Regridded Harmonized World Soil Database v1.2

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Revision Date: September 15, 2014

Summary:

This data set describes select global soil parameters from the Harmonized World Soil Database (HWSD) v1.2, including additional calculated parameters such as area weighted soil organic carbon (kg C per m2), as high resolution NetCDF files. These data were regridded and upscaled from the Harmonized World Soil Database v1.2.

The HWSD provides information for addressing emerging problems of land competition for food production, bio-energy demand and threats to biodiversity and can be used as input to model global carbon cycles.

The data are presented as a series of 27 NetCDF v3/v4 (*.nc4) files at 0.05-degree spatial resolution, and one NetCDF file regridded to the Community Land Model (CLM) grid cell resolution (0.9 degree x 1.25 degree) for the nominal year of 2000.

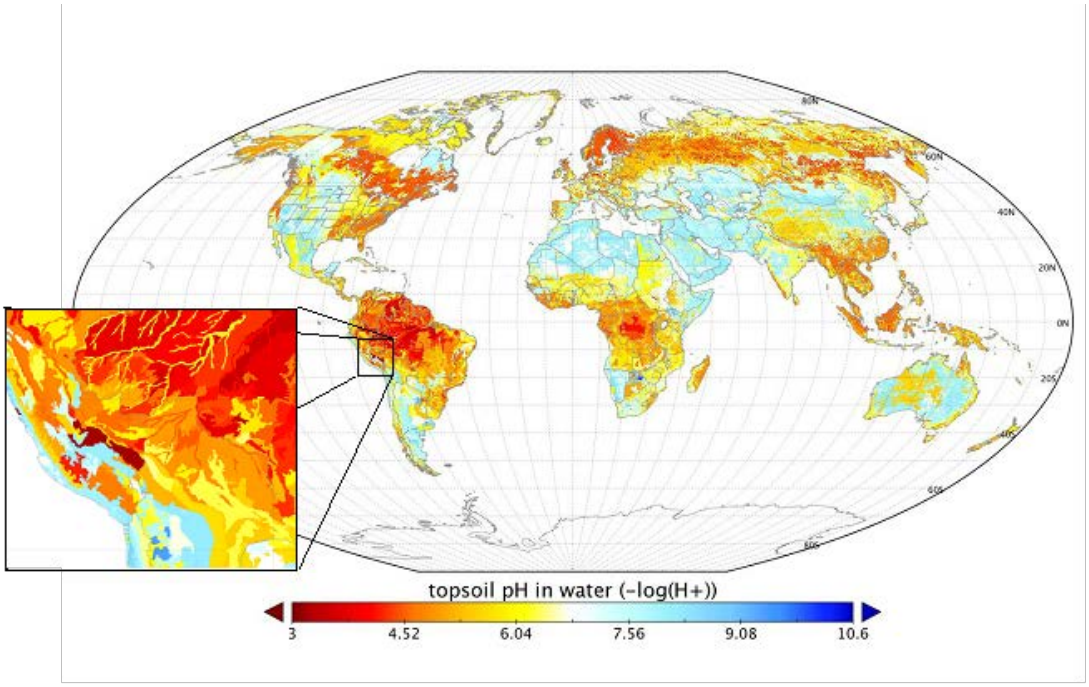

Figure 1. Global map of topsoil pH in water. Inset shows topsoil pH data for southern Peru and Bolivia as an example of the spatial detail available with the 0.05-degree files.

Data and Documentation Access:

Get Data: http://daac.ornl.gov/cgi-bin/dsviewer.pl?ds_id=1247

Data Citation:

Cite this data set as follows:

Wieder, W.R., J. Boehnert, G.B. Bonan, and M. Langseth. 2014. Regridded Harmonized World Soil Database v1.2. Data set. Available on-line [http://daac.ornl.gov] from Oak Ridge National Laboratory Distributed Active Archive Center, Oak Ridge, Tennessee, USA. http://dx.doi.org/10.3334/ORNLDAAC/1247 .

Table of Contents:

1. Data Set Overview:

Investigators: William Wieder (wwieder@ucar.edu), Jennifer Boehnert, Gordon. B. Bonan, and Madison Langseth, National Center for Atmospheric Research.

This data set describes select global soil parameters from the Harmonized World Soil Database v1.2, including additional calculated parameters such as area weighted soil organic carbon (kg C per m2), as high resolution NetCDF files. These data were regridded and upscaled from the Harmonized World Soil Database v1.2.

