROCK). One option would be to include Table 1 somewhere in the readme file and add information needed on parent materials, vegetation types, bedrock and soil orders.

Another general comment would be that it is not clear how you excluded agricultural land and on which basis you separated between natural – semi natural and extensively used (grass-)land. It is a great idea, to not mask out cropland or other heavily influenced areas in your map and data tables but instead present the predicted "background" or "natural" values. However, I think this also needs to be described in the readme file very briefly to avoid misunderstanding and misuse of data. May be this should also be stated in the abstract, to make very clear, that you give "potential natural background" values of P in these areas.

Abstract

Very well written indeed!

23   what do you mean "predictions increased"? The predicted amount increased? Or reliability of predictions increased?

Introduction

Also very well written and interesting to read.

78: do you mean to say that you explicitly exclude agricultural used soils? This is not clear (was only clear after reading the methods). And if so, on which basis did you do this separation between natural – semi-natural (extensively used grassland?) and agricultural (arable and intensive grassland?).

83 global total P stock including "background values" of agricultural soils? So this would be some kind value of potential P content with no human influence?

Methods

93-94: which efforts? What are the criteria?

97 why web of science and not google scholar? Web of science often seems exclusive of some journals or data sets which are still peer reviewed.

Figure 1 and lines 140-141: would it be possible to also give WRB soil types? This might increase understanding (and citation) in the whole of Europe soil science community.

179-180 this is a great idea, to not mask out cropland or other heavily influenced areas. However, I think this also needs to be described in the readme file very briefly to avoid misunderstanding and

misuse of data. May be this should also be stated in the abstract, to make very clear, that you give "natural background" values of P in these areas.

Results

I think it would be very interesting, if you would extend Tables 2 and 3 to the 0-30 cm layer, so give 0-30 and 0-1m, separately.

214 – 216 this is surprising as we would expect strongly weathered soils to be significantly lower than intermediate weathered soils, and intermediate soils higher than young, low weathered soils. Any explanation?

252 increase only from equator to high northern latitudes? Any explanation why this increase is seen?

257 African highlands do not show this?

Discussion

Generally, a very clear and good discussion. Only the above-mentioned points, why younger soils are clearly higher in P than intermediate soils and intermediates soils not higher than strongly weathered (old) soils are missing. This kind of contradicts our text book knowledge of young soils being low in P, than slowly accumulating P to a certain peak (intermediate weathered soils) and finally loosing soil again. And may be you should briefly discuss high southern latitudes (no glaciations, so strongly weathered?)

Conclusions:

361 this is not totally correct, as we would have expected highest P contents in medium aged, intermediate weathered soils (e.g. peak of weathering, not so much lost yet).