1. TITLE

1.1 Data Set Identification

ISLSCP II IGBP NPP Output from Terrestrial Biogeochemistry Models

1.2 Database Table Name(s)

Not applicable to this data set.

1.3 File Name(s)

There are 2 *.zip data files with this data set in one degree (1deg) and half degree (hdeg) spatial resolution: **model_npp_1deg.zip** and **model_npp_hdeg.zip**.

When extrapolated, the zip files contain the following ASCII (.asc) files (See Section 8.2 for complete file descriptions):

modeled_npp_average_Xd.asc: data for the gridded average Net Primary Productivity (NPP) for 17 global models of biogeochemistry, in gC/m^2. Xd is for files (2) in 1deg and hdeg resolution.

modeled_npp_cv_Xd.asc: data on the coefficient of variation (cv) of the NPP of the 17 models, in percent. Xd is for files (2) in 1deg and hdeg resolution.

modeled_npp_stdev_Xd.asc: data for the the standard deviation (stdev) of the NPP of the 17 models in gC/m^2. Xd is for files (2) in 1deg and hdeg resolution.

1.4 Revision Date of this Document

August 26, 2011

2. INVESTIGATOR(S)

2.1 Investigator(s) Name and Title

Dr. Wolfgang Cramer, Potsdam Institut für Klimafolgenforschung e.V. (PIK), Potsdam, Germany.

2.2 Title of Investigation

Comparing global models of terrestrial net primary productivity (NPP).

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2.4 Data Set Citation

Camer, W. 2011. ISLSCP II IGBP NPP Output from Terrestrial Biogeochemistry Models. In Hall, F.G., G. Collatz, B. Meeson, S. Los, E. Brown de Colstoun, and D. Landis (eds.). ISLSCP Initiative II Collection. Data set. Available on-line [http://daac.ornl.gov/] from Oak Ridge National Laboratory Distributed Active Archive Center, Oak Ridge, Tennessee, U.S.A. http://dx.doi.org/10.3334/ORNLDAAC/1027

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.

Cramer, W., D. W. Kicklighter, A. Bondeau, B. Moore III, G. Churkina, B. Nemry, A. Ruimy, A. L. Schloss and The Participants of the Potsdam NPP Model Intercomparison (1999). Comparing global models of terrestrial net primary productivity (NPP): overview and key results. *Global Change Biology*, Volume 5 Issue S1:1-15

3. INTRODUCTION

3.1 Objective/Purpose

Seventeen global models of terrestrial biogeochemistry were compared with respect to annual and seasonal fluxes of net primary productivity (NPP) for the land biosphere. The comparison, sponsored by the International Geosphere Biosphere Programme (IGBP), its task forces Global Analysis, Interpretation and Modeling (GAIM), and Data and Information Systems (DIS) and its core project Global Change and Terrestrial Ecosystems (GCTE), used standardized input variables wherever possible and was carried out through two international workshops and over the Internet. The models differed widely in complexity and original purpose, but could be grouped in three major categories: satellite-based models that use data from the Advanced Very High Resolution Radiometer (AVHRR) sensor as their major input stream (CASA, GLO-PEM, SDBM, SIB2 and TURC), models that simulate carbon fluxes using a prescribed vegetation structure (BIOME-BGC, CARAIB 2.1, CENTURY 4.0, FBM 2.2, HRBM 3.0, KGBM, PLAI 0.2, SILVAN 2.2 and TEM 4.0), and models that simulate both vegetation structure and carbon fluxes (BIOME3, DOLY and HYBRID 3.0). See Section 9.1 for a list of all the participating models. Results of this model intercomparison are published in several companion papers in a special issue of the journal *Global Change Biology* (e.g. Cramer et al. 1999).

3.2 Summary of Parameters

This data set contains modeled annual net primary production (NPP) for the land biosphere from seventeen different global models (see Section 9.1). Annual NPP is defined as the net difference of annual carbon uptake ($gCm^{-2} yr^{-1}$) from the atmosphere through photosynthesis by the land vegetation and that lost back to the atmosphere through autotrophic or maintenance respiration. NPP is also related to the Net Ecosystem Exchange (NEE) of carbon accumulated by or lost from the surface by its vegetation and soils. NPP is NEE plus heterotrophic (decomposition) respiration of the vegetation and soils. Only NPP values are included in this data set as some models did not estimate NEE. The mean, standard deviation and coefficient of variation of NPP for the 17 models are provided in their original tabular format and on global Earth grids.

