Developing a high-resolution global digital soil map for enhanced hydrological modeling with the SWAT+ model

International Soil and Water Assessment Tool (SWAT)
Conference 26-30 June 2023

Aarhus University, Department of Ecoscience, Denmark.

Adrián López-Ballesteros, Anders Nielsen, Gerardo Castellanos-Osorio, Dennis Trolle, Javier Senent-Aparicio.

PhD in Computer Technology and Environmental Engineering.
Catholic University of Murcia (Spain).

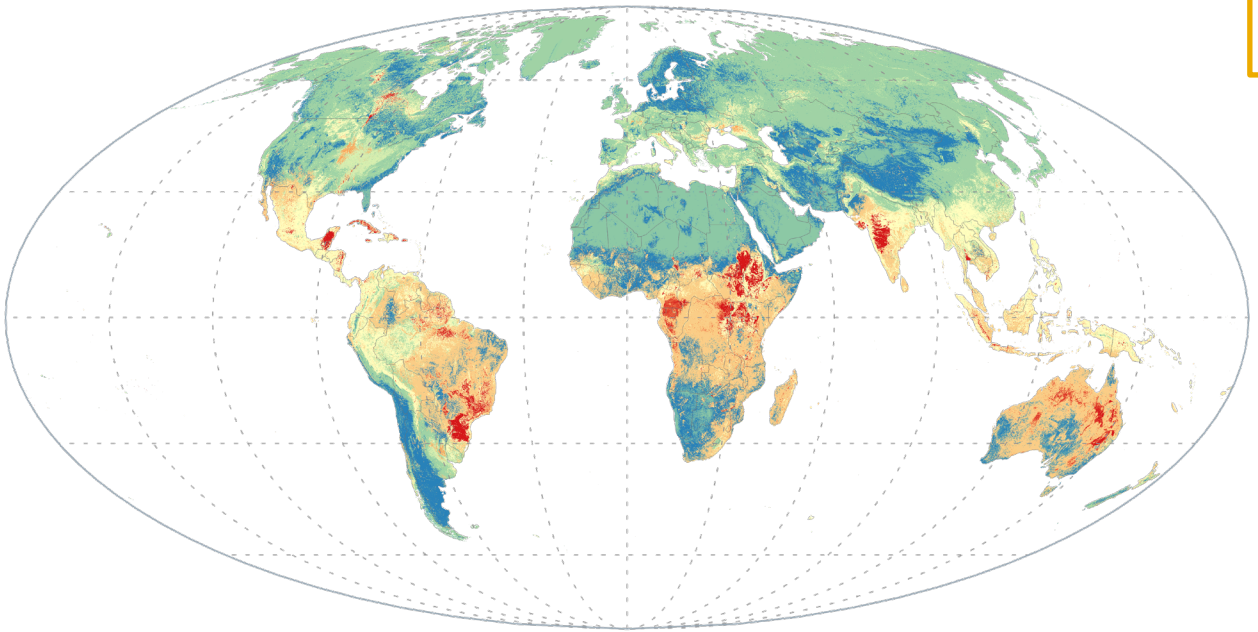
AARHUS UNIVERSITY
DEPARTMENT OF ECOSCIENCE

Soil & Water Assessment Tool SWAT

UCAM
UNIVERSIDAD CATÓLICA DE MURCIA

SMART LAGOON

What are we offering?



UCAM
UNIVERSIDAD CATÓLICA DE MURCIA

+

WATERITECH

- **DSOLMap:**
  - New soil map for SWAT+.
  - Global scale.
  - Spatial resolution 250 m.
  - 6 soil horizons (up to 2 m).
  - For free.

INDEX

INTRODUCTION

- ✓ **Sanchez et al. (2009)**

POLICYFORUM

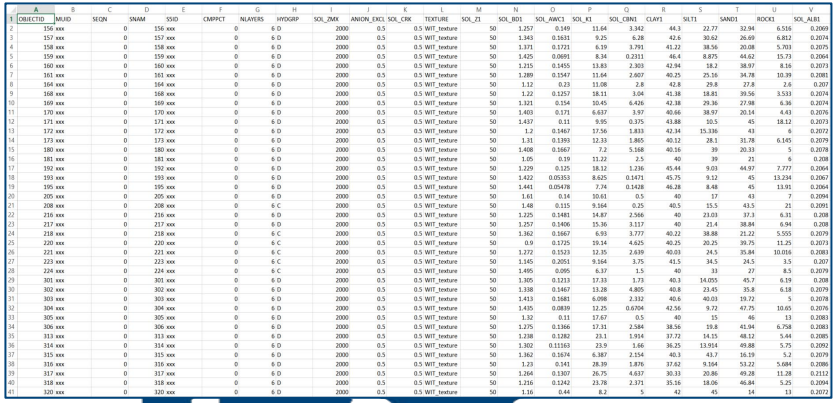
ENVIRONMENTAL SCIENCE

Digital Soil Map of the World

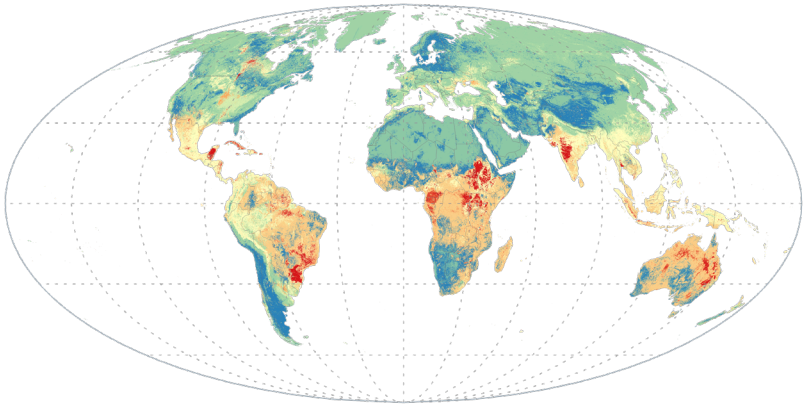
Pedro A. Sanchez,[1*] Sonya Ahamed,[1] Florence Carré,[2] Alfred E. Hartemink,[3] Jonathan Hempel,[4] Jeroen Huising,[5] Philippe Lagacherie,[6] Alex B. McBratney,[7] Neil J. McKenzie,[8] Maria de Lourdes Mendonça-Santos,[9] Budiman Minasny,[7] Luca Montanarella,[2] Peter Okoth,[5] Cheryl A. Palm,[1] Jeffrey D. Sachs,[1] Keith D. Shepherd,[10] Tor-Gunnar Vågen,[10] Bernard Vanlauwe,[5] Markus G. Walsh,[1] Leigh A. Winowiecki,[1] Gan-Lin Zhang[11]

- ➢ **Soil database**
- ➢ **GIS layer**

Spatial database of soil properties

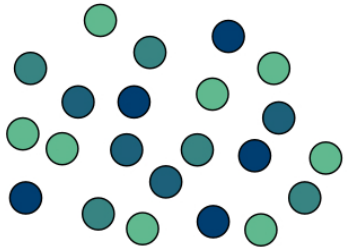


+



Digital Soil Open Land Map (DSOLMap)

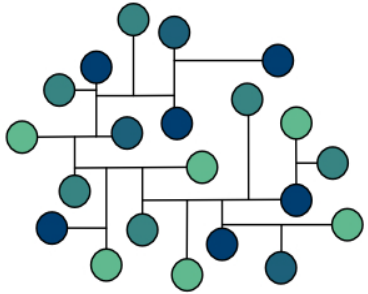
- **Dataset vs Database:**



A **dataset** is a collection of data generally associated with a unique work.

OpenLandMap

www.openlandmap.org



A **database** is an organized collection of data stored as multiple datasets.

