1. TITLE

1.1 Data Set Identification

ISLSCP II Land and Water Masks with Ancillary Data.

1.2 Database Table Name(s)

Not applicable to this data set.

1.3 File Name(s)

The data are provided at three spatial resolutions of 0.25, 0.5 and 1-degree in latitude and longitude.

Standard Land/Water Masks

land_water_masks_xdeg.zip: When expanded, this file contains the following:

land_water_mask_xx.asc: Global gridded binary land/water masks, with values of 0 and 1 (0=water, 1=land). *xx* can be qd, hd, and 1d, denoting a spatial resolution of 0.25, 0.5, and 1-degree, respectively. These files contain many small inland water bodies and rivers.

land_percent_xx.asc: Percentage of original 30 arcsecond land cells located within coarser resolution cells, from 0 to 100. *xx* is the resolution as above. These files were used to construct the binary land/water masks.

water_percent_xx.asc: Percentage of original 30 arcsecond water cells (including inland water) located within coarser resolution cells, from 0 to 100. *xx* is the resolution as above. These files were used to construct the binary land/water masks.

Special Land/Water Masks (land=-88, water=-99)

land_water_masks-99_xdeg.zip: When expanded, this file contains the following:

land_water_mask-99_xx.asc: Global gridded binary land/water masks, with values of -88 and -99 (water=-99, land=-88). *xx* is the resolution as above. These files were created from the **land_water_mask_xx.asc** files listed above. These files were used as the bases for several derived map products (point data was plotted on top of these maps), so they are included here as a baseline comparison product.

Special Land/Ocean Masks (no inland water bodies)

land_ocean_masks_xdeg.zip: When expanded, this file contains the following:

land_ocean_mask_xx.asc: Global gridded binary land/ocean masks, with values of 0 and 1. *xx* can be qd, hd, and 1d denoting a spatial resolution of 0.25, 0.5, and 1-degree, respectively. **NOTE** that these are masks of only land and oceans and do not contain inland water bodies.

land_percent2_xx.asc: Percentage of original 30 arcsecond land cells located within coarser resolution cells, from 0 to 100. *xx* is the resolution as above. These files were used to construct the binary land/ocean masks. **NOTE**: these files are different from the **land_percent_xx.asc** files because inland water bodies are not included.

ocean_percent2_xx.asc: Percentage of original 30 arcsecond ocean cells located within coarser resolution cells, from 0 to 100. *xx* is the resolution as above. These files were used to construct the binary land/ocean masks. **NOTE**: these files do not contain inland water bodies and are different from the **water_percent_xx.asc** files mentioned above.

Special Inland Water Masks (only inland water bodies)

inland_water_masks_xdeg.zip: When expanded, this file contains the following:

inland_water_mask_xx.asc: Global gridded binary inland water bodies masks, with values of 0 and 1. *xx* can be qd, hd, and 1d denoting a spatial resolution of 0.25, 0.5, and 1-degree, respectively. **NOTE**: these are masks of only inland water bodies, no land or oceans are included.

other_percent_xx.asc: Percentage of original 30 arcsecond non-inland water cells (i.e. land and oceans) located within coarser resolution cells, from 0 to 100. *xx* is the resolution as above. These files were used to construct the binary inland water bodies masks.

inland_water_percent_xx.asc: Percentage of original 30 arcsecond inland water cells located within coarser resolution cells, from 0 to 100. *xx* is the resolution as above. These files were used to construct the binary inland water bodies masks.

Land/Water Outlines (continent outlines)

land_only_outlines_xdeg.zip and land_water_outlines_xdeg.zip: When expanded, this file contains the following:

land_water_outline_xx.asc: Outline of the land masses and water bodies, including many outlines of inland water bodies, with values of 0 and 1 (outline=1). *xx* can be qd, hd, and 1d denoting a spatial resolution of 0.25, 0.5, and 1 degree, respectively.

land_only_outline_xx.asc: Outline of the land masses and oceans, with values of 0 and 1 (outline=1). *xx* is the resolution as above. **NOTE**: these files do not contain inland water

bodies (they are just continent outlines) and are different from the previously listed **land_water_outline_xx.asc** files.

Latitude and Longitude Grid Coordinates

lat_lon_grid_coords_xdeg.zip: When expanded, this file contains the following:

lat_grid_coord_xx.asc: Global grids with latitude coordinates in decimal degrees for the center of each grid cell. *xx* can be qd, hd, and 1d denoting a spatial resolution of 0.25, 0.5, and 1-degree, respectively.

lon_grid_coord_xx.asc: Global grids with longitude coordinates in decimal degrees for the center of each grid cell. *xx* is the resolution as above.

