1. TITLE

1.1 Data Set Title

ISLSCP II Global Gridded Soil Characteristics

.

1.2 Database Table Name(s)

Not applicable to this data set.

1.3 File Name(s)

This data set provides gridded data for selected soil parameters derived from data and methods developed by the Global Soil Data Task, coordinated by the now defunct Data and Information System (DIS) of the International Geosphere-Biosphere Programme (IGBP), or IGBP-DIS. The ISLSCP II data sets have been produced by the ISLSCP II staff from an IGBP-DIS soil data CD-ROM distributed by the Oak Ridge National Laboratory Distributed Active Archive Center (ORNL DAAC, http://daac.ornl.gov/).

DATA USER NOTE
The ORNL DAAC no longer distributes the IGBP-DIS soil data CD-ROM referenced throughout this document.

The data files and documentation may be accessed at:

Global Soil Data Task Group. 2000. Global Gridded Surfaces of Selected Soil Characteristics (IGBP-DIS). Data set. Available on-line [http://daac.ornl.gov] from Oak Ridge National Laboratory Distributed Active Archive Center, Oak Ridge, Tennessee, U.S.A. doi:10.3334/ORNLDAAC/569

These data files are also available from the ORNL DAAC Spatial Data Access Tool (SDAT) web service.

http://webmap.ornl.gov/wcsdown/dataset.jsp?ds_id=569

 For the ISLSCP II data collection, gridded global maps of selected soil parameters, including soil texture, are provided on a 1.0 degree by 1.0 degree Earth grid and for two soil depths (0-30cm and 0-150cm). There are 36 soils data files for this data collection with the following naming convention:

soil_*parameterdepth*_1d.asc   Example: **soil_bulk_dens0-150_1d.asc**

where:
parameter   is the particular soil parameter (see Section 3.2 and 8.2 for a list of parameters and descriptions).
depth   is the soil depth in cm for the estimated soil parameter (i.e. 0-30 or 0-150).
1d   identifies the spatial resolution of the data as 1 degree in both latitude and longitude.
.asc   identifies the format of the data as ASCII, or text format.

***NOTE:** The files for soil thermal capacity are named **soil_therm_cap*WC*_*depth*_1d.asc**, where *WC* is the percent water content of the soil: 0, 10, 50 or 100 percent.

1.4 Revision Date of this Document
        April 12, 2011

2. INVESTIGATOR(S)

2.1 Investigator(s) Name and Title
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2.2 Title of Investigation
        Global Soil Data Task (IGBP-DIS).

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2.4 Data Set Citation

Scholes, R. J., and E. Brown de Colstoun. 2011. ISLSCP II Global Gridded Soil Characteristics. In Hall, Forrest G., G. Collatz, B. Meeson, S. Los, E. Brown de Colstoun, and D. Landis (eds.). ISLSCP Initiative II Collection. Data set. Available on-line [http://daac.ornl.gov/] from Oak Ridge National Laboratory Distributed Active Archive Center, Oak Ridge, Tennessee, U.S.A. doi:10.3334/ORNLDAAC/1004

2.5 Requested Form of Acknowledgment

Users of the International Satellite Land Surface Climatology (ISLSCP) Initiative II data collection are requested to cite the collection as a whole (Hall et al. 2006) as well as the individual data sets. Please cite the following publications when these data are used:

Hall, F.G., E. Brown de Colstoun, G. J. Collatz, D. Landis, P. Dirmeyer, A. Betts, G. Huffman, L. Bounoua, and B. Meeson, The ISLSCP Initiative II Global Data sets: Surface Boundary Conditions and Atmospheric Forcings for Land-Atmosphere Studies, *J. Geophys. Res.*, 111, doi:10.1029/2006JD007366, 2006.

Users are requested to acknowledge the Global Soil Data Task, the IGBP, ORNL DAAC and ISLSCP Initiative II for provision of the data. A formal citation for ISLSCP II data sets is forthcoming. Please use the following citation when these data are used:

Global Soil Data Task. 2000. *Global Gridded Surfaces of Selected Soil Characteristics (IGBP-DIS).* International Geosphere-Biosphere Programme - Data and Information Services.