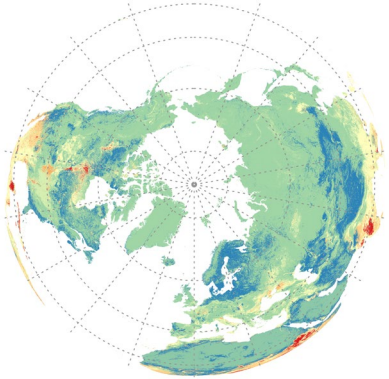
python

www.python.org

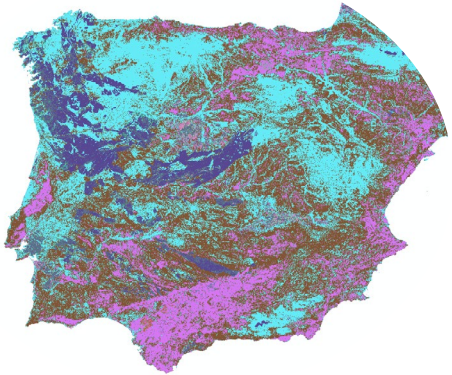
Digital Soil Open Land Map (DSOLMap)

❖ **Main features:**

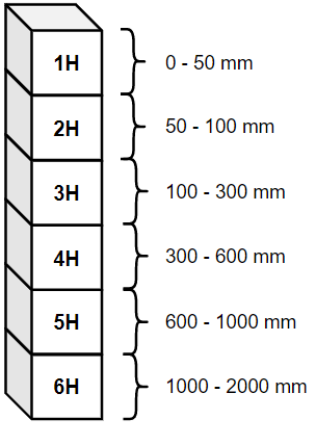
✓ **Global scale**



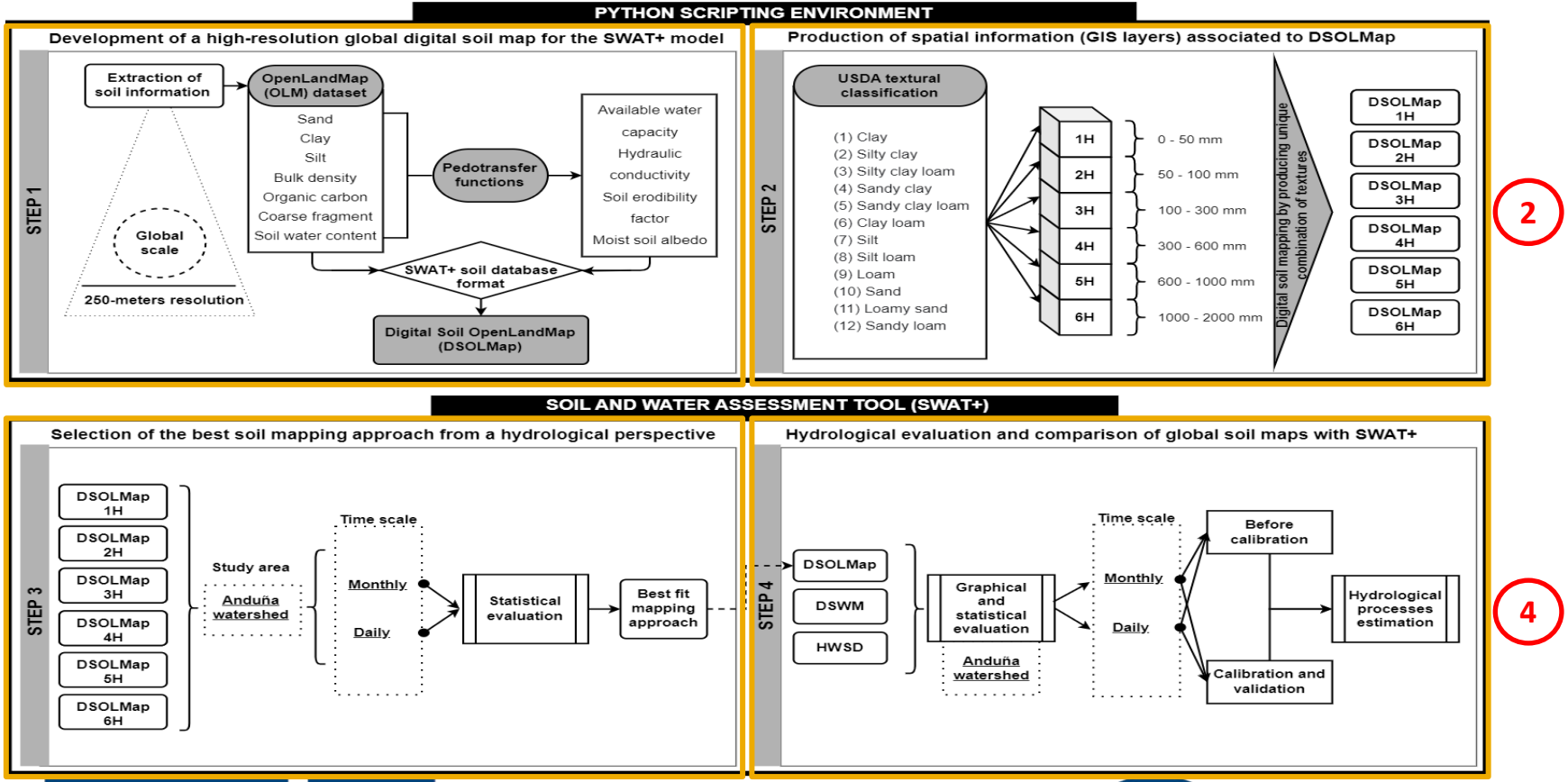
✓ **250-m resolution**



✓ **6 soil horizons**



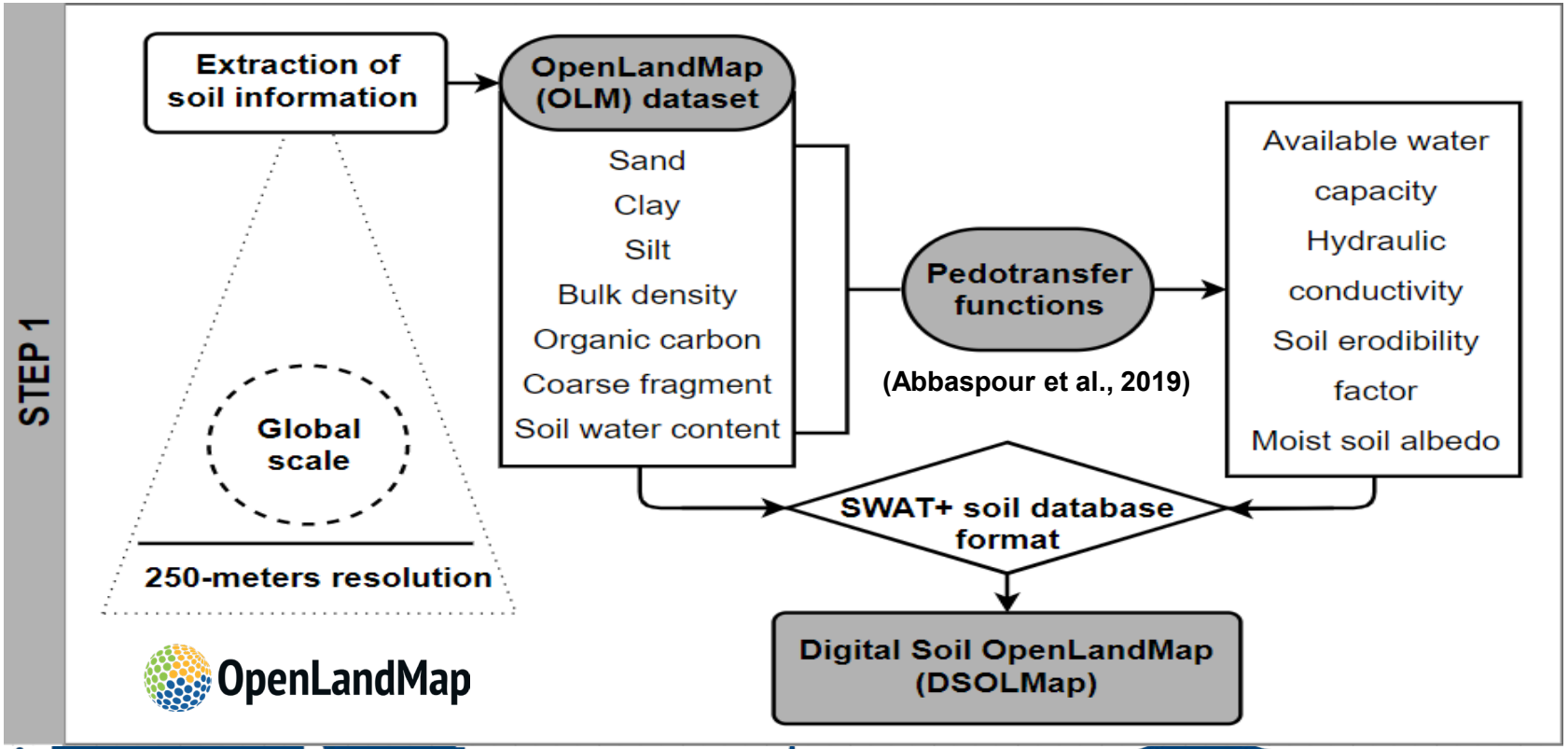
DSOLMap flowchart



METHODOLOGY

STEP 1

Development a global soil database for the SWAT+ model



OpenLandMap
www.openlandmap.org

An **open-access web-GIS system** for **global environmental layers** created and hosted by the **OpenGeoHub foundation**.

