Working Paper and Preprint **96/05**

DOCUMENTATION TO ISRIC-WISE GLOBAL DATA SET OF DERIVED SOIL PROPERTIES ON A ½° BY ½° GRID

(Version 1.0)

N.H. Batjes
September 1996

INTERNATIONAL SOIL REFERENCE AND INFORMATION CENTRE

ISRIC

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TABLE OF CONTENTS

Abstract

Raster image files of soil properties, derived from the "World Inventory of Soil Emission Potentials" (WISE) database, are presented on a ½° by ½° global grid, including: (1) Total Available Water Capacity (TAWC) in mm water per 1 m soil depth; (2) soil organic carbon density (kg C m^{-2} for 0-30 cm depth range); (3) soil organic carbon density (kg C m^{-2} for 0-100 cm depth range); (4) soil carbonate carbon density (kg C m^{-2} for 0-100 cm depth range); (5) soil pH (for 0-30 cm depth range); and (6) soil pH (for 30-100 cm depth range). Meta-data on the various data sets are presented. The raster image and documentation files follow the format of the NOAA Global Ecosystems Database, permitting their widespread use in global environmental studies.

Keywords: digital data sets; GIS; raster images; soil properties; global change

1 Introduction

The compilation and processing of large-scale data sets of the world's environmental resources, using well-documented procedures and standards, is crucial for many global modelling activities (Zuidema *et al.*, 1994; Scholes *et al.*, 1995; Ingram and Gregory, 1996). In spite of the importance of proper selection and quantification of soil factors for use in global models there still are only few published studies on this topic. Often, soil data sets are based on limited profile data and coarse resolution spatial data (Zobler, 1986; Webb *et al.*, 1991). Thus it remains crucial to update and expand soil data bases specifically developed to support sustainable development at the continental level (Oldeman and Van Engelen 1993; Arnold 1995; Madsen and Jones 1995).

Staff at ISRIC have developed a uniform methodology for a global database of soil properties within the framework of WISE, a project on World Inventory of Soil Emission Potentials (Batjes and Bridges, 1994; Batjes *et al.*, 1995). This report presents the documentation to six, WISE-derived, spatial databases which have been released by ISRIC for use by global modellers.

2 Methodology

The WISE database, which currently contains data for 4353 profiles, has been used to generate a series of uniform data sets of derived soil properties for each of the 106 soil units considered on the Soil Map of the World (FAO-UNESCO, 1974). These data sets were then linked to a ½° longitude by ½° latitude version of the edited and digital Soil Map of the World (FAO, 1995) to generate a number of GIS raster image files, including: (1) Total Available Water Capacity (TAWC) in mm water per 1 m soil depth; (2) soil organic carbon density (kg C m^{-2} for 0-30 cm depth range); (3) soil organic carbon density (kg C m^{-2} for 0-100 cm depth range); (4) soil carbonate carbon density (kg C m^{-2} for 0-100 cm depth range); (5) soil pH (for 0-30 cm depth range); and (6) soil pH (for 30-100 cm depth range). Full meta-data are presented in the Appendix.

The raster image files (see IDRISI, 1993) follow the format of the NOAA Global Ecosystem Database (Kinneman, 1992). As such, they can be used readily in a range of studies of global environmental change. Meta-data on the various data sets are included in the Appendix. References to the original publications, which include tabular data on the considered soil properties by FAO-UNESCO soil unit, are listed at the end of each documentation file.

3 Installation

The PKZIP®-compressed data files and documentation are distributed by ISRIC as e-mail attachments which include: WIS_SPA.TXT, WIS_INS.BAT and WIS_INS.ZIP.

The data set can be installed by typing **WIS_INS** from within the directory where the above files arrived as attachments on your PC [e.g. C:\E_MAIL\WIS_INS or C:\ANYNAME\WIS_INS]. Thereafter, the GIS-documentation (NAME.DOC), image (NAME.IMG) and palette (NAME.PAL) files and current documentation (ISRIC_WP96_05.PDF) are decompressed to the directory C:\ISRIC_W.

In order to access the data files using IDRISI®, the default path must be set to **C:**, and the default data path to **\ISRIC_W**, using options [1] and [2] of **ENVIRON**ment.

4 Conclusions

In its capacity as ICSU World Data Centre—C for Soils, ISRIC is releasing six spatially explicit databases of soil properties derived from the WISE database. The current data set complements an earlier data file with soil 1,125 profiles (Batjes, 1995), which formed an ISRIC contribution to the activities of the Global Soils Data Task Group of IGBP-DIS (Scholes *et al.*, 1995).

