LAND-OCEAN INTERACTIONS IN THE COASTAL ZONE (LOICZ)

Core Project of the
International Geosphere-Biosphere Programme: A Study of Global Change (IGBP)

LOICZ TYPOLOGY DATA SET DOCUMENTATION

Compiled and edited by:
M. van der Zijp
LOICZ Core Project Office
Netherlands Institute for Sea Research (NIOZ)
P.O. Box 59, 1790 AB Den Burg
Texel, The Netherlands

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1. INTRODUCTION

There are large and diverse areas of the globe that are associated with the coastal zone. In order to achieve the LOICZ goals of global synthesis and models, it is necessary to make full use of the existing research that is carried out in more restricted geographic areas. A coastal typology has been proposed as a way of generalising and extrapolating the results of well studies areas to not-so-well studies areas. For the typology data set, variables have therefore been selected for which global or near global data is available and which would promote a wide variety of applications within the wider LOICZ research community.

The Typology Data Set is made available to the public by Internet and in the near future will be published in co-operation with the Food and Agriculture Organization of the United Nations (FAO) on CD-ROM. This CD-ROM will find its place in FAO's CD-ROM sequence; "Land and Water Digital Media Series".

Both publications are to encourage researcher to provide us with information of needs and directions. The Typology data set is however not supposed to be a static product and will change as a consequence of additional demands and the availability of new data sets.

2. THE TYPOLOGY DATA SET

During the LOICZ Workshop on Typology in Feb. ‘97 it was agreed that for the immediate activities the geographic focus would be between 50 m elevation and 50 m depth. This data is available from the 5x5 minute digital elevation chart of the world (TerrainBase CD-ROM, NOAA, 1995). The 50 m elevation and depth contours were thought to provide a conservative definition that would ensure that the geographic area of interest would be included in the compiled data set and allow for additional refinements in the definition of the coastal zone in the future.

Most of today’s available data sets with a global or near global coverage come in a spatial resolution of a 1x1 degree. In order to extract from these data sets the information for our area of interest, the digital elevation chart was re-sampled to this resolution of 1x1 degree. As a result of the vertical increment and overall slope of the coastal zone not every coastal section contains a grid cell with a value between 50 and -50 meter. For these sections “artificial” grid cells were inserted so each coastal section is represented by one cell above and one cell below sea level. This implies that the average elevation of the cells are not necessarily between -50 and 50 meter elevation.

In total 9362 grid cells are selected to make up the coastal zone as defined above.

2.1. Data base and Geographic Information System

A great variety of data can be collected for the coastal zone. For the LOICZ Typology study the data requirements are; the information provided should have a global or near global coverage, be available in a digital format, need to promote a wide variety of applications and address any number of questions by the wider LOICZ research community.

Having acquired the available data, the information for the coastal zone is extracted. The above mentioned 1x1 degree elevation grid was used for this purpose. When, as a result of differences in the position of the shoreline between the data layers, the cells do not receive the required information. They are updated according to a position as identified by the 1x1 degree elevation grid. The data were extrapolated using the proximity command for variables having large homogenous spatial units and interpolation over the 12 nearest cells was used for continues data grids.

In a Geographic Information System (GIS) tables of different grid layers can be combined to form a single table. There are however hardware limitations to the number of tables that can be combined. In this study the total of selected tables exceeded this number. It was therefore decided to put the Typology data in a Data Base and provide for each record a unique number over which the data can be linked to a spatial cover. For this purpose a global grid was created in which the 1x1 degree cell squares are numbered from the upper left (90°N,180°W) to the lower right side (90°S,180°E), row wise.

2.2. Basic Structure of the Typology Data Base

The typology data base contains a number of data tables. In the table “A TYPOLOGY DATA SET” the primary data for the coastal zone is stored together with the above mentioned ID number and descriptor variables like; country and region name, etc. This table contains numeric data which is either quantitative data or a coding for qualitative information. A description of the coding used is provided in the table which has the same name as the field in question.

Not all information in the typology data base is based on 1x1 degree data sets. In the typology data base two additional tables exist; “A GLORI DATA” containing river discharge information based on river name, and “A FERTILIZER DATA” which contains fertiliser data, consumption/production, etc. based on country name.

The data table “A VARIABLE DESCRIPTION” provides a description of the fields in the “A TYPOLOGY DATA SET” table plus a reference code to their source(s). The full reference listing can be found in the table “A REFERENCE LIST”.

3. META DATA

In this chapter information about the used data set's is provided. This information will help users to understand the procedures used for coding and data measurement. It is however recommended that for detailed information users refer to the documentation of the original data source(s). A listing of all data sources is provided in appendix 3.

Most of today's data sets of interest to this study have a spatial resolution of 1x1 degree grid squares. It was therefore decided to use this resolution as our present standard. Data available in other resolutions are re-sampled to this 1x1 degree standard (180 rows, 360 columns, geographic projection). Re-sampling was executed using ARC/INFO's re-sample command with a nearest-neighbour assignment.

In Appendix 1 a listing of the variables in the present data set is provided. In the first column the variable or field name is given, followed by the description of the variable. The third column, where appropriate, the class limits are presented but for variables with numerous classes these limits are presented in appendix 2. The code of references for the variables, given in column 4, can be found in appendix 3.

3.1. Variable: Grid cell ID

Data source:

Original cell resolution:

Data description:

The grid cell id is a unique number for each of the global 1x1 degree grid squares. A global grid was created in which the 1x1 degree cell squares are numbered from the upper left (90°N, 180°W) to the lower right side (90°S, 180°E), row wise.

Comments:

This variable is provided to be able to link the data base with the GIS and overcome a hardware limitation of combining numerous grid layer to a single grid.

From the grid cell id cover the cells of the coastal zone are extracted and put in the data base. In total 9362 grid cells are selected to make up the coastal zone.

Processing to ARC/INFO and editing for ARC/INFO and Arcview by M. van der Zijp, LOICZ Core Project Office Netherlands Institute for Sea Research (NIOZ) P.O. Box 59, 1790 AB Den Burg Texel, The Netherlands. (1997).

3.2. Variable: Longitude and Latitude

Data source:

Original cell resolution:

Data description:

The longitude and latitude of the centre point of the grid cell.

Comments:

This information is provided in the data base as an additional indication of the grid cell location. With this information the cells can easily be mapped or located on the globe.

3.3. Variable: Country name, Region and Continent

Data source:

ArcWorld CD-ROM 1:3M, Edition 1 '92, Environmental Systems Research Institute, Inc. (ESRI). Original data from U.S. Government World Bank II, 1988.

Original cell resolution:

ARC/INFO Polygon covers.

Data description:

The ARC/INFO polygon covers have been converted to 1x1 degree grids.

Comments:

The country, region and continent name of the grid cell is provided for easy location of the grid cell. The data has not been checked for imperfections in country boundaries (a 1x1 degree grid cell has an approximate size of 100 km at the equator).

3.4. Variable: Basin ID

Data source:

GlobalARC GIS Data base '96, Center for Remote Sensing and Spatial Analysis, Cook College, Rutgers University New Brunswick, New Jersey, USA. Telephone - 1-908-932-9631. E-mail: global.sales@ocean.rutgers.edu. Reclassified map based on: digitally derived basin definitions.

Original cell resolution:

0.08 degree grid cells.

Data description:

ID number of the Basin name connected with the coastal zone. For this study the basin data sets from the GlobalARC CD-ROM are merged together to form a continues global cover and then re-sampled to 1x1 degree grid squares.

Comments:

Generated from a series of runs of r.watershed and r.reclass in GRASS in 1991. Data upon which this is based is etopo5, known locations of rivers, known locations of hydrologic depressions and stochastic data integration to ensure non-linear stream courses. The original raw basin map consisted of about 3500 computer generated digitally derived basins. A year was spent naming these basins and identifying areas of overlapping basins (per basin naming convention in the categories). It is realised that some basins overlap, these situations are indicated in the category names. Additional related data layers will be made available as they are developed based on funding priorities.

For the GlobalARC CD-ROM then converted to Arc/Info format. Because ARC/INFO has a value called "nodata" and GRASS4.1 does not, value 0 (which referred to "ocean/marine areas, or land other than Africa") of the GRASS version of this map was manually changed to the more appropriate value "nodata" in this ARC/INFO version.

Watershed modeling and processing by R. Lozar, basin identification by P. Jahn, GRASS software enhancements by C. Ehlschlaeger at USA-CERL, Champaign, IL. Editing of GRASS version completed at the Cook College Remote Sensing Center, Rutgers University, New Brunswick, NJ by: M. Crowley. Processing to ARC/INFO and editing for ARC/INFO version by C.O'Neil and A.Rowan at CRSSA, Cook College, Rutgers University, New Brunswick, NJ, U.S.A. (1996).

3.5. Variable: Cell Location ID

Data source:

Original cell resolution:

Data description:

This variable indicates the position of the cell in the coastal zone which was defined as the area between the 50 meter bathymetry and 50 meter contour line. The land-water boundary is based on the 1x1 degree re-sampled 5x5 minute digital elevation chart of the world (TerrainBase CD-ROM, NOAA, 1995).

Comments:

In order to indicate the position of a grid cell in the coastal zone. A cell is marked as being; offshore, along shore, onshore or inland. An onshore cell position is the first cell bordering the shoreline on the landward side. A cell identified as along shore is located at the seaward side of the shoreline. The offshore and inland positions are found further seawards or inland within the above mentioned perimeter.

As discussed in the chapter 2 “The Typology data set” each coastal section should have at least one along shore and one onshore cell. Where needed “artificial” grid cells were inserted implying that the average elevation of these cells are not necessarily between -50 and 50 meter elevation.

3.6. Variable: Wave height

Data source:

From Times Atlas of the Oceans, p 58.

Original cell resolution:

Data description:

Greatest Wave Height with a frequency of 3% or more.

Comments:

The wave height (wave energy) is important for sorting sediments. It also influences the magnitude of the longshore current, resulting from waves moving towards the beach at an oblique angle.

The grid cover was created from the map from the Times Atlas of the Oceans. This map was first digitised into an ARC/INFO polygon cover which was then converted to a 1x1 degree grid cover.

Processing to ARC/INFO and editing for ARC/INFO and Arcview by M. van der Zijp, LOICZ Core Project Office Netherlands Institute for Sea Research (NIOZ) P.O. Box 59, 1790 AB Den Burg Texel, The Netherlands. (1997).

3.7. Variable: Tidal type

Data source:

World Atlas of Geomorphic Features. Snead, R.E., 1980. Robert E. Krieger.288 p.

Original cell resolution:

Data description:

Global Tidal Types; semi diurnal, mixed or diurnal.

Comments:

The number of high and low tides within approximately 24 hours (tidal type) determines the flow velocity of the tidal current. For any given range, a diurnal tide will produce less rapid currents than a semidiurnal tide, because the alternation in water level takes about twice as much time. A diurnal tide, however, entails intrusion of salt water further upstream, especially during periods of relatively low river discharge, i.e., in the dry season.

The small scale map produced by Snead, R.E., 1980 was digitised into an ARC/INFO polygon cover which was then converted into a grid with 1x1 degree resolution.

Processing to ARC/INFO and editing for ARC/INFO and Arcview by M. van der Zijp, LOICZ Core Project Office Netherlands Institute for Sea Research (NIOZ) P.O. Box 59, 1790 AB Den Burg Texel, The Netherlands. (1997).

3.8. Variable: Tidal range

Data source:

Geographical Variation in Coastal Development, Davies, J.L., 1980.. London: Longman Group Ltd. 212 p. Global overview of tidal range classes.