Available online [http://daac.ornl.gov/] from the ORNL Distributed Active Archive Center, Oak Ridge National Laboratory, Oak Ridge, Tennessee, U.S.A. . doi:10.3334/ORNLDAAC/569

3. INTRODUCTION

3.1 Objective/Purpose

The Global Soil Data Task was an international collaborative project with the objective of making accurate and appropriate data relating to soil properties accessible to the global change research community. The collaborators are holders of major international pedosphere data sets, such as the United States Department of Agriculture (USDA), the Food and Agriculture Organization (FAO) of the United Nations, and the International Soil Reference and Information Centre (ISRIC), as well as national soils institutes, individual soil scientists, and users of soil data. The task was coordinated by the now defunct Data and Information System framework activity of the International Geosphere-Biosphere Programme (IGBP-DIS).

The Global Soil Data Task assembled a reliable and accessible data set on pedosphere properties on a global scale. The data are sufficiently detailed to support rigorous analysis, and accessible to and understandable by soil scientists and non-soil scientists alike. The immediate goal was to supply pedosphere information to global change researchers, but the unification and distribution of the existing soils data bases is of great benefit to all researchers, not only those directly involved in global change studies. The task was enabled by the active participation of the principal international custodians of pedosphere data.

A CD-ROM disk containing extensive global pedon data, and the so-called "SoilData" software to create global gridded layers of selected soil parameters from the FAO Digital Soil Map of the World (DSMW) was one outcome of this IGBP-DIS activity which is currently available from the ORNL DAAC at http://daac.ornl.gov. The ISLSCP II staff has used the IGBP-DIS data and software to generate two-dimensional gridded maps of selected soil parameters, including soil texture, at a 1.0 by 1.0 degree spatial resolution and for two soil depths. All data layers have been adjusted to match the ISLSCP II land/water mask.

3.2 Summary of Parameters

Eighteen selected soil parameters are provided on an equal-angle Earth grid with spatial resolution of 1.0 by 1.0 degree in both latitude and longitude. Data are provided for two soil depths of 0-30cm and 0-150cm. The selected soils parameters and the abbreviations used in the file name (see Section 1.2) are given in Table 1 below:

Table 1. Soil parameters extracted from the IGBP-DIS Soils Database for ISLCP II. Data are provided for soil depths of 0-30cm and 0-150cm.

Parameter **Name**	**Units**	**Description**
bulk_dens	g/cm^3	Bulk Density.
clay_perc	% w/w	% Clay Content.
field_cap	mm	Field Capacity (FC), with FC water potential = -10 kPa
ksat	cm/day	Saturated Hydraulic Conductivity or K_{sat}
nitrogen_dens	g/m^2	Soil Nitrogen Density
org_carb_dens	kg/m^2	Soil Carbon Density

org_carb_perc	%	Percent Soil Organic Carbon Content
pawc	mm	Profile Available Water Content (PAWC), with: FC water potential = -10 kPa WP water potential = -1500 kPa
res_wat_cont	cm^3/cm^3	Residual Water Content
sand_perc	% w/w	% Sand Content
sat_wat_cont	cm^3/cm^3	Saturated Water Content or Porosity
silt_perc	% w/w	% Silt Content
texture	N/A	12 Soil Texture Classes after USDA soil texture classes.
therm_cap	$J/m^3/K$	Thermal Capacity, with 0, 10, 50 and 100 % volumetric soil-water fraction (i.e. four data files for each soil depth).
wilting_point	mm	Wilting Point (WP), with WP water potential = -1500 kPa

***NOTE: Soil Thermal Conductivity layers are not available at this revision because of technical difficulties with the "SoilData" software.