OpenGeoHUB
www.opengeohub.org

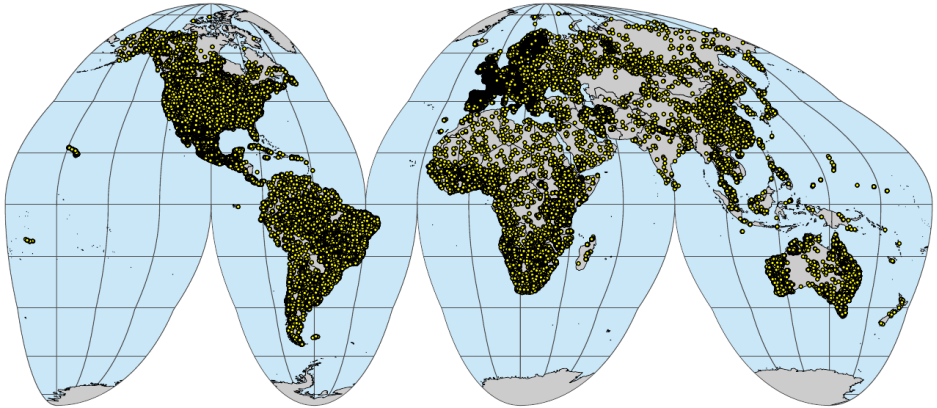


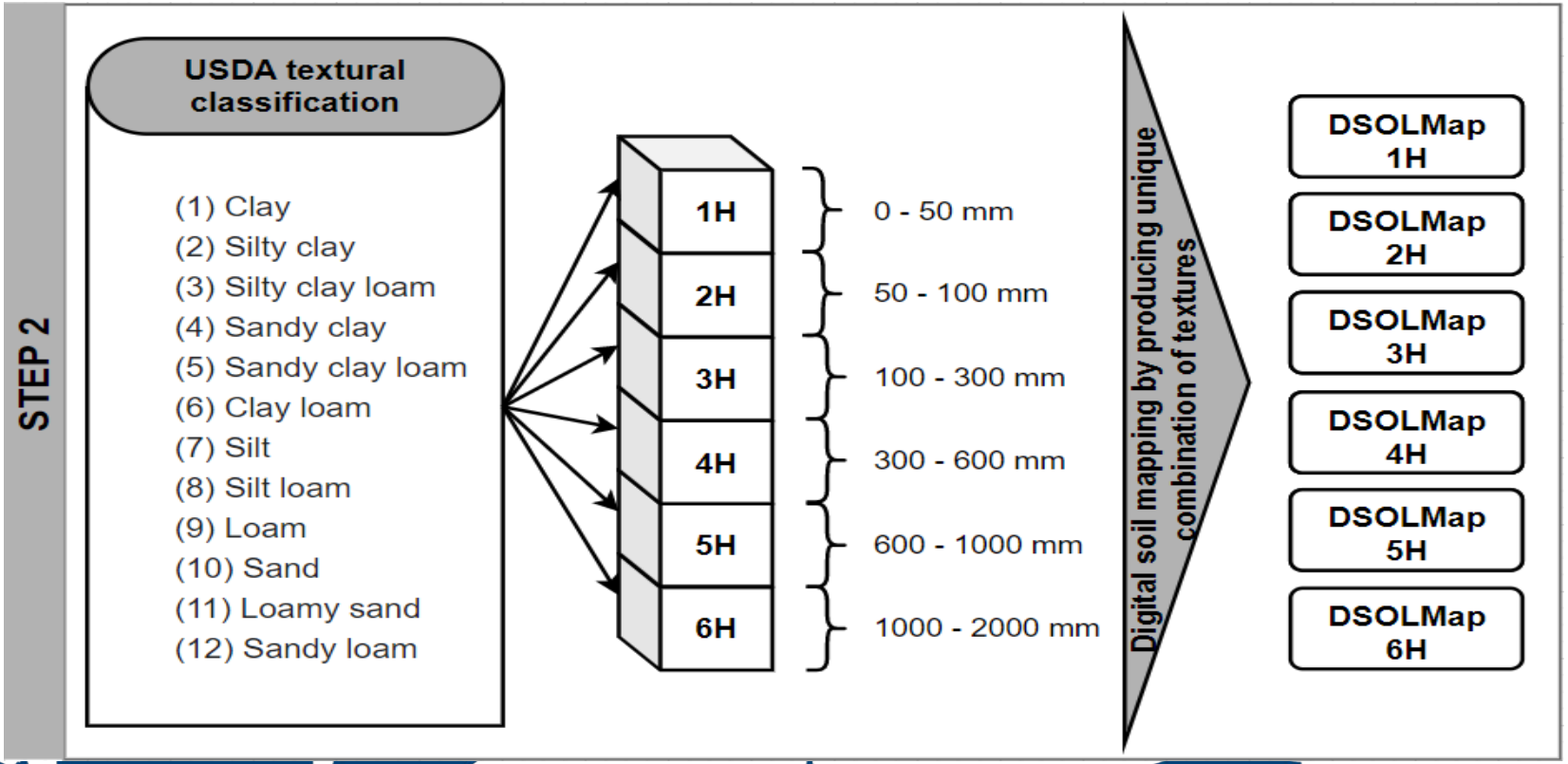
Table 1. Main national and international soil point data sources.

Source	Acronym	Reference
US Government National Cooperative Soil Characterization Database	NSCD	https://ncsslabdatamart.sc.egov.usda.gov
Africa Soil Profiles Database	AfSP	https://www.isric.org/projects/africa-soil-profiles-database-afsp
Land Use/Cover Area Frame Statistical Survey Soil database	LUCAS	https://esdac.jrc.ec.europa.eu/resource-type/soil-point-data
Repositório Brasileiro Livre para Dados Abertos do Solo	FEBR	https://www.pedometria.org/febr/
The Northern Circumpolar Soil Carbon Database	NCSCD	https://bolin.su.se/data/ncscd/
World Soil Information Service Soil Profile Database	WoSIS	https://www.isric.org/explore/wosis

- Global soil layers.
- 3D (longitude, latitude, depth) machine learning predictions.
- >350,000 soil observations.

