Revision Note

Journal Name: Geoscientific Model Development

Manuscript Number: gmd-2016-165

Manuscript Title: Establishing relationship between measured and predicted soil water characteristics using SOILWAT model in three agro-ecological zones of Nigeria

Dear Editor,

Thank you very much for providing me with the opportunity to revise the manuscript. I have revised and improved all sections following your suggestions.

 NB: All revised areas have been highlighted in yellow colour in the annotated manuscript (manuscript tagged "Soil Water Characteristics Model Revised").

ANONYMOUS REFEREE #1

General comments

This study compared the measured and predicted soil physical properties (soil available water, bulk density, field capacity, hydraulic conductivity, moisture content, maximum water holding capacity, and wilting point) at three agro-ecological zones of Nigeria. The model examined is the version 6.1.52 of the Soil Water Characteristics Program (SOILWAT model). The motivation behind this study was that soil available water has important impacts on soil nutrients availability, and the use of numerical models to estimate soil physical properties is necessary to avoid time consuming and labor intensive soil measurements.

However, all soil physical properties predicted by SOILWAT model were significantly different from the measured values at all of the examined agro- ecological zones, which suggests that current version of the SOILWAT model cannot be applied to represent soil water characteristics. Extensive improvements are needed for the SOILWAT model before it can be used for irrigation planning. I suggest rejecting this manuscript at this time.

Response: The results did not show all soil physical properties predicted by SOILWAT model to be significantly different from measured values. In Lines 19-20, it was reported that the SOILWAT model using texture and salinity data recorded similar textural classes for all the agro-ecological zones studied. Also, in Lines 326-328, the results showed that the use of the model with texture and salinity data alone strongly predicted witling point for two agro-ecological zones. As such the study do not suggest that the current version of the SOILWAT model cannot be applied to represent soil water characteristics. However, Lines 328-329, has been properly modified to conclude that texture and salinity alone are not sufficient to predict soil water characteristics. Lines 329-330 has been adjusted to advise that variables such as organic matter, bulk density and gravel be included for accurate prediction of soil water characteristics.

It was stated in Line 15-16 that the model was assessed for its efficiency in predicting soil moisture characteristics using only soil texture and salinity data, as opposed to the use of soil texture and organic matter data which was validated to be sufficient for accurate prediction for soil moisture characteristics in the advent of limited data conditions by Saxton and Rawls (2006) (Lines 75-77). Although, this was not clearly stated in the text, it has now been articulated in the objective (Page 3, Line 84) and materials and methods (Page 6, Line 185-188) to clearly reflect the focus of the study.

Specific comments

Query:
Page 2, ln 37-39: Is there any reference that supports this statement? If so, please cite here.

Response:
The references to support the statements have been included in Page 2, Lines 36 and 38.

Query:
Page 3, ln 96: What type of grassy vegetation is predominant here? C3 or C4 photosynthesis pathway?

Response:
The grassy vegetation are predominantly those that assimilate carbon dioxide by the C4 photosynthetic pathway (Page 3, Line 97).

Query:
Page 4, ln 112: Please indicate the location of this agro-ecological zone as the format used in "Derived Savannah".

Response:
The location (Kogi State) of the agro-ecological zone has been indicated (Page 4, Line 113).

Query:
Page 4, ln 117: Please indicate the location of this agro-ecological zone as the format used in "Derived Savannah".

Response:
The location (Edo State) of the agro-ecological zone has been indicated (Page 4, Line 118).

Query:
Page 6, ln 181: Which type of the T-test is used in the analysis? One-tailed or two-tailed?

Response:
The type of T-test (two-tailed) has been included in Page 6, Line 184.
Query:
Page 7, ln 221-223: Please rephrase the sentence. The R-squared value (0.44) could be acceptable here, but it doesn't mean that SOILWAT model can be used to predict soil available water.

Response:
The sentence has been rephrased in line 226-228 as suggested by the reviewer.

Query:
Page 7, ln 225-228: If model performance relies highly on soil organic matter, why didn't the authors include this information in the SOILWAT model?

Response:
It was stated in Line 15-16 that the model was assessed for its efficiency in predicting soil moisture characteristics using only soil texture and salinity data, as opposed to the use of soil texture and organic matter data which was validated to be sufficient for accurate prediction for soil moisture characteristics in the advent of limited data conditions by Saxton and Rawls (2006) (Lines 75-77). Although, this was not clearly stated in the text, it has now been articulated in the objective (Page 3, Line 84) and materials and methods (Page 6, Line 185-188) to clearly reflect the focus of the study.

Query:
Page 8, ln 239-245: Why didn't include silt adjustments in SOILWAT model to improve its performance for bulk density?

Response:
The authors did not include appropriate local adjustments for silt because there is no provision for silt input and adjustments in the version of the SOILWAT model used.

Query:
Page 8, ln 255-260: Why didn't include appropriate local adjustments for soil organic matter to improve the model results?

Response:
The authors did not include appropriate local adjustments for soil organic matter to improve the model results because we were only considering texture and salinity variable adjustments in this assessment of the SOILWAT model.

Query:
Page 9, ln 272-278: I agree with the authors that soil density can largely affect soil hydraulic conductivity simulations, but can it cause an order of magnitude difference between the measured and predicted soil hydraulic conductivity? Was there anything wrong in the SOILWAT model configurations?

Response:
There was nothing wrong in the SOILWAT model configuration. I think that the exclusion of organic matter adjustments in this prediction study could have been responsible for this disparity as organic matter is a fundamental parameter that strongly influences soil hydraulic conductivity.

Query:

Page 10, ln 329-333: The authors claimed that additional variables can help improve the simulation results from SOILWAT model; however, no results were shown to support this statement. More efforts are needed before using the SOILWAT model to predict soil moisture characteristics for irrigation planning and scheduling.

Response:

The statement has been re-casted to make reference to earlier studies as intended by the authors in Page 11, Line 333,334 and 336.

Query:

Page 15, Table 1: Please correct the format for "moisture-conductivity" and "gravel effects" (center, bold, and underline).

Response:

The format for "moisture-conductivity" and "gravel effects" has been corrected (centralized, bold, and underlined) as suggested by the reviewer.

Query:

Page 21, Fig. 1: Please provide a better resolution figure to replace this one. It's hard to tell the characters in each shaded box.

Response:

Efforts to get a better resolution to replace this version of Figure 1 have been proved abortive.

NB: Due to the revision carried out on the manuscript, additional references have been added to the list of references.

Appreciation

I must sincerely appreciate your criticism, contributions and suggestions, which have tremendously improved this manuscript.

Thank you very much.

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