Original cell resolution:

Data description:

Tidal range classes based on a small scale map produced by Davies, J.L., 1980.

Comments:

The combined effect of wave and tidal processes is an important mechanism in shoreline sedimentation and thus the type of shoreline that develops. The small scale global map produced by Davies, J.L., 1980 was first digitised into an ARC/INFO poly cover and later converted to 1x1 degree grid.

Processing to ARC/INFO and editing for ARC/INFO and Arcview by M. van der Zijp, LOICZ Core Project Office Netherlands Institute for Sea Research (NIOZ) P.O. Box 59, 1790 AB Den Burg Texel, The Netherlands. (1997).

3.9. Variable: Cultivation intensity

Data source:

Generated by Mimportcell in GRASS for Global GRAS CD-ROM #1 from NASA Goddard Space Flight Center Technical Memorandum 86107: Natural (Pre-agricultural) Vegetation, E. Matthews, 1983 the original data source. Later converted to ARC/INFO format for the GlobalARC CD-ROM.

Original cell resolution:

The resolution of the data on the GlobalARC CD-ROM is 0.08 degree. The original data had a resolution of 1 degree.

Data description:

Aerial extent of presently cultivated land (%) in 5 categories. For this study re-sampled to the original resolution of 1 degree.

Comments:

Aerial extent of presently cultivated land. Category 1 shows zero percent cultivation and 100 percent natural vegetation. Category 2 is 20% cultivated and 80% natural vegetation. Category 3 shows 50%-50% cultivated to natural vegetation. Category 4 represents a 75%-25% ratio of cultivated to natural vegetation. And Category 5 shows 100% cultivated land and zero percent natural vegetation. A complete discussion of the data set is found in: E. Matthews, 1983, Global Vegetation and Land Use: New High Resolution Data Bases for Climate Studies, "J. Climat. Appl. Meteor." 22, 474-487.

Processing to GRASS format by R. Lozar, edited by M.Anderson at Construction Eng. Research Lab, Champaign, IL. Processing to ARC/INFO and editing for ARC/INFO version by C.O'Neil and A.Rowan at CRSSA, Cook College, Rutgers University, New Brunswick, NJ, U.S.A. (1996).

3.10. Variable: Methane

Data source:

Generated from data of the National Center for Atmospheric Research, by extraction from 1/2" tape, imported to GRASS for Global GRASS CD-ROM #5, and then converted to ARC/INFO format for the GlobalARC CD-ROM.

Original cell resolution:

The data on the GlobalARC CD-ROM has a resolution of 0.08 degree. The original data had a 1 degree x 1 degree resolution.

Data description:

Kilograms of Methane produced per square kilometer x 1000.

Comments:

The numbers produced were multiplied by 1000 to produce non-decimal numbers. For the GlobalARC CD-ROM, these data were converted to ARC/INFO. The cell value = Kilograms of methane produced/sq. km x 1,000. The original National Center for Atmospheric Research data were 1 degree x 1 degree resolution.

Processed to GRASS by J. Thompson and R. Lozar, at Construction Engineering Research Lab., Champaign, IL Editing of GRASS version completed at the Center for Remote Sensing and Spatial Analysis, Cook College, Rutgers University, New Brunswick, New Jersey, USA by: L. Rakos Processing to ARC/INFO and editing for ARC/INFO version by C.O'Neil and A.Rowan at CRSSA, Cook College, Rutgers University, New Brunswick, New Jersey, U.S.A. (1996).

3.11. Variable: Soil type

Data source:

Generated from data of NOAA/NCAR from NASA Goddard Space Flight Center, Institute for Space Studies, NASA Tech Mem #100685, B. Staub & C. Rosenzweig by Mimportcell in GRASS for Global GRASS CD-ROM #1, then converted to ARC/INFO for the GlobalARC CD-ROM.

Original cell resolution:

The data on the GlobalARC CD-ROM has a resolution of 0.08 degree. The original data had 1 degree x 1 degree resolution.

Data description:

Clustered soil type based on dominant features.

Comments:

Based on the FAO 1974 Soil Map of the World and on the Matthews (1983;1984) vegetation data set Zobler re-sampled this data to a 1 degree grid size, which filled in data missing from the original map, and reconciles certain discrepancies Zobler (1986).

In total 106 different soil types are distinguished in the FAO Soil Map of the World (1974). A soil is the result of soil forming processes on rock. The nature and intensity of these soil forming processes is defined by; parent material, climate, relief, and the influence of; men, animal or plant, and time. A soil therefore reflects to a great extend the morphology and the type of material (Duchaufour 1982). In order to reduce the number of soil types and provide descriptive information of the physiographic and morphologic conditions, soil type, textural class and its phase are used to create the following classes, see table 2.

Table 2 Soil type to features.

Soil type	Important feature
no soils	No data and marine areas
fluvisols	flood plain soils/intermediate drained soils
gleysoils/planosols/histosols	wet soils/poorly drained/peat soils
yermosols/xerosols/regosols/arenosols	well drained/dry soils
lithosols/redzinas	rocky soils
kastanozems/chernozems/phaeozoems/greyzems/ranker	soils rich in organic matter
vertisols/	heavy textured soils
solonchaks/solonetz	salty soils
cambisols	soils lacking most of the other features
luvisols/podzols/podzolluvisol	lessived soils
ferrosols/acrisols/nitosols	iron rich soils
andosols	soils on vulcanic material
all types with gelic	permafrost soils
no soils	land ice

3.12. Variable: Dominant Soil Texture.

Data source:

International Satellite Land Surface Climatology Project (ISLSCP), Global data set for land-atmosphere models Initiative 1: '87-88 Volumes 1-5. NASA Goddard DAAC Science Data series. The Dominant Soil Texture data is based on the work of Zobler (1986).

Original cell resolution:

1 degree X 1 degree array.

Data description:

Soil texture is characterised here as either coarse, medium/coarse, medium, fine/medium, fine, ice or organic.

Comments:

The data is based on the work of Zobler (1986) who converted the three textural classes recognised by the FAO Soil Map of the World (1974) into a 1x1 degree array with 5 textural classes.

The Dominant Soil Texture is characterised here as either coarse, medium/coarse, medium, fine/medium, fine, ice or organic. These textural classes reflect the relative proportions of clay (fraction less than 2 micrometers), silt (2-50 micrometers), and sand (50-2,000 micrometers) in the soil. The texture of a soil is very important because, in combination with other properties, it influences soil structure, consistence, porosity, cation exchange capacity, permeability and water holding capacity.

3.13. Variable: Soil carbon content

Data source:

Downloaded from UNEP Grid-Archive: http://www.grid.unep.ch/gridhoeme.html
Original data source: Batjes, N.H., 1996. Total Carbon and Nitrogen in the Soils of the World. European Journal of Soil Science, 47, 151-163. Derived from World Inventory of Soil Emission Potentials Database (WISE).

Original cell resolution:

0.5x0.5 degree

Data description:

Soil carbonate carbon expressed as kg C/m^2 to 100 cm soil depth.

Comments:

3.14. Variable: DSRF, Dunes, Swamps and Glaciers

Data source:

International Satellite Land Surface Climatology Project (ISLSCP), Global data set for land-atmosphere models Initiative 1: '87-88 Volumes 1-5. NASA Goddard DAAC

Science Data series. The hydrological coverage data was derived from published maps by J.G.Cogley (1987) at Trent University.

Original cell resolution:

spatial resolution of 1 X 1 degree.

Data description:

These data provide global areal coverage of different hydrological terrain.

Comments:

DSRF is short for "dry surface". This field is simply the sum of the percentages in land (Exposed land not covered by swamp, intermittent water bodies, glacier ice, sand dunes, saltmarsh or salt flats.) + swamp + dunes + salt marsh cover. Dunes means Sand dunes. Swamp is swamp, marsh and other wetlands. Salt marsh is simply salt marsh but glaciers is glacier ice, including shelf ice but excluding pack ice.
The data has been grouped in four classes: 1 = 0 - 25%, 2 = 26 - 50%, 3 = 51 - 75% and 4 = 76 - 100% of areal extent.

3.15. Variable: Ecosystem

Data source:

NOAA/Oak Ridge National Laboratory, Martin Marietta Energy Systems, Inc, The CDIC Numeric Data Collection. Generated by Src/import.rle/import.rle in GRASS for Global GRASS CD-ROM #1, then to ARC/INFO format for the GlobalARC CD-ROM which is used as data source for this study.

Original cell resolution:

The GlobalARC data is in a resolution of 0.08 degree. The original data from The CDIC Numeric Data Collection came in 0.5 degree grid squares.

Data description:

Spatial distribution of major ecosystem complexes estimated for 1980.

Comments:

The global ecology map shows the spatial distribution of major world ecosystem complexes estimated for 1980. It was generated by Src/import.rle/import.rle in GRASS for Global GRASS CD-ROM #1, then to ARC/INFO format for the GlobalARC CD-ROM and re-sampled to a 1x1 degree grid for the LOICZ typology data set. Because some information sources documented are older, some of this information may not be current.

Processing to GRASS format by R. Lozar, edited by M.Anderson at Construction Eng. Research Lab, Champaign, IL. Processing to ARC/INFO and editing for ARC/INFO version by C.O'Neil and A.Rowan at CRSSA, Cook College, Rutgers University, New Brunswick, NJ, U.S.A. (1996).

3.16. Variable: Coral

Data source:

Generated by Gmapcalc in GRASS for Global GRASS CD-ROM #1 from Times Atlas of the Oceans, pp. 210-211, then converted to ARC/INFO format for the GlobalARC CD-ROM used here.

Original cell resolution:

0.08 degree grid squares.

Data description:

Presence or absence of coral reefs.

Comments:

Areas of coral reefs are the high mid-seas production areas. They are also highly susceptible to environmental abuses. Thus, coral reef locations are considered important and fragile environments. This map was generated from Gmapcalc in GRASS, and was later converted to ARC/INFO.

Processing to GRASS format by D. Knapp and R. Lozar Edited by M.Anderson, at Construction Eng. Research Lab, Champaign, IL. Processing to ARC/INFO and editing for ARC/INFO version by C.O'Neil and A.Rowan at CRSSA, Cook College, Rutgers University, New Brunswick, NJ, U.S.A. (1996).

3.17. Variable: vegetation class

Data source:

International Satellite Land Surface Climatology Project (ISLSCP), Global data set for land-atmosphere models Initiative 1: '87-88 Volumes 1-5. NASA Goddard DAAC Science Data series. Original data source: DeFries, R. S. and J. R. G. Townshend, 1994a, NDVI-derived land cover classification at global scales. International Journal of Remote Sensing, 15:3567-3586. Special Issue on Global Data Sets.

Original cell resolution:

1x1 degree grid squares.

Data description:

The data set describes the geographic distributions of eleven major cover types based on interannual variations in NDVI.

Comments:

The ISLSCP data set was developed to explore the conceptual and methodological issues that arise when using the Normalized Difference Vegetation Index (NDVI) as a basis for global classification of vegetative land cover. The purpose of the study was to use satellite data to improve currently available information on global land cover for applications to global change research.