Version 1.0 of the ISRIC-WISE spatial data set is being released with the implicit understanding that the source will be acknowledged in all publications and products arising from use of the data. The data set is particularly meant for those scientists who wish to consider soil properties in ½° by ½° based studies of global change.

The full WISE database is not yet available in the public domain. However, it is the intention of FAO and ISRIC to merge data sets derived from the full WISE database with the recently released Digital Soil Map of the World (FAO, 1995) on a single CD-ROM in the near future.[1]

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[1] **Addendum:**
Initial results of work on combining the full-WISE database and the FAO/SMW data, prepared in a joint study by ISRIC, FAO and IIASA, have been presented as http//www.iiasa.ac.at/cgi-bin/pubsrch?ir97025. In this study, data have been compiled for all the considered combinations of soil unit, topsoil textural class, attribute and depth zone, both for the 1974 and 1990 Legend. In an ongoing activity gaps that remain in the derived data sets for the 1974 Legend are being "filled" in close consultation with a group of international soil experts. This follow-up activity, co-ordinated by FAO-AGLS, is considered necessary to arrive at a mutually agreed upon set of derived soil properties for land evaluation and environmental studies at the continental and global level, for subsequent release as a unified product to the global modelling community.

Acknowledgements

Version 1.0 of WISE was developed at the International Soil Reference and Information Centre (ISRIC) for a project on the Geographic Quantification of Soil Factors and Processes that Control Fluxes of Greenhouse Gases — known as World Inventory of Soil Emission Potentials (WISE) — with sponsorship from the Netherlands National Research Programme on Global Air Pollution and Climate Change (Project 851039). The projectinvolved close cooperation with the Food and Agriculture Organization (FAO) of the United Nations. The contributions of Drs E.M. Bridges (ISRIC) and F.O. Nachtergaele (FAO-AGLS) are specially acknowledged.

References

Arnold, R.W., 1995. Role of soil survey in obtaining a global carbon budget. In: *Soils and Global Change* (eds R. Lal, J. Kimble, E. Levine, and B.A. Stewart), pp. 257-263. Lewis Publishers, Boca Raton.

Batjes, N.H., 1995a. *World Inventory of Soil Emission Potentials: WISE 2.1 - Profile database user manual and coding protocols*. Technical Paper 26, ISRIC, Wageningen.

Batjes, N.H., 1995b. *A homogenized soil data file for global environmental research: A subset of FAO, ISRIC and NRCS profiles (Version 1.0)*. Working Paper and Preprint 95/10, ISRIC, Wageningen.

Batjes, N.H. and E.M. Bridges, 1994. Potential emissions of radiatively active gases from soil to atmosphere with special reference to methane: development of a global database (WISE). *Journal of Geophysical Research* **99(D8):** 16,479-16,489.

Batjes, N.H., E.M. Bridges and F.O. Nachtergaele, 1995. World Inventory of Soil Emission Potentials: Development of a global soil database of process controlling factors. In: *Climate Change and Rice* (eds S. Peng, K.T. Ingram, H.U. Neue and L.H. Ziska), pp. 102-115. Springer-Verlag, Heidelberg, pp. 102-115.

FAO, 1993. *Digitized Soil Map of the World.* World Soil Resources Report 67, FAO, Rome.

FAO, 1995. *Digital Soil Map of the World and Derived Soil Properties (version 3.5)*. FAO, Rome.

FAO-UNESCO, 1974. *Soil Map of the World. Volume I: Legend*. UNESCO, Paris.

IDRISI, 1993. *IDRISI User Guide (Version 4.0)*. Clark University, Worcester.

Ingram, S. and P. Gregory (eds), 1996. *Effects of global change on soils: implementation plan*. Global Change and Terrestrial Ecosystems Report No. 12, GCTE, Wallingford.

Kinneman, J.J., 1992. *Global Ecosystems Database, Version 1.0.* United States Department of Commerce, National Oceanic and Atmospheric Administration, National Geophysical Data Centre and World Data Centre-A for Solid Earth Geophysics, Boulder, Colorado.

Madsen, H.B. and R.J.A. Jones, 1995. The establishment of a soil profile analytical database for the European Union. In *European Land Information Systems for Agro-Environmental Monitoring* (eds D. King, R.J.A. Jones and A.J. Thomasson), pp. 55-63. Office for Official Publications of the European Communities, Luxembourg.