3.3 Discussion

All data surface created here were produced by the ISLSCP II staff from the SoilData System, which was developed by the Global Soil Data Task of the IGBP-DIS. The SoilData System generates soil information and maps for geographic regions at soil depths and resolutions selected by the user. Derived surfaces of selected soil characteristics are suitable for modeling and inventory purposes. Selected data surfaces at the full spatial resolution of the FAO DSMW (~4km) are also distributed as part of the Global Soil Data Products CD-ROM (see http://daac.ornl.gov/SOILS/soils_collections.html)

The SoilData System uses a statistical bootstrapping approach to link the pedon records in the ISRIC Global Pedon Database to the FAO/UNESCO Digital Soil Map of the World. It can generate maps and output data sets for a range of original and derived soil parameters, such as carbon and nitrogen density, thermal capacity, and water-holding capacity, for any part of the world at user-selected depth ranges. The digital output can be at any resolution (in increments of 5 minutes in lat./long.).

Three types of soil data products are contained on the IGBP-DIS Global Soils Data CD-ROM:

1. The SoilData System uses a statistical bootstrapping approach to link the pedon records in the Global Pedon Database to the FAO/UNESCO Digital Soil Map of the World. It can generate maps and output data sets for a range of original and derived soil parameters, such as carbon and nitrogen density, thermal conductivity, and water-holding capacity, for any part of the world at user-selected depth ranges. The digital output can be at any resolution (in increments of 5') and is appropriate for modeling and inventory purposes.

2. The Global Pedon Database which contains 1,125 soil profile descriptions, profile locations, FAO soil map legend classes, and fundamental soil properties such as depth, particle size distribution, bulk density and extractable nutrient composition. The Global Pedon Database was developed by ISRIC http://www.isric.org/NR/exeres/545B0669-6743-402B-B79A-DBF57E9FA67F.htm

3. Interpreted Surfaces are global surfaces (at 5'x5' resolution) of the statistical properties of organic carbon density, soil water-holding capacity and easily available water capacity by major classes of global soils. These have been interpreted and

spatially mapped using a combination of base data and field experience by soil experts. More information on the FAO/UNESCO Digital Soil Map of the World (1995) is available at http://www.fao.org/ .

The operation and algorithms of the SoilData System are fully explained in an accompanying on-line help manual on the Global Soils Data CD.

The ISLSCP II staff has used the IGBP-DIS Soils CD-ROM to create multiple layers of selected soil properties on a 1 by 1 degree Earth grid. Realistic data for three of the six "miscellaneous" soil units of the FAO DSMW (Dunes or Shifting Sands (DS), Rock Debris or Desert Detritus (RK), and Salt Flats (ST)) have been used to fill in missing areas in the data for several soil parameters. Soil Texture classes have been assigned to each cell based on the % Sand, Silt and Clay compositions and rules from the USDA soil staff (see Section 9.4). Finally, all data layers have been made consistent with the ISLSCP II land/water mask.

4. THEORY OF ALGORITHM/MEASUREMENTS

The background information presented below was extracted from the IGBP Global Soil Data Task CD-ROM (Global Soil Data Task 2000).

The Global Soil Data Task aims to "assemble a reliable and accessible data set on pedosphere properties on a global scale" (Scholes et al. 1995). Its objectives include the production of (a) specific-purpose derived data-sets (e.g., statistical properties of soil water-holding capacity) for major classes of global soils and (b) spatial data on specific soil properties (e.g., water-holding capacity) at various scales appropriate for modelling and inventory purposes (Scholes et al. 1995).

In the first phase of the task, these data are to be derived from (a) the World Inventory of Soil Emission Potentials (WISE) WISE pedon-database produced by the International Soil Reference and Information Centre (ISRIC) (Batjes 1995) and (b) the FAO-UNESCO Digital Soil Map of the World (DSMW) (FAO 1995). Each pedon-record in the WISE-database is classified in the FAO-UNESCO 1974 legend (FAO 1995). The WISE-database therefore provides soil-profile data that can be directly linked to the DSMW. Hence, it provides a basis for generating statistics on soil properties for major classes of global soils and for different areas of the world at various spatial scales.

5. EQUIPMENT

Various instruments and other equipment were used to make the measurements that are included in the WISE pedon database. No satellites or other remotely-sensed data were used to create the data sets provided here.