Phenological differences among vegetation types, reflected in temporal variations in NDVI derived from satellite data, have been used to classify land cover at continental scales. The ISLSCP study explored methodologies for extending this concept to a global scale. A coarse resolution (one by one degree) data set of monthly NDVI values for 1987 (Los, et al. 1994, Sellers, et al. 1994, 1995b) was used as the basis for a supervised classification of eleven cover types that broadly represent the major biomes of the world. Because of missing values at high latitudes, the Pathfinder AVHRR data set for 1987 (James and Kalluri, 1994) for summer monthly NDVI and red reflectance values were used to distinguish the following cover types: tundra, high latitude deciduous forest and woodland, coniferous evergreen forest and woodland.
The eleven cover types were selected primarily to conform with the cover types required as input to climate models. Training sets for each of the eleven cover types were identified as the areas where three existing ground-based data sets of global land cover (Matthews 1983, Olson, et al. 1983, Wilson and Henderson-Sellers 1985) agree that the land cover is present.

The global land cover data set is the result of a maximum likelihood classification of eleven cover types. The data set has not been systematically validated. Cursory validation indicates that the user should be aware of the following problems:
1) the distinction between "cultivated" and "grassland" cover types may be inaccurate because the NDVI temporal profiles of these two cover types are not significantly distinct.
2) the "tundra" cover type may be inaccurate because of missing data at high latitudes.

3.18. Variable: Tropical forest destruction

Data source:

Manually digitised in GRASS, from edited World Wildlife Fund's Atlas of the Environment (1992) analog map, for Global GRASS CD-ROM #5, then converted to ARC/INFO format for the GlobalARC CD-ROM.

Original cell resolution:

0.08 degree on GlobalARC and GRASS CD-ROM.

Data description:

The extent of tropical rain forest destruction between 1940 late 1980's.

Comments:

This map was manually digitised from the analogue map "Tropical Forest Destruction" contained in the 1992 World Wildlife Fund's Atlas of the Environment (pp. 66-67). The categories depict the extent of tropical rainforests circa 1940 (Cat 1) and again in the late 1980s (Cat 2). The original data was derived from:

1. Smithsonian Institution 1988 Tropical Rainforests: A Disappearing Treasure. Washington DC: Smithsonian Institution Travelling Exhibition Service
2. Collins, M. The Last Rainforests. London. Mitchell Beazley in 1990 association with the IUCN-The World Conservation Union.

The data was transferred from the analogue map to mylar and digitised in XY. The cell resolution of the XY grid was the same as the standard Lat-Long used in the Global GRASS CDs which facilitated the conversion of the vector map to a raster map in Lat-Long, the format of the data released on GlobalARC CD-ROM.

Digitising and editing by L. Rakos at the Center for Remote Sensing and Spatial Analysis, Cook College, Rutgers University, New Brunswick, New Jersey, USA. Processing to ARC/INFO and editing for ARC/INFO version by C.O'Neil and A.Rowan at CRSSA, Cook College, Rutgers University, New Brunswick, New Jersey, U.S.A. (1996).

3.19. Variable: Morphologic and Tectonic classification of coasts

Data source:

Inman and Nordstrom, 1971. On the Tectonics and Morphologic Classification of Coasts. The Journal of Geology, Volume 79, number 1.

Original cell resolution:

Data description:

Tectonics and Morphologic Classification of Coasts

Comments:

A coastal classification, based in part on a synthesis of the statistics on coastal morphology developed for first- and second-order features. The first order, tectonic, feature features defines whether a coast is a collision or a trailing-edge coast. A second order feature is the physical characteristic of a coast classed as; erosional versus a depositional coast or a coast with the growth of organic reefs.

The small scale map was digitised into an ARC/INFO arc cover which was then converted to a 1x1 degree grid cover.

Processing to ARC/INFO and editing for ARC/INFO and Arcview by M. van der Zijp, LOICZ Core Project Office Netherlands Institute for Sea Research (NIOZ) P.O. Box 59, 1790 AB Den Burg Texel, The Netherlands. (1997).

3.20. Variable: LGP

Data source:

Reference Length of Growing Period. FAO

Original cell resolution:

0.5 x 0.5 degree grid squares.

Data description:

The Length of Growing Period (LGP) describes the potential of the land for crop production considering climate as the limiting factor.

Comments:

The length of the available growing period (LGP) concept, was developed by FAO in the late seventies to quantify the period when temperature and moisture conditions are such to allow crop growth. FAO applied it in an agro-ecological inventory and rainfed crop suitability evaluation in the tropics and subtropics.

In the length-of-growing-period the operational definition of growing period is 'the period (in days) during the year when precipitation (P) exceeds half the potential evapotranspiration (PET) plus a period required to evapotranspire up to 100 mm of water from excess precipitation assumed stored in the soil profile' (FAO, 1978). The rationale for these operational limits can be found in the source publication, but basically they represent empirically validated thresholds for the reliable start and end of the agronomically relevant growing period, which take due account of respectively early, unreliable rains, and stored soil moisture.

Obviously in temperate and cold areas temperature becomes a more critical factor in determining the growing season than in tropical and subtropical areas. In addition, variations of day length, negligible at lower latitudes, becomes sufficiently important at higher latitudes to influence the agricultural productivity of particular seasons. At the same time moisture constraints remain important determinants.

3.21. Variable: GNP

Data source:

Reclassified map from World Wildlife Fund's Atlas of the Environment (1992), (on Global GRASS CD1) for Global GRASS CD-ROM #5, then converted to ARC/INFO format for the GlobalARC CD-ROM which is used here.

Original cell resolution:

0.08 degree on GlobalARC and GRASS CD-ROM.

Data description:

Per Capita Gross National Product (GNP) (U.S.$ 1990)

Comments:

The Gross National Product data was obtained from the chloropleth map depicting "Per capita GNP" contained in the 1992 World Wildlife Fund's Atlas of the Environment (pp. 42-43).

Categories 2 - 8 depict per capita Gross National Product by country in 1990. Category 1 indicates areas of insufficient data. The original data was obtained by the WWF from The World Bank Atlas 1991 Washington, DC: World Bank

The GNP for the following countries is an estimated World Bank figure: Namibia, Congo, Liberia, Djibouti, Sudan, Yemen-PDR, Iraq, Lebanon, Afghanistan, Burma, Cambodia, Laos, Mongolia, New Caledonia, Bermuda,Nicaragua, French Guiana, Greenland.

The GNP map for the GlobalARC CD-ROM was generated by reclassifying an existing raster map of NATIONS. NATIONS can be found on Global GRASS CD-ROM 1 and was itself generated from a digitised file of the political boundaries of the world. The scale of the original political map was 1:40,000,000 and was digitised from a paper map in the University of Illinois library by D. Knapp and R. Lozar at CERL. The map had no copyright or author. Some of the small island nations were too small to digitise and thus are not present.

The GRASS module r.reclass was used to change the original political information into the present GNP GlobalARC categories. Because ARC/INFO has a value called "nodata" and GRASS4.1 does not, value 1 (which referred to "insufficient data") of the

GRASS version of this map was manually changed to the more appropriate value "nodata" in this ARC/INFO version.

Processing for GRASS version by L. Rakos at the Center for Remote Sensing and Spatial Analysis, Cook College, Rutgers University, New Brunswick, New Jersey, USA. Processing to ARC/INFO and editing for ARC/INFO version by C. O'Neil and A. Rowan at CRSSA, Cook College, Rutgers University, New Brunswick, NJ, U.S.A. (1996).

3.22. Variable: Population density

Data source:

Gridded Population of the World prepared by National Center for Geographic Information and Analysis (NCGIA). "downloaded from CIESIN, ftp://ftp.ciesin.org".

Original cell resolution:

0.0833 degree grid squares.

Data description:

The estimated 1994 population of two hundred seventeen countries assigned to five minute by five minute quadrilaterals covering the world. The grid extends from latitude 57^{o} south to 72^{o} north latitude. For the LOICZ Typology data set the raw population density data was re-sampled to a 1x1 degree grid and grouped into 6 classes. Data above 72^{o} north and below 57^{o} south is set to “nodata”.

Comments:

As a first step towards a global socio- political- demographic- economic- database indexed by latitude and longitude The Global Demography Project has produced a consistent data set of population numbers for the world. This required the collection of two major components. The first component was spatial boundary information describing administrative regions within the countries of the world, followed by assembly of the corresponding enumerations (or estimates) of the total population residing in each of these regions. In this initial attempt only information on the total number of people was collected. From these two components a gridded data set of population numbers for the globe at a modest resolution was derived. The Global Demography Project refers to this as modest or medium resolution because, as described earlier, finer data exists for several parts of the world. But the project not concerned with data at the city block level. And it recognised that simply knowing the geographic arrangement of the world's population is not sufficient to determine its two-way interaction with the environment.

Boundary data

The key to producing a spatial demographic database are the geographic boundaries that are used to reference socio-economic information. Virtually every country of the world has instituted an administrative hierarchy that partitions the country into units; often an attempt is made to have these be more or less homogeneous units. For the purposes of this the country is defined to be the zero-level within the hierarchy. In the United States, the 50 states (plus Washington D.C.) define the first sub-national level, the 3141 counties represent the second level, and so on. The size of these units obviously varies greatly by country. Most first level units in Zaire, for example, are still larger than the neighbouring countries of Rwanda and Burundi. For that reason, objective measures such as the average size of a unit at a given level (i.e., mean resolution as previously defined) or the number of people per unit in a country provide a basis for cross-national comparison. These measures are generally more appropriate than the position or level of the unit in the political hierarchy.

The Global Demography Project attempted to obtain second level boundaries, corresponding to counties or districts, except in the case of very small countries or islands. It is referred to here as medium resolution because this level of detail bridges the gap between the coarse resolution of national level data and high resolution at the block or enumeration area level. Due to the limited time and resources available, the global demography project relied mostly on existing spatial boundary data sources. The primary producers of such data are national or supra-national public data collecting agencies (e.g., US Census Bureau, Eurostat), international institutions (e.g., UN-FAO, UNEP, CGIAR), universities engaged in research activities around the world, and private companies providing spatially referenced socio-economic data chiefly for marketing applications. For a few countries for which no existing boundary data could be obtained, administrative boundaries were digitised at NCGIA using maps found in the University of California system libraries.

3.23. Variable: Runoff

Data source:

International Satellite Land Surface Climatology Project (ISLSCP), Global data set for land-atmosphere models Initiative 1: '87-88 Volumes 1-5. NASA Goddard DAAC Science Data series. Original data source: The hydrological cover data was acquired from J.G. Cogley at Trent University and was derived from maps in a considerable number of sources, of which Korzun et al. (1977) was the most important.

Original cell resolution:

In the above mentioned source the resolution was 1x1 degree but in the original data the resolution was 2x2 degree, see comment.

Data description:

Classed Surface runoff of water in mm per year

Comments:

This field contains the annual average of surface water runoff from land surfaces (in mm/yr.). Because runoff is a dynamic quantity it is harder to measure reliably than the static (or very slowly changing) and maps of hydrological quantities like runoff are therefore less reliable than maps of hydrographic properties such as the extent of salt flats or wetlands. For this reason a working resolution of 2 degrees by 2 degrees was adopted when transferring information from runoff maps to digital storage, and an effort was made to quantify the error in the runoff estimates. However Runoff is presented at 1x1 resolution: 1x1 land cells were assigned the runoff estimated for the 2x2 cell to which they belong, and ocean cells were assigned runoff of zero. For cells containing large lakes, only the runoff from land portions of the cell was recorded.

Surface runoff is negative over some parts of the Earth's land surface -- for example in the centres of enclosed drainage basins, and in places where large rivers like the Nile flow across deserts, losing water steadily -- but this phenomenon was not allowed for in Runoff. (It is difficult to obtain accurate estimates of the magnitude of negative runoff, which will generally be small.) An estimated runoff of 1 mm/yr. should be taken to mean that the actual runoff is probably indistinguishable from zero. However where an element of Runoff is 0 the implication is that the runoff is indeed zero, because the cell in question contains no hydrographic evidence of surface runoff. For the LOICZ data set the runoff has been reduced to 8 classes.