1.4 Revision Date of this Document

December 4, 2013

2. INVESTIGATOR(S)

2.1 Investigator(s) Name and Title

Not applicable to this data set.

2.2 Title of Investigation

The International Satellite Land Surface Climatology Project (ISLSCP) Initiative II.

2.3 Contacts (For Data Production Information)

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2.4 Data Set Citation

Jet Propulsion Laboratory. 2013. ISLSCP II Land and Water Masks with Ancillary Data. In Hall, Forrest G., G. Collatz, B. Meeson, S. Los, E. Brown de Colstoun, and D. Landis (eds.). ISLSCP Initiative II Collection. Data set. Available on-line [http://daac.ornl.gov/] from Oak Ridge National Laboratory Distributed Active Archive Center, Oak Ridge, Tennessee, USA.

http://dx.doi.org/10.3334/ORNLDAAC/1200

2.5 Requested Form of Acknowledgment

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

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

The International Satellite Land Surface Climatology Project (ISLSCP) Initiative II land/water masks are based on the EOS AM1 land/water masks produced by the EOS DEM Science Working Group and the EOS ASTER Instrument Project at NASA/Jet Propulsion Laboratory.

3. INTRODUCTION

3.1 Objective/Purpose

Many global studies and/or models require *a prior* knowledge of the spatial distribution of land masses and water bodies on the surface of the Earth. In support of the International Satellite Land Surface Climatology Project (ISLSCP) Initiative II user community, we have created a series of land/water and land/ocean masks along with other potentially useful ancillary data sets. The original intent was to provide these data as separate data sets so that the user would have some flexibility in applying any mask to the various data sets of the ISLSCP II data collection. Based on recommendations from the ISLSCP II Science Working Group and the modeling community, the ISLSCP II land/water and/or land/ocean masks have been applied to all ISLSCP II data sets that require clear land/water boundaries.

3.2 Summary of Parameters

This data set is comprised of binary land/water and land/ocean masks (i.e. land or water/ocean), and binary masks of inland water bodies; files with the fraction of land, water, ocean or inland water within each cell; overlays of land/water and land/ocean boundaries; and

files with the center coordinates for each grid cell. All of these data sets are provided at three spatial resolutions of 0.25, 0.5, and 1-degree in latitude and longitude and on a common Earth grid.

3.3 Discussion

The ISLSCP II masks are based on the best available 30 arcsecond (~1 km) land/water masks produced at NASA/Jet Propulsion Laboratory (JPL) in support of the Earth Observing System (EOS) AM-1 satellite platform. The JPL masks are based in turn on vector data from the World Vector Shoreline (WVS) database (Solluri and Woodson 1990) for coastlines, and the Digital Chart of the World (DCW) (Danko 1992) for inland water bodies. The WVS is based on older 1:250,000 scale Defense Mapping Agency JOG (Joint Operational Graphics) charts produced from a variety of sources. DCW is based on a photogrammetric consistent mapping at a scale of 1:1,000,000. The ISLSCP II staff have aggregated the 1-km data to spatial resolutions of 0.25, 0.5, and 1-degree, in the process generating layers with the percentage of land/water or land/ocean cells within the coarse resolution cells. An arbitrary threshold of ≥50% water was used to designate water dominated cells and to produce binary land/water or land/ocean masks for the data collection. These land/water and land/ocean masks have been used to produce an inland water mask and land outline files.

4. THEORY OF ALGORITHM/MEASUREMENTS

Many global studies and/or models require *a priori* knowledge of the spatial distribution of land masses and water bodies on the surface of the Earth. As an example, a model may use two different algorithms when water or land is dominant and this will clearly impact the results that are output. A satellite retrieval algorithm may need this information for stratification purposes or for data reduction thereby assisting scientists in eliminating unnecessary processing over geographic areas not associated with their land-only or water-only science activities.

Typically, many land/water masks are based on land cover classifications that derive their land/water boundaries from satellite processing systems, as was done for the first ISLSCP data collection. Other methods such as those used to generate the EOS masks use high resolution vector data bases such as the WVS and DCW to create highly detailed and accurate land/water masks until such time as better or more dynamic masks can be created directly from the satellite data. With these high resolution databases, it is also possible to derive the fraction of land or water within a cell when the data are aggregated to coarser resolutions. These data provide significant improvements and flexibility over the single binary land/water masks provided with the ISLSCP I collection.