5.1 Instrument Description
5.1.1 Platform (Satellite, Aircraft, Ground, Person)
Not applicable to this data set.

5.1.2 Mission Objectives

Not applicable to this data set.

5.1.3 Key Variables
Not applicable to this data set.

5.1.4 Principles of Operation
Not applicable to this data set.

5.1.5 Instrument Measurement Geometry
Not applicable to this data set.

5.1.6 Manufacturer of Instrument
Not applicable to this data set.

5.2 Calibration
5.2.1 Specifications
5.2.1.1 Tolerance
Not applicable to this data set.

5.2.2 Frequency of Calibration
Not applicable to this data set.

5.2.3 Other Calibration Information
Not applicable to this data set.

6. PROCEDURE

6.1 Data Acquisition Methods
Because these data were compiled from a variety of sources, errors may be associated with different measurement methods and sampling designs used by the individual investigators.

The Soil Task had two phases. The first phase was based on the WISE project, and activity carried out by ISRIC. Data from major international data holdings (FAO, USDA and ISRIC) were screened and suitable profiles brought together into a preliminary global soil database. The conversion of the data on measured soil attributes into information on inferred soil properties involved participation of the wider soil science and global change modeling community. This was achieved through a series of workshops and sub-tasks delegated to specific institutions.

The second phase expanded the database to ensure that it is representative of all parts of the global land surface, and of all soil types. This was achieved by identifying the geographical areas and soil types where there are insufficient data, and updating them first from national data sources, secondly from published and unpublished literature, and as a last resort, by collecting new data. Quality control criteria, methodological consistency and traceable data lineages were maintained throughout the task. These aspects required special emphasis associated with the number and diversity of data sources.

Soil scientists and non-soil scientists, who use soil data, participated in the Global Soils Data Task. Community participation involved four main areas. (1) The provision of soil profile descriptions and analyses, whose geographical location is precisely known, and where the analytical procedures and laboratories are recorded. The profile descriptions must be sufficiently complete to allow categorization according to the FAO Soil Legend (1990), and preferably according to USDA 'Soil Taxonomy' (1994) as well. (2) The translation of fundamental observed soil properties, such as particle size distribution, into inferred properties such as the water retention curve, or calculated quantities such as the carbon density. (3) The extrapolation and interpolation of data from point locations to values representing areas, by linkage to soil maps. (4) Use of the soil data, and feedback to the task group regarding data needs and the suitability of the products.

The generation of the Soil Data CD-ROM was performed by IGBP-DIS at the Potsdam Institut für Klimafolgenforschung (PIK), in Potsdam, Germany and provided to the ORNL DAAC for distribution. ISLSCP II staff acquired the data CD-ROM directly from the ORNL DAAC. All original pedon databases and many other soil data are available from the ORNL DAAC at http://daac.ornl.gov/SOILS/soils_collections.html

6.2 Spatial Characteristics
6.2.1 Spatial Coverage
The data are global for all land areas except areas with permanent ice cover (e.g. Greenland and Antarctica).

6.2.2 Spatial Resolution
The SoilData system can provide data layers in increments of 5 minutes in lat/long. This ISLSCP II data set is provided on an equal-angle Earth grid with a spatial resolution of 1 degree in both latitude and longitude. Note that higher spatial resolution (i.e. 1/2 and 1/4 degrees) products will be available in a future revision of this data set.

6.3 Temporal Characteristics
6.3.1 Temporal Coverage
The soil pedon database that form the basis for all data provided here is based on soil measurements made throughout the world at many different times. For this data set, the soil properties are assumed to remain constant in time.