3.24. Variable: Tropical Storms

Data source:

Original Data Source: Couper, Alastair. 1983. Times Atlas of the Oceans. Van Nostrand Reinhold Co.:New York, pp. 160-1 Original Cell Resolution: 4 Minutes 48 Seconds Data Description: generated by VECT_TO_CELL in GRASS for Global GRASS CD-ROM #5, then converted to ARC/INFO format for the GlobalARC CD-ROM which is used here.

Original cell resolution:

0.08 degree on GlobalARC.

Data description:

Tropical storms with a likelihood of a Beaufort force of 8 or above.

Comments:

This map shows tropical storms with a likelihood of a Beaufort force of 8 or above. These would be areas of increased risk for shipping. Areas shown which cover land are correct except for Australia.

Processing to GRASS format by R. Lozar at Construction Eng. Research Lab, Champaign, IL GRASS version edited by M. Stallings at the Center for Remote

Sensing and Spatial Analysis, Cook College, Rutgers University, New Brunswick, New Jersey, USA. Processing to ARC/INFO and editing for ARC/INFO version by C.O'Neil and A.Rowan at CRSSA, Cook College, Rutgers University, New Brunswick, New Jersey, U.S.A. (1996).

3.25. Variable: Winter Gales

Data source:

Original Data Source: Couper, Alastair. 1983. Times Atlas of the Oceans. Van Nostrand Reinhold Co.:New York. p160-1. Manually digitised and modified with Gmapcalc command in GRASS for Global GRASS CD-ROM #5, then converted to ARC/INFO format for the GlobalARC data set used here.

Original cell resolution:

Original Cell Resolution: 4 Minutes 48 Seconds. The grid data on GlobalARC CD-ROM has a resolution of 0.08 degree grid squares.

Data description:

Winter gales show those areas where the Beaufort Force 7 is exceeded.

Comments:

This map was created by sketching the polygons from the original analog map, on page 160 and 161 of the Times Atlas of the Oceans, onto a geographic projection.
Winter gales show those areas where the Beaufort Force 7 is exceeded. The isolines indicate the percentage of the year Force 7 is exceeded. The higher the percentage indicated, the more dangerous these areas are considered for purposes of shipping.

Processing to GRASS format by R. Lozar at Construction Eng. Research Lab, Champaign, IL GRASS version edited by M. Stallings at the Center for Remote Sensing and Spatial Analysis, Cook College, Rutgers University, New Brunswick, New Jersey, USA. Processing to ARC/INFO and editing for ARC/INFO version by C.O'Neil and A.Rowan at CRSSA, Cook College, Rutgers University, New Brunswick, New Jersey, U.S.A. (1996).

3.26. Variable: Precipitation

Data source:

International Satellite Land Surface Climatology Project (ISLSCP), Global data set for land-atmosphere models Initiative 1: '87-88 Volumes 1-5. NASA Goddard DAAC Science Data series. Thanks to B. Rudolf and U. Schneider of the WCRP Global Precipitation Climatology Centre for Providing the GPCP/GPCC, 1994: Preliminary 1987/88 continental precipitation data sets for ISLSCP on a 1 degree grid based on precipitation-gauge measurements.

Original cell resolution:

1x1 degree.

Data description:

Mean Seasonal Precipitation (mm/yr.) calculated from the monthly precipitation as analysed from precip-gauge measurements.

Comments:

The 1 x 1 degree precipitation data sets, produced for the ISLSCP CD-ROM, are based only on the precipitation-gauge analysis. The main basis for this precipitation analyses over land are conventional precipitation-gauge measurements. Area-average monthly precipitation is calculated from the point measurements by using a spatial objective analysis method, which is based on an inverse distance and directional weighting. The point measurements at the stations are representative only for an area surrounding the rain-gauge, the size of which depends on orographic and climatic conditions.

For the LOICZ data set the 3 month's seasonal means were calculated and grouped into 10 classes based on a visual interpretation of the selected class limits.
The seasons are defined as: Winter: December(same year), January and February. Spring: March, April and May. Summer: June, July and August. Autumn: September, October and November.
.

3.27. Variable: PAR

Data source:

International Satellite Land Surface Climatology Project (ISLSCP), Global data set for land-atmosphere models Initiative 1: '87-88 Volumes 1-5. NASA Goddard DAAC Science Data series. The 3-hourly radiation fluxes were produced at the Department of Meteorology, University of Maryland by Drs. R.T. Pinker and I. Laszlo under grants NA16RC0113-01 and NA36GP0386 from NOAA/Climate and Global Change Program Operational Measurements and NAG5-914 from the National Aeronautics and Space Administration, Earth Science and Applications Division, Climate Research Program.

Original cell resolution:

Resolution of the data on the ISLSCP CD-ROM is 1x1 degree.

Data description:

The Monthly 3-Hourly Surface Photosynthetically Active Radiation downward flux (PAR) data transformed into seasonal maximum and minimum classed data.

Comments:

Information on PAR is important for modelling evapotranspiration over land and in controlling biogeochemical cycles in the oceans and over land. The Monthly 3-Hourly PAR data from the ISLSCP CD-ROM is transformed into seasonal maximum and minimum classed data in order to allow for comparison of values between longitudinal distributed regions. For each 3 month seasonal period the maximum and minimum values of the monthly 3-hourly radiation fluxes were calculated and classed to minimise differences in in-between successive sample moments.
The seasons are defined as: Winter: December(same year), January and February. Spring: March, April and May. Summer: June, July and August. Autumn: September, October and November.

The PAR 3-hourly radiation flux was derived from an inference model. The primary inputs to the model came from satellite sources. ISCCP-C1 data sets (spatial resolution of 2.5 X 2.5 degrees) were chosen as inputs because most of the data for these sets came from operational satellite sources.

The ISCCP C1 data used to derive the PAR fluxes are produced from Stage B3, reduced resolution narrowband radiance (600 nm and 11,000 nm) measurements made by the imaging radiometers on five geostationary satellites (METEOSAT, INSAT, GMS, GOES-EAST and GOES-WEST) and at least one polar orbiting NOAA satellite (only one year of complete INSAT data have been obtained but they are not included). The ISCCP C1 is described in Rossow and Schiffer (1991), Schiffer and Rossow (1983), and Schiffer and Rossow (1985). The angular models used in the inference model are described in Suttles et. al. (1988).

3.28. Variable: Dew point temperature

Data source:

International Satellite Land Surface Climatology Project (ISLSCP), Global data set for land-atmosphere models Initiative 1: '87-88 Volumes 1-5. NASA Goddard DAAC Science Data series.

Original cell resolution:

Monthly 6 hourly data with a spatial resolution of 1x1 degree grid squares. The original data was given on a regular lat/long grid that had a spatial resolution of 1.125 X 1.125, with an origin point at the Greenwich meridian (90 degrees latitude, 0 degrees longitude). The Goddard DAAC converted this data to a 1 X 1 degree lat/long grid with an origin point at the international date line (90 degrees latitude North, 180 degree longitude West)

Data description:

Seasonal maximum and minimum of the Dew point temperature at 2 meters above ground.

Comments:

The monthly 6 hourly data has been transformed in seasonal maximum and minimum information. The seasons are defined as: Winter: December(same year), January and February. Spring: March, April and May. Summer: June, July and August. Autumn: September, October and November.
.

3.29. Variable: Mean Air temperature

Data source:

International Satellite Land Surface Climatology Project (ISLSCP), Global data set for land-atmosphere models Initiative 1: '87-88 Volumes 1-5. NASA Goddard DAAC Science Data series.

Original cell resolution:

Monthly 6 hourly data with a spatial resolution of 1x1 degree grid squares. The original data was given on a regular lat/long grid that had a spatial resolution of 1.125 X 1.125, with an origin point at the Greenwich meridian (90 degrees latitude, 0 degrees longitude). The Goddard DAAC converted this data to a 1 X 1 degree lat/long grid with an origin point at the international date line (90 degrees latitude North, 180 degree longitude West)

Data description:

Seasonal maximum and minimum of the Mean Air temperature at 2 meter above ground.

Comments:

The original monthly 6 hourly data has been changed in seasonal maximum and minimum. The yearly seasons are defined as: Winter: December, January and

February. Spring: March, April and May. Summer: June, July and August. Autumn: September, October and November.

3.30. Variable: U-wind

Data source:

International Satellite Land Surface Climatology Project (ISLSCP), Global data set for land-atmosphere models Initiative 1: '87-88 Volumes 1-5. NASA Goddard DAAC Science Data series.

Original cell resolution:

Monthly 6 hourly data with a spatial resolution of 1x1 degree grid squares. The original data was given on a regular lat/long grid that had a spatial resolution of 1.125 X 1.125, with an origin point at the Greenwich meridian (90 degrees latitude, 0 degrees longitude). The Goddard DAAC converted this data to a 1 X 1 degree lat/long grid with an origin point at the international date line (90 degrees latitude North, 180 degree longitude West)

Data description:

The U (Zonal) component of wind velocity, at 10 meter above the ground.

Comments:

For information on how u-wind is derived see Janssen et al. (1992). The monthly 6 hourly data is converted for the LOICZ Typology data set in seasonal maximum and minimum. The yearly seasons are defined as: Winter: December, January and February. Spring: March, April and May. Summer: June, July and August. Autumn: September, October and November.

3.31. Variable: NDVI

Data source:

International Satellite Land Surface Climatology Project (ISLSCP), Global data set for land-atmosphere models Initiative 1: '87-88 Volumes 1-5. NASA Goddard DAAC Science Data series.

Original cell resolution:

1 X 1 degree monthly data.

Data description:

Monthly data of Normalized Difference Vegetation Index (NDVI)

Comments:

Normalized Difference Vegetation Index calculated from AVHRR channel 1 and 2 radiance data, normalized for incoming solar radiation. Holben, (1986); Los et al(1994). The 1 X 1 degree monthly normalised difference vegetation index (NDVI) data sets for 1987 - 1988 were compiled from the 8 km global area coverage (GAC) continental NDVI data sets that have been processed by the global inventory monitoring and modelling studies (GIMMS) group at NASA- Goddard Space Flight Center. These data sets were created for the study of vegetation dynamics around the globe. The data set described here is the basis for a corrected version of the NDVI data (see FASIR-NDVI data sets) that is used to calculate the global distribution of biophysical parameters: fraction of photosynthetic active radiation absorbed by the green part of vegetation (FPAR), leaf area index (LAI), green fraction of vegetation (Greenness), roughness length and albedo.

3.32. Variable: Surface temperature

Data source:

International Satellite Land Surface Climatology Project (ISLSCP), Global data set for land-atmosphere models Initiative 1: '87-88 Volumes 1-5. NASA Goddard DAAC Science Data series.

Original cell resolution:

Monthly 6 hourly data with a spatial resolution of 1x1 degree grid squares. The original data was given on a regular lat/long grid that had a spatial resolution of 1.125 X 1.125, with an origin point at the Greenwich meridian (90 degrees latitude, 0 degrees longitude). The Goddard DAAC converted this data to a 1 X 1 degree lat/long grid with an origin point at the international date line (90 degrees latitude North, 180 degree longitude West)

Data description:

Monthly 6 hourly Surface temperature data converted to seasonal maximum and minimum information.