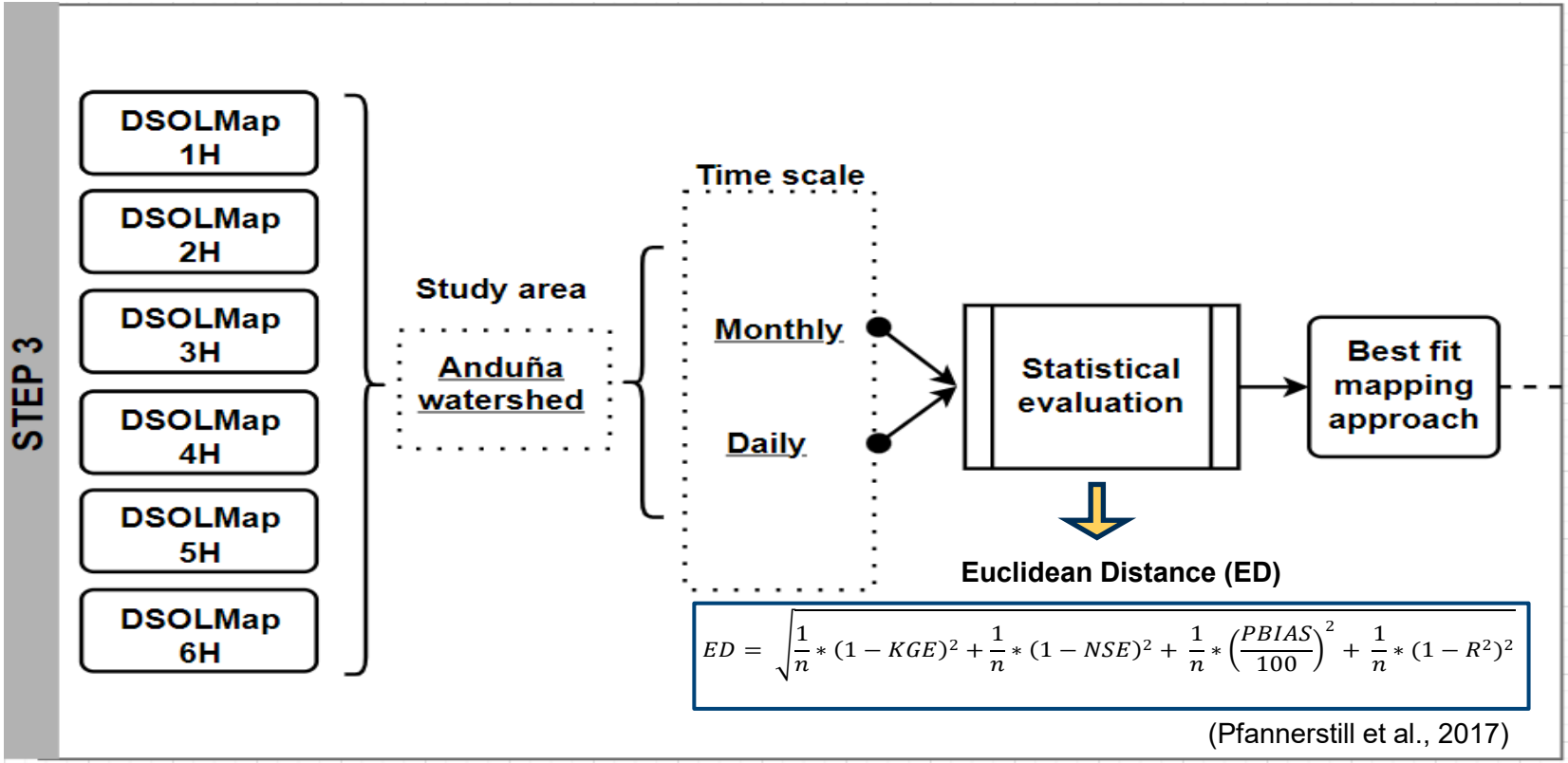
STEP 2

Production of spatial information (GIS layers) associated to DSOLMap



STEP 3

Selection of the best soil mapping approach from a hydrological point of view



(Pfannerstill et al., 2017)

Study area

Anduña watershed

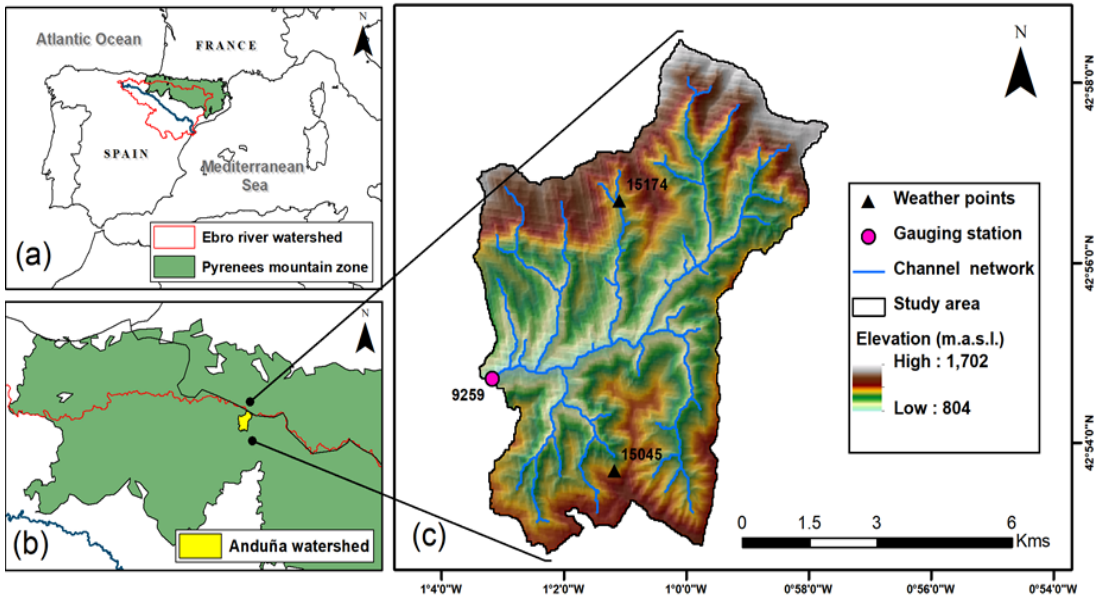
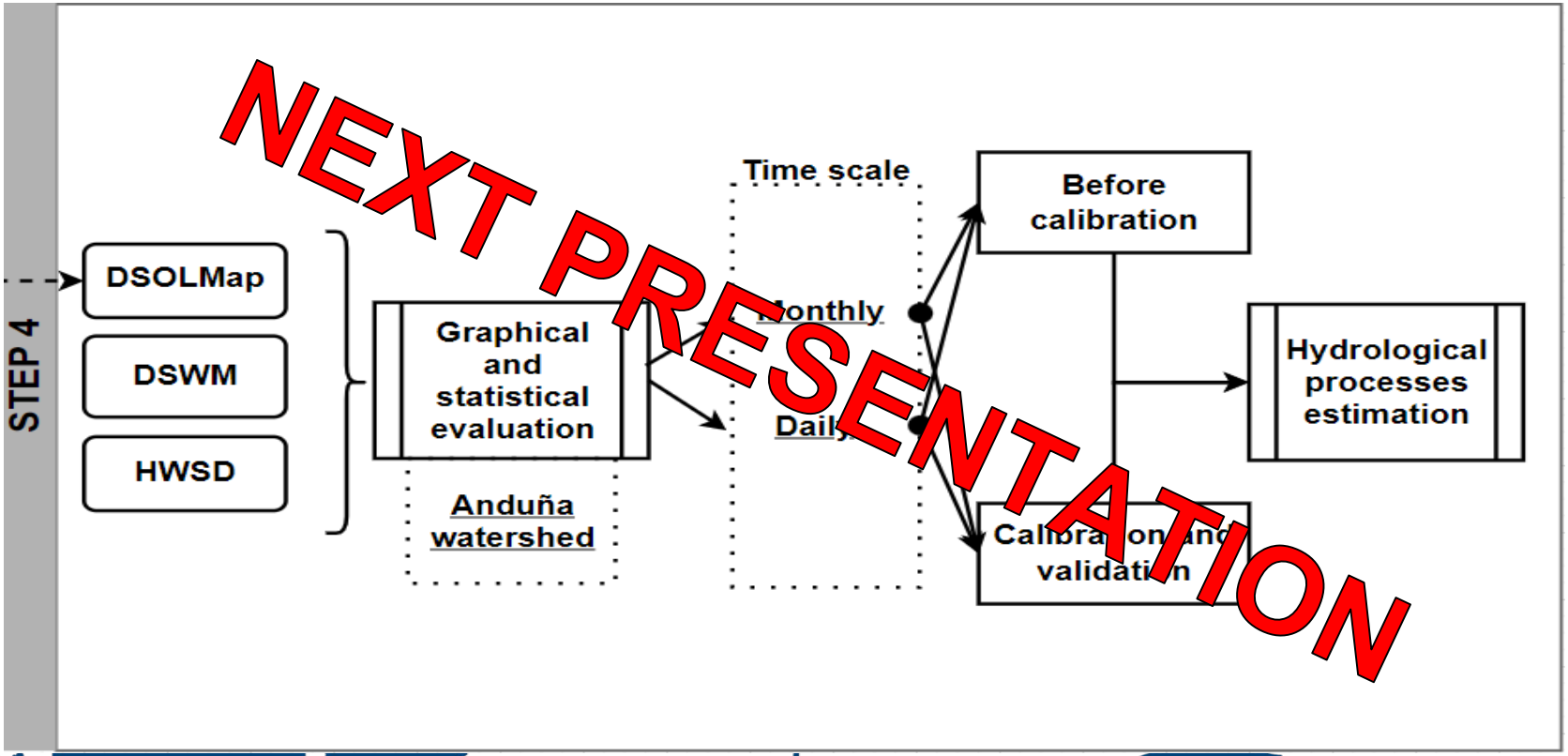


Table 2. Main characteristics of the Anduña watershed.