6.3.2 Temporal Resolution
Fixed.

7. OBSERVATIONS

7.1 Field Notes
Not applicable to this data set.

8. DATA DESCRIPTION

8.1 Table Definition with Comments
        Not applicable to this data set.

8.2 Type of Data

8.2.1 Parameter/ Variable Name	8.2.2 Parameter/ Variable Description	8.2.3 Data Range*	8.2.4 Units of Measurement	8.2.5 Data Source
bulk_dens	Bulk Density.	Water=-99 Permanent Ice=-77	g/cm^3	IGBP-DIS Soil Data System
clay_perc	% Clay Content.	Water=-99 Permanent Ice=-77	% w/w	
field_cap	Field Capacity (FC), with FC water potential = -10 kPa	Water=-99 Permanent Ice=-77	mm	
Ksat	Saturated Hydraulic Conductivity or K_{sat}	Water=-99 Permanent Ice=-77	cm/day	
Nitrogen_dens	Soil Nitrogen Density	Water=-99 Permanent Ice=-77	g/m^2	
org_carb_dens	Soil Carbon Density	Water=-99 Permanent Ice=-77	kg/m^2	
org_carb_perc	Percent Soil Organic Carbon Content	Water=-99 Permanent Ice=-77	%	
Pawc	Profile Available Water Content (PAWC), with: FC water potential = -10 kPa WP water potential = -1500 kPa	Water=-99 Permanent Ice=-77	mm	
res_wat_cont	Residual Water Content	Water=-99 Permanent Ice=-77	cm^3/cm^3	
sand_perc	% Sand Content	Water=-99 Permanent Ice=-77	% w/w	
sat_wat_cont	Saturated Water Content or Porosity.	Water=-99 Permanent Ice=-77	cm^3/cm^3	
silt_perc	% Silt Content	Water=-99 Permanent Ice=-77	% w/w	
Texture	Soil Texture Classes after USDA soil texture classes:	0-13	See 8.2.2	Assigned from %

				Sand, Silt and Clay
	0 = Water 1 = Sand 2 = Loamy Sand 3 = Sandy Loam 4 = Loam 5 = Silt Loam 6 = Silt 7 = Sandy Clay Loam 8 = Clay Loam 9 = Silty Clay Loam 10 = Sandy Clay 11 = Silty Clay 12 = Clay 13 = Permanent Ice			
therm_cap	Thermal Capacity, with 0, 10, 50 and 100 % volumetric soil-water fraction	Water=-99 Permanent Ice=-77	$J/m^3/K$	
wilting_point	Wilting Point (WP), with WP water potential = -1500 kPa	Water=-99 Permanent Ice=-77	mm	

* Data ranges are not available at this revision.

8.3 Sample Data Record

Not applicable to this data set.

8.4 Data Format

All of the files in the ISLSCP Initiative II data collection are in the ASCII grid format. The file format consists of numerical fields of varying length, which are delimited by a single space and arranged in columns and rows. The files each contain 360 columns by 180 rows. All values in these files are written as real numbers. Cells over water or permanent ice are assigned the value -99 or -77, respectively, on all data layers except soil texture, where they are assigned the values 0 and 13.

All files are gridded to a common equal-angle lat/long grid, where the coordinates of the upper left corner of the files are located at 180 degrees W, 90 degrees N and the lower right corner coordinates are located at 180 degrees E, 90 degrees S. Data in the map files are ordered from North to South and from West to East beginning at 180 degrees West and 90 degrees North.

8.5 Related Data Sets

Other soil data sets available at the ORNL DAAC can be accessed at http://daac.ornl.gov/SOILS/soils_collections.html. ISLSCP II project information and data sets can also be obtained from the ORNL DAAC at http://daac.ornl.gov/ISLSCP_II/islscpii.html .

9. DATA MANIPULATIONS

9.1 Formulas

9.1.1 Derivation Techniques/Algorithms

The background information presented below was extracted from the IGBP Global Soil Data Task CD-ROM (Global Soil Data Task 2000). Basically, the SoilData system creates pedon attribute files for primary and derived pedon attributes, including those provided in this ISLSCP II data set.