Oldeman, L.R. and V.W.P. Van Engelen, 1993. A World Soils and Terrain Digital Database (SOTER) — An improved assessment of land resources. *Geoderma* **60**, 309-35.

Scholes, R. J., D. Skole and J. S. Ingram, 1995. *A global database of soil properties: proposal for implementation*. IGBP-DIS Working Paper 10, International Geosphere Biosphere Program, Data and Information System, Paris.

Webb, S.R., C.E. Rosenzweig and E.R. Levine, 1991. *A global data set of soil particle size properties*. NASA Technical Memorandum 4286, New York.

Zobler, L., 1986. *A world soil file for global climate modelling*. NASA Technical Memorandum 87802, New York.

Zuidema, G., G.J. van den Born, J. Alcamo and G.J.J. Kreileman, 1994. Simulation of global land cover changes as affected by economic factors and climate. *Water, Air and Soil Pollution*, **76**: 163-198.

Appendix Meta-data on global ISRIC-WISE spatial data sets

ISRIC-WISE GLOBAL DATA SET OF DERIVED SOIL PROPERTIES ON A ½° BY ½° GRID (Version 1.0)

Contains: 6 IDRISI raster image files, including: soil pH (0-30 cm and 30-100 cm depth), soil moisture retention (to 100 cm depth), soil organic carbon density (0-30 cm and 0-100 cm depth), and soil carbonate carbon density (0-100 cm depth)

DATA-SET DESCRIPTION

Data-Set Name:

ISRIC-WISE global data set of derived soil properties on a ½° by ½° grid (Version 1.0)

Principal Investigator:

Niels H. Batjes

Scientific Reference:

Batjes, N.H., 1995. *World Inventory of Soil Emission Potentials: WISE 2.1 - Database User's Manual and Coding Protocols*. Technical Paper 26, ISRIC, Wageningen.

Batjes, N.H., 1995. *A Global Data Set of Soil pH Properties*. Technical Paper 27, ISRIC, Wageningen.

Batjes, N.H., 1996. Development of a World Data Set of Soil Water Retention Properties using Pedotransfer Rules. *Geoderma* **71**, 31-52.

Batjes, N.H., 1996. Total Carbon and Nitrogen in the Soils of the World. *European Journal of Soil Science*, **47**, 151-163.

Batjes, N.H., E.M. Bridges and F.O. Nachtergaele, 1995. World Inventory of Soil Emission Potentials: Development of a global soil database of process controlling factors. In: *Climate Change and Rice* (eds S. Peng, K.T. Ingram, H.U. Neue and L.H. Ziska), pp. 102-115. Springer-Verlag, Heidelberg, pp. 102-115.

SOURCE

Source Data Citation:

Batjes, N.H., 1996. Documentation to ISRIC-WISE global data set of derived soil properties on a ½° by ½° grid (Version 1.0). Working Paper and Preprint 96/05, ISRIC, Wageningen.

Contributor:

International Soil Reference and Information Centre (ISRIC)
P.O. Box 353, 6700 AJ Wageningen, The Netherlands
E-mail: SOIL@ISRIC.NL

Distributor:

see Contributor above

Vintage: 1996

Lineage:

1) N.H. Batjes and E.M. Bridges
International Soil Reference and Information Centre (ISRIC)
P.O. Box 353, 6700 AJ Wageningen, The Netherlands
E-mail: SOIL@ISRIC.NL
2) F.O. Nachtergaele
Food and Agriculture Organization of the United Nations (FAO)
Via delle Terme di Caracalla
00100 Rome, Italy
E-mail: AGL-Registry@fao.org

ORIGINAL DESIGN

Variables:

(1) Total Available Water Capacity (TAWC) in mm water per 1 m soil depth.
(2) Soil organic carbon density (kg C m^{-2} for 0-30 cm depth range)
(3) Soil organic carbon density (kg C m^{-2} for 0-100 cm depth range)
(4) Soil carbonate carbon density (kg C m^{-2} for 0-100 cm depth range)
(5) Soil pH (for 0-30 cm depth range)
(6) Soil pH (for 30-100 cm depth range)

Origin:

The current spatial data sets were derived from the World Inventory of Soil Emission Potentials (WISE) database which consists of: (1) a file with data on the type and relative extent of the component soil units of each ½º latitude by ½º longitude grid cell of the world, derived from the corrected 1:5 M scale FAO-UNESCO Soil Map of the World; and

(2) selected morphological, physical and chemical data for over 4300 soil profiles considered representative for the respective soil units of the world.