5. EQUIPMENT

These data sets are based on 30 arcsecond (~1 km) land/water and land/ocean masks that were in turn derived from vector data. No instruments were used in the production of this data set.

5.1 Instrument Description

5.1.1 Platform (Satellite, Aircraft, Ground, Person)

Not applicable to this data set.

5.1.2 Mission Objectives
Not applicable to this data set.

5.1.3 Key Variables
Not applicable to this data set.

5.1.4 Principles of Operation
Not applicable to this data set.

5.1.5 Instrument Measurement Geometry
Not applicable to this data set.

5.1.6 Manufacturer of Instrument
Not applicable to this data set.

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

5.2.2 Frequency of Calibration
Not applicable to this data set.

5.2.3 Other Calibration Information
Not applicable to this data set.

6. PROCEDURE

6.1 Data Acquisition Methods
The EOS AM1 30 arcsecond land/water and land/ocean masks were acquired directly from Dr. Thomas Logan at JPL. Both the DCW and the WVS data bases used to create the original 30 arcsecond products are available to the general public from a variety of sources. See Soluri and Woodson (1990) or http://shoreline.noaa.gov/data/datasheets/wvs.html for more information on the WVS. See Danko (1992) or http://webgis.wr.usgs.gov/globalgis/metadata_qr/metadata/political_bnd.htm for more information on the DCW.

6.2 Spatial Characteristics
6.2.1 Spatial Coverage
The spatial coverage is global.

6.2.2 Spatial Resolution
As previously noted, the original spatial resolution of the EOS AM1 mask is 30 arcsecond, or approximately 1-km. The ISLSCP II data are provided in equal angle

lat./long. Earth grids with spatial resolutions of 0.25, 0.5, and 1-degree in both latitude and longitude.

6.3 Temporal Characteristics

6.3.1 Temporal Coverage

These data are time invariant. However, the DCW lake boundary data are based on pre-1990 data. As such, the boundaries for ephemeral and/or time varying water bodies (.e.g. Lake Chad) will more closely correspond to those boundaries in the mid- to late-1980s.

6.3.2 Temporal Resolution

These data are time invariant. They do not change through time in this collection.

7. OBSERVATIONS

7.1 Field Notes

Not applicable to this data set.

8. DATA DESCRIPTION

8.1 Table Definition with Comments

Not applicable to this data set.

8.2 Type of Data

8.2.1 Parameter/ Variable Name	8.2.2 Parameter/ Variable Description	8.2.3 Data Range	8.2.4 Units of Measurement	8.2.5 Data Source
1) Land/Water Masks				
Binary Land/Water Mask	ISLSCP II land/water mask with water/land dominated cells coded as: 0= Water (including inland water) 1= Land	0-1	See 8.2.2	ISLSCP II Land/Water Percent
Land Percent	Percentage of 30 arcsecond land cells in each coarser resolution cell. For use with land/water mask.	0-100	Percent	EOS AM1 Land/Water Mask
Water Percent	Percentage of 30 arcsecond water cells in each coarser resolution cell. Includes both	0-100	Percent	EOS AM1 Land/Water Mask

	oceans and inland water bodies.			
2) Land/Ocean Masks				
Binary Land/Ocean Mask	ISLSCP II land/ocean mask with ocean/land dominated cells coded as: 0= Ocean 1= Land (no inland water)	0-1	See 8.2.2	ISLSCP II Land/Ocean Percent
Land Percent2	Percentage of 30 arcsecond land cells in each coarser resolution cell. Valid with land/ocean mask.	0-100	Percent	EOS AM1 Land/Ocean Mask
Ocean Percent2	Percentage of 30 arcsecond ocean cells in each coarser resolution cell. Includes only oceans.	0-100	Percent	EOS AM1 Land/Ocean Mask
3) Inland Water Masks				
Binary Inland Water Bodies Mask	ISLSCP II inland water bodies mask with cells coded as: 0= Non-Inland Water 1= Inland Water Bodies	0-1	See 8.2.2	ISLSCP II Inland Water Bodies Percent
'Other' Percent	Percentage of 30 arcsecond non-inland water bodies cells in each coarser resolution cell. Valid with inland water bodies mask.	0-100	Percent	ISLSCP II Land/Water and Land/Ocean Masks
Inland Water Bodies Percent	Percentage of 30 arcsecond inland water bodies cells in each coarser resolution cell. Includes only inland water bodies.	0-100	Percent	ISLSCP II Land/Water and Land/Ocean Masks
4) Land Outlines				
Land Outlines	Outlines of global land masses, including inland water bodies (outlines=1)	0-1	See 8.2.2	ISLSCP II Land/Water Mask
Continent Outlines	Outlines of global land masses, with no inland water bodies (outlines=1)	0-1	See 8.2.2	ISLSCP II Land/Water Mask
5) Grid Coordinates				
Latitude Grid Center	Latitude coordinate for the center of each grid cell. South latitudes are negative.	89.875 degrees to –89.875	Decimal Degrees	ISLSCP II Earth Grid

