

Earth Syst. Sci. Data Discuss., author comment AC2
<https://doi.org/10.5194/essd-2021-169-AC2>, 2021
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Reply on RC2

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Author comment on "Development of soil and land cover databases for use in the Soil Water Assessment Tool from Irish National Soil Maps and CORINE Land Cover Maps for Ireland" by Bidroha Basu, Earth Syst. Sci. Data Discuss.,
<https://doi.org/10.5194/essd-2021-169-AC2>, 2021

Comment 1. The manuscript entitled "Development of soil and land cover databases for use in the Soil Water Assessment Tool from Irish National Soil Maps and CORINE Land Cover Maps for Ireland" introduced new soil and land cover databases, which can be directly used to setup the Soil Water Assessment Tool (SWAT) model for Irish catchments. It mainly describes how to develop the new databases but I am afraid that it lacks important validation results. Although the new soil database is based on the national soil information and the hydrological model should give more accurate results using this soil database as input, there is no evidence showing that there is no mistake within this database and the local soil information supports a better model performance than global soil databases, e.g. the global input data for SWAT by Abbaspour et al. (2019). It would be good to show one modelling practice using the new database to check the data quality. In addition, a comparison of the modelling performance using the local and global input data can highlight the added values of the new databases.

Response to Comment 1. The author thanks the reviewer for this valuable comment.

The author wishes to inform that the National Soil Map of Ireland was prepared as part of the Science, Technology and Research & Innovation for the Environment (STRIVE) programme that was jointly funded by Teagasc and Environmental Protection Agency (EPA) Ireland and was led by Teagasc, Cranfield University from the United Kingdom, and University College Dublin, Ireland. The maps were prepared by combining information related to key soil formation factors such as geology, vegetation and topography obtained from land surveyors. Subsequently, the information was mapped into a soil predictive model for the entire country, and a level 1 soil map output was generated. The level 1 maps were then combined with previously mapped soil data, other geological variables such as subsoil permeability, pre-existing map data obtained from National Soil Survey from 1959-1980's at 1:126,720 scale, and General Soil Map of Ireland developed in 1969 and 1980 at 1:575,000 scale, to develop a level 2 National Soil map for Ireland. Accuracy assessment of the final map was performed at ~15,000 training data points and more than 10,000 random points covering entire Ireland. The accuracy assessment was performed for each county in Ireland separately and soil maps corresponding to each county was finalized after ensuring that the accuracy is at least 75% or higher. Details on the accuracy assessment can be found in Fealy et al. (2009). Those details have been included in the revised manuscript (please see page 3, lines 75-84).

Fealy, R. M., Green, S., Loftus, M., Meehan, R., Radford, T., Cronin, C. and Bulfin, M.: Teagasc EPA Soil and Subsoils Mapping Project-Final Report. Volume I. Teagasc. Dublin, 2009.

Based on the comment of the reviewer, a SWAT model has been developed for a chosen catchment in Ireland. The selected catchment belongs to River Rye (Ryewater), which is a tributary of River Liffey, the main river in capital of Ireland, Dublin. River Rye meets Liffey at Leixlip. River discharge data for River Rye at Leixlip stream gauge station has been available from Office of Public Works (OPW) website (<https://waterlevel.ie/0000009001/>) from 1956 onwards at daily scale. The catchment area upstream of the stream gauge station at Leixlip is 215 sq. km. Details on the SWAT model has been included in the revised manuscript (please see Section 7).

In order to compare the performance of the National Soil Map of Ireland with FAO/UNESCO Soil Map of the World, the developed SWAT model was re-run by replacing the National Soil Map of Ireland with the FAO/UNESCO World Soil Map, while retaining all the other variables (DEM, watershed boundary, landcover, slope information, weather variables) the same. Comparison of monthly maximum and monthly mean runoff obtained based on the two SWAT models with observed streamflow discharge at Leixlip stream gauge were shown in Figure 10 of the revised manuscript.

Other minor comments:

Comment 2. Introduction: the authors ignored the global input data for SWAT (Abbaspour et al. 2019), which can also be used for Ireland. The authors should discuss it why it is not appropriate for the applications in Ireland. In addition, it would be good to give the most potential applications of SWAT for Ireland in the near future.