It is a pleasure to acknowledge the assistance of the following organizations and persons who have supplied advice, as well as soil profiles and analytical data from their records, including: A. Dubali, Instituti I Studimit Te Tokave, Tirana, Albania; J.C. Salazar Leaplaza, INTA, Centro de Investigaciones de Recursos Naturales, Buenos Aires, Argentina; R. Swift, Head, Division of Soils, CSIRO, Adelaide and G. Murtha, Division of Soils, CSIRO, Canberra, Australia; B.G. Moganane, Soil Survey Section, Ministry of Agriculture, Gaborone, Botswana; C. Tarnocai and J.A. Shields, Centre for Land Resources Research, Agriculture Canada, Ottawa, Canada; P.G. Jones and D.M. Castro, Centro International de Agricultura Tropical (CIAT), Cali, Colombia; H. Breuning-Madsen, Geografisk Institut, Kobenhavn Universitet, Denmark; S. Abdel Rahman, Department of Soils and Water Use, National Research Centre, Dokki, Cairo, Egypt; L. Urvas, Institute of Soils and Environment, Agricultural Research Centre of Finland, Jokionen, Finland; W. Eckelmann, Bundesanstalt für Geowissenschaften und Rohstoffe, Hannover and K.J. Hartmann, Elberswalde-Finow, Germany; G. Varallyay, Research Institute for Soil Science and Agricultural Chemistry, Budapest, Hungary; S. Diamond, Soils and Environmental Research and Development Centre, Johnstown Castle, Wexford, Ireland; D. Magaldi, Departimento Scienza del Suolo, Firenze, Italy; M. Duwayri, National Centre for Agricultural Research, Beqaa and A. Rihani, National Map and Land Use Project, Amman, Jordan; P.A. Finke, SC-DLO, Wageningen, The Netherlands; A. Hewitt, Landcare Research, Dunedin, New Zealand; E.O.U. Okoye, Department of Agricultural Land Resources, Abuja, Nigeria; J. Marcinek, Polish Society of Soil Science, Warsaw and A. Oldak, University of Warsaw, Poland; R.P.Ricardo, Centro de Estudos de Pedologia, Lisbon, Portugal; D.G. Paterson, Institute for Soil, Climate and Water, Pretoria, Republic of South Africa; C. Rauta, Research Institute for Soil Science and Soil Fertility, Bucarest, Romania; J. Gauld, Macaulay Land Use Research Institute, Aberdeen, Scotland; J.J. Ibanez, Centro de Ciencas Medioambientales, Madrid, Spain; J. Eriksson, Department of Soil Sciences, Swedish University of Agricultural Sciences, Uppsala, Sweden; S.E. Mugogo, Agricultural Research Institute Mlingano, Tanga, Tanzania; S. Senol, Department of Soil Science, University of Cukurova, Adana, Turkey; J.H. Molfino. Direccion de Suelos y Aguas, Ministerio de Ganaderia Agricultura y Pesca, Montevideo, Uruguay; R.J.A. Jones, Soil Survey and Land Research Centre, Silsoe, England; J. Kimble, National Soil Survey (SCS-NRCS), Lincoln and H. Eswaran, World Soil Resources (SCS-NRCS), Washington, USA; F.O. Nachtergaele, FAO-AGL, Rome; and J.H. Kauffman, ISRIC, Wageningen.

Version 1.0 of the WISE database has been developed at ISRIC in the framework of the Dutch National Research Programme on Global Air Pollution and Climate Change (Project 851039).

Geographic coverage:

Global

Maximum Latitude	+ 90 degrees (N)
Minimum Latitude	- 90 degrees (S)
Maximum Longitude	+180 degrees (E)
Minimum Longitude	-180 degrees (W)

Geographic sampling:

Spatial soil data derived from centre-point sampling of 5 by 5 minute grid cells of the corrected 1:5 M scale FAO-UNESCO Soil Map of the World (excl. Franz Josef Land and Svalbard), giving the full soil unit composition for these cells. This information was then aggregated to half-degree grid cells using FAO's Soil Composition Rules (see FAO World Soil Resources Report 67; griding algorithms developed by Dr F.O. Nachtergaele, FAO-AGL).

Temporal sampling:

Soil properties were derived from over 4300 soil profiles considered to be representative for the 106 soil units shown on the Soil Map of the World, mostly collected between 1950 and 1995. Main profile data contributors were: USDA Soil Conservation Service (SCS-NRCS), Food and Agriculture Organization (FAO), International Soil Reference and Information Centre (ISRIC), and a wide range of national soil survey organizations (see under lineage above).