Anduña watershed	
Area	47 km^2
Climate	Oceanic
Precipitation	1,740 mm/year
Altitude	1,129 m.a.s.l
Land cover	~80% forest

STEP 4

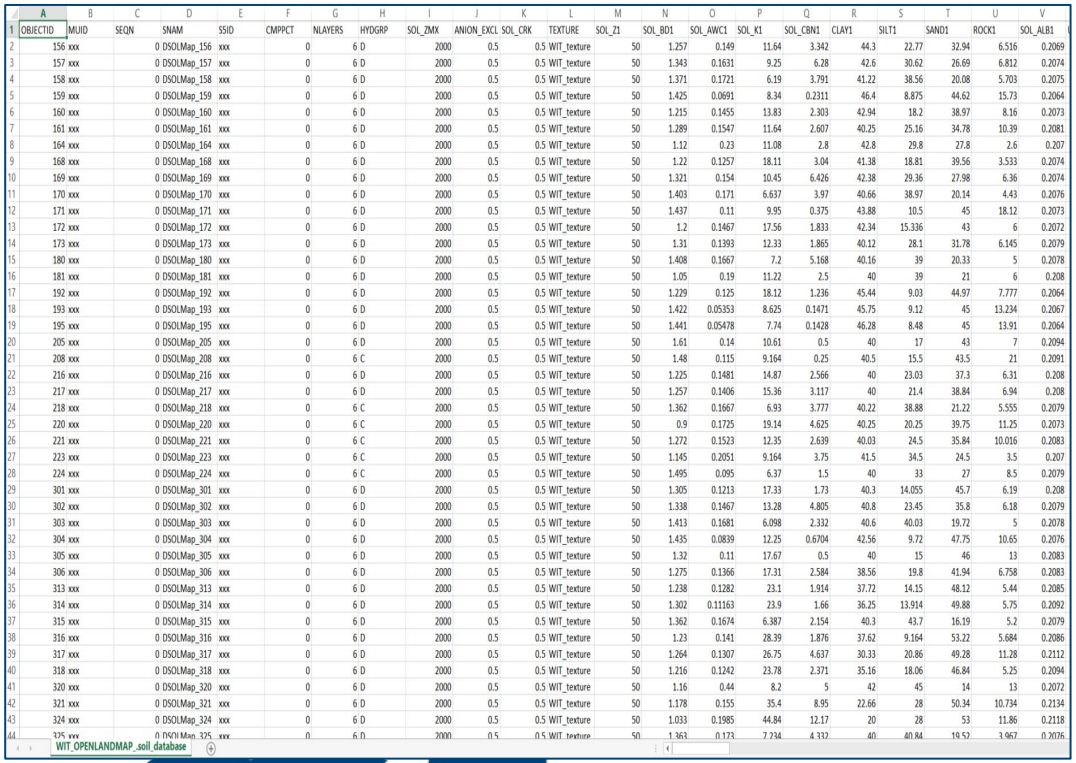
- **Hydrological evaluation and comparison of DSOLMap with other global soil maps**



RESULTS

Digital Soil Open Land Map (DSOLMap)

STEP 1: Development a global soil database for the SWAT+ model



OBJECTID	MUID	SEQN	SNAM	SSID	CMPPCT	NLAYERS	HYDGRP	SOL_ZMX	ANION_EXCL	SOL_CRK	TEXTURE	SOL_Z1	SOL_BD1	SOL_AWC1	SOL_K1	SOL_CBN1	CLAY1	SILT1	SAND1	ROCK1	SOL_ALB1
156	xxx	0	DSOLMap_156	xxx	0	6	D	2000	0.5	0.5	WIT_texture	50	1.257	0.149	11.64	3.342	44.3	22.77	32.94	6.516	0.2069
157	xxx	0	DSOLMap_157	xxx	0	6	D	2000	0.5	0.5	WIT_texture	50	1.343	0.1631	9.25	6.28	42.6	30.62	26.69	6.812	0.2074
158	xxx	0	DSOLMap_158	xxx	0	6	D	2000	0.5	0.5	WIT_texture	50	1.371	0.1721	6.19	3.791	41.22	38.56	20.08	5.703	0.2075
159	xxx	0	DSOLMap_159	xxx	0	6	D	2000	0.5	0.5	WIT_texture	50	1.425	0.0691	8.34	0.2311	46.4	8.875	44.62	15.73	0.2064
160	xxx	0	DSOLMap_160	xxx	0	6	D	2000	0.5	0.5	WIT_texture	50	1.215	0.1455	13.83	2.303	42.94	18.2	38.97	8.16	0.2073
161	xxx	0	DSOLMap_161	xxx	0	6	D	2000	0.5	0.5	WIT_texture	50	1.289	0.1547	11.64	2.607	40.25	25.16	34.78	10.39	0.2081
164	xxx	0	DSOLMap_164	xxx	0	6	D	2000	0.5	0.5	WIT_texture	50	1.12	0.23	11.08	2.8	42.8	29.8	27.8	2.6	0.207
168	xxx	0	DSOLMap_168	xxx	0	6	D	2000	0.5	0.5	WIT_texture	50	1.22	0.1257	18.11	3.04	41.38	18.81	39.56	3.533	0.2074
169	xxx	0	DSOLMap_169	xxx	0	6	D	2000	0.5	0.5	WIT_texture	50	1.321	0.154	10.45	6.426	42.38	29.36	27.98	6.36	0.2074
170	xxx	0	DSOLMap_170	xxx	0	6	D	2000	0.5	0.5	WIT_texture	50	1.403	0.171	6.637	3.97	40.66	38.97	20.14	4.43	0.2076
171	xxx	0	DSOLMap_171	xxx	0	6	D	2000	0.5	0.5	WIT_texture	50	1.437	0.11	9.95	0.375	43.88	10.5	45	18.12	0.2073
172	xxx	0	DSOLMap_172	xxx	0	6	D	2000	0.5	0.5	WIT_texture	50	1.2	0.1467	17.56	1.833	42.34	15.336	43	6	0.2072
173	xxx	0	DSOLMap_173	xxx	0	6	D	2000	0.5	0.5	WIT_texture	50	1.31	0.1393	12.33	1.865	40.12	28.1	31.78	6.145	0.2079
180	xxx	0	DSOLMap_180	xxx	0	6	D	2000	0.5	0.5	WIT_texture	50	1.408	0.1667	7.2	5.168	40.16	39	20.33	5	0.2078
181	xxx	0	DSOLMap_181	xxx	0	6	D	2000	0.5	0.5	WIT_texture	50	1.05	0.19	11.22	2.5	40	39	21	6	0.208
192	xxx	0	DSOLMap_192	xxx	0	6	D	2000	0.5	0.5	WIT_texture	50	1.229	0.125	18.12	1.236	45.44	9.03	44.97	7.777	0.2064
193	xxx	0	DSOLMap_193	xxx	0	6	D	2000	0.5	0.5	WIT_texture	50	1.422	0.05353	8.625	0.1471	45.75	9.12	45	13.234	0.2067
195	xxx	0	DSOLMap_195	xxx	0	6	D	2000	0.5	0.5	WIT_texture	50	1.441	0.05478	7.74	0.1428	46.28	8.48	45	13.91	0.2064
205	xxx	0	DSOLMap_205	xxx	0	6	D	2000	0.5	0.5	WIT_texture	50	1.61	0.14	10.61	0.5	40	17	43	7	0.2094
208	xxx	0	DSOLMap_208	xxx	0	6	C	2000	0.5	0.5	WIT_texture	50	1.48	0.115	9.164	0.25	40.5	15.5	43.5	21	0.2091
216	xxx	0	DSOLMap_216	xxx	0	6	D	2000	0.5	0.5	WIT_texture	50	1.225	0.1481	14.87	2.566	40	23.03	37.3	6.31	0.208
217	xxx	0	DSOLMap_217	xxx	0	6	D	2000	0.5	0.5	WIT_texture	50	1.257	0.1406	15.36	3.117	40	21.4	38.84	6.94	0.208
218	xxx	0	DSOLMap_218	xxx	0	6	C	2000	0.5	0.5	WIT_texture	50	1.362	0.1667	6.93	3.777	40.22	38.88	21.22	5.555	0.2079
220	xxx	0	DSOLMap_220	xxx	0	6	C	2000	0.5	0.5	WIT_texture	50	0.9	0.1725	19.14	4.625	40.25	20.25	39.75	11.25	0.2073
221	xxx	0	DSOLMap_221	xxx	0	6	C	2000	0.5	0.5	WIT_texture	50	1.272	0.1523	12.35	2.639	40.03	24.5	35.84	10.016	0.2083
223	xxx	0	DSOLMap_223	xxx	0	6	C	2000	0.5	0.5	WIT_texture	50	1.145	0.2051	9.164	3.75	41.5	34.5	24.5	3.5	0.207
224	xxx	0	DSOLMap_224	xxx	0	6	C	2000	0.5	0.5	WIT_texture	50	1.495	0.095	6.37	1.5	40	33	27	8.5	0.2079
301	xxx	0	DSOLMap_301	xxx	0	6	D	2000	0.5	0.5	WIT_texture	50	1.305	0.1213	17.33	1.73	40.3	14.055	45.7	6.19	0.208
302	xxx	0	DSOLMap_302	xxx	0	6	D	2000	0.5	0.5	WIT_texture	50	1.338	0.1467	13.28	4.805	40.8	23.45	35.8	6.18	0.2079
303	xxx	0	DSOLMap_303	xxx	0	6	D	2000	0.5	0.5	WIT_texture	50	1.413	0.1681	6.098	2.332	40.6	40.03	19.72	5	0.2078
304	xxx	0	DSOLMap_304	xxx	0	6	D	2000	0.5	0.5	WIT_texture	50	1.435	0.0839	12.25	0.6704	42.56	9.72	47.75	10.65	0.2076
305	xxx	0	DSOLMap_305	xxx	0	6	D	2000	0.5	0.5	WIT_texture	50	1.32	0.11	17.67	0.5	40	15	46	13	0.2083
306	xxx	0	DSOLMap_306	xxx	0	6	D	2000	0.5	0.5	WIT_texture	50	1.275	0.1366	17.31	2.584	38.56	19.8	41.94	6.758	0.2083
313	xxx	0	DSOLMap_313	xxx	0	6	D	2000	0.5	0.5	WIT_texture	50	1.238	0.1282	23.1	1.914	37.72	14.15	48.12	5.44	0.2085
314	xxx	0	DSOLMap_314	xxx	0	6	D	2000	0.5	0.5	WIT_texture	50	1.302	0.11163	23.9	1.66	36.25	13.914	49.88	5.75	0.2092
315	xxx	0	DSOLMap_315	xxx	0	6	D	2000	0.5	0.5	WIT_texture	50	1.362	0.1674	6.387	2.154	40.3	43.7	16.19	5.2	0.2079
316	xxx	0	DSOLMap_316	xxx	0	6	D	2000	0.5	0.5	WIT_texture	50	1.23	0.141	28.39	1.876	37.62	9.164	53.22	5.684	0.2086
317	xxx	0	DSOLMap_317	xxx	0	6	D	2000	0.5	0.5	WIT_texture	50	1.264	0.1307	26.75	4.637	30.33	20.86	49.28	11.28	0.2112
318	xxx	0	DSOLMap_318	xxx	0	6	D	2000	0.5	0.5	WIT_texture	50	1.216	0.1242	23.78	2.371	35.16	18.06	46.84	5.25	0.2094
320	xxx	0	DSOLMap_320	xxx	0	6	D	2000	0.5	0.5	WIT_texture	50	1.16	0.44	8.2	5	42	45	14	13	0.2072
321	xxx	0	DSOLMap_321	xxx	0	6	D	2000	0.5	0.5	WIT_texture	50	1.178	0.155	35.4	8.95	22.66	28	50.34	10.734	0.2134
324	xxx	0	DSOLMap_324	xxx	0	6	D	2000	0.5	0.5	WIT_texture	50	1.033	0.1985	44.84	12.17	20	28	53	11.86	0.2118
325	xxx	0	DSOLMap_325	xxx	0	6	D	2000	0.5	0.5	WIT_texture	50	1.363	0.173	7.234	4.332	40	40.84	19.52	3.967	0.2076