Comments:

The seasonal maximum and minimum surface temperature is calculated from the climatological surface temperature which is derived according to the procedure described by Brankovic and Van Maanen (1985). The yearly seasons are defined as: Winter: December, January and February. Spring: March, April and May. Summer: June, July and August. Autumn: September, October and November.

Since this data is based on early climatological information no longer in general use and has been highly manipulated to meet modelling requirements, it should be used with caution except for understanding its role in derivation of the time-dependent model surface fields.

3.33. Variable: Soil moisture

Data source:

International Satellite Land Surface Climatology Project (ISLSCP), Global data set for land-atmosphere models Initiative 1: '87-88 Volumes 1-5. NASA Goddard DAAC Science Data series.

Original cell resolution:

Monthly 6 hourly data with a spatial resolution of 1x1 degree grid squares. The original data was given on a regular lat/long grid that had a spatial resolution of 1.125 X 1.125, with an origin point at the Greenwich meridian (90 degrees latitude, 0 degrees longitude). The Goddard DAAC converted this data to a 1 X 1 degree lat/long grid with an origin point at the international date line (90 degrees latitude North, 180 degree longitude West)

Data description:

Monthly 6 hourly Soil moisture data changed in seasonal maximum and minimum information.

Comments:

The maximum and minimum soil moisture is calculated from the surface field soil moisture which is derived in a straightforward way from the surface soil moisture climate data set. The surface soil moisture climate data set is defined on a global 4 x 5 degree lat/long grid and is available for the 1st and 16th day of each month (Mintz and Serafini, 1981). The surface soil moisture climate data are interpolated to a user-defined grid. The original maximum value of the moisture that the soil can hold is set to 15 cm of water. Since, the first ground layer reaches only 7.2 cm in depth, it is assumed that the maximum water content for this layer cannot exceed 2 cm, and therefore all original values are scaled accordingly.

The yearly seasons are defined as: Winter: December(same year), January and February. Spring: March, April and May. Summer: June, July and August. Autumn: September, October and November.

3.34. Variable: CZCS

Data source:

The CZCS data is downloaded form the SeaWiFS Project Image Archive at the Goddard Space Flight Center (GSFC) Distributed Active Archive Center (DAAC): http://seawifs.gsfc.nasa.gov/SEAWIFS.html.

Original cell resolution:

1x1 degree grid squares.

Data description:

Seasonal averages of Coastal Zone Color Scanner level 3 data (CZCS) average of: mean of mean, weighted mean of mean and standard deviation of the means.

Comments:

For most regions of the world, the color of the ocean is determined primarily by the abundance of phytoplankton and their associated photosynthetic pigments. As the concentration of phytoplankton pigments increases, ocean color shifts from blue to green. Taking advantage of this change, NASA developed the Coastal Zone Color Scanner (CZCS) which was launched on the Nimbus-7 satellite in October 1978. During its 7 1/2 year lifetime (October 1978 - June 1986), CZCS acquired nearly 68,000 images, each covering up to 2 million square kilometres of ocean surface. The CZCS level 1, 2 and 3 data products are available from the Goddard Space Flight Center (GSFC) Distributed Active Archive Center (DAAC).

Description of the ASCII version of the Level 3 Data used to generate the seasonal averages. The yearly seasons are defined as: Winter: December(same year), January and February. Spring: March, April and May. Summer: June, July and August. Autumn: September, October and November. The original information is represented in a single one-degree by one-degree square (in a cylindrical equirectangular sense) on the earth's surface.

Mean of the Mean CZCS Pigments [mg chl/m**3] values were generated by taking the arithmetic mean of the mean CZCS pigments stored in the CZCS level 3 file whose time period matches this file's. All level 3 values that were located within 1/sqrt(2) degrees of the centre of a given one-degree bin were included in the mean for that bin.

The Weighted Mean of the Mean CZCS Pigments [mg chl/m**3] are also calculated from the CZCS pigments in a 1/sqrt(2) degree circle centred at the given co-ordinates. Values nearer the centre are weighted more heavily than more distal values, however.

Standard Deviation of the Means [mg chl/m**3] contains the standard deviation of all of the CZCS pigments that were used to calculate the values for the mean of mean and weighted mean. (N.B. This standard deviation of the means represents level 3 CZCS pigments and not a standard deviation of the original level-2 CZCS pigments.)

Values of zero indicate that there were no level-3 pigment data within the 1/sqrt(2) degree circle surrounding the specified co-ordinate pair.

It is strongly recommended that anyone using the data for scientific hypothesis testing to look carefully at the algorithms used to generate it. For a very brief description of the CZCS data processing scenario up through level 3, see: Ocean Color: Availability of the Global Data Set Eos, Transactions of the American Geophysical Union Vol. 70, No. 23, June 6, 1989, pages 634 35, 640-41. More information is available at the following Internet address: http://seawifs.gsfc.nasa.gov/SEAWIFS.html.

3.35. Variable: Salinity

Data source:

World Ocean Atlas 1994, CD-ROM Data Sets. U.S. Department of Commerce National Oceanic and Atmospheric Administration, National Environmental Satellite, Data, and Information Service, National Oceanographic Data Center, Ocean Climate Laboratory.

Original cell resolution:

1x1 degree data

Data description:

Seasonal mean of the monthly salinity data composite of the ocean surface, 0 meter (level 1).

Comments:

The monthly data composite of the ocean surface salinity (level 1) have been extracted from the World Ocean Atlas 1994 and converted to mean seasonal 1x1 degree grid covers. For some near shore missing values a neighbourhood mean is calculated. No calculations/interpolation for missing values has taken place for cells in relative large estuaries or cells covered by sea ice, due to unknown model parameters for fresh water input.
The seasons are defined as: Winter: December(same year), January and February. Spring: March, April and May. Summer: June, July and August. Autumn: September, October and November.
For more information users are advised the look at the following WEB page: http://www.scd.ucar.edu/

3.36. Variable: Ocean Current

Data source:

Data Support Section, Scientific Computing Division, National Center for Atmospheric Research. NOO'S GLOBAL OCEAN SFC CURRENTS, SEASONAL 1901-1978. The Original data source was: PROJECT MEEHL, National Center for Atmospheric Research

Original cell resolution:

5x5 degree grid squares.

Data description:

Ocean current U and V component *100 (cm/sec) grids for the Mid-season months of January, April, July, and October.

Comments:

Gerald Meehl, National Center for Atmospheric Research, using pilot charts published by the U.S. Naval Oceanographic Office, has extracted, analyzed, and digitized long-term observed ocean seasonal surface currents on a 5-degree world grid. These 5x5 degree have been re-sampled to 1x1 degree in order to update the data base. Prior to re-sampling the data to a 1x1 degree grid the data has been optimized for a best fit with the continent contours.

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5. Glossary of acronyms

AVHRR	Advanced Very High Resolution Radiometer
CD-ROM	Compact Disk (optical), Read Only Memory
DAAC	Distributed Active Archive Center
ECMWF	European Center for Medium-Range Weather Forecasts
FASIR (NDVI)	Fourier Adjusted, Solar zenith angle correction, Interpolation (of missing data during winter), and Reconstruction of NDVI (over tropical forests).
FPAR	Fraction of Photosynthetic Active Radiation absorbed by green vegetation
GAC	Global Area Coverage
GCM	General Circulation Model of the atmosphere
GIMMS	Global Inventory Monitoring and Modeling Studies at NASA GSFC
GPCP	Global Precipitation Climatology Project
GSFC	Goddard Space Flight Center
ISLSCP	International Satellite Land Surface Climatology Project
LAI	Leaf Area Index
NASA	National Aeronautics and Space Administration
NCAR	National Center for Atmospheric Research
NDVI	Normalized Difference Vegetation Index
NOAA	National Oceanographic and Atmospheric Administration
SiB2	Simple Biosphere model (Sellers et al 1995a,b)
WCRP	World Climate Research Project

6. Appendices 1-3

Appendix 1

Listing of variables and description.

Variable name	Description of variable	Class limits	Ref ID
Grid cell ID	Grid cell ID. Numbered from top left to bottom right, along rows (global cover 1x 1 degree grid)		
Longitude	Longitude of Center point of grid cell (degrees)		
Latitude	Latitude of Center point of grid cell (degrees)		
Country name	Country name		1
Region	Name of a larger region to which the cell belongs.		1
Continent	Name of the continent.		1
Basin ID	World drainage basin ID.		2
Cell location id	Location of the grid cell.	-2 (offshore), -1 (along shore), 1 (onshore), 2 (inshore)	
Wave height	Wave height in meters. Greatest height with a frequency of 3% or more.	0 No waves, permanent sea ice 1 0 - 2.5 meter 2 2.5 - 3.5 meter 3 3.5 - 5.0 meter 4 5.0 - 6.5 meter 5 > 6.5 meter	8
Tidal type	Tidal type	1 (Semi diurnal), 2 (Mixed) or 3(Diurnal).	3
Tidal range	Tidal range class.	1 (tide less), 2 (<2m), 3 (2-4m), 4 (4-8m), 5 (>8m)	4
Cultivation intensity	Intensity of present aerial agricultural cultivation extent. (%).	0 marine areas/No data 1 100% natural vegetation 2 20% cultivated 80% natural vegetation 3 50% - 50% cultivated - natural vegetation 4 75% - 25% cultivated to natural vegetation 5 100% cultivated land	2
Methane	Kilograms of Methane produced per square kilometer (x1000). Reference ID 2	See appendix table 1	2
Soil type	Soils of the world based on FAO data.	1 no soils 2 fluvisols 3 gleysoils/planosols/histosols 4 yermosols/xerosols/regosols/arenosols 5 lithosols/redzinas 6 kastanozems/chernozems/phaeozoems /greyzems/ranker 7 vertisols/ 8 solonchaks/solonetz 9 cambisols 10 luvisols/podzols/podzolluvisol 11 ferrosols/acrisols/nitosols 12 andosols 13 all types with gelic 14 no soils	2
Dominant Soil texture	Dominant soil texture. FAO Data	0 (ocean), 1 (coarse), 2 (medium/coarse), 3 (medium), 4 (fine/medium), 5 (fine), 6 (ice), 7 (organic).	5
DSRF	Dry surface area. Sum % in land (exposed land) + swamp + dunes + salt marsh cover.	1 (0 - 25%), 2 (26 - 50%), 3 (51 - 75%), 4 (76 - 100%)	5
Dunes	Land covered by sand dunes.	1 (0 - 25%), 2 (26 - 50%), 3 (51 - 75%), 4 (76 - 100%)	5
Swamp	Land covered by swamp.	1 (0 - 25%), 2 (26 - 50%), 3 (51 - 75%), 4 (76 - 100%)	5
Glaciers	Land covered by glaciers.	1 (0 - 25%), 2 (26 - 50%), 3 (51 - 75%), 4 (76 - 100%)	5
Eco-sytems	Major world ecosystem complexes.	See appendix table 2	2
Coral	Presence of corals	0 (No Coral Reefs Known), 1 (Coral Reefs)	2
Vegetation class	Global land cover classification from satellite data.	-9999 water 1 broadleaf evergreen forest 2 broadleaf deciduous forest 3 mixed coniferous and broad-leaf deciduous forest and woodland 4 coniferous forest and woodland 5 high latitude deciduous forest and woodland 6 wooded c4 grassland	5