The following pedotransfer functions are used for deriving secondary pedon-attribute data from the primary pedon records. In all cases, ρ_i denotes the bulk density (g cm^{-3}), and z_i the thickness (m), of soil-horizon i.

a) Soil carbon density (kg m^{-2}), the total mass of organic carbon in a given soil-depth interval, is given by

$$c = \sum_i 10 \; \rho_i \; c_i \; z_i \tag{1}$$

where c_i is the organic carbon content (% by weight) of all soil-horizons i in the required soil-depth interval.

b) Total soil-nitrogen content (g m^{-2}) is given by

$$N = \sum_i 10000 \; \rho_i \; n_i \; z_i \tag{2}$$

where n_i is the nitrogen content (% by weight) of soil-horizon i.

c) The soil water-content (mm) at field capacity (θ_{FC}) and wilting-point (θ_{WP}) are derived using the van Genuchten (1980) equation:

$$\theta = \theta_r + (\theta_s - \theta_r) \; / \; (1 + |\alpha\psi|^n \;)^m \tag{3}$$

where θ is the volumetric water content (m^3 m^{-3}), θ_s is the saturated water content (m^3 m^{-3}), θ_r is the residual water content (m^3 m^{-3}), φ is the matrix water potential (kPa) and α, n and m are curve parameters, with $m = 1 - 1/n$. By default, $\varphi = -10$ kPa for θ_{FC}, and $\varphi = -1500$ kPa for θ_{WP} (IGBP-DIS 1998), although φ can be set in each case as required.

d) The profile available water content (PAWC) is given by

$$PAWC = \theta_{FC} - \theta_{WP} \tag{4}$$

e) The soil thermal capacity (J/m^3/K) is given by

$$C = \sum C_{dryi} + 4.195 \; \theta_i \tag{5}$$

where

$$C_{dryi} = \sum 0.076 + 0.748 \; \theta_i \tag{6}$$

where θ_i is the volumetric soil-water fraction (% v/v) for soil-horizon i (Hubrechts & Feyen 1996). SoilData will generate a pedon-attribute file for some input value of $\theta \geq$

0.0. If values for C_{dry} (the thermal capacity for an oven-dry soil) are required, θ is simply set to 0.0.

9.2 Data Processing Sequence

9.2.1 Processing Steps and Data Sets

There are three basic steps that are involved in the creation of global soil data layers from the IGBP-DIS soil data CD-ROM:

1) Create pedon attribute files that provide data for each of the 106 soil units and 6 miscellaneous land units described by the FAO DSMW. These data are extracted from the WISE pedon database and a general or „average" default file used to patch in soils with no data for any particular pedon attribute.

2) Create map unit files that list, for each of the 4931 "map units" contained in the FAO DSMW, a set of statistics describing the pedon-attribute contained in the pedon-attribute file created in 1). A global soil unit file taken directly from the DSMW file "solunit.asc" (FAO 1995) is used to describe the composition of each soil unit. Map units that are not homogenous are composed of a dominant soil and up to seven other component soils (FAO 1995). The statistics in a map unit file include the mean, standard deviation, minimum, maximum and all nine population deciles, computed from a large bootstrap-sample of data (i.e. 500 samples) created by continued random sampling of the data-sets (contained in a pedon-attribute file) of each soil unit that the map unit contains. Land units with no data in the pedon-attribute file (i.e. Inland Water, No Data and Glaciers map units) can contribute no data to a bootstrap sample.

3) Create data surfaces from the map unit files created in 2). SoilData will create a data-surface file that lists pedon-attribute statistics for any globe-area at some multiple of the 5 arc-minute scale. SoilData can produce data-surface files in its own (non-standard) format or in a format suitable for the GIS software IDRISI. IDRISI files were produced by the ISLSCP II and then imported into the PCI image processing package for final processing and application of the ISLSCP II land/water mask.

Final steps in the processing of this data set included creating soil texture class files by using the percent sand, silt and clay in each cell and USDA decision rules (See Figure 1). For some cells the % sand, silt and clay did not add up to 100% so the data were first normalized by the total value in these cases and new % sand, silt and clay values were recalculated. Finally, the data layers were compared with the ISLSCP II land/water mask in order to provide consistency with all other ISLSCP II data sets. A small number of cells with no data over land were filled from an average of all surrounding cells. Cells over water in the ISLSCP II land/water mask were assigned the value of -99 on all layers (0 for soil texture) while cells with permanent ice in the EROS Data Center (EDC) global land cover classification (also this collection) were assigned the value -77 on all soil layers except the soil texture file (value=13).