3.3 Discussion

The model intercomparison on which these data are based was the first for total biospheric carbon flux estimates at the global scale. This was carried out during two workshops at the Potsdam Institute of Climate Impact Research (PIK) in June 1994 and July 1995, followed by joint activities of modeling and writing teams. These results are nearly 10 years old and models have been modified and/or improved since then, allowing closer agreement between current models (e.g. Cramer et al. 2001). Nonetheless, the Science Working Group of the International Satellite Land Surface Climatology Project (ISLSCP) Initiative II felt that it was important for users of the collection to have a data set that could illustrate global patterns of NPP and also the differences between global models. This data set has been made consistent with the land/water mask used in the collection. Additionally, the ISLSCP II staff has created a 1.0 degree version of the 17 model NPP average by averaging the original 0.5 degree data. This data set is recommended for general visualization and education purposes and not for model validation.

4. THEORY OF ALGORITHM/MEASUREMENTS

Net Primary Production is an important component of the carbon cycle and, among the pools and fluxes that make up the cycle, it is one of the steps that are most accessible to field measurement. While easier than some other steps to measure, direct measurement of NPP is tedious and not practical for large areas and so models are generally used to study the carbon cycle at a global scale. Nevertheless these models require field measurements of NPP for parameterization, calibration and validation. Most NPP data are for relatively small field plots that cannot represent the 0.5 degree x 0.5 degree grid cells that are commonly used in global scale models. Furthermore, technical difficulties generally restrict NPP measurements to aboveground parts and sometimes do not even include all components of aboveground NPP. Thus direct inter-comparison between field data obtained in different studies and coarse resolution model outputs can be misleading. As a surrogate for direct model validation, model comparisons have been used to check the applicability of various kinds of models (e.g. Cramer et al. 1999,2001).

5. EQUIPMENT

5.1 Instrument Description

This data set is derived entirely from global biogeochemical models. Some of these models use remotely sensed data and others do not. Please see Cramer et al. (1999) for more information on the particular required model inputs.

5.1.1 Platform (Satellite, Aircraft, Ground, Person)

See Cramer et al. (1999).

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.

6. PROCEDURE

6.1 Data Acquisition Methods

17 global models of terrestrial biogeochemistry were tested using standardized input variables. The input data were provided by the Potsdam Institute of Climate Impact Research (PIK) in Potsdam, Germany. PIK has provided the average, standard deviation and coefficient of variation of NPP for the 17 models for the ISLSCP II collection.

6.2 Spatial Characteristics

6.2.1 Spatial Coverage

The spatial coverage is for all global terrestrial surfaces, except for Greenland and Antarctica.

6.2.2 Spatial Resolution

This ISLSCP II data set is provided on an equal-angle Earth grid with spatial resolutions of 0.5 and 1.0 degree in both latitude and longitude.

6.3 Temporal Characteristics

6.3.1 Temporal Coverage

The various models used input AVHRR satellite data for 1987 and climatological long-term means of temperature and precipitation for the period 1931-1960.

6.3.2 Temporal Resolution

Values are provided as the mean, standard deviation and coefficient of variation of annual NPP for the 17 models.

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) Original File (model_npp_hdeg.zip)				
LONG	Longitude for the center of a 0.5 degree cell. West longitudes are negative.	-179.75 degrees to 179.75 degrees	Decimal Degrees	PIK
LAT	Latitude for the center of a 0.5 degree cell. South latitudes are negative.	82.75 degrees to –54.75 degrees	Decimal Degrees	PIK
NPP_AVE	Average NPP for 17 global biogeochemical models.	3.3-1372.7	gC/m^2	PIK
NPP_STD	Standard deviation of NPP for 17 global biogeochemical models.	1.74-225.1	gC/m^2	PIK
NPP_CV	Coefficient of variation of NPP for 17 global biogeochemical models.	2.93-99.69	Percent	PIK
2) (model_npp_1deg.zip)				
Average NPP	Average NPP for 17 global biogeochemical models .	3.3-1372.7 Water=-9.999 No data over land=-8.888	gC/m^2	Original data
Standard Deviation NPP	Standard deviation of NPP for 17 global biogeochemical models.	1.74-225.1 Water=-9.999 No data over land=-8.888	gC/m^2	Original data
Coefficient of Variation NPP	Coefficient of variation of NPP for 17 global biogeochemical models.	2.93-99.69 Water=-9.999 No data over land=-8.888	Percent	Original data