		degrees		
Longitude Grid Center	Longitude coordinate for the center of each grid cell. West longitudes are negative	-179.875 degrees to 179.875 degrees	Decimal Degrees	ISLSCP II Earth Grid

8.3 Sample Data Record

Not applicable to this data set.

8.4 Data Format

All of the files in the ISLSCP Initiative II data collection are in the Arc GIS ASCII grid format. The file format consists of numerical fields of varying length, which are delimited by a single space and arranged in columns and rows. The values for the binary land/water or land/ocean masks and the land outlines files are written as integers from 0 to 1. All values in the land/water/ocean fraction files are written as integers from 0 to 100. The values in the coordinate files are written as real numbers.

The files at different spatial resolutions each contain the following numbers of columns and rows:

1 degree: 360 columns by 180 rows
0.5 degree: 720 columns by 360 rows
0.25 degree: 1440 columns by 720 rows

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

8.5 Related Data Sets

Nearly all of the data sets in the ISLSCP II collection have been made consistent with these land/water/ocean masks. More recent updates of the 30 arcsecond EOS land/water masks are available at http://duckwater.bu.edu/lc/mod12q1.html#gl_ll . ISLSCP II project information and data sets can also be obtained from the Oak Ridge National Laboratory Distributed Active Archive Center (ORNL DAAC): http://daac.ornl.gov/ISLSCP_II/islscpii.html .

9. DATA MANIPULATIONS

9.1 Formulas

9.1.1 Derivation Techniques/Algorithms

The EOS Land/Water mask uses the World Vector Shoreline (WVS) coastline (Soluri and Woodson 1990) and the DCW (Danko 1992) for inland water bodies. WVS is based on older 1:250,000 scale Defense Mapping Agency JOG (Joint Operational Graphics) charts and coastal nautical charts compiled from a variety of sources. DCW is based on a photogrammetrically consistent mapping at a scale of 1:1,000,000. Both vector data sets were reduced to the 1-km scale for creation of the mask at JPL. These 1-km data

were further aggregated to 0.25, 0.5, and 1-degree spatial resolutions for ISLSCP II. See Soluri and Woodson (1990) for more information on the WVS. See Danko (1992) for more information on the DCW.

9.2 Data Processing Sequence

The WVS and DCW data layers were aggregated to 30 arcsecond or 1-km resolution at JPL and then to the three spatial resolutions of the ISLSCP II collection. During the aggregation the percentage of each land or water/ocean 30 arcsecond cell within the coarser resolution cell was calculated. Using the percentage of land/water or land/ocean, all cells with a water or ocean percentage greater than or equal to 50% were assigned the value 0 (i.e. water/ocean dominated) in the ISLSCP II binary masks, with all other values assigned the value of 1 (i.e. land dominated). An inland water bodies mask was derived from the difference of the ISLSCP II land/water masks and the land/ocean masks. Finally, land outlines were derived by searching for land cells bordered by water. These outline cells were all assigned a value of 1 and are at the same spatial resolution as other cells in any particular file.

9.2.1 Processing Steps and Data Sets

See Section 9.2.

9.2.2 Processing Changes

None.

9.2.3 Additional Processing by the ISLSCP Staff

See Section 9.2.

9.3 Calculations

9.3.1 Special Corrections/Adjustments

None.

9.4 Graphs and Plots

None.