WIT_OPENLANDMAP_soil_database

DSOLMap database

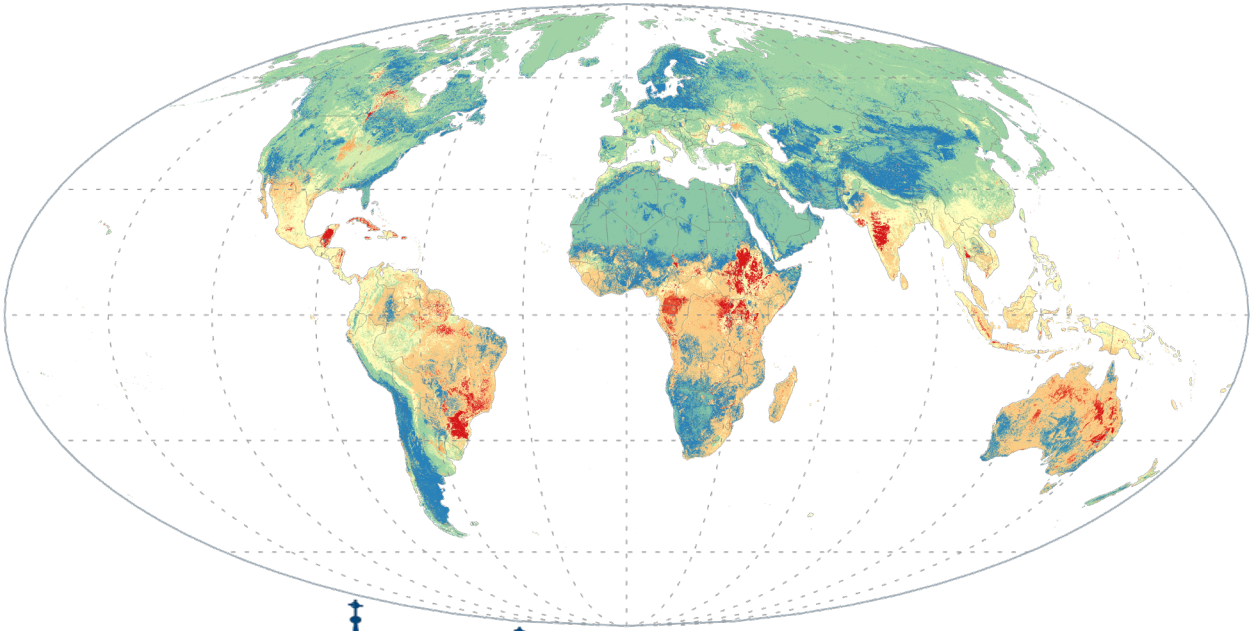
Table 3. SWAT+ required soil properties

Parameter	Description	Units
NLY	Number of soil horizons within soil profile	-
ZMX	Maximum rooting depth of soil profile	mm
Z[1]	Depth from surface to bottom of soil horizon	mm
BD[1]	Soil bulk density	g/cm^3
AWC[1]	Available water capacity	mm/mm
K[1]	Saturated hydraulic conductivity	mm/hr
CBN[1]	Organic carbon content	% of soil weight
CLAY[1]	Clay fraction	% of soil weight
SILT[1]	Silt fraction	% of soil weight
SAND[1]	Sand fraction	% of soil weight
ROCK[1]	Coarse fragment content	% of total weight
ALB	Moist soil albedo of topsoil horizon	-
USLE_K	Soil erodibility factor of topsoil horizon	cm/day

[1]Values per soil horizon

Digital Soil Open Land Map (DSOLMap)

STEP 2: Production of spatial information (GIS layers) associated to DSOLMap



DSOLMap raster layer

	A	B	C	D
1	OBJECTID	SNAM		
2	156	DSOLMap_156		
3	157	DSOLMap_157		
4	158	DSOLMap_158		
5	159	DSOLMap_159		
6	160	DSOLMap_160		
7	161	DSOLMap_161		
8	164	DSOLMap_164		
9	168	DSOLMap_168		
10	169	DSOLMap_169		
11	170	DSOLMap_170		
12	171	DSOLMap_171		
13	172	DSOLMap_172		
14	173	DSOLMap_173		
15	180	DSOLMap_180		
16	181	DSOLMap_181		
17	192	DSOLMap_192		
18	193	DSOLMap_193		
19	195	DSOLMap_195		
20	205	DSOLMap_205		
21	208	DSOLMap_208		
22	216	DSOLMap_216		
23	217	DSOLMap_217		
24	218	DSOLMap_218		
25	220	DSOLMap_220		
26	221	DSOLMap_221		
27	223	DSOLMap_223		
28	224	DSOLMap_224		
29	301	DSOLMap_301		
30	302	DSOLMap_302		
31	303	DSOLMap_303		
32	304	DSOLMap_304		
33	305	DSOLMap_305		
34	306	DSOLMap_306		
35	313	DSOLMap_313		
36	314	DSOLMap_314		
37	315	DSOLMap_315		
38	316	DSOLMap_316		
39	317	DSOLMap_317		
40	318	DSOLMap_318		
41	320	DSOLMap_320		
42	321	DSOLMap_321		
43	324	DSOLMap_324		
44	325	DSOLMap_325		