INTEGRATED DATA-SET

Data-set citation:

Batjes, N.H., 1996. Documentation to ISRIC-WISE global data set of derived soil properties on a ½° by ½° grid (Version 1.0). Working Paper and Preprint 96/05, ISRIC, Wageningen.

Projection: geographic (lat/long)

Data representation: various classes and explanatory notes on these classes

Compressed data volume: about 104 Kb [PKZIP®]

ADDITIONAL REFERENCES

Batjes, N.H. and E.M. Bridges, 1992. *A Review of Soil Factors and Processes that Control Fluxes of Heat, Moisture and Greenhouse Gases*. Technical Paper 23, ISRIC, Wageningen.

Batjes, N.H., 1995. *A Homogenized Soil Data File for Global Environmental Research: A Subset of FAO, ISRIC and NRCS Profiles (Version 1.0)*. Working Paper and Preprint 95/10, ISRIC, Wageningen.

Batjes, N.H., 1997. A world data set of derived soil properties by FAO-UNESCO soil unit for global modelling. *Soil Use and Management*, **13:** 9-16.

Batjes, N.H. and E.M. Bridges, 1994. Potential Emissions of Radiatively Active Gases from Soil to Atmosphere with Special Reference to Methane: Development of a Global Database (WISE). *Journal of Geophysical Research - Atmospheres*, **99(D8)**:16,479-16,489.

Batjes, N.H., E.M. Bridges and F.O. Nachtergaele, 1995. World Inventory of Soil Emission Potentials: Development of a Global Soil Database of Process-controlling Factors. In *Climate Change and Rice* (eds S. Peng, K.T. Ingram, H.U. Neue and L.H. Ziska), pp. 102-115. Springer-Verlag, Heidelberg.

FAO, 1995. *Digitized Soil Map of the World.* World Soil Resources Report 67 (Version 1.0). FAO, Rome.

FAO-UNESCO, 1974. *Soil Map of the World. Volume I: Legend*. UNESCO, Paris.

DATA-SET FILES

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		WISE_CAC.DOC	1268
		WISE_CAC.IMG	259200
		WISE_CAC.PAL	224
		WISE_PH1.DOC	1174
		WISE_PH1.IMG	259200
		WISE_PH2.PAL	224
		WISE_PH2.DOC	1180
		WISE_PH2.IMG	259200
		WISE_PH2.PAL	224
		WISE_SC1.DOC	1279
		WISE_SC1.IMG	259200
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Total files listed			
18 files		1564408	bytes

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file type : binary
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rows : 360
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ref. units : deg
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max. X : 180.0000000
min. Y : -90.0000000
max. Y : 90.0000000
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resolution : 0.5000000
min. value : 0
max. value : 10
value units : classes
value error : unknown
flag value : none
flag def'n : none
legend cats : 11
category 0 : Background
category 1 : 0-4 kg C m^{-2}
category 2 : 4-8 kg C m^{-2}
category 3 : 8-12 kg C m^{-2}
category 4 : 12-16 kg C m^{-2}
category 5 : 16-24 kg C m^{-2}
category 6 : 24-36 kg C m^{-2}
category 7 : 36-48 kg C m^{-2}
category 8 : >48 kg C m^{-2}
category 9 : Glaciers
category 10 : Oceans & Inland waters
comment : Soil carbonate carbon is expressed as kg C m^{-2} to 100 cm depth
lineage : Source
lineage : Batjes, N.H., 1996. Total Carbon and Nitrogen in the Soils of
lineage : the World. *European Journal of Soil Science*, **47**, 151-163.
lineage : Derived from World Inventory of Soil Emission Potentials Database (WISE)
lineage : Copyright, ISRIC, Wageningen (1996)

DATA FILE DESCRIPTION
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SERIES:
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SPATIAL META-DATA:
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data type   : byte
file type   : binary
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ref. units : deg
unit dist. : 1.0000000
min. X   : -180.0000000
max. X   : 180.0000000
min. Y   : -90.0000000
max. Y   : 90.0000000
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value units : classes
value error : unknown
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flag def'n : none
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category 2 : 5.5<pH<=7.3
category 3 : 7.3<pH<=8.5
category 4 : 8.5<pH
category 5 : 4.0<pH<=8.5 Complex unit
category 6 : Glaciers
category 7 : Oceans
comment   : Topsoil refers to 0 to 30 cm depth range
lineage   : Source:
lineage   : Batjes, N.H., 1995. A global data set of soil pH properties.
lineage   : International Soil Reference and Information Centre (ISRIC),
lineage   : Technical Paper 27, Wageningen, The Netherlands.
lineage   : Derived from World Inventory of Soil Emission Potentials Database (WISE)
lineage   : Copyright, ISRIC, Wageningen (1996).