8.3 Sample Data Record

Sample data records for the file **model_npp_hdeg.zip** are given below:

```
LON,LAT,NPP_AVE,NPP_STD,NPP_CV,LAND_MASK
-64.75,82.75,4.50,4.37,97.320,1
-64.25,82.75,4.50,4.34,97.300,1
-63.75,82.75,5.10,5.00,97.650,1
-64.75,82.25,5.00,4.94,97.750,1
-64.25,82.25,4.90,4.82,97.700,1
```

8.4 Data Format

All of the files in the ISLSCP Initiative II data collection are in the ESRI ArcGIS ASCII, or text format. The files in this data set contain 720 columns by 360 rows for the 0.5 degree data , and 360 columns and 180 rows for the 1.0 degree data.. All values are written as real numbers. Missing values are assigned the value of -99.99.

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..

8.5 Related Data Sets

Two other NPP data sets are provided in the ISLSCP II collection: One is a collection of point NPP measurements compiled from the literature, and the other is a gridded NPP product produced from many of these point measurements, but without global coverage. ISLSCP II project information and other data sets can also be obtained from the ORNL DAAC http://daac.ornl.gov/ISLSCP_II/islscpii.shtml. For additional NPP data sets archived at the DAAC: http://daac.ornl.gov/cgi-bin/dataset_lister.pl?p=13 .

9. DATA MANIPULATIONS

9.1 Formulas

9.1.1 Derivation Techniques/Algorithms

Three general types of models, using common driver data were used to calculate Net Primary Production (See Table 1 for a list of all models used and appropriate references). The first type uses satellite data to determine the temporal behavior of the photosynthetically active tissue. These models can be used to examine the effect of climate variability on NPP, but the time of interest is limited to that of the satellite archive. From the satellite observations, they provide some certainty for the seasonal dynamics (phenology) of biospheric production.

The second group simulates the biogeochemical fluxes on the basis of soil and climate characteristics, using either vegetation maps or biogeography models to prescribe vegetation structure. With one exception, these models simulate phenology either explicitly or implicitly so that the seasonal activity of the canopy can change in response to climate change. Such models can only describe functional changes within particular vegetation types and thereby ignore the possible effects of (slow) vegetation redistribution.

The third group simulates changes in both ecosystem structure (vegetation distribution and phenology) and function (biogeochemistry). Generally, equilibrium between climate and vegetation is assumed, but the models can be turned into Dynamical Global Vegetation Models (DGVMs). At the time of the comparison project, they have been applied to potential vegetation only. This is in contrast to some of the models in the other categories which account for land use either explicitly (CARAIB) or implicitly through the use of satellite observations.

The models use different input data sets to represent global climate, vegetation and soils (when needed). Most input data sets have been standardized (see Methods: Common data sets below), but this was not possible in all cases. For example, a model that requires a known vegetation distribution must use a global vegetation map (or an estimate from a biogeography model) which is in agreement with its modeling strategy, while others may use either different vegetation classes or no map at all. In addition, the input data sets used by model developers vary in spatial and temporal resolution.

The relative influence of different driving variables on NPP varies among models. Most models simulate the influence of solar radiation (R_s, generally represented through Photosynthetically Active Radiation, or PAR) on NPP. CENTURY and HRBM, however, do not explicitly consider solar radiation -- its influence is implicitly included in the effects of temperature or self-shading on NPP. With the exception of TURC, all models simulate the influence of water availability on NPP using soil water status and/or vapor pressure deficit. In BIOME-BGC, DOLY, HYBRID, and TEM, Gross Primary Productivity (GPP) and/or autotrophic respiration (R_A) depend on nutrient availability. In CENTURY and HRBM nutrients affect NPP directly.

Because the storage of carbon in vegetation is represented differently among the models, several approaches are used to estimate GPP, R_A and NPP. For example, some models use only one single pool of carbon (e.g. TEM) with a single equation describing either GPP, R_A, or NPP, whereas other models (e.g. CENTURY) allocate carbon to many pools (e.g. leaves, sapwood, heartwood, fine roots) and estimate respiration and the accumulation of carbon, either by GPP or allocation. The following sections provide some more detail on the different models within each category. The user is encouraged to consult Cramer et al. (1999) for more details on the specific models.