		7 9 10 11 12 13 14 15	c4 grass land shrubs and bare ground tundra desert bare ground cultivation ice c3 wooded grassland, c3 grassland	
Tropforest dest	Tropical forest destruction since c. 1940.	-9999 0 1 2	Water/Marine Areas/No data Other Land Extent of Tropical Forests, Late 1980s Forest Destroyed or Seriously Degraded Since c.1940	2
Morph-Tectonics	Morphologic and Tectonic classification of coasts.	See appendix 1 table 3		9
LGP	Length of Growing Period (LGP) (days/year).	-9999 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16	No Data 0 1 - 29 30 - 59 60 - 89 90 -119 120 -149 150 -179 180 -209 210 -239 240 -269 270 -299 300 -329 330 -364 365- 365 365+	6
GNP	Gross National Product (GNP) per capita (U.S. $ 1990).	0 2 3 4 5 6 7 8	Water/Marine Areas Under 500 500 - 1,499 1,500 - 2,999 3,000 - 4,999 5,000 - 9,999 10,000 - 19,999 20,000 >	2
Population density	Mean population density (Pers/sq.km).	-9999 0 1 2 3 4 5	No Data 0 1 2 - 10 11 - 100 101 - 200 > 200	7
Runoff	Annual average surface runoff from the land surfaces (mm/yr.).	-9999 1 2 3 4 5 6 7 8	nodata 0-50 51 - 100 101 - 200 201 - 400 401 - 800 801 - 1600 1601 - 3200 >3200	5
Tropstorm	Presence of Tropical storms (presence of Beaufort force >8).	0 1 2 3 4 5 6 7 8	Areas not often effected by tropical storms Beaufort force above 8 expected during April to Nov. Beaufort force above 8 expected during April to Dec. Beaufort force above 8 expected during May to Dec. Beaufort force above 8 expected during June to Aug. Beaufort force above 8 expected during June to Oct. Beaufort force above 8 expected during June to Nov. Beaufort force above 8 expected during Nov. to May Beaufort force above 8 expected during Dec. to March	2
Winter Gales	Winter Gale intensity (% of beaufort force 7 per time period).	0 1 2 4 5 6 7 8 9	No Gales of Beaufort Force 7 Major % of the Year North Hem.: < 20% of yr for Beaufort Force 7: Oct.-March South Hem.: < 20% of yr for Beaufort Force 7: May-Oct. North Hem.: 20-30% of yr for Beaufort Force 7: Oct.-March South Hem.: 20-30% of yr for Beaufort Force 7: May-Oct. Arab Sea: 20-30% of yr for Beaufort Force 7: May-Jun,Oct-Nov North Hem.: 30-40% of yr for Beaufort Force 7: Oct.-March South Hem.: 30-40% of yr for Beaufort Force 7: May-Oct. Arab Sea: 30-40% of yr for Beaufort Force 7: May-Jun,Oct-Nov	2

		10 11 12 13	North Hem.: >40% of yr for Beaufort Force 7: Oct.-March South Hem.: >40% of yr for Beaufort Force 7: May-October Arab Sea: 40-50% of yr for Beaufort Force 7: May-Jun,Oct-Nov Arab Sea: >50% of yr for Beaufort Force 7: May-Jun,Oct-Nov	
Precipitation (m1 -m 4)	Mean seasonal precipitation (mm). m1 = Dec, Jan, Febr. '87. m2 = Mar, April, May. '87. m3 = Jun, Jul, Aug. '87. m4 = Sept, Oct, Nov. '87.	0 1 2 3 4 5 6 7 8 9 10	0 1 - 5 6 - 10 11 - 25 26 - 50 51 - 100 101 - 200 201 - 300 301 - 400 401 - 500 > 500	5
Par(1- 4max)	Surface Photosynthetically Active Radiation (Par) downward flux (Watts/m^2). 1max = Maximum over Dec, Jan, Febr.'87 2max = Maximum over Mar, April, May.'87 3max = Maximum over Jun, Jul, Aug.'87. 4max = Maximum over Sept, Oct, Nov.'87	1 2 3 4 5 6	0 - 50 51 - 100 101 - 150 151 - 200 201 - 325 326 - 500	5
Par(1-3)min	Surface Photosynthetically Active Radiation (Par) downward flux (Watts/m^2). 1min = Minimum over Dec, Jan, Febr.'87. 3min = Minimum over Jun, Jul, Aug.'87.	1 2 3 4	0 - 10 11 - 20 21 - 50 51 - 100	5
Dew point (1-4)max	Maximum of mean 6 hourly Dew point temp. (K). 1max = Maximum over Dec, Jan, Febr.'87. 2max = Maximum over Mar, April, May.'87. 3max = Maximum over Jun, Jul, Aug.'87. 4max = Maximum over Sept, Oct, Nov.'87.			5
Dew point (1-4)min	Minimum of mean 6 hourly Dew point temp. (K). 1min = Minimum over Dec, Jan, Febr.'87. 2min = Minimum over Mar, April, May.'87. 3min = Minimum over Jun, Jul, Aug.'87. 4min = Minimum over Sept, Oct, Nov.'87.			5
Mean air temperature (1-4)max	Maximum of mean air temperature (K) at 2 m above ground. 1max = over Dec, Jan, Febr.'87. 2max = over Mar, April, May.'87. 3max = over Jun, Jul, Aug.'87. 4max = over Sept, Oct, Nov.'87.			5
Mean air temperature (1-4)min	Minimum of mean air temperature (K) at 2 m above ground. 1min = over Dec, Jan, Febr.'87. 2min = over Mar, April, May.'87. 3min = over Jun, Jul, Aug.'87. 4min = over Sept, Oct, Nov.'87.			5
Mean U-wind (1-4)max	Maximum of U-Wind (m/s), U (zonal) component of wind velocity at 10 m above ground 1max = over Dec, Jan, Febr.'87. 2max =- over Mar, April, May.'87. 3max = over Jun, Jul, Aug.'87. 4max = over Sept, Oct, Nov.'87.			5
Mean U-wind (1-4)min	Minimum of U-wind (m/s), U (zonal) component of wind velocity at 10 m above ground 1min = over Dec, Jan, Febr.'87. 2min = over Mar, April, May.'87. 3min = over Jun, Jul, Aug.'87. 4min = over Sept, Oct, Nov.'87.			5
NDVIm(1-4)	Normalized difference vegetation index (NDVI) mean *1000 m1 = over Dec, Jan, Febr.'87. m2 = over Mar, April, May.'87. m3 = over Jun, Jul, Aug.'87. m4 = over Sept, Oct, Nov.'87.			5
Mean Surface temp (1-4)max	Mean temperature (K) of the soil above 7 cm depth of the soil maximum. 1max = over Dec, Jan, Febr.'87. 2max = over Mar, April, May.'87 3max = over Jun, Jul, Aug.'87. 4max = over Sept, Oct, Nov.'87.			5
Mean Surface temp (1-4)min	1min = over Dec, Jan, Febr.'87. 2min = over Mar, April, May.'87.			5

	3min = over Jun, Jul, Aug.'87. 4min = over Sept, Oct, Nov.'87.		
Sea surface temp m(1-4)	Mean sea surface temperature *1000 (K). m1 = over Dec, Jan, Febr.'87. m2 = over Mar, April, May.'87. m3 = over Jun, Jul, Aug.'87. m4 = over Sept, Oct, Nov.'87.		5
Soil moisture 1max	1max = over Dec, Jan, Febr.'87. 2max = over Mar, April, May.'87 3max = over Jun, Jul, Aug.'87. 4max = over Sept, Oct, Nov.'87.		5
Soil moisture 1min	Minimum of monthly mean Surface Soil moisture (mm of water) 1min = over Dec, Jan, Febr.'87. 2min =over Mar, April, May.'87. 3min = over Jun, Jul, Aug.'87. 4min = over Sept, Oct, Nov.'87.		5
Soil Carbon Content	Soil carbonate carbon kgC/m^2 to 100 cm depth.	0 Background 1 0-4 kgC/m2 2 4-8 kgC/m2 3 8-12 kgC/m2 4 12-16 kgC/m2 5 16-24 kgC/m2 6 24-36 kgC/m2 7 36-48 kgC/m2 8 >48 kgC/m2 9 Glaciers 10 Oceans & Inland waters	10
CZCSmm(1-4)	Coastal Zone Color Scanner data average of mean of the mean CZCS Pigments (mg chl/m**3). m1 = monthly average over Dec, Jan, Febr. m2 = monthly average over Mar, April, May. m3 = monthly average over June, July, Aug. m4 = monthly average over Sept, Oct, Nov.		11
CZCSwm(1-4)	Coastal Zone Color Scanner data, monthly average. Weighted mean of the mean CZCS Pigments (mg chl/m**3). wm1 = monthly average over Dec, Jan, Febr. wm2 = monthly average over Mar, April, May. wm3 = monthly average over June, July, Aug. wm,4 = monthly average over Sept, Oct, Nov.		11
CZCSsd(1-4)	Coastal Zone Color Scanner data, monthly average. Standard Deviation of the means CZCS Pigments (mg chl/m**3). sd1 = monthly average over Dec, Jan, Febr. sd2 = monthly average over Mar, April, May. sd3 = monthly average over June, July, Aug. sd4 = monthly average over Sept, Oct, Nov.		11
Salinity	Ocean Surface Salinity seasonal mean (*100 p.s.u.) m1 = monthly average over Dec, Jan, Febr. m2 = monthly average over Mar, April, May. m3 = monthly average over June, July, Aug. m4 = monthly average over Sept, Oct, Nov.		12
Ocean Current	Ocean Current U and V component (*100 cm/sec) 1U or 1V is U or V component of Jan. 4U or 4V is U or V component of April 7U or 7V is U or V component of July 10U or 10V is U or V component of Oct.		13