9.2.2 Processing Changes

None.

9.2.3 Additional Processing by the ISLSCP II Staff

All of the processing to create the data files from the original data contained on the IGBP-DIS soils data CD-ROM (as listed in Section 9.2.1) was performed by Eric Brown de Colstoun of the ISLSCP II Staff.

9.3 Calculations
9.3.1 Special Corrections/Adjustments
If values for the 6 miscellaneous map units in the FAO DSMW of the world are not assigned the SoilData program outputs large areas with missing data. In an effort to create spatially complete data sets for global modelers, the ISLSCP II staff assigned realistic values of all pedon attributes in the pedon attribute files discussed above. The sources of some of the values were from the IGBP-DIS CD-ROM itself but also from Dr. Henk Wosten at Alterra in The Netherlands. The table below shows the values used for the Dunes or Shifting Sands (DS), Rock Debris or Desert Detritus (RK), and Salt Flats (ST) categories. Glaciers (GL) were set to 0 on all data layers but most of these points were then replaced with the value -77.

Table 2. Values used to fill in 3 of the 6 miscellaneous data categories from the FAO DMSW.

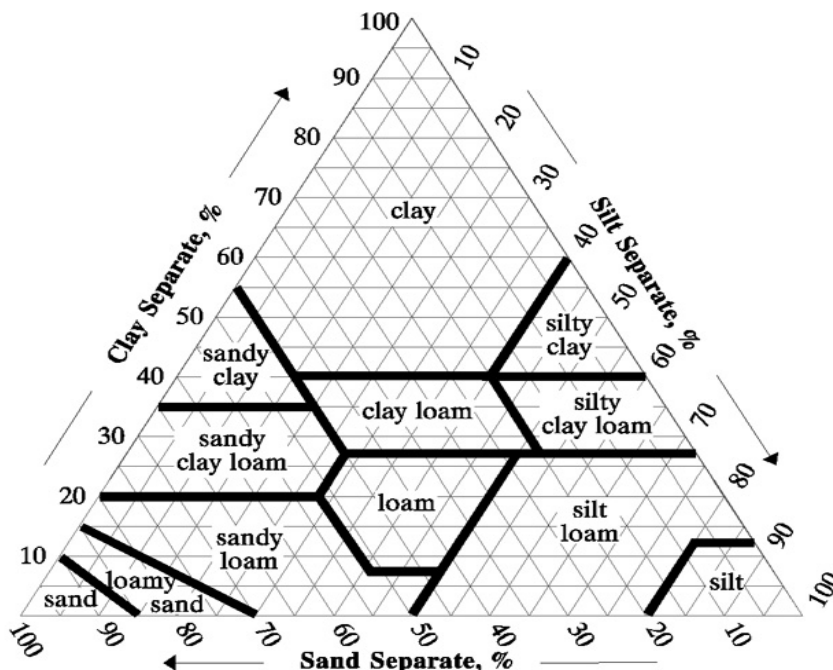| Parameter	DS	ST	RK
Soil Carb. Density	0	7.3	0
Total Nitrogen Dens.	0	720	0
Field Capacity	100	0	0
Wilting Point	20	0	0
PAWC	80	0	0
Thermal Capacity	1.33	1.27	2.02
Bulk Density	1.6	1.6	2.6
% Organic Carbon	0.2	1	0
%Sand	95	20	0
%Silt	5	30	0
%Clay	0	50	0
Texture Class	Sand	Clay	N/A
Residual Water Content	0.01	0.01	0
Saturated Water Content	0.35	0.5	0
Ksat	10	5	0

9.4 Graphs and Plots

Figure 1. USDA soil textural triangle used to assign soil texture classes. The percentage of sand, silt, and clay present in each soil textural class is obtained by reading the numbers parallel to each base of the triangle (i.e., percentages of clay are on lines parallel to the sand base).