10. ERRORS

10.1 Sources of Error

The primary files for building the EOS land/water mask are the Digital Chart of the World (DCW) and World Vector Shoreline (WVS) data sets. The WVS file provides world coastlines at a scale of 1:250,000; excludes all inland water bodies; is based on relatively old map sources, and has an accuracy statement that 90% of all identifiable shoreline features will be located within 500 meters (circular error) of their true geographic position. The DCW, at a scale of 1:1,000,000, provides a vast array of geographic terrain features that can often be picked and matched to provide desired classes. However, the currency of DCW classes may be questionable in a climatically changing world despite their preparation from global photogrammetric sources, and the stated horizontal accuracy of 2040 meters (circular error) is fairly coarse. We expect that the aggregation of these data sources to 30 arcsecond and then to 0.25, 0.5, and 1-degree will

further reduce the importance of those errors found in the original WVS and DCW sources. However, we do note that the boundaries of water bodies that are ephemeral or are changing in time, such as Lake Chad for example, are based on 1993 DCW data, and may not be entirely accurate throughout the entire 1986-1995 time period covered by the ISLSCP II data collection. Finally, we also note that the percentages of land/water/ocean are accurate to 1% in this collection. Therefore, land masses or water bodies with fractions less than 1% in the 0.25, 0.5, and 1-degree files are not resolved here.

10.2 Quality Assessment

10.2.1 Data Validation by Source

The 30 arcsecond (~1 km) EOS Land/Water mask (in Plate Carree projection) was subjected to considerable testing at JPL and ultimately found to satisfy all key requirements for EOS support.

10.2.2 Confidence Level/Accuracy Judgment

An assessment of the differences between DCW and WVS was conducted at JPL. To determine the difference between the two, DCW and WVS overlays were prepared for the Mediterranean Sea, Indonesia, Brazil/Uruguay/La Plata coast, and the Chilean archipelago. Qualitative analysis of these four areas revealed a remarkable one-to-one correspondence between WVS and DCW. Most differences were within one or two pixels, and the differences tended to be in small localized areas. Between the Mediterranean, Indonesian, and Brazilian overlays, only two small areas were found to vary on the order of 5-6 pixels. However, a much greater number of localized differences were found among the glaciated islands, shores, and bays of the Chilean archipelago, although the maximum error was still about 6 pixels. The WVS was also found to provide more islands which met the 1-km threshold than DCW, although a few similar size islands were found in DCW that were not provided by WVS. Antarctica was not evaluated, but differences between ice pack and land boundaries should be anticipated. All-in-all, these differences do not appear significant for a preliminary product expected to be replaced early in the *Terra* mission by a Land Cover product from the MODerate Resolution Imaging Spectroradiometer (MODIS). Updated versions of the 30 arcsecond EOS land/water masks are available through Boston University at http://duckwater.bu.edu/lc/mod12q1.html#gl_ll

10.2.3 Measurement Error for Parameters and Variables

See Section 10.1.

10.2.4 Additional Quality Assessment Applied

None.

11. NOTES

11.1 Known Problems with the Data

The accuracy of these data sets is only as good as the map sources they are derived from, which tend to suffer from varied dates, definitions, coverage density, and accuracies. Thus, it is a

static, actually historical approximation of the world. We expect that many of these error sources will be minimized in aggregating to the coarse resolutions of ISLSCP II.

11.2 Usage Guidance

Users should use these files as a resource should any questions arise with land/ocean or land/water boundaries. These data were used to make the entire ISLSCP II data collection internally consistent based on the needs of the modeling community. However, users can use the percentages of land/water/ocean to create different masks based on percentages that may better address their particular needs.

11.3 Other Relevant Information

None.

12. REFERENCES

12.1 Satellite/Instrument/Data Processing Documentation

http://eros.usgs.gov/

12.2 Journal Articles and Study Reports

Danko, D.M. (1992). The Digital Chart of the World Project, *Photogrammetric Engineering and Remote Sensing*, 58:1125-1128.

Soluri, E.A. and V.A. Woodson (1990) World Vector Shoreline. *International Hydrographic Review* LXVII(1).

13. DATA ACCESS

13.1 Contacts for Archive/Data Access Information

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

13.2 Contacts for Archive

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

13.3 Archive/Status/Plans

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

14. GLOSSARY OF ACRONYMS

DAAC	Distributed Active Archive Center
DCW	Digital Chart of the World
EOS	Earth Observing System

GSFC	Goddard Space Flight Center (NASA)
ISLSCP	International Satellite Land Surface Climatology Project
JOG	Joint Operational Graphics
JPL	Jet Propulsion Laboratory (NASA)
MODIS	MODerate Resolution Imaging Spectroradiometer
NASA	National Aeronautics and Space Administration
ORNL	Oak Ridge National Laboratory
WVS	World Vector Shoreline