WIT_OPENLANDMAP_.soil_database_

DSOLMap lookup table

Digital Soil Open Land Map (DSOLMap)

STEP 3: Selection of the best soil mapping approach from a hydrological point of view

SWAT+ SOIL & WATER ASSESSMENT TOOL

(Before calibration)

- DSOLMap 1H
- DSOLMap 2H
- DSOLMap 3H
- DSOLMap 4H
- DSOLMap 5H
- DSOLMap 6H

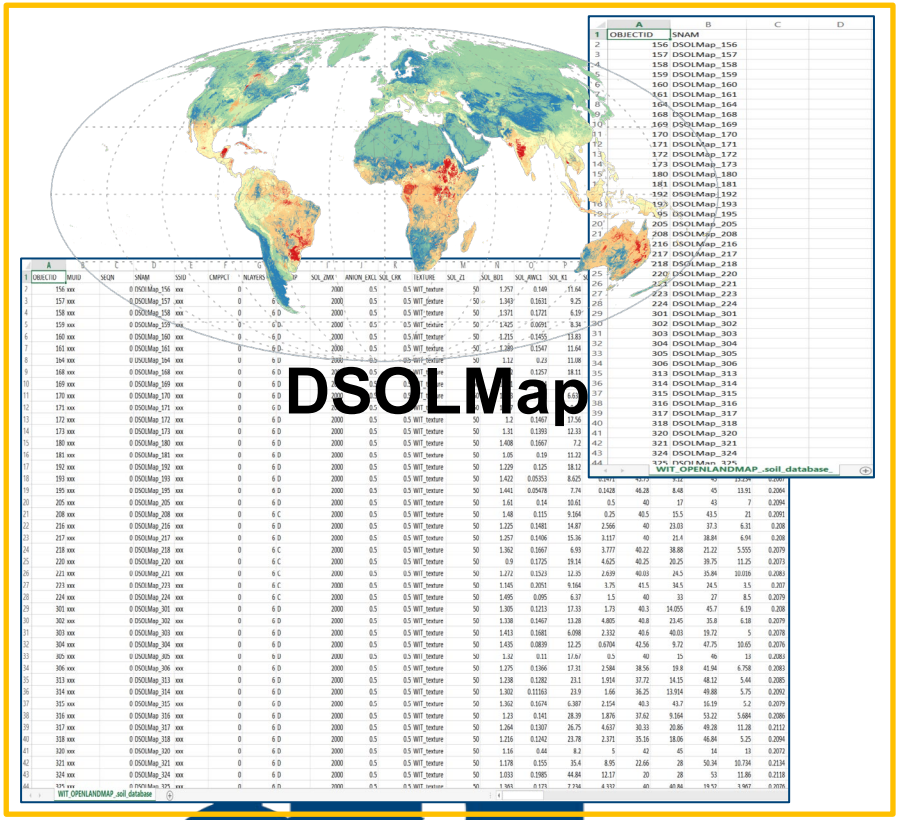
Table 4. Number of SMUs and statistical indices obtained in the Anduña watershed

Digital Soil Property Map	SMU	HRUs	Daily					Monthly				
			KGE	NSE	PBIAS	R^2	ED	KGE	NSE	PBIAS	R^2	ED
DSOLMap 1H	2	857	0.54	0.01	-0.34	0.41	0.620	0.88	0.78	-0.93	0.8	0.160
DSOLMap 2H	4	1166	0.54	0.01	-0.37	0.41	0.620	0.87	0.78	-0.95	0.8	0.162
DSOLMap 3H	5	1335	0.53	-0.02	-0.27	0.41	0.634	0.87	0.78	-0.86	0.81	0.159
DSOLMap 4H	6	1414	0.53	-0.03	-0.26	0.41	0.638	0.87	0.78	-0.85	0.81	0.159
DSOLMap 5H	9	1484	0.52	-0.03	-0.26	0.41	0.640	0.87	0.78	-0.85	0.81	0.159
DSOLMap 6H	12	1535	0.52	-0.03	-0.26	0.41	0.640	0.87	0.78	-0.85	0.81	0.159

DSOLMap 3H

Digital Soil Open Land Map (DSOLMap)

UCAM



Soil suplementary information

SoilID	TextureID	Order	Suborder	Group	Horizon_1	Horizon_2	Horizon_3
156	11010101	Vertisols	Usterts	chromusterts	clay	clay	clay
157	11010102	Inceptisols	Ochrepts	xerochrepts	clay	clay	silty clay
158	11010103	Inceptisols	Ochrepts	xerochrepts	clay	clay	silty clay loam
159	11010104	Entisols	Psamments	torripsamments	clay	clay	sandy clay
160	11010105	Mollisols	Ustolls	haplustolls	clay	clay	sandy clay loam
161	11010106	Vertisols	Usterts	chromusterts	clay	clay	clay loam
164	11010109	Alfisols	Udalfs	hapludalfs	clay	clay	loam
168	11010201	Ultisols	Udults	paleudults	clay	silty clay	clay
169	11010202	Inceptisols	Ochrepts	cryochrepts	clay	silty clay	silty clay
170	11010203	Inceptisols	Ochrepts	xerochrepts	clay	silty clay	silty clay loam
171	11010204	Entisols	Psamments	torripsamments	clay	silty clay	sandy clay
172	11010205	Mollisols	Ustolls	haplustolls	clay	silty clay	sandy clay loam
173	11010206	Inceptisols	Ochrepts	xerochrepts	clay	silty clay	clay loam
180	11010301	Mollisols	Aquolls	calciaquolls	clay	silty clay loam	clay
181	11010302	Entisols	Aquents	fluvaquents	clay	silty clay loam	silty clay
192	11010401	Oxisols	Orthox	haplorthox	clay	sandy clay	clay
193	11010402	Entisols	Psamments	torripsamments	clay	sandy clay	silty clay
195	11010404	Entisols	Psamments	torripsamments	clay	sandy clay	sandy clay
205	11010502	Vertisols	Usterts	chromusterts	clay	sandy clay loam	silty clay
208	11010505	Aridisols	Calcids	petrocalcids	clay	sandy clay loam	sandy clay loam
216	11010601	Vertisols	Usterts	chromusterts	clay	clay loam	clay
217	11010602	Oxisols	Ustox	acrustox	clay	clay loam	silty clay
218	11010603	Alfisols	Udalfs	hapludalfs	clay	clay loam	silty clay loam
220	11010605	Mollisols	Ustolls	haplustolls	clay	clay loam	sandy clay loam
221	11010606	Vertisols	Usterts	chromusterts	clay	clay loam	clay loam
223	11010608	Spodosols	Orthods	haplorthods	clay	clay loam	silt loam
224	11010609	Mollisols	Udolls	hapludolls	clay	clay loam	loam
301	11020101	Oxisols	Orthox	haplorthox	silty clay	clay	clay
302	11020102	Entisols	Fluvents	torrifluvents	silty clay	clay	silty clay
303	11020103	Inceptisols	Ochrepts	xerochrepts	silty clay	clay	silty clay loam
304	11020104	Vertisols	Xererts	chromoxererts	silty clay	clay	sandy clay
305	11020105	Entisols	Orthents	torriorthents	silty clay	clay	sandy clay loam
306	11020106	Entisols	Fluvents	torrifluvents	silty clay	clay	clay loam
313	11020201	Oxisols	Orthox	haplorthox	silty clay	clay	clay
314	11020202	Oxisols	Orthox	haplorthox	silty clay	silty clay	silty clay
315	11020203	Inceptisols	Ochrepts	xerochrepts	silty clay	silty clay	silty clay loam
316	11020204	Oxisols	Orthox	haplorthox	silty clay	silty clay	sandy clay
317	11020205	Inceptisols	Ochrepts	cryochrepts	silty clay	silty clay	sandy clay loam
318	11020206	Oxisols	Ustox	acrustox	silty clay	silty clay	clay loam
320	11020208	Oxisols	Orthox	haplorthox	silty clay	silty clay	silt loam
321	11020209	Inceptisols	Ochrepts	cryochrepts	silty clay	silty clay	loam
324	11020212	Inceptisols	Ochrepts	cryochrepts	silty clay	silty clay	sandy loam
325	11020301	Vertisols	Aquerts	epiaquerts	silty clay	silty clay loam	clay