Remote Sensing Based Models

The appearance of global data sets from satellites like the NOAA/AVHRR since the late 1970s has provided new opportunities for the global monitoring of the temporal variation of terrestrial ecosystems. The linkage between Vegetation Indices (VIs), which are various combinations of the satellite measurements in the red and near infrared bands, and the fraction of canopy-absorbed photosynthetically active radiation (FPAR) provides the absorbed photosynthetically active radiation (APAR), and thereby connects satellite observations to biological productivity on large scales. The Production Efficiency Models (PEMs) use the concept of light use efficiency (LUE) for the conversion of APAR to biomass. Since, under ideal conditions, the rate of primary production is linearly related to PAR absorption (Monteith 1977; Landsberg 1986), LUE can be regarded as a conservative quantity, which can be used to scale the integral of FPAR*PAR (over the growing season) to primary production. This concept is suitable for use with remotely sensed observations which provide both the timing of the active period and the quantitative values of FPAR.

Actual production varies depending on the environment and between plants with different photosynthetic pathways and respiration rates (Jarvis & Leverenz 1983; Prince 1991). Therefore, some models combine the PEM structure with more classical process based formulations, including nutrient cycling and photosynthetic controls, to estimate the variability of the LUE. These models have very different levels of mechanism in the description of the effects of the environment on LUE. Some apply the LUE concept to NPP (CASA, SDBM), others to GPP. In most PEMs (CASA, TURC, SDBM), the potential LUE value is empirically derived and then reduced due to environmental constraints. GLO-PEM is unique among all models by not using any climatic driving variables observed on the ground (except for distinguishing between C_3 and C_4 grasses). All variables about climate and vegetation structure are derived from satellite observations. SIB2, despite being a remote sensing based model, is not a PEM: fluxes are simulated at the leaf level and then integrated over the canopy, therefore the production is not linearly related to canopy APAR through a light use efficiency. It is a soil-vegetation-atmosphere-transfer (SVAT) model and simulates land surface processes in detail and with short time steps(minutes) and coarse spatial resolution (4° latitude 5° longitude) coupled to a General Circulation Model. Several parameters are derived from satellite data, including roughness length, albedo, FPAR and Leaf Area Index (LAI).

Models of Seasonal Biogeochemical Fluxes

All models in this category use climate and soils data as input variables. Vegetation distribution (either from one of several available maps or from the climate-based BIOME model, is required for the parameterization of some processes. The level of process mechanism is very different between these models, ranging from the largely empirical regression model HRBM to several different explicitly mechanistic models including photosynthesis and respiration. Some models in this category use satellite data as well, but only for the calibration or prescription of some processes.

Models of Process and Pattern (Function and Structure)

The three models in this class (BIOME3, DOLY, and HYBRID) all simulate biogeochemical processes (fluxes) and pattern (vegetation type and structure) simultaneously. The determination of the vegetation types follows process optimization rules (maximization of the NPP according to soils and climate, or maximization of the LAI to satisfy the annual moisture and carbon balances). The results are not calibrated--the parameter values for individual process descriptions are chosen from the literature. CO_2 fluxes are simulated at hourly/daily time steps and directly coupled with water fluxes. HYBRID is the only non-equilibrium model of the comparison--it applies a gap-model strategy with explicit growth formulations at the global scale. It therefore is a Dynamic Global Vegetation Model (DGVM), capable of predicting the response of vegetation to climate change, due to the dynamic coupling of the temporal changes of both structure (like LAI) and function (like the fluxes of carbon, water and nutrients).

Table 1. Global Models used in the Potsdam NPP intercomparison.

