FAIR USE POLICY

- The database is intended for synthesis work i.e. studying global patterns, studying regional patterns, validating models, validating remote sensing products, comparison of individual sites with a wide range of similar or contrasting sites, etc.
- If your study relies on one or few individual site observations contained in this database please contact the principal investigator of the site (e-mail and addresses are listed at the end of this document).
- If the data source states 'pers. commun.' the data were not published at the time the database was compiled, please contact the principal investigator to obtain permission to use the data (e-mail and addresses are listed at the end of this document).
- If you use this database please cite as: Luyssaert S, Inglima I, Jung M *et al.* (2007) The CO_2-balance of boreal, temperate and tropical forest derived from a global database. *Global Change Biology*, **13,** 2509-2537.
- Lead authors of studies making use of this database are responsible to acknowledge the contributions of the different networks and their funding agencies in all presentations and publications that result from this database.
- Suggested acknowledgement (in addition to proper citation): 'We thank all site investigators, their funding agencies, the various regional flux networks (Afriflux, AmeriFlux, AsiaFlux, CarboAfrica, CarboEurope-IP, ChinaFlux, Fluxnet-Canada, KoFlux, LBA, NECC, OzFlux, TCOS-Siberia, USCCC), and the FLUXNET project, whose support is essential for obtaining the measurements without which the type of integrated analyses conducted in this study would not be possible.'

Table of Content

Version information

Changes between version workshop (15.06.2006) and 1.0 (10.07.2006)

- Data selection criterion was strictly applied, many entries were deleted.
- New data have been added.
- Existing data were corrected according to group input.
- Needle-leaved vs. broadleaved and deciduous vs. evergreen instead of previous classes.
- NPP table (values) was restructured to increase data consistency.
- NPP entries were checked (methods and values).
- Added a separate entry for Reco to avoid problems with combing Reco data from different methods.
- GPP_NEP_Reco tables (methods and values) were restructured to increase methodological consistency.
- GPP, NEP and Reco entries were checked (methods).
- Tabel with 8-character label was added (required with some software).
- Queries were written to compute weighted means and uncertainty at the stand and site level.
- Methods applied in the queries were documented.
- Data selection was documented.
- Listed contributing authors.

Changes between version 1.0 (10.07.2006) and 1.1 (15.08.2006)

- A bug in the queries was removed. The queries now handle missing data correctly.
- A soil composition table was added.
- Consistent climatic data based on the CRU dataset were added.
- A NDVI-table was added.
- Modelled N-deposition data were added.

Changes between version 1.1 (15.08.2006) and 1.2 (15.05.2007)

- CE-IP coordinates were corrected
- Linked 4_stand_monthly_climate_1901-2003 to 1_site_information
- Added a tropical site Porce
- Removed a duplicate Bordeaux/Le Bray
- Split Tapajos in 67 and 83
- Split Manaus in Jacaranda and Cuieras
- Added 12 sites at Andrews, 12 sites at Cascade head and 11 sites at Metolius
- Added Changbai Mountains
- Corrected NEP Bornhoved
- Corrected NEP Wind River
- Corrected Age, Biomass and Density for Hainich
- Corrected Sylvania
- Checked Lavarone against Fluxnet data, contacted PI

Changes between version 1.2 (15.05.2007) and 2.1(1.06.2007)

- 50+ sites added
- Uncertainty calculation of NEP for sites between 23N and 23S changed
- The CRU database gave -9999 for sites close to large water bodies. For these sites the climate of the nearest site in our database was used. Added a flag to the CRU/ORCHIDEE data indicating whether these are extracted from the database or duplicates of the nearest site.
- 4_Stand_monthly_climate_1901_2003 has been split in 4_Stand_monthly_cloudcover_CRU and 4_Stand_wet_days_CRU.
- Updated documentation file

Changes between version 2.1 (1.06.2007) and 2.2(16.04.2008)

- 13+ sites added
- Corrected sources of Andrews, Cascade head and Metolius chronosequences. Please notice that the PI should be contacted when these data are used.
- Updated meta data.
- Updated documentation file.

Changes between version 2.2 (16.04.2008) and 3.1 (12.06.2008)

- Changed the query structure. The aggregated flux uncertainty is now calculated as $s_{ijl} = \left(p_i \times RF_j\right) \Big/ \sqrt{l_{ijl}}$ Where p_i is the initial uncertainty for site i in the absence of measurements (see Tables 1 and 2) and RF_j is the reduction factor for method j according to Tables 1 and 2 and l_{ij} is the length of the time series (in years) for site i for which the fluxes where estimated with method j in year l. According to the analyses presented in this study the data had first to be aggregated by year and then by site. For a given site (i), a single weighted mean flux estimate (F) was produced for each available year l. When the flux component was determined with k different methods j in year l, the flux determined by method j for site i was then given as F_{ijl}. The average flux across methods (F_{il}) was calculated as the weighted mean:

  $F_{il} = \sum_{j=1}^{k}\left(w_{ijl} \times F_{ijl} \Big/ \sum_{j=1}^{k} w_{ijl} \right)$ Where, $w_{ijl} = 1/s_{ijl}^2$. The uncertainty of the weighted mean was estimated by means of error propagation: $s_{il} = \sqrt{\sum_{j=1}^{k} s_{ijl}^4 \times w_{ijl}}$ Following, the weighted mean flux component was calculated across years:

  $F_i = \sum_{l=1}^{m}\left(w_{il} \times F_{il} \Big/ \sum_{l=1}^{m} w_{il} \right)$ Where, $w_{il} = 1/s_{il}^2$, m the number of years for which flux estimates are available for site i. The uncertainty of the weighted mean was estimated by means of error propagation: $s_i = \sqrt{\sum_{l=1}^{m} s_{il}^4 \times w_{il}}$

Documentation

Tables

1_Site information

1_Site information		
Plot name	Text	Name of the plot according to CarboEurope-IP, Ameriflux, FLUXNET or publication.
Climatic region	Text	Climatic region according to the U.S. Dept. of Agriculture, Natural Resources Conservation Service. The biome classification distinguishes eight forested biomes: boreal humid, boreal semi-arid, temperate humid, temperate semi-arid, mediterranean warm, mediterranean cold, tropical humid and, tropical semi-arid sites. Sites are classified according to their geographical location.
Needles/ Leaves	Text	Indicate whether the tree species are needle leaved, broadleaved or a mixture of both form.
Evergreen/ Deciduous	Text	Indicate whether the growth strategy of the tree species is evergreen, deciduous or a mixture of both strategies.
Tree species 1	Text	Dominant tree species of the stand.
Tree species 2	Text	Co-dominant tree species of the stand.
Latitude	Number	Latitude in **decimal** degrees indicate South with – & North with +. Decimal degrees were used to ease plotting graphs with latitude on an axis.
Longitude	Number	Longitude in **decimal** degrees indicate West with – & East with +. Decimal degrees were used to ease plotting graphs with longitude on an axis.
Elevation	Number	Elevation above sea level in **m**.
Management code	Text	2 characters indicating the management, NI (No Information), M (Managed), UM (Unmanaged), RD (Recently disturbed), FI (Fertilized and/or Irrigated), PO (Polluted).
Management	Text	Relevant information on management and disturbance.
Source 1,2& 3	Text	Website or publication where the plot information is available

Use
- There is no referential integrity in this table, when more than one source is given it is not clear which fields were taken from which source.

- This table (at least the field ‘Plot name’) should be filled before any other table can be filled. All other tables except the level 2 tables are linked to this table (more specific to the field ‘Plot name’).

- Failure of filling out the other field of this table will likely result is excluding the site from the planned analyses as most analyses will use one of these fields to stratify the data.

Contributions
Sebastiaan Luyssaert
Giorgio Matteucci

2_Methodology_GPP_NEP_Reco

2_Methodology_GPP_NEP_Reco		
Methodology number	Number	Unique number within this table, this number is used to describe the methodology in the level 3 tables
Eddy covariance	Yes/No	Indicate whether eddy covariance measurements were used to estimate GPP, NEP and/or NEP
Specific parameters	Yes/No	Indicate whether site-specific parameters were available for the model
NPP, biomass, Reco measurements	Yes/No	Indicate whether independent measurements of NPP, biomass, Reco, etc were used to test the model output
NEP	Text	Describe the method that was used to estimate the NEP i.e. Eddy covariance, NPP-direct measurements of Rh, model (give name of the model), etc.
NEP_method	Number	Method-specific reduction factor of total uncertainty of NEP see Table 1
Reco	Text	Describe the method that was used to estimate the Reco i.e. Ecosystem respiration based on night time respiration vs soil or air temperature relationship, direct measurement of of the components of Reco with chambers, model (give name of the model), etc.
Reco_method	Number	Method-specific reduction factor of total uncertainty of Reco see Table 2
GPP	Text	Describe the method that was used to estimate the GPP i.e. NEP + estimated Re, NPP + direct measurements of Ra, model (give name of the model), etc.
GPP_method	Number	Method-specific reduction factor of total uncertainty of GPP see Table 1
Source	Text	Website or publication where the methodology is given

Use
- This table (at least the field 'Methodology number') should be filled before the level 3 table '3_Estimate_NEP_GPP_Reco') can be filled. The level 3 table is linked to this table (more specific to the field 'Methodology number').

- The methodology number refers to the combination of the methodologies used to estimate NEP, GPP and Reco.

- The field 'Source' refers to a reference were more information concerning the methodology can be found. If the methodological approach is not common, this reference will be the same reference as in the level 3 tables. For common methodological approaches this reference could refer to a general methodological paper i.e. Aubinet *et al.* 2000.

-Table 1. Method-specific reduction factors for GPP, NPP and NEP determined by expert judgment. The reduction factors account for the precision of a method and were used to reduce the initial variability.

Method	GPP	NPP	NEP	Reduction factor
Eddy covariance and data assimilation	x		x	0.2
Eddy covariance based	x		x	0.3
Measured increment and litterfall		x		0.3
Measured and modeled increment and litterfall		x		0.6
Process-model based	x	x	x	0.6
Flux components based	x	x	x	1.0

- Table 2. Method-specific reduction factors for Re, Rs, Rh and Ra determined by expert judgment. The reduction factors account for the precision of a method and were used to reduce the initial variability.

Method	Re	Rs	Rh	Ra	Reduction factor
Eddy covariance	x	x			0.3
Chamber based		x			0.4
Process-model based	x				0.6
Chamber + girdling			x		0.8
Chamber + root excised			x		0.8
Chamber + trenching			x		0.8
Radiocarbon			x		0.8
Chamber based				x	0.8
Alkali absorption		x			0.8
Chamber + gap based			x		0.9
Process-model based		x	x	x	1.0
Flux component based		x	x	x	1.0

Contributions
Sebastiaan Luyssaert
Expert panel (A’dam workshop June 2006)

2_Methodology_NPP

2_methodology_NPP		
Methodology number	Number	Unique number within this table, this number is used to describe the methodology in the level 3 tables
Foliage	Yes/No	Indicate whether foliage production is included in the NPP estimate
Stem	Yes/No	Indicate whether stem production is included in the NPP estimate
Coarse roots	Yes/No	Indicate whether coarse root production is included in the NPP estimate
Coarse root methodology	Text	Describe the method used to estimate the coarse root NPP i.e. allometric relationships, sequential coring, in-growth cores, etc.
Fine roots	Yes/No	Indicate whether fine root production is included in the NPP estimate
Fine root methodology	Text	Describe the method used to estimate the coarse root NPP i.e. Sequential coring, in-growth cores, minirhizotrons, Raich and Nadelhoffer approximation (1989)
Branches	Yes/No	Indicate whether branch production is included in the NPP estimate
Understory	Yes/No	Indicate whether understory production is included in the NPP estimate
Herbivory	Yes/No	Indicate whether herbivory loss is included in the NPP estimate
VOC	Yes/No	Indicate whether volatile organic compound loss is included in the NPP estimate
Reproductive parts	Yes/No	Indicate whether reproductive parts are included in the NPP estimate
Leaching	Yes/No	Indicate whether leaching from foliage and root exudation is included in the NPP estimate
Comments	Text	Essential comments to describe the methodology that was used to estimate NPP
Methodology class	Number	Method-specific reduction factor of total uncertainty of NP see Table 1
Source	Text	Website or publication where the NPP methodology is given

Use
- This table (at least the field ‘Methodology number’) should be filled before the level 3 table ‘3_Estimate_NPP’ can be filled. The level 3 table is linked to this table (more specific to the field ‘Methodology number’).

- The field ‘Source’ refers to a reference were more information concerning the methodology can be found. If the methodological approach is not common, this reference will be the same reference as in the level 3 tables. For common methodological approaches this reference could refer to a general methodological paper.

Contributions
Sebastiaan Luyssaert
Expert panel (A’dam workshop June 2006)

2_Methodology_Rs_Rh_Ra

2_Methodology_Rs_Rh_Ra		
Methodology number	Number	Unique number within this table, this number is used to describe the methodology in the level 3 tables
Rs	Text	Describe the method for measuring total soil respiration i.e. chambers, ground level eddy covariance or n.a. when not measured
Rs_method	Number	Method-specific reduction factor of total uncertainty of Rs see Table 2
Rh	Text	Describe the method for measuring heterotrophic respiration i.e. trenching, clear cuts, NPP-NEP, etc
Rh_method	Number	Method-specific reduction factor of total uncertainty of Rh see Table 2
Ra	Text	Describe the method for measuring autotrophic respiration
Ra_method	Number	Method-specific reduction factor of total uncertainty of Ra see Table 2 i.e. chamber, GPP-NPP, model (give name of model), etc.
Reference	Text	Website or publication where the Rs, Rh and/or Ra methodology is given

Use
- This table (at least the field 'Methodology number') should be filled before the level 3 table '3_Estimate_Rs_Rh_Ra' can be filled. The level 3 table is linked to this table (more specific to the field 'Methodology number').

- The methodology number refers to a specific combination of the methodologies used to estimate Rs, Rh and Ra.

- The field 'Source' refers to a reference were more information concerning the methodology can be found. If the methodological approach is not common, this reference will be the same reference as in the level 3 tables. For common methodological approaches this reference could refer to a general methodological paper.

Contributions
Sebastiaan Luyssaert
Ilaria Inglima
Expert panel (A'dam workshop June 2006)

3_Estimate_GPP_NEP_Reco

3_Estimate_GPP_NEP_Reco		
Plot	Text	Plot name according to table '1_Site_information'
Begin year	Number	First year that GPP, NEP and/or Reco were estimated, 9999 when not known
End year	Number	Last year of the period that GPP, NEP and or Reco were estimated, use the year of publication when not known
NEP	Number	g C m-2.a-1
Reco	Number	g C m-2.a-1
GPP	Number	g C m-2.a-1
Methodology	Number	Number of the methodology according to table '2_Methodology_GPP_NEP_Reco'
Source	Text	Website or publication where GPP, NEP and/or Reco data are available

Use:
- The field 'Plot' is linked to the field [1_Site_information][Plot_name]. Only plot names already registered in the level 1 table can be entered in this level 3 table.

- The field 'Methodology' is linked to the field [2_Methodology_GPP_NEP_Reco][Methodology_number]. Only methodologies already registered in the level 2 table can be entered in this level 3 table.

- If the measurements did not started on January 1st and ended on December 31st. Round to the nearest data. i.e. measurements from April 1999 to March 2000 should be entered as begin year 1999 and end year 1999.

Contributions
Sebastiaan Luyssaert
Dario Papale

3_Estimate_NPP

3_Estimate_NPP		
Plot	Text	Plot name according to table '1_Site_information'
Begin year	Number	First year that NPP was estimated, 9999 when not known
End year	Number	Last year of the period that NPP was estimated, use the year of publication when not known
NPP stem	Number	NPP of the stem g C m-2.a-1
NPP foliage	Number	NPP of the foliage g C m-2.a-1
ANPP_1	Number	Stem + foliage NPP
NPP branch	Number	NPP of the branches g C m-2.a-1
NPP wood	Number	Stem + branch NPP
ANPP_2	Number	Foliage + wood NPP
NPP coarse	Number	NPP of the coarse roots g C m-2.a-1
NPP fine	Number	NPP of the fine roots g C m-2.a-1
BNPP_1	Number	Coarse + fine root NPP
TNPP_1	Number	Foliage + wood + coarse root + fine root NPP
NPP understory	Number	NPP of the understory g C m-2.a-1
TNPP_2	Number	TNPP_1 + understory NPP
NPP repro	Number	NPP of the reproductive organs g C m-2.a-1
TNPP_3	Number	TNPP_2 + reproductive parts NPP
NPP herbivory	Number	NPP of herbivory g C m-2.a-1
TNPP_4	Number	TNPP_3 + herbivory NPP
NPP VOC	Number	NPP of VOC's g C m-2.a-1
TNPP_5	Number	TNPP_4 + VOC NPP
NPP leaching	Number	NPP of leaching from foliage and root exudates g C m-2.a-1
TNPP_6	Number	TNPP_5 + leaching NPP
Methodology	Number	Number of the methodology according to table '2_Methodology_NPP'
Source	Text	Website or publication where NPP data are available

Use
- The field 'Plot' is linked to the field [1_Site_information][Plot_name]. Only plot names already registered in the level 1 table can be entered in this level 3 table.

- The field 'Methodology' is linked to the field [2_Methodology_NPP][Methodology_number]. Only methodologies already registered in the level 2 table can be entered in this level 3 table.

- If the measurements did not started on January 1st and ended on December 31st. Round to the nearest data. i.e. measurements from April 1999 to March 2000 should be entered as begin year 1999 and end year 1999.

Contributions
Sebastiaan Luyssaert

3_Estimate_Rs_Rh_Ra

3_Estimate_Rs_Rh_Ra		
Plot	Text	Plot name according to table '1_Site_information'
Begin year	Number	First year that Rs, Rh and/or Ra were estimated, 9999 when not known
End year	Number	Last year of the period that Rs, Rh and/or Ra were estimated, use the year of publication when not known
Rs	Number	Total soil respiration g C m-2.a-1
Rh	Number	Heterotrophic respiration g C m-2.a-1
Ra	Number	Autotrophic (belowground + aboveground) respiration g C m-2.a-1
Methodology	Number	Number of the methodology according to table '2_Methodology_Rs_Rh_Ra'
Reference	Text	Website or publication where Rs, Rh and and/or Ra data are available

Use
- The field 'Plot' is linked to the field [1_Site_information][Plot_name]. Only plot names already registered in the level 1 table can be entered in this level 3 table.

- The field 'Methodology' is linked to the field [2_Methodology_Rs_Rh_Ra][Methodology_number]. Only methodologies already registered in the level 2 table can be entered in this level 3 table.

- If the measurements did not started on January 1st and ended on December 31st. Round to the nearest data. i.e. measurements from April 1999 to March 2000 should be entered as begin year 1999 and end year 1999.

Contributions
Ilaria Inglima
Sebastiaan Luyssaert

4_Site_labels

4_Site_labels		
Site ID	Auto Number	Unique number, assigned automatically
Site name	Text	Plot name according to table ‘1_Site_information’
Site label	Text	Unique 8 character label, the first 5 letters of the site name and 3 digits

Use
- The field ‘Site name’ is linked to the field [1_Site_information][Plot_name]. Only plot names already registered in the level 1 table can be entered in this level 4 table.

- The table can be used to generate queries with a number or label instead of the long site names. Numbers or labels can be more convenient for statistical analysis or plotting.

4_Stand_biomass_observed

4_Stand_biomass_observed		
Plot	Text	Plot name according to table '1_Site_information'
Begin year	Number	First year that the biomass was estimated, 9999 when not known
End year	Number	Last year of the period that the biomass was estimated, use the year of publication when not known
Foliar biomass	Number	Foliar biomass in g C m-2
Branch biomass	Number	Branch biomass in g C m-2
Stem biomass	Number	Stem biomass in g C m-2
Stump biomass	Number	Stump biomass in g C m-2
Coarse root biomass	Number	Coarse root biomass in g C m-2
Fine root biomass	Number	Fine root biomass in g C m-2
Total aboveground biomass	Number	Total aboveground biomass in g C m-2
Total belowground biomass	Number	Total belowground biomass in g C m-2
Source	Text	Website or publication where the stand biomass data are available, please provide the complete bibliographic reference

Use
- The field 'Plot' is linked to the field [1_Site_information][Plot_name]. Only plot names already registered in the level 1 table can be entered in this level 4 table.

- If the measurements did not started on January 1st and ended on December 31st. Round to the nearest data. i.e. measurements from April 1999 to March 2000 should be entered as begin year 1999 and end year 1999.

Contributions
Sebastiaan Luyssaert

4_Stand_climate_observed

STAND CLIMATE		
Plot	Text	Plot name according to table '1_Site_information'
Begin year	Number	First year that the climate was observed, 9999 when not known or when an unspecified long-term mean value
End year	Number	Last year of the period that the climate was observed, use the year of publication when not known or when an unspecified long-term mean value
Temperature	Number	Mean annual temperature in °C
Precipitation	Number	Total annual precipitation in mm
Evaporation	Number	Total annual evaporation in mm
APAR	Number	Total annual absorbed radiation in MJ.m-2
PAR	Number	Total annual incident radiation in MJ.m-2
Reference	Text	Website or publication where the climatic data are available

Use
- The field 'Plot' is linked to the field [1_Site_information][Plot_name]. Only plot names already registered in the level 1 table can be entered in this level 4 table.

- If the measurements did not started on January 1st and ended on December 31st. Round to the nearest data. i.e. measurements from April 1999 to March 2000 should be entered as begin year 1999 and end year 1999.

Source
APAR with reference JRC_2006 were calculated from 0.25° fapar and radiation data as APAR= FAPAR * PAR; assuming that PAR is 0.45 * global radiation.
The FAPAR data were extracted from the EC-JRC database JRC 2006 and radiation data come from a regional climate model (Remo) that was driven with NCEP reanalysis GKSS 2001.

Contributions
Sebastiaan Luyssaert
Martin Jung

4_Stand_description_observed

4_Stand_description_observed		
Plot	Text	Plot name according to table '1_Site_information'
Begin year	Number	First year that the stand was described, 9999 when not known
End year	Number	Last year of the period that the stand was described, use the year of publication when not known
Basal area	Number	Basal area in m-2.ha-1
Diameter	Number	Diameter at breast height in m
Height	Number	Mean tree height in m
Density	Number	Stand density in number of trees.ha-1
Age	Number	Age of the dominant trees in years
Reference	Text	Website or publication where the stand description data are available

Use
- The field 'Plot' is linked to the field [1_Site_information][Plot_name]. Only plot names already registered in the level 1 table can be entered in this level 4 table.

- If the measurements did not started on January 1st and ended on December 31st. Round to the nearest data. i.e. measurements from April 1999 to March 2000 should be entered as begin year 1999 and end year 1999.

Contributions
Sebastiaan Luyssaert

4_Stand_leaf_area_index_observed

4_Stand_leaf_area_index_observed		
Plot	Text	Plot name according to table '1_Site_information'
Begin year	Number	First year that the stand was described, 9999 when not known
End year	Number	Last year of the period that the stand was described, use the year of publication when not known
LAI	Number	Maximal LAI between begin year and end year in m2.m-2
Projected	Text	Projected vs. total
Method	Text	Hemispherical photo, LI2000, litterfall, allometric relationship
Source	Text	Website or publication where the stand biomass data are available, please provide the complete bibliographic reference

Use
- The field 'Plot' is linked to the field [1_Site_information][Plot_name]. Only plot names already registered in the level 1 table can be entered in this level 4 table.

- If the measurements did not started on January 1st and ended on December 31st. Round to the nearest data. i.e. measurements from April 1999 to March 2000 should be entered as begin year 1999 and end year 1999.

Contributions
Sebastiaan Luyssaert

4_Stand_monthly_xxx_CRU and 4_Stand_monthly_xxx_ORCHIDEE

4_Stand_monthly_air_humidity_CRU 4_Stand_monthly_precipitation_CRU 4_Stand_monthly_temprature_CRU 4_Stand_monthly_wet_days_CRU 4_Stand_monthly_cloudcover_CRU 4_Stand_monthly_incoming_radiation_ORCHIDEE 4_Stand_monthly_net_solar_rad_ORCHIDEE 4_Stand_monthly_absor_down_long_rad_ORCHIDEE 4_Stand_monthly_net_surf_long_rad_ORCHIDEE 4_Stand_monthly_soil_moisture_ORCHIDEE		
Plot	Text	Plot name according to table '1_Site_information'
Flag	Number	1 = values extracted from CRU or Orchidee; 2 Values obtained from Replacement site (see Table 4)
xxxx	Number	The columns in these files are named using the following naming convention: YYYYMM where, YYYY represents Year, MM represents Month.

Use
- The field 'Plot' is linked to the field [1_Site_information][Plot_name]. Only plot names already registered in the level 1 table can be entered in this level 4 table.

- For sites located near large water bodies, the resolution of the CRU database was sometimes insufficient resulting in identifying the pixel as water. For those sites we replaced the missing climatic data with the climatic data from the nearest site in the database.

- Table 4. Site replacements

Data missing for	Data replaced by
Brookhaven	Morgan Monroe
Chamela 1	Luquillo
Chamela 2	Luquillo
Chamela 3	Luquillo
Cocoflux	Howards Spring
Kohala	Hawaii C
Kokee	Hawaii C
Michigan F3	Michigan C2
Mt Odaighara	Takayama
Mt Takoe	Takayama
Osa	La Selva
Puu Kolekole	Hawaii C
University of Michigan	Michigan C2

Source
Mitchell & Jones 2005

Contributions
Shilong Piao
Markus Reichstein

4_Stand_NDVI_xxxx_xxxx_GMISS

4_Stand_NDVI_1982_1989_GMISS 4_Stand_NDVI_1990_1997_GMISS 4_Stand_NDVI_1998_2003_GMISS		
Plot	Text	Plot name according to table '1_Site_information'
NDVI	number	The columns in these files are named using the following naming convention: ndYYYYMMa where, YYYY represents Year, MM represents Month, a denotes the days 1-15 of the month, and b denotes the days from 16 to the end of the month. Example: nd198207a is the data for 1-15 of July,1982, and nd198207b is the data for 16-31 of July,1982,

Use
- The field 'Plot' is linked to the field [1_Site_information][Plot_name]. Only plot names already registered in the level 1 table can be entered in this level 4 table.

- In the formulas below, the data, once imported, is referred to as the 'raw' data. To recover the -1 to 1 range of NDVI, use the following formula: NDVI = raw/10000;
Example: If the value of a site is 6780, the value of NDVI of that site is:
6780*0.0001=0.6780

- In the NDVI data, Water pixels have a value of -10000 in the raw data, and -5000 are masked pixels, and missing are -2000 plus the flag 6. The flag files can be retrieved from the NDVI data by the following formula: FLAG = raw - floor(raw/10) * 10; (where FLOOR(X) rounds the elements of X to the nearest integers towards minus infinity.)

- The meaning of the FLAG:
FLAG = 6 (missing data)
FLAG = 5 (NDVI retrieved from average seasonal profile, possibly snow)
FLAG = 4 (NDVI retrieved from average seasonal profile)
FLAG = 3 (NDVI retrieved from spline interpolation, possibly snow)
FLAG = 2 (NDVI retrieved from spline interpolation)
FLAG = 1 (Good value, possibly snow)
FLAG = 0 (Good value)

The NDVI is the difference of near-infrared (channel 2) and visible (channel 1) reflectance values normalized over the sum of channels 1 and 2 (NIR-VIS)/(NIR+VIS). The NDVI equation produces values in the range of -1.0 to 1.0, where increasing positive values indicate increasing green vegetation and negative values indicate nonvegetated surface features such as water, barren, ice, snow, or clouds.

Source
Kidwell 1997

Contributions
Shilong Piao

4_Stand_ monthly_xxxx_ORCHIDEE

4_Stand_monthly_net_solar_radiation_ORCHIDEE 4_Stand_monthly_net_surface_long_radiation_ORCHIDEE 4_Stand_monthly_absor_down_long_radiation_ORCHIDEE 4_Stand_monthly_soil_moisture_ORCHIDEE		
Plot	Text	Plot name according to table '1_Site_information'
Variable	Number	The columns in these files are named using the following naming convention: YYYYMM where, YYYY represents Year and MM represents Month

Use
- The field 'Plot' is linked to the field [1_Site_information][Plot_name]. Only plot names already registered in the level 1 table can be entered in this level 4 table.

- Variable depends on the table. The following variables have separate tables: net solar radiation (W.m-2), net surface longwave radiation (W.m-2), absorbed downwards longwave radiation (W.m-2) and soil moisture (mm).

Source
The data are derived from the ORCHIDEE model for the period 1990-2003

Contributions
Shilong Piao

4_Stand_xx_deposition_ORCHIDEE

4_Stand_N_dry_deposition_ORCHIDEE 4_Stand_N_wet_deposition_ORCHIDEE 4_Stand_NHx_deposition_ORCHIDEE		
Plot	Text	Plot name according to table '1_Site_information'
Variable	Number	The columns in these files are named using the following naming convention: MM where, MM represents Month

Use
- The field 'Plot' is linked to the field [1_Site_information][Plot_name]. Only plot names already registered in the level 1 table can be entered in this level 4 table.

- Variable depends on the table. The following variables have separate tables: dry N deposition (gN/m2/mth), wet N deposition (gN/m2/mth) and Ammonia deposition(gN/m2/mth) derived from the emission field.

Source
The data are derived from the ORCHIDEE model for the period 1990-2003

Contributions
Shilong Piao

4_Stand_N_deposition_1993_GALLOWAY

Plot	Text	Plot name according to table '1_Site_information'
Flag for wet deposition	Number	1: observed deposition (modeled EMEP, NADP or NDDN) 3: corrected modeled deposition
Wet deposition	Number	Deposition value gC.m-2.a-1
Flag for dry deposition	Number	1: observed deposition (modeled EMEP, NADP or NDDN) 2: corrected observed deposition 3: corrected modeled deposition
Dry deposition	Number	Deposition value gC.m-2