WIT_OPENLANDMAP_soil_lookup

USDA soil taxonomy

USDA texture classes

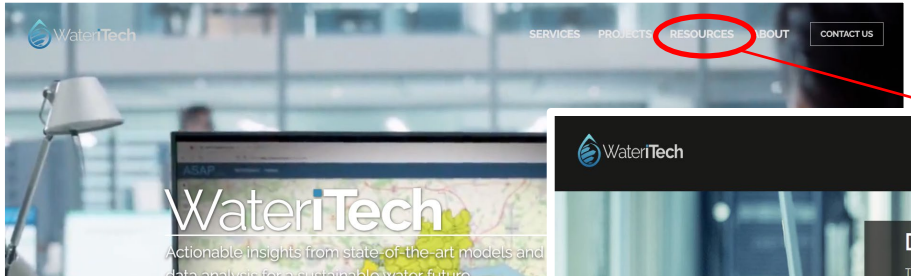
How to download:

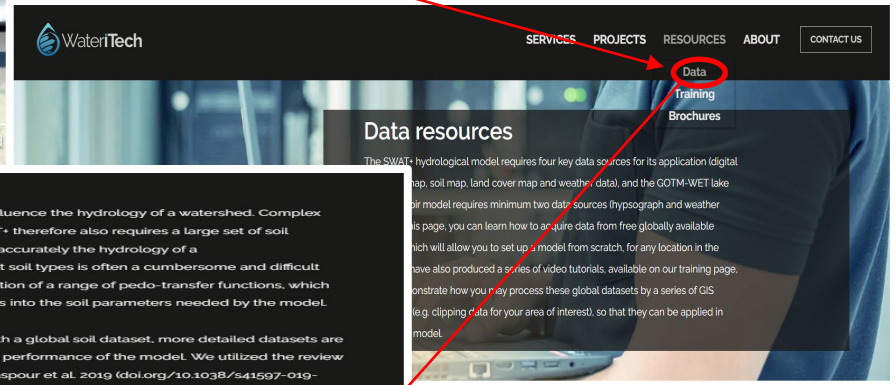
Digital Soil Open Land Map (DSOLMap)

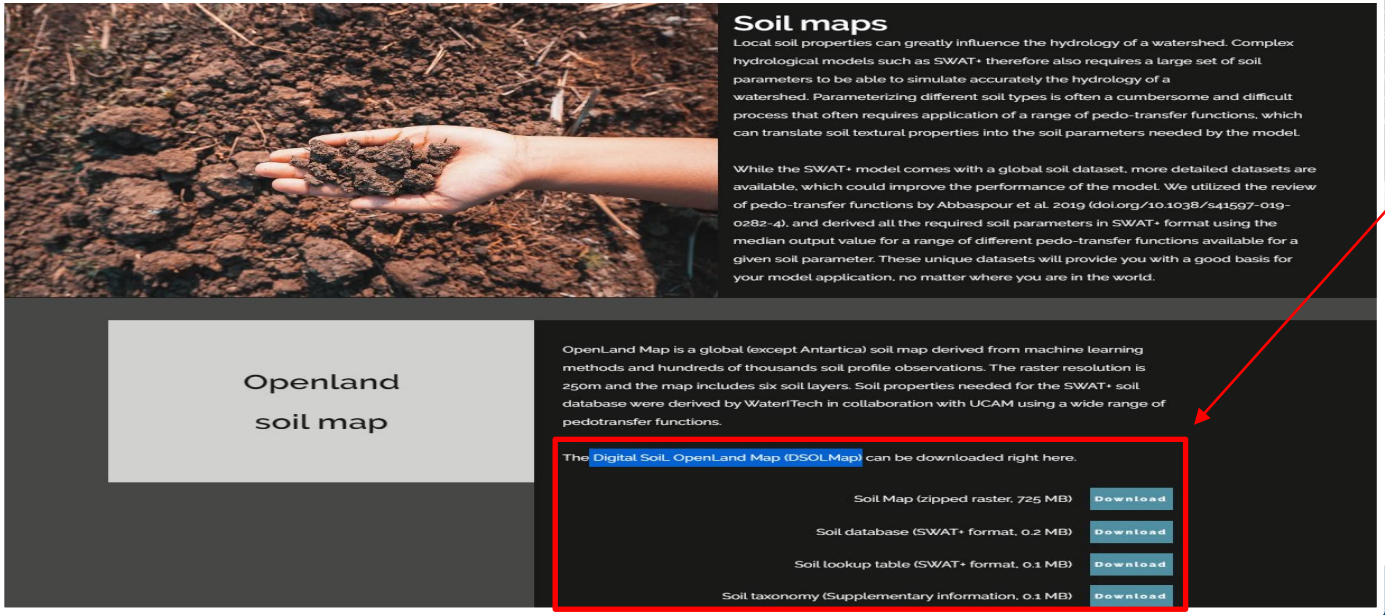
UCAM

- **How to download:**

www.wateritech.com







How to cite:

How to cite:

López-Ballesteros, A.; Nielsen, A.; Castellanos-Osorio, G.; Trolle, D.; Senent-Aparicio, J. (2023). **DSOLMap, a novel high-resolution global digital soil property map for the SWAT + model: Development and hydrological evaluation**. Catena, 231, 107339. https://doi.org/10.1016/j.catena.2023.107339

Catena 231 (2023) 107339

Contents lists available at ScienceDirect

Catena

journal homepage: www.elsevier.com/locate/catena

DSOLMap, a novel high-resolution global digital soil property map for the SWAT + model: Development and hydrological evaluation

Adrián López-Ballesteros [a,*], Anders Nielsen [b], Gerardo Castellanos-Osorio [a], Dennis Trolle [b], Javier Senent-Aparicio [a]

[a] Department of Civil Engineering, Catholic University of San Antonio, Campus de Los Jerónimos s/n, 30107 Guadalupe, Murcia, Spain
[b] WaterITech, Krakesvej 53, 8660 Skanderborg, Denmark

ARTICLE INFO

Keywords:
SWAT+ model
Digital soil property map
Soil database
High resolution

ABSTRACT

This research paper addresses the ongoing challenge of developing fine-resolution global digital soil property maps for hydrological modelling applications. Hydrological models are essential for understanding watershed dynamics and the impact of human activities on water resources. Soil data, which plays a crucial role in the hydrological cycle, is a requisite model input. Global digital soil property maps usually have coarse spatial resolutions, adding considerable uncertainty to hydrological models despite calibration efforts. To address this issue, a new global digital soil property map with 250 m spatial resolution, known as Digital Soil Open Land Map (DSOLMap), was developed and evaluated in this study. The DSOLMap has a finer spatial resolution than existing global soil maps and a more detailed soil profile divided into six soil horizons. This new high-resolution global digital soil property map was tailored to the SWAT + model format. SWAT + is the latest released version of the Soil and Water Assessment Tool (SWAT), one of the most comprehensive hydrological models, and is widely used worldwide. A hydrological evaluation was conducted with the DSOLMap and its results were compared to two other global soil databases using the SWAT + model in a basin located in the north of Spain. The findings showed that using more detailed, finer-resolution soil data, such as those that the DSOLMap offers, improved the hydrological performance of the SWAT + model on a daily scale before and after calibration and validation procedures. The DSOLMap represents a global step forward in hydrological modelling, notably for regions with scarce or unavailable soil information. This new digital soil property map can help decision-makers address global challenges related to water resources and environmental issues through hydrological modelling.

CONCLUSIONS

Conclusions

- ✓ **A new global digital soil map with a spatial resolution of 250 m and a six-horizons soil profile is provided for direct use with the SWAT+ model.**
- ✓ **The DSOLMap represents a step forward in hydrological modelling worldwide, especially for regions where soil information is scarce or limited.**
- ✓ **The DSOLMap is available in open access to encourage hydrological modellers to further explore its capabilities in depth.**

THANKS FOR YOUR ATTENTION

“Strive not to be successful, but rather to be useful”
Albert Einstein (1879 - 1955)

alopez6@ucam.edu

@AdrLBallesteros