MODEL	MODEL NAME	INSTITUTION	REFERENCE
BIOME3		Department of Ecology, Lund University, Sweden	Haxeltine & Prentice 1999
BIOME-BGC	Biome BioGeochemical Cycles model	School of Forestry, University of Montana, Missoula, MT, USA	Running & Hunt 1993
CARAIB 2.1	CARbon Assimilation In the Biosphere model	Laboratory for Planetary and Atmospheric Physics, Liege University, Liege, Belgium	Warnant et al. 1994, Nemry et al. 1996
CASA	Carnegie Ames Stanford Approach	Carnegie Institute of Washington, Stanford University, Stanford, CA, USA	Potter et al. 1993; Field et al. 1995
CENTURY 4.0		Colorado State University, Fort Collins, CO, USA	Parton et al. 1993
DOLY		Department of Plant and Animal Sciences, Sheffield University, Sheffield, UK & Department of Environmental Sciences, University of Virginia, Charlottesville, VA, USA	Woodward et al. 1995
FBM 2.2	Frankfurt Biosphere Model	Department of Theoretical and Physical Chemistry, Johann-Wolfgang-Goethe University,	Lüdeke et al. 1994; Kohlmaier et al. 1997

		Frankfurt /Main, Germany	
GLO PEM	GLObal Production Efficiency Model	Department of Geography, University of Maryland, MD, USA	Prince 1991; Prince & Goward 1995
HRBM 3.0	High Resolution Biosphere Model	Department of Plant Ecology, Justus-Liebig-University, Gießen, Germany	Esser et al. 1994
HYBRID 3.0		Institute of Terrestrial Ecology, Edinburgh, UK	Friend 1995; Friend et al. 1997
KGBM	Kergoat Global Biosphere Model	Laboratory of Terrestrial Ecology, Toulouse, France	Kergoat 1998
PLAI 0.2	Potsdam Land Atmosphere Interaction Model	Potsdam Institute for Climate Impact Research, Potsdam, Germany	Plöchl & Cramer 1995a+b
SDBM	Simple Diagnostic Biosphere Model	Max-Planck Institute for Meteorology, Hamburg, Germany	Knorr & Heimann 1995
SIB2	Simple Interactive Biosphere Model	NASA/Goddard Space Flight Center, Greenbelt, MD, USA	Sellers et al. 1996a+ b
SILVAN 2.2	SImulating Land Vegetation And NPP model	Max-Planck-Institute for Meteorology, Hamburg, Germany	Kaduk & Heimann 1996
TEM 4.0	Terrestrial Ecosystem Model	University of Alaska, Fairbanks, AK, USA	McGuire et al. 1995
TURC	Terrestrial Uptake and Release of Carbon	Laboratoire d'Ecophysiologie Vegetale, Orsay, France	Ruimy et al. 1996

9.2 Data Processing Sequence

9.2.1 Processing Steps and Data Sets

Common Input Data Sets

Full standardization of all input data sets, spatial scale assumptions, etc. is not achievable for a broad comparison of this type. We nevertheless aimed for the highest possible level of standardization using a common spatial framework for most data sets. Being climate-driven, all NPP models require data on temperature and moisture availability. All models (except GLO-PEM, spatial resolution 8 km and SIB2, 4.0 degree x 5.0 degree) already used climate data sets gridded at 0.5 degree longitude/latitude resolution. GLO-PEM was run at that resolution to allow direct comparison at the workshop. Again, apart from GLO-PEM and SIB2, all models use monthly long-term means of climatic variables (those running at daily time steps usually generate quasi-daily climate data from monthly averages internally). A few models interpolate quasi-hourly climate data for estimating GPP whereas others (e.g. CARAIB, HYBRID) apply weather generators to simulate daily variability. The CLIMATE data base (long-term means 1931-60, version 2.1, (W. Cramer et al. unpublished data) was used by all participants for monthly mean air temperatures and precipitation values. Unless indicated otherwise, temperature concerns air temperature throughout the comparison.

Solar radiation is required by most models, but the formulations for estimating it differ among the models. Some models estimate radiation from latitude and cloudiness using gridded sunshine hour percentages as a proxy for cloudiness from the CLIMATE data base (R.D. Otto et al. unpublished data). SIB2 is linked to a General Circulation Model and derives solar radiation from that model. To simplify model comparisons, it was suggested that those models that require satellite data for the quantitative prescription of seasonal changes in FPAR all use the FASIR (Fourier-Adjustment, Solar zenith angle corrected, Interpolated Reconstructed) data set for 1987 of the ISLSCP1 CD-ROM database. This data set consists of monthly Normalized Difference Vegetation Index (NDVI) at a spatial resolution of 1.0 degree with improved processing compared to the standard Global Vegetation Index (GVI) product widely used before. However, not all satellite-based models were developed using the FASIR data set--their adaptation to it for the comparison resulted in weaker performance. GLO-PEM, for example, was designed to use satellite data at a higher temporal and spatial resolution (AVHRR Pathfinder) that provide other information (e.g. surface temperature, humidity) that are not available from the FASIR data set. Therefore, the FASIR-based results of GLO-PEM used here are neither optimal nor do they correspond to the published values. The results of TURC are also different from the published ones, because its calibration to the FASIR data could not be adjusted in time for the workshop. The results available for SDBM are based on another satellite data set, as well as another radiation data set—they are therefore used only for the papers focusing on light interception/light use efficiency and seasonality.