The HWSD v1.2 (FAO 2012) represents the most exhaustive, comprehensive, and contemporary database of soil characteristics that is available for global analyses and is a powerful resource for evaluating soil biogeochemistry models. Soil characteristics in the HWSD represent data from real soil profiles at various stages of pedogenic development, land use, land use history, and disturbance history. Soil properties in the HWSD are available for surface soil horizons (0 to 30cm) and deeper soil profiles (30 to 100 cm). The HWSD provides information for addressing emerging problems of land competition for food production, bio-energy demand and threats to biodiversity and can be used as input to model global carbon cycles.

The regridded HWSD data are presented as a series of 27 NetCDF v3/v4 (*.nc4) files at 0.05-degree spatial resolution, and one NetCDF file regridded to the Community Land Model (CLM) grid cell resolution (0.9 degree x 1.25 degree) for the nominal year of 2000.

2. Data Characteristics:

Data are presented as a series of 27 NetCDF v3/v4 (*.nc4) files at 0.05-degree spatial resolution, one for each soil parameter (listed in Table 1). Topsoil refers to soil between 0 and 30 cm and subsoil to soil between 30 and 100 cm. Grid cells with no data (fill value or missing values) are represented by "-1".

Eight of the HWSD soil parameters (listed in Table 2) have been further upscaled to CLM grid cell resolution (0.9-degree x 1.25-degree), in one file "**HWSD_SOIL_CLM_RES.nc4**". Soil level 0 here refers to topsoil, and level 1 to subsoil. Grid cells with no data (fill value or missing values) are represented by "9.969E36."

A companion file HWSD1.2_documentation.pdf contains a full description of the data compilation and harmonization procedure for the original HWSD v1.2 data.

Data File Information

Table 1. Data File Information

File Name	Description	Units	Notes
AWC_CLASS	Available water storage capacity	Coded values 1 through 7	1 = 150 mm water per m of the soil unit, 2 = 125 mm, 3 = 100 mm, 4 = 75 mm, 5 = 50 mm, 6 = 15 mm, 7 = 0 mm.
ISSOIL	Soil or non-soil units	0 or 1	ISSOIL indicates whether the soil mapping unit is a soil (1) or non-soil (0)
			MU_GLOBAL provides a link from the grid cell to the other

MU_GLOBAL	HWSD global mapping unit identifier	numerical ID	attributes.The HWSD v1.2 attribute lookup table is available from the HWSD project (FAO 2012)
REF_DEPTH	Reference soil depth	cm	Reference soil depth of all soil units are set at 100 cm, except for Rendzinas and Rankers of FAO-74 and Leptosols of FAO-90, where the reference soil depth is set at 30 cm, and for Lithosols of FAO-74 and Lithic Leptosols of FAO-90, where it is set at 10 cm.
ROOTS	Depth of obstacles to roots	Coded values 0 through 6	0 = no information, 1 = no obstacles to roots between 0 and 80 cm depth, 2 = obstacles to roots between 60 and 80 cm depth, 3 = obstacles between 40 and 60 cm, 4 = 20 and 40 cm, 5 = 0 and 80 cm, 6 = 0 and 20 cm.
T_BULK_DEN	Topsoil bulk density	kg dm-3	
S_BULK_DEN	Subsoil bulk density	kg dm-3	
T_REF_BULK	topsoil bulk density	kg dm-3	Reference bulk density values are calculated from equations developed by Saxton et al. (1986) that relate to the texture of the soil only. These estimates, although generally reliable, overestimate the bulk density in soils that have a high porosity (Andosols) or that are high in organic matter content (Histosols). The calculation procedures for reference bulk density can be found in Saxton et al (1986)
S_REF_BULK	Subsoil reference bulk density	kg dm-3	
T_CEC_CLAY	Cation exchange capacity of the clay fraction in the topsoil	cmol per kg	
S_CEC_CLAY	Cation exchange capacity of the clay fraction in the subsoil	cmol per kg	
T_CLAY	Topsoil clay fraction	% weight	
S_CLAY	Subsoil clay fraction	% weight	
T_GRAVEL	Topsoil gravel content	% volume	
S_GRAVEL	Subsoil gravel content	% volume	
T_SAND	Topsoil sand fraction	% weight	
S_SAND	Subsoil sand fraction	% weight	
T_SILT	Topsoil silt fraction	% weight	
S_SILT	Subsoil silt fraction	% weight	
T_PH_H20	Topsoil pH (in H2O)	-log(H+)	
S_PH_H20	Subsoil pH (in water)	-log(H+)	
T_C	Topsoil carbon content	kg C m-2	Topsoil and subsoil carbon content (T_C and S_C) are based on the carbon content of the dominant soil type in each regridded cell rather than a weighted average.
S_C	Dominant soil type subsoil carbon content	kg C m-2	
T_OC	Topsoil organic carbon	% weight	
S_OC	Subsoil organic carbon	% weight	
AWT_S_SOC	Area weighted subsoil carbon content	kg C m-2	AWT_S_SOC = (sum(SEQ(SHARE * S_OC)) * 7 * S_BULK_DENSITY)
AWT_T_SOC	Area weighted topsoil carbon content	kg C m-2	AWT_T_SOC = (sum(SEQ(SHARE * T_OC)) * 3 * T_BULK_DENSITY)