DATA FILE DESCRIPTION
DATA ELEMENT:
STRUCTURE:
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SERIES:
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category 4 : 8.5<pH
category 5 : 4.0<pH<=8.5 Complex unit
category 6 : Glaciers
category 7 : Oceans
comment   : Subsoil refers to 30 to 100 cm depth range
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lineage   : Batjes, N.H., 1995. A global data set of soil pH properties.
lineage   : International Soil Reference and Information Centre (ISRIC),
lineage   : Technical Paper 27, Wageningen, The Netherlands.
lineage   : Derived from World Inventory of Soil Emission Potentials Database (WISE)
lineage   : Copyright, ISRIC, Wageningen (1996).

DATA FILE DESCRIPTION
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WISE_SC1.DOC
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max. Y : 90.0000000
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flag def'n : none
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category 2 : 4-8 kg C m^{-2}
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category 6 : 24-36 kg C m^{-2}
category 7 : 36-48 kg C m^{-2}
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category 9 : Glaciers
category 10 : Oceans & Inland waters
comment : Soil organic carbon is expressed as kg C m^{-2} to 30 cm depth
lineage : Source:
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lineage : the World. *European Journal of Soil Science*, **47**, 151-163.
lineage : Derived from World Inventory of Soil Emission Potentials Database (WISE)
lineage :

DATA FILE DESCRIPTION
DATA ELEMENT:
STRUCTURE:
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data type : byte
file type : binary
columns : 720
rows : 360
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ref. units : deg
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max. X : 180.0000000
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max. Y : 90.0000000
pos'n error : unknown
resolution : 0.5000000
min. value : 0
max. value : 10
value units : classes
value error : unknown
flag value : none
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category 10 : Oceans & Inland waters
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lineage : Batjes, N.H. 1996. Total Carbon and Nitrogen in the Soils of
lineage : the World. *European Journal of Soil Science*, **47(2)** (in press)
lineage : Derived from World Inventory of Soil Emission Potentials Database (WISE)
lineage :

DATA FILE DESCRIPTION
DATA ELEMENT:
STRUCTURE:
Raster Data File: 30 x 30 minute grid
SERIES:
None
SPATIAL META-DATA:
WISE_AWC.DOC
file title : ISRIC-WISE Soil Moisture Retention (0-1 m)
data type : byte
file type : binary
columns : 720
rows : 360
ref. system : lat/long
ref. units : deg
unit dist. : 1.0000000
min. X : -180.0000000
max. X : 180.0000000
min. Y : -90.0000000
max. Y : 90.0000000
pos'n error : unknown
resolution : 0.5000000
min. value : 0
max. value : 11
value units : classes
value error : unknown
flag value : none
flag def'n : none
legend cats : 12
category 0 : Background
category 1 : T<=60 mm/m (> 66% of grid; mm m^{-1})
category 2 : 60<T<=90 (> 66% of grid; mm m^{-1})
category 3 : 90<T<=120 (> 66% of grid; mm m^{-1})
category 4 : 120<T<=150 (> 66% of grid; mm m^{-1})
category 5 : 150<T<=200 (> 66% of grid; mm m^{-1})
category 6 : 200<T<500 (> 66% of grid; mm m^{-1})
category 7 : T<=90 Complex (> 50% of grid; mm m^{-1})
category 8 : 90<T<=150 Complex (> 50% of grid; mm m^{-1})
category 9 : 150<=T Complex (> 50% of grid; mm m^{-1})
category 10 : Glaciers (> 66% of grid; mm m^{-1})
category 11 : Oceans (> 66% of grid; mm m^{-1})
comment : T is abbreviation for Total Available Water Capacity (TAWC) in mm
comment : to a depth of 100 cm (except for shallow Lithosols, Rankers and
Comment : Rendzinas)
lineage : Source:
lineage : Batjes, N.H., 1996. Development of a world data set of soil water
lineage : retention properties using pedotransfer rules. Geoderma (71), 31-52.
lineage : Derived from World Inventory of Soil Emission Potentials Database (WISE)
lineage : Copyright, ISRIC, Wageningen (1996).