Appendix 2

Methane id	Methane class limits
0	No Methane Produced
1	Less than 1000 kg of Methane Produced per Square Kilometer (x1000)
2	5000 to 9999 kg of Methane Produced per Square Kilometer (x1000)
3	11000 to 11299 kg of Methane Produced per Square Kilometer (x1000)
4	15000 to 19999 kg of Methane Produced per Square Kilometer (x1000)
5	20000 to 22999 kg of Methane Produced per Square Kilometer (x1000)
6	28300 kg of Methane Produced per Square Kilometer (x1000)
7	30000 to 34999 kg of Methane Produced per Square Kilometer (x1000)
8	35000 to 39999 kg of Methane Produced per Square Kilometer (x1000)
9	40000 to 41999 kg of Methane Produced per Square Kilometer (x1000)
10	47000 to 49999 kg of Methane Produced per Square Kilometer (x1000)
11	55000 to 59999 kg of Methane Produced per Square Kilometer (x1000)
12	62200 kg of Methane Produced per Square Kilometer (x1000)
13	67000 to 69999 kg of Methane Produced per Square Kilometer (x1000)
14	70000 to 74999 kg of Methane Produced per Square Kilometer (x1000)
15	75800 kg of Methane Produced per Square Kilometer (x1000)
16	80000 to 83999 kg of Methane Produced per Square Kilometer (x1000)
17	85000 to 87000 kg of Methane Produced per Square Kilometer (x1000)
18	93000 to 93999 kg of Methane Produced per Square Kilometer (x1000)
19	100000 to 104999 kg of Methane Produced per Square Kilometer (x1000)
20	106000 kg of Methane Produced per Square Kilometer (x1000)
21	110000 to 114999 kg of Methane Produced per Square Kilometer (x1000)
22	129000 kg of Methane Produced per Square Kilometer (x1000)
23	141000 to 144999 kg of Methane Produced per Square Kilometer (x1000)
24	154000 kg of Methane Produced per Square Kilometer (x1000)
25	163000 kg of Methane Produced per Square Kilometer (x1000)
26	170000 kg of Methane Produced per Square Kilometer (x1000)
27	175000 kg of Methane Produced per Square Kilometer (x1000)
28	189000 kg of Methane Produced per Square Kilometer (x1000)
29	197000 kg of Methane Produced per Square Kilometer (x1000)
30	200000 kg of Methane Produced per Square Kilometer (x1000)
31	208000 to 209000 kg of Methane Produced per Square Kilometer (x1000)
32	211000 kg of Methane Produced per Square Kilometer (x1000)
33	218000 kg of Methane Produced per Square Kilometer (x1000)
34	220000 kg of Methane Produced per Square Kilometer (x1000)
35	232000 to 234000 kg of Methane Produced per Square Kilometer (x1000)
36	239000 kg of Methane Produced per Square Kilometer (x1000)
37	244000 kg of Methane Produced per Square Kilometer (x1000)
38	265000 to 268000 kg of Methane Produced per Square Kilometer (x1000)
39	272000 kg of Methane Produced per Square Kilometer (x1000)
40	282000 to 284000 kg of Methane Produced per Square Kilometer (x1000)
41	292000 kg of Methane Produced per Square Kilometer (x1000)
42	298000 kg of Methane Produced per Square Kilometer (x1000)
43	306000 kg of Methane Produced per Square Kilometer (x1000)
44	317000 kg of Methane Produced per Square Kilometer (x1000)
45	326000 kg of Methane Produced per Square Kilometer (x1000)
46	340000 to 341000 kg of Methane Produced per Square Kilometer (x1000)
47	371000 kg of Methane Produced per Square Kilometer (x1000)
48	376000 to 377000 kg of Methane Produced per Square Kilometer (x1000)
49	381000 kg of Methane Produced per Square Kilometer (x1000)
50	387000 kg of Methane Produced per Square Kilometer (x1000)
51	401000 to 402000 kg of Methane Produced per Square Kilometer (x1000)
52	407000 kg of Methane Produced per Square Kilometer (x1000)
53	413000 kg of Methane Produced per Square Kilometer (x1000)
54	415000 kg of Methane Produced per Square Kilometer (x1000)
55	421000 kg of Methane Produced per Square Kilometer (x1000)
56	425000 to 427000 kg of Methane Produced per Square Kilometer (x1000)
57	438000 to 439000 kg of Methane Produced per Square Kilometer (x1000)
58	446000 kg of Methane Produced per Square Kilometer (x1000)
59	452000 kg of Methane Produced per Square Kilometer (x1000)
60	457000 kg of Methane Produced per Square Kilometer (x1000)
61	460000 to 462000 kg of Methane Produced per Square Kilometer (x1000)

Methane id	Methane class limits
62	476000 to 478000 kg of Methane Produced per Square Kilometer (x1000)
63	482000 kg of Methane Produced per Square Kilometer (x1000)
64	485000 kg of Methane Produced per Square Kilometer (x1000)
65	495000 kg of Methane Produced per Square Kilometer (x1000)
66	500000 kg of Methane Produced per Square Kilometer (x1000)
67	503000 kg of Methane Produced per Square Kilometer (x1000)
68	505000 kg of Methane Produced per Square Kilometer (x1000)
69	516000 to 518000 kg of Methane Produced per Square Kilometer (x1000)
70	528000 kg of Methane Produced per Square Kilometer (x1000)
71	534000 kg of Methane Produced per Square Kilometer (x1000)
72	537000 kg of Methane Produced per Square Kilometer (x1000)
73	540000 kg of Methane Produced per Square Kilometer (x1000)
74	547000 kg of Methane Produced per Square Kilometer (x1000)
75	550000 to 553000 kg of Methane Produced per Square Kilometer (x1000)
76	561000 kg of Methane Produced per Square Kilometer (x1000)
77	565000 to 569000 kg of Methane Produced per Square Kilometer (x1000)
78	573000 kg of Methane Produced per Square Kilometer (x1000)
79	575000 kg of Methane Produced per Square Kilometer (x1000)
80	591000 kg of Methane Produced per Square Kilometer (x1000)
81	595000 kg of Methane Produced per Square Kilometer (x1000)
82	600000 kg of Methane Produced per Square Kilometer (x1000)
83	601000 kg of Methane Produced per Square Kilometer (x1000)
84	617000 kg of Methane Produced per Square Kilometer (x1000)
85	635000 kg of Methane Produced per Square Kilometer (x1000)
86	643000 kg of Methane Produced per Square Kilometer (x1000)
87	649000 kg of Methane Produced per Square Kilometer (x1000)
88	661000 kg of Methane Produced per Square Kilometer (x1000)
89	677000 kg of Methane Produced per Square Kilometer (x1000)
90	680000 kg of Methane Produced per Square Kilometer (x1000)
91	694000 kg of Methane Produced per Square Kilometer (x1000)
92	698000 kg of Methane Produced per Square Kilometer (x1000)
93	699000 kg of Methane Produced per Square Kilometer (x1000)
94	709000 kg of Methane Produced per Square Kilometer (x1000)
95	715000 kg of Methane Produced per Square Kilometer (x1000)
96	720000 kg of Methane Produced per Square Kilometer (x1000)
97	734000 kg of Methane Produced per Square Kilometer (x1000)
98	742000 kg of Methane Produced per Square Kilometer (x1000)
99	746000 kg of Methane Produced per Square Kilometer (x1000)
100	749000 kg of Methane Produced per Square Kilometer (x1000)
101	755000 kg of Methane Produced per Square Kilometer (x1000)
102	759000 kg of Methane Produced per Square Kilometer (x1000)
103	762000 kg of Methane Produced per Square Kilometer (x1000)
104	763000 kg of Methane Produced per Square Kilometer (x1000)
105	765000 kg of Methane Produced per Square Kilometer (x1000)
106	766000 kg of Methane Produced per Square Kilometer (x1000)
107	771000 kg of Methane Produced per Square Kilometer (x1000)
108	774000 kg of Methane Produced per Square Kilometer (x1000)
109	775000 kg of Methane Produced per Square Kilometer (x1000)
110	777000 kg of Methane Produced per Square Kilometer (x1000)
111	791000 kg of Methane Produced per Square Kilometer (x1000)
112	813000 kg of Methane Produced per Square Kilometer (x1000)
113	832000 kg of Methane Produced per Square Kilometer (x1000)
114	851000 kg of Methane Produced per Square Kilometer (x1000)
115	857000 kg of Methane Produced per Square Kilometer (x1000)
116	882000 kg of Methane Produced per Square Kilometer (x1000)
117	884000 kg of Methane Produced per Square Kilometer (x1000)
118	897000 kg of Methane Produced per Square Kilometer (x1000)
119	900000 kg of Methane Produced per Square Kilometer (x1000)
120	926000 kg of Methane Produced per Square Kilometer (x1000)
121	931000 kg of Methane Produced per Square Kilometer (x1000)
122	933000 kg of Methane Produced per Square Kilometer (x1000)
123	939000 kg of Methane Produced per Square Kilometer (x1000)
124	949000 kg of Methane Produced per Square Kilometer (x1000)
125	966000 kg of Methane Produced per Square Kilometer (x1000)
126	968000 kg of Methane Produced per Square Kilometer (x1000)

Methane id	Methane class limits
127	977000 kg of Methane Produced per Square Kilometer (x1000)
128	1000000 kg of Methane Produced per Square Kilometer (x1000)
129	1010000 kg of Methane Produced per Square Kilometer (x1000)
130	1020000 kg of Methane Produced per Square Kilometer (x1000)
131	1060000 kg of Methane Produced per Square Kilometer (x1000)
132	1070000 kg of Methane Produced per Square Kilometer (x1000)
133	1090000 kg of Methane Produced per Square Kilometer (x1000)
134	1110000 kg of Methane Produced per Square Kilometer (x1000)
135	1130000 kg of Methane Produced per Square Kilometer (x1000)
136	1140000 kg of Methane Produced per Square Kilometer (x1000)
137	1150000 kg of Methane Produced per Square Kilometer (x1000)
138	1160000 kg of Methane Produced per Square Kilometer (x1000)
139	1170000 kg of Methane Produced per Square Kilometer (x1000)
140	1180000 kg of Methane Produced per Square Kilometer (x1000)
141	1190000 kg of Methane Produced per Square Kilometer (x1000)
142	1200000 kg of Methane Produced per Square Kilometer (x1000)
143	1220000 kg of Methane Produced per Square Kilometer (x1000)
144	1230000 kg of Methane Produced per Square Kilometer (x1000)
145	1240000 kg of Methane Produced per Square Kilometer (x1000)
146	1250000 kg of Methane Produced per Square Kilometer (x1000)
147	1260000 kg of Methane Produced per Square Kilometer (x1000)
148	1270000 kg of Methane Produced per Square Kilometer (x1000)
149	1290000 kg of Methane Produced per Square Kilometer (x1000)
150	1310000 kg of Methane Produced per Square Kilometer (x1000)
151	1320000 kg of Methane Produced per Square Kilometer (x1000)
152	1350000 kg of Methane Produced per Square Kilometer (x1000)
153	1360000 kg of Methane Produced per Square Kilometer (x1000)
154	1380000 kg of Methane Produced per Square Kilometer (x1000)
155	1390000 kg of Methane Produced per Square Kilometer (x1000)
156	1410000 kg of Methane Produced per Square Kilometer (x1000)
157	1420000 kg of Methane Produced per Square Kilometer (x1000)
158	1440000 kg of Methane Produced per Square Kilometer (x1000)
159	1450000 kg of Methane Produced per Square Kilometer (x1000)
160	1460000 kg of Methane Produced per Square Kilometer (x1000)
161	1530000 kg of Methane Produced per Square Kilometer (x1000)
162	1540000 kg of Methane Produced per Square Kilometer (x1000)
163	1570000 kg of Methane Produced per Square Kilometer (x1000)
164	1580000 kg of Methane Produced per Square Kilometer (x1000)
165	1600000 kg of Methane Produced per Square Kilometer (x1000)
166	1630000 kg of Methane Produced per Square Kilometer (x1000)
167	1650000 kg of Methane Produced per Square Kilometer (x1000)
168	1690000 kg of Methane Produced per Square Kilometer (x1000)
169	1710000 kg of Methane Produced per Square Kilometer (x1000)
170	1730000 kg of Methane Produced per Square Kilometer (x1000)
171	1750000 kg of Methane Produced per Square Kilometer (x1000)
172	1780000 kg of Methane Produced per Square Kilometer (x1000)
173	1800000 kg of Methane Produced per Square Kilometer (x1000)
174	1820000 kg of Methane Produced per Square Kilometer (x1000)
175	1850000 kg of Methane Produced per Square Kilometer (x1000)
176	1900000 kg of Methane Produced per Square Kilometer (x1000)
177	1990000 kg of Methane Produced per Square Kilometer (x1000)
178	2010000 kg of Methane Produced per Square Kilometer (x1000)
179	2020000 kg of Methane Produced per Square Kilometer (x1000)
180	2040000 kg of Methane Produced per Square Kilometer (x1000)
181	2080000 kg of Methane Produced per Square Kilometer (x1000)
182	2090000 kg of Methane Produced per Square Kilometer (x1000)
183	2130000 kg of Methane Produced per Square Kilometer (x1000)
184	2230000 kg of Methane Produced per Square Kilometer (x1000)
185	2260000 kg of Methane Produced per Square Kilometer (x1000)
186	2270000 kg of Methane Produced per Square Kilometer (x1000)
187	2320000 kg of Methane Produced per Square Kilometer (x1000)
188	2330000 kg of Methane Produced per Square Kilometer (x1000)
189	2390000 kg of Methane Produced per Square Kilometer (x1000)
190	2400000 kg of Methane Produced per Square Kilometer (x1000)
191	2420000 kg of Methane Produced per Square Kilometer (x1000)