10. ERRORS

10.1 Sources of Error

The primary source of error is missing pedons for soil units or land unit data. Some of the land units were filled from realistic values as shown above. However, the global pedon database contains pedons representing only 89 of the 106 FAO soil units. The 17 soil units not represented are (by FAO 1974-classification symbol) Bx, Cl, Cg, Dg, I, Kl, Mg, Oe, Ox, Pf, Rx, Sm, U, Wd, Wh, Wx and Yt. Pedon-attribute files therefore normally lack data for these 17 soil units. Depending on the pedon-attribute they record, pedon-attribute files may also lack data for other soil units, since pedon records in the database do not always contain a full complement of data or for particular depth that are needed.

SoilData provides an optional facility to patch pedon-attribute files with data for those soil units that might otherwise lack data, using the data contained in the default soil unit file. Note that this applies only to those variables for which data exist in the default soil unit file. Note further that such patching will influence the statistical variability of bootstrap-samples drawn from these pedon-attribute files, since soil units for which data are taken from the default soil unit file will have a data-set consisting of only a single datum.

Pedon-attribute files must contain at least one datum for each of the 106 FAO soil units. If any soil units lack data, representative pedon-attribute data for these soil units will have to be inserted into the file using a standard text editor. The rest of the data-generation procedure requires that pedon-attribute files contain at least one datum for all 106 FAO soil units. This is not so for the 6 miscellaneous land units, which will often lack data. Representative pedon-

attribute data must therefore be inserted into pedon-attribute files for all soil units that lack data. Since pedon-attribute files are in ASCII format, they can be edited with any text editor, provided that their simple structure is maintained. The ISLSCP II staff did this for 3 of the 6 miscellaneous land units as shown in Table 2. The other categories were ignored.

SoilData users who are interested in soil-water properties should note that caution is given regarding mathematical error in the derivation of surfaces for the van Genuchten (1980) equation-parameters.

10.2 Quality Assessment
10.2.1 Data Validation by Source
See Section 10.1.

10.2.2 Confidence Level/Accuracy Judgment
Not available at this revision.

10.2.3 Measurement Error for Parameters and Variables
Not available at this revision.

10.2.4 Additional Quality Assessment Applied
Not available at this revision.

11. NOTES

11.1 Known Problems with the Data
See Section 10.1 for more information on special cases and handling of missing data.

11.2 Usage Guidance
The Global Soil Data Task assembled a reliable and accessible data set on pedosphere properties on a global scale. The data are sufficiently detailed to support rigorous analysis, and accessible to and understandable by soil scientists and non-soil scientists alike. The immediate goal was to supply pedosphere information to global change researchers, but the unification and distribution of the existing soils data bases will be of great benefit to all researchers, not only those directly involved in global change studies.

12. REFERENCES

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13. DATA ACCESS

13.1 Contacts for Archive/Data Access Information

The ISLSCP Initiative II data available are archived and distributed through the Oak Ridge National Laboratory (ORNL) DAAC for Biogeochemical Dynamics at http://daac.ornl.gov.

13.2 Contacts for Archive

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

13.3 Archive/Status/Plans

The ISLSCP Initiative II data are archived at the ORNL DAAC. There are no plans to update these data.

14. GLOSSARY OF ACRONYMS

CSIR	Council for Scientific and Industrial Research
DAAC	Distributed Active Archive Center
DSMW	Digital Soil Map of the World
EDC	EROS Data Center
FAO	Food and Agriculture Organization of the United Nations
FC	Field Capacity
GSFC	Goddard Space Flight Center
IGBP	International Geosphere-Biosphere Programme

IGBP-DIS   IGBP-Data and Information System
ISLSCP   International Satellite Land Surface Climatology Project
ISRIC   International Soil Reference and Information Centre
NASA   National Aeronautics and Space Administration
NRCS   Natural Resources Conservation Service
ORNL   Oak Ridge National Laboratory
PAWC   Profile Available Water Content
PIK   Potsdam Institut für Klimafolgenforschung
USDA   U.S. Department of Agriculture
WISE   World Inventory of Soil Emission Potentials
WP   Wilting Point