The FASIR satellite data we used correspond to observations from 1987, while the climate data used are the 1931-60 long-term means (exception for GLO-PEM and SIB2). The years from 1931 to 1960 differed climatically from present long-term means and probably also from 1987. The impact of this inconsistency on global NPP is probably limited, but the diagnostic values from simulations combining satellite derived vegetation activity and climate from different periods must be treated cautiously.

9.2.2 Processing Changes

Among the data sets that could not be standardized for the intercomparison were average humidity and wind speed, which were required by some models. Vegetation distribution is an input to several models, and the selected maps (or models) affect results both at the levels of model calibration and application--a strict standardization would have removed features that are critical for the individual model design. Furthermore, the models that estimate both fluxes and vegetation structure (BIOME3, DOLY, HYBRID) do not predict identical vegetation distributions. Practically all soils data came from the Food and Agriculture Organization (FAO) Soil Map of the World (FAO/UNESCO 1974), but the interpretations of its categories in terms of soil factors cannot be standardized across models easily. Some models use the translation of the Zobler (1986) soil texture to field capacity and wilting point. Pan et al. (1996) recently explored the sensitivity of biosphere models to such different soil data sets.

The land area considered for the comparison included all major landmasses except Antarctica. When the data from different sources and different spatial resolution is applied to this land mask at 0.5 degree longitude/latitude, then the terrestrial boundaries do not match precisely. After selection of only those cells that had data for all variables, 56 785 grid cells were left for the standardized input files (from 62 483 grid cells in CLIMATE, 58 440 for soil texture, 86 624 for the FASIR-NDVI). Model outputs covered still fewer numbers of cells for some models. This is due to:

- the use of additional data by these models;
- some models do not simulate fluxes in certain vegetation types (deserts in FBM, wetlands in TEM); and
- the different spatial resolution of SIB2.

In the most extreme case (FBM), the effective total land area is 18% less than the 128.7 10^6 km^2 of the 56 785 grid cells of the common input data sets. In the accompanying papers, the number of models which could be used for the comparison, differs for various reasons explained there.

9.2.3 Additional Processing by the ISLSCP Staff

The ISLSCP II staff has used the 0.5 degree resolution original data provided by PIK to create global maps of the average, standard deviation and coefficient of variation in NPP for the 17 models. After the **modeled_npp_data_hd.zip** file is expanded, every cell in the resulting ASCII (.asc) files, was assigned to its corresponding location on a global 0.5 degree Earth grid using the latitude and longitude coordinates that were provided. Individual files for each NPP statistic were created and written to the ASCII format. The ISLSCP II staff has also made the data set consistent with the 0.5 degree land/water mask used in the collection. Points where the original data showed water or no data and the ISLSCP II mask showed land (e.g. Greenland, Antarctica) have been have been assigned a value of -88.88 (i.e. No data over land). Water bodies in the ISLSCP II land/water mask have also been forced over original land points where needed and assigned the value of -99.99 (NOTE: All water bodies have the same value of -99.99). Finally, the ISLSCP II staff has created a 1.0 degree version of the average NPP of the 17 models by aggregating the 0.5 degree file to the coarser resolution. This was done by averaging the 17 model average NPP for the 4 0.5 degree cells contained within each 1.0 degree cell, ignoring any water or missing data cells. This 1.0 degree data set was also adjusted to match the 1.0 degree ISLSCP II land/water mask in the same fashion as with the 0.5 degree data set.

9.3 Calculations

9.3.1 Special Corrections/Adjustments

None.