Table 2. HWSD_SOIL_CLM_RES file contents.

Variable	Description	Units
AWT_SOC	Area-weighted soil organic carbon content	kg C m-2
BULK_DEN	Soil bulk density	kg dm-3
DOM_MU	Dominant mapping unit ID from HWSD (MU_GLOBAL above)	

DOM_SOC	Dominant soil mapping unit soil organic carbon content (T_C & S_C above)	kg C m-2
PCT_CLAY	Soil clay fraction by percent weight	%
PCT_SAND	Soil sand fraction by percent weight	%
PH	Soil pH in water for the dominant mapping unit	-log(H+)
REF_BULK	Soil reference bulk density	kg dm-3

Spatial Coverage

Global

Spatial Resolution

Most data files contain grid cells at 3 minute x 3 minute (0.05 degrees or approximately 8-km). File "**HWSD_SOIL_CLM_RES.nc4**" provides eight soil characteristics at 0.9-degree x 1.25-degree resolution.

Site boundaries: (All latitude and longitude given in degrees and fractions)

Westernmost Longitude	Easternmost Longitude	Northernmost Latitude	Southernmost Latitude
-180	180	90	-90

Temporal Coverage

One time.

Time period

The data set has no explicit temporal component. Data are nominally for the year 2000/01/01 to 2000/12/31.

3. Data Application and Derivation:

The HWSD provides information for addressing emerging problems of land competition for food production, bio-energy demand and threats to biodiversity. These data can be used as input to terrestrial biosphere models, such as the Community Land Model (CLM) (see Wieder et al. 2014).

4. Quality Assessment:

All fields in the Harmonized World Soil Database were checked for minimum, maximum, average, and standard deviation values in order to find outliers, data entry errors etc. Few errors were found, and these were corrected from neighboring units consisting of the same soil type. Few missing data values exist in the source databases. Many missing values were replaced with data extracted from the most appropriate neighboring units having the same soil type.

5. Data Acquisition Materials and Methods

The investigators regridded the HWSD from its native resolution to 0.05 degree resolution grid cells and upscaled these to the CLM grid, 0.9 degree x 1.25 degree. Using Environmental Systems Research Institute ArcGIS 10.0, they performed zonal statistics on the HWSD to obtain the most common HWSD soil mapping unit identifier (MU_GLOBAL) for each 0.05-degree grid cell. They then calculated the SOC by multiplying the soil organic C (%) by bulk density (kilogram per cubic meter) and soil depth for each soil mapping unit. They regridded the SOC pools from the 30 arc sec HWSD grid to the CLM grid cell using an area-weighted, mass-conserving algorithm. This area-weighting approach better represents the spatial heterogeneity of SOC pools within the larger CLM grid cell. More details can be found in Wieder et al. (2014).

A full description of the data compilation and harmonization procedure for the original HWSD v1.2 data are provided in the companion file: HWSD1.2_documentation.pdf.

6. Data Access:

This data is available through the Oak Ridge National Laboratory (ORNL) Distributed Active Archive Center (DAAC).

Data Archive Center:

Contact for Data Center Access Information:

E-mail: uso@daac.ornl.gov
Telephone: +1 (865) 241-3952

7. References:

FAO 2012. Harmonized World Soil Database (version 1.2). Food Agriculture Organization, Rome, Italy and IIASA, Laxenburg, Austria (http://webarchive.iiasa.ac.at/Research/LUC/External-World-soil-database/HTML/)

Wieder, W.R., J. Boehnert, and G.B. Bonan. (2014). Evaluating soil biogeochemistry parameterizations in Earth system models with observations, Global Biogeochem. Cycles, 28, 211–222, doi:10.1002/2013GB004665.

Saxton, K.E., W.J. Rawls, J.S. Romberger, and R.I. Papendick. 1986. Estimating Generalized Soil-water Characteristics from Texture. Soil Sci. Soc. Am. J 50, 1031-1036.