Response to Comment 2. As per the suggestion of the reviewer, description of the FAO/UNESCO World Soil Map has been included in the revised manuscript. It needs to be noted that the FAO/UNESCO World Soil Map was developed at 1:5,000,000 scale, while the National Soil Map of Ireland was developed at 1:250,000 scale. This indicate that the length of each grid/pixel in the FAO/UNESCO World Soil Map is 20 times coarser when compared to that of the National Soil Map of Ireland, which is evident by visual comparison between the two maps (please see Figures 2 and 4). Furthermore, the National Soil Map of Ireland consists of a total of 69 soil types, while that for the FAO/UNESCO World Soil Map consider 12 soil types for Ireland. As mentioned in response to Comment 1 of the reviewer, the National Soil Map for Ireland has been validated by for entire Ireland. A further point to be noted is that the National Soil Map of Ireland considers up to 5 subsoil layers and a depth till 1650mm, while the FAO/UNESCO World Soil Map consider two soil layers (one top soil of depth 300mm and a subsoil of depth 700mm) for the entire World (Abbaspour et al. 2019) while developing the SWAT soil database. Another point to be noted is that the SWAT database SWAT2012.mdb for the FAO/UNESCO World Soil Map available at Water Weather Energy Ecosystem website <https://www.2w2e.com/> is not an open source data, hence either the user has to purchase it or need to create the soil database for the study area using the description provided in Abbaspour et al. (2019). Those details have been included in the revised manuscript (please see section 2.4).

The author thanks the reviewer for the comment regarding most potential applications of

SWAT for Ireland. Potential applications of SWAT for Ireland have been included in the conclusions section of the revised manuscript (please see page 13, lines 357-362).

Comment 3. Page 5: the authors used the equations from Saxton and Rawls (2006) to develop the soil parameters, but they didn't tell why to select these equations. In Abbaspour et al. (2019), they listed many equations, and they selected the appropriate ones based on the region.

Response to Comment 3. The author thanks the reviewer for the comment. Please note that there are no unique equations that are found to perform better in estimation of moist bulk density, available water capacity of the soil layer and saturated hydraulic conductivity. Some of those equations used by Abbaspour et al. (2019) requires lesser soil related variables, while the other equations need more soil-related variables for estimation of the three parameters. The reason for choosing Saxton and Rawls (2006) for Ireland is that all the soil-related variables needed are available for Ireland from Teagasc. However, alternative equations could have been used as well. This point has been included in the revised manuscript (please see page 6, lines 163-165).

Comment 4. Page 8: the authors suggested the measurements, E-OBS and ERA5 data as the meteorological input. However, none of them can provide all meteorological variables for all catchments. It would be good to know the author's suggestions how to select and apply these databases for SWAT modelling.

Response to Comment 4. The author wishes to inform that during the preparation of the manuscript for the initial stage, E-OBS database provided four of the five meteorological variables (excluding wind speed) required for the SWAT model at 0.1° grid interval. However, the E-OBS database has been revised and daily mean wind speed has been included in the new version. Hence, all the five meteorological variables needed for the SWAT model are available from 1950 to 2019 at daily time scale at 0.1° grid interval for Europe in the recent version 23.1e. The ERA5-land database, however, does not include the relative humidity. In order to run the SWAT model for Ireland at daily scale, COPERNICUS E-OBS database can be solely used. However, in situations where the SWAT model needs to be run at sub-daily time scale, ERA5-land data can be one option. It needs to be noted that SWAT requires only the rainfall data at sub-daily time scale and the other four meteorological data at daily time scale, even though the model is run at sub-daily time scale. For this purpose, the rainfall data obtained at hourly time scale from ERA5-land database can be combined with the maximum and minimum temperature, relative humidity, wind speed and solar radiation obtained from E-OBS at daily time scale and fed into the SWAT model to obtain runoff at sub-daily time scale. Those points have been included in the revised manuscript (please see pages 9, lines 258-262).