9.4 Graphs and Plots

See Cramer et al. (1999) and other papers in the 1999 special issue of *Global Change Biology (Vol. 5 Suppl.1).*

10. ERRORS

10.1 Sources of Error

The simulations resulted in a range of total NPP values (44.4-66.3 Pg C yr^{-1}), after removal of two outliers (which produced extreme results as artifacts due to the comparison). The broad global pattern of NPP and the relationship of annual NPP to the major climatic variables coincided in most areas. Differences could not be attributed to the fundamental modeling strategies, with the exception that nutrient constraints generally produced lower NPP. Regional and global NPP were sensitive to the simulation method for the water balance. Seasonal variation among models was high, both globally and locally, providing several indications for specific deficiencies in some models. Users should consult the various papers in the 1999 special issue of *Global Change Biology (Vol. 5 Suppl.1)* for more in depth discussion of differences between the models.

The FASIR satellite data we used correspond to observations from 1987, while the climate data used are the 1931-60 long-term means (exception for GLO-PEM and SIB2). The years from 1931 to 1960 differed climatically from present long-term means and probably also from 1987. The impact of this inconsistency on global NPP is probably limited, but the diagnostic values from simulations combining satellite derived vegetation activity and climate from different periods must be treated with caution.

10.2 Quality Assessment

10.2.1 Data Validation by Source

None available at this revision.

10.2.2 Confidence Level/Accuracy Judgment

This data set was created in the mid-1990s with 17 models available at that time. It is reasonable to expect that these models will have been updated and/or modified since then, and that the variability shown in the data sets here may have decreased.

10.2.3 Measurement Error for Parameters and Variables

None available at this revision.

10.2.4 Additional Quality Assessment Applied

None.

11. NOTES

11.1 Known Problems with the Data

None reported at this revision.

11.2 Usage Guidance

This data set was created in the mid-1990s with 17 models available at that time. It is reasonable to expect that these models will have been updated and/or modified since then, and that the variability shown in the data sets here may have decreased. This data set is recommended for general visualization of coarse global NPP patterns and education purposes and not for model validation. This data set also illustrates the broad variability of NPP retrieved from several global biogeochemical models at the time.

11.3 Other Relevant Information

None.

12. REFERENCES

12.1 Satellite/Instrument/Data Processing Documentation

None

12.2 Journal Articles and Study Reports

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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

APAR	Absorbed Photosynthetically Active Radiation
AVHRR	Advanced Very High Resolution Radiometer
BIOME-BGC	Biome BioGeochemical Cycles model
CARAIB 2.1	CARbon Assimilation In the Biosphere model
CASA	Carnegie Ames Stanford Approach
DAAC	Distributed Active Archive Center
DGVM	Dynamical Global Vegetation Model
DIS	Data and Information System (IGBP)
FAO	Food and Agriculture Organization (United Nations)
FASIR	Fourier-Adjustment, Solar zenith angle corrected, Interpolated Reconstructed
FBM 2.2	Frankfurt Biosphere Model
FPAR	Fraction of canopy-absorbed Photosynthetically Active Radiation
GAIM	Global Analysis, Interpretation and Modeling (IGBP)
GCTE	Global Change and Terrestrial Ecosystems (IGBP)
GLO-PEM	GLObal Production Efficiency Model
GPP	Gross Primary Productivity
GSFC	Goddard Space Flight Center (NASA)
GVI	Global Vegetation Index
HRBM 3.0	High Resolution Biosphere Model
IGBP	International Geosphere Biosphere Programme
ISLSCP	International Satellite Land Surface Climatology Project
KGBM	Kergoat Global Biosphere Model
LAI	Leaf Area Index
LUE	Light Use Efficiency
NASA	National Aeronautics and Space Administration
NDVI	Normalized Difference Vegetation Index
NEE	Net Ecosystem Exchange
NPP	Net Primary Productivity
ORNL	Oak Ridge National Laboratory
PAR	Photosynthetically Active Radiation
PEM	Production Efficiency Model
PIK	Potsdam Institut für Klimafolgenforschung
PLAI 0.2	Potsdam Land Atmosphere Interaction Model

SDBM	Simple Diagnostic Biosphere Model
SIB2	Simple Interactive Biosphere Model
SILVAN 2.2	SImulating Land Vegetation And NPP model
SVAT	Soil-Vegetation-Atmosphere-Transfer model
TEM 4.0	Terrestrial Ecosystem Model
TURC	Terrestrial Uptake and Release of Carbon
VI	Vegetation Indices