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Earth System Science Data Discussions

Interactive comment on "Depth-to-Bedrock Map of China at a Spatial Resolution of 100 Meters" *by* Fapeng Yan et al.

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Comment: Reading the manuscript title, one has the feeling that it could be a contribution of interest to global soil map project because the manuscript could improve the fragmented and dated knowledge of the world soil resources.

Reply: Thanks for your valuable advice. Indeed, the dataset associated with this manuscript could be a contribution of interest to globalsoilmap project (https://www.globalsoilmap.net/), as depth to bedrock (DTB) is a primary variable required by its official specification. DTB is also a variable provided by the "soilgrids" project (https://soilgrids.org), in which one of the coauthor Wei Shangguan has contribution to this project. In the introduction of our manuscript, we also discussed the

measurement of DTB (the depth to the R horizon) in soil survey:" Although DTB is often considered equal to the thickness of the soil, there are great differences between different measurement results. Soil thickness is mostly determined based on soil profiles from soil surveys and borehole profiles from geological surveys. The observed depth of a soil profile is generally less than 2 meters, and the thickness of the soil is therefore recorded as a value lower than 2 meters (Shangguan et al., 2017)." We can conclude that DTB is a major object in soil science research. Due to this comment, we added a sentence in the first paragraph of the introduction: In soil science, DTB is a key indicator of soil resources, because it restricts root penetration of plants. DTB is a key variable provided by global soil projects such as the Globalsoilmap (https://www.globalsoilmap.net/) and Soilgrids project (https://soilgrids.org).

Comment: The Authors have also invoked the concepts and methodologies of digital soil mapping, and the scorpan approach (McBratney et al., 2003) for predictive modelling and mapping of soil. Scorpan, which is rooted in earlier works of Jenny (1941) and Russian soil scientist Dokuchaev, is a mnemonic for factors for prediction of soil attributes: soil climate, organism, relief, parent materials, age, and spatial position. Unfortunately, the topic of the manuscript is not the soil knowledge because the depths taken into account go over what could be included in the soil concept. In addition, it is not even possible to invoke the use of factors of soil formation to select covariables for improving the estimation of depth to bedrock depth because they cannot act at the measured depths. However, the manuscript could be an interesting contribution to other research areas, which they have also mentioned by Authors. The manuscript should be revised accordingly the real research area refocusing properly the manuscript and particularly the methods. The concept of soil cannot be considered and the Authors should talk about only the depth to bedrock.

Reply: We adopt the scorpan approach in digital soil mapping to develop depth-to-bedrock map in China and the result is considerable with 57% variation explained, providing the most detail DTB for China at the national scale. Bedrock is one of the

parent material of soil (there are other kinds of parent material such as a superficial or drift deposit), and soil is developed based on these parent material via physical, chemical and biological processes. Therefore, depth to bedrock is closely related to soil development. Factors affecting soil also affect DTB, including all the 'scorpan' factors. However, depth to bedrock may be also influenced by geological characteristics (e.g. rock type) and deeper and historical geological processes (e.g. formation of rocks and deposition), but no available covariates can serve as now except the rock type map used in this study. Several depth-to-bedrock maps at global and regional scales (Hengl et al., 2014; Pelletier et al., 2016; Shangguan et al., 2017 et al) mentioned in this manuscript were produced using scorpan factors and the result dataset are reasonable, which means this methodology is effective to develop our dataset. As you said, our manuscript could be an interesting contribution to other research areas, but it is also of great importance to soil. So, DTB and soil is close related and need to be addressed together in our work. Based on the above points, we added a paragraph in section 2.3: Although DTB is somewhat different from basic soil properties, it is closely related to soil because bedrock is a kind of parent material for soil. Soil is developed based on bedrock or regolith such as deposit via physical, chemical and biological processes. Factors affecting the soil development also affect DTB. Therefore, it is reasonable to include factors of soil formation in the prediction of DTB. However, DTB is also influenced by geological characteristics and processes such as formation of rocks and deposition. Due to the lack of geology data, we used only the rock type as a geological covariate.

Comment: Finally, a lot of comments and suggestions are possible but I think at this moment are needless and I hope to review soon a revised version of the manuscript.

Reply: We hope that the reviewer could give us these comments and suggestions in the current discussion stage. It will help us to improve our draft and speed up the review process.

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