Methane id	Methane class limits
192	2440000 kg of Methane Produced per Square Kilometer (x1000)
193	2460000 kg of Methane Produced per Square Kilometer (x1000)
194	2490000 kg of Methane Produced per Square Kilometer (x1000)
195	2590000 kg of Methane Produced per Square Kilometer (x1000)
196	2620000 kg of Methane Produced per Square Kilometer (x1000)
197	2630000 kg of Methane Produced per Square Kilometer (x1000)
198	2700000 kg of Methane Produced per Square Kilometer (x1000)
199	2710000 kg of Methane Produced per Square Kilometer (x1000)
200	2780000 kg of Methane Produced per Square Kilometer (x1000)
201	2830000 kg of Methane Produced per Square Kilometer (x1000)
202	2940000 kg of Methane Produced per Square Kilometer (x1000)
203	2990000 kg of Methane Produced per Square Kilometer (x1000)
204	3060000 kg of Methane Produced per Square Kilometer (x1000)
205	3070000 kg of Methane Produced per Square Kilometer (x1000)
206	3120000 kg of Methane Produced per Square Kilometer (x1000)
207	3150000 kg of Methane Produced per Square Kilometer (x1000)
208	3230000 kg of Methane Produced per Square Kilometer (x1000)
209	3260000 kg of Methane Produced per Square Kilometer (x1000)
210	3290000 kg of Methane Produced per Square Kilometer (x1000)
211	3320000 kg of Methane Produced per Square Kilometer (x1000)
212	3370000 kg of Methane Produced per Square Kilometer (x1000)
213	3380000 kg of Methane Produced per Square Kilometer (x1000)
214	3460000 kg of Methane Produced per Square Kilometer (x1000)
215	3760000 kg of Methane Produced per Square Kilometer (x1000)
216	3840000 kg of Methane Produced per Square Kilometer (x1000)
217	3860000 kg of Methane Produced per Square Kilometer (x1000)
218	3970000 kg of Methane Produced per Square Kilometer (x1000)
219	4090000 kg of Methane Produced per Square Kilometer (x1000)
220	4370000 kg of Methane Produced per Square Kilometer (x1000)
221	4500000 kg of Methane Produced per Square Kilometer (x1000)
222	4630000 kg of Methane Produced per Square Kilometer (x1000)
223	4750000 kg of Methane Produced per Square Kilometer (x1000)
224	4770000 kg of Methane Produced per Square Kilometer (x1000)
225	4910000 kg of Methane Produced per Square Kilometer (x1000)
226	4930000 kg of Methane Produced per Square Kilometer (x1000)
227	4970000 kg of Methane Produced per Square Kilometer (x1000)
228	5130000 kg of Methane Produced per Square Kilometer (x1000)
229	5160000 kg of Methane Produced per Square Kilometer (x1000)
230	5220000 kg of Methane Produced per Square Kilometer (x1000)
231	5270000 kg of Methane Produced per Square Kilometer (x1000)
232	5780000 kg of Methane Produced per Square Kilometer (x1000)
233	6340000 kg of Methane Produced per Square Kilometer (x1000)
234	7210000 kg of Methane Produced per Square Kilometer (x1000)
235	7380000 kg of Methane Produced per Square Kilometer (x1000)
236	7410000 kg of Methane Produced per Square Kilometer (x1000)
237	7670000 kg of Methane Produced per Square Kilometer (x1000)
238	9700000 kg of Methane Produced per Square Kilometer (x1000)
239	11400000 kg of Methane Produced per Square Kilometer (x1000)
255	Water/Marine Areas

Eco syst id	Ecosystem type
0	No Data/Marine Areas
17	Antarctica
20	Major Woods-MainTaiga
21	Major Woods-MainTaiga
22	Major Woods-Other Conifer
23	Major Woods-Mixed: Decid & Evergrn Broad Lf with conifer
24	Major Woods-Mixed: Decid & Evergrn Broad Lf with conifer
25	Major Woods-TempBroad Lf Forest
26	Major Woods-TempBroad Lf Forest
27	Major Woods-Other Conifer
28	Interrupted Woods-Trop Mountain: frst,grass,scrub,paramo,rock
29	Major Woods-Trop/Subtrop Broad Lf Humid frst
30	Non Woods-Cool/Cold Farms/Towns
31	Non Woods-Warm/Hot Farms/Towns
32	Major Woods-Trop/Subtrop Dry frst and Woodlnd
33	Major Woods-Trop/Subtrop Broad Lf Humid frst
36	Non Woods-Irrigated Paddylnd
37	Non Woods-OtherIrrigated Drylnd
38	Non Woods-OtherIrrigated Drylnd
39	Non Woods-OtherIrrigated Drylnd
40	Non Woods-Main Cool Scrub & Grasslnd
41	Non Woods-Main Warm/Hot Scrub & Grasslnd
42	Non Woods-Tibetan, Siberian Cold Grass/Stunted Wood Complex
43	Interrupted Woods-Trop Savanna & Woodlnd
44	Wetlnd/Coastal-Major Bog/Mire, Cool/Cold Climates
45	Wetlnd/Coastal-Major Warm/Hot Mangrove/Tropical Swamp Forest
46	Interrupted DryWoods-Mediterranean types
47	Interrupted DryWoods-Other Dry & Highlnd wds
48	Interrupted DryWoods-Semiarid Woodlnd & Low Frst
49	Non Woods-Nonpolar Sparse (rocky) Vegetation
50	Non Woods-Nonpolar Sand Desert
51	Non Woods-OtherNonpolar Desert & Semidesert
52	Non Woods-Nonpolar Cool Semidesert Scrub
53	Non Woods-Tundra
54	Non Woods-Tundra
55	Interrupted Woods-Trop/Temp wds, Fields, Grass, Scrub
56	Interrupted Woods-2nd grow Trop/sub Trop, Humid/temp/boreal frst
57	Interrupted Woods-2nd grow Trop/sub Trop, Humid/temp/boreal frst
58	Interrupted Woods-Trop/Temp wds, Fields, Grass, Scrub
59	Interrupted DryWoods-Succulent & thorn
60	Major Woods-Southern Taiga
61	Major Woods-Southern Taiga
62	Interrupted Woods-North/Maritime Taiga, subalpine
63	Non Woods-WoodedTundra Cold Grass/Stunted Wood Complex
64	Non Woods-Heath& Moorland
65	Wetlnd/Coastal-Shore and Hinterland Complexes
66	Wetlnd/Coastal-Shore and Hinterland Complexes
67	Wetlnd/Coastal-Shore and Hinterland Complexes
68	Wetlnd/Coastal-Shore and Hinterland Complexes
69	Non Woods-Polaror Rock Desert
70	Non Woods-Ice
71	Non Woods-OtherNonpolar Desert & Semidesert

Morph-Tectonics id	Description Morphology-Tectonics
1	MOUNTAINOUS,shelf width <50 km; coastal mountains >300 m; rocky cliffed shore zone with occasional pocket beaches. With cessation of collision and maturity of erosion cycle mountainous coasts grade into hilly coasts.
2	NARROW SHELF HILLY, shelf width <50 km; coastal hills averaging < 300m, forming occasional headlands; shore zone between headlands usually contains beach backed by cliffs or smaller hills, occasional barrier lagoons, or baymouth barriers. If the coastal relief is continuous, rather than hilly, "plateau coast" is a more appropriate term.
3	NARROW SHELF PLAINS, shelf width >50 km; differs from the wide-shelf plains coast in that the plains may be somewhat more elevated, the shore zone deposits are less extensive, and there may be occasional low sea cliffs and low headlands.
4	WIDE SHELF PLAINS, shelf width > 50 km; low-lying coastal plains bordered by wide shore zone, usually including barrier beaches of some kind. This is typified by the Amero-trailing-edge coastline.
5	WIDE SHELF HILLY, shelf width > 50 km; differs from narrow-shelf hilly coast in that headlands are usually more widely separated, shore zone may be wider, has fewer cliffs, and may contain more barrier beaches. Wide-shelf hilly coasts grade into plains coast.
6	REEF, Shore zone of the coast consist in part of resistant material of organic origin. The reef may be fringing (i.e., built out from the shoreline) or, it may be a barrier (i.e., separating the sea from the shoreline by forming an enclosed or partially enclosed bdy of water, such as a lagoon).
7	GLACIATED, Coastal features dominated by the erosional effects of glaciers. Commonly has precipitous cliffs with deep embayments or fjords.
8	DELTA, Coast consists of the sediments deposited where a river(s) enter the sea.
10	Not classified, (Suez canal, black sea, Mexico).

Appendix 3

Reference id	Reference
1	ArcWorld 1:3M, Edition 1 '92, Environmental Systems Research Institute (ESRI).
2	GLobalARC Gis Data base '96, Center for Remote Sensing and Spatial Analysis, Cook College, Rutgers University New Brunswick, New Jersey, USA. Telephone - 1-908-932-9631. E-mail: global.sales@ocean.rutgers.edu.
3	Snead, R.E., 1980. World Atlas of Geomorphic Features. Robert E. Krieger.288 p.
4	Davies, J.L., 1980. Geographical Variation in Coastal Development. London: Longman Group Ltd. 212 p.
5	International Satellite Land Surface Climatology Project (ISLSCP), Global data set for land-atmosphere models Initiative 1: '87-88 Volumes 1-5. NASA Goddard DAAC Science Data series.
6	Food and Agriculture Organization of the United Nations (FAO). Length of Growing Period (LGP) data.
7	National Center for Geographic Information and Analysis (NCGIA). Gridded Population of the World prepared by NCGIA."downloaded from CIESIN, ftp://ftp.ciesin.org"
8	Times Atlas of the Oceans, Times Books Limited, London 1983.
9	Inman and Nordstrom, 1971. On the Tectonics and Morphologic Classification of Coasts. The Journal of Geology, Volume 79, number 1.
10	Batjes, N.H., 1996. Total Carbon and Nitrogen in the Soils of the World. European Journal of Soil Science, 47, 151-163. Derived from World Inventory of Soil Emission Potentials Database (WISE). ISRIC, Wageningen (1966).
11	Coastal Zone Scanner data. Nimbus 7. Available from Sea-viewing Wide Field-of-view Sensor (SeaWiFS) Project at NASA. http://seawifs.gsfc.nasa.gov/SEAWIFS.html
12	World Ocean Atlas 1994. CD-ROM Data sets. U.S. Department of Commerce National Oceanic and Atmospheric Administration, National Environmental Satellite, Data, and Information Service, National Oceanographic Data Center, Ocean Climate Laboratory.
13	NOO'S Global Ocean SFC Currents, Seasonal 1901-1978. National Center for Atmospheric Research, MEEHL. May 1981. Home page http://www.scd.ucar.edu/dss/datasets/ds280.0.html
FERTILIZER DATA	Fertilizer data from the Food and Agriculture Organization of the United Nations (FAO) Agriculture Department: Homepage http://www.fao.org/waicent/agricul.htm
GLORI DATA	River Discharge to the Sea; a GLobal River Index (GLORI) data base. Milliman, J.D., C. Rutkowski, & M. Meybeck 1995. LOICZ Reports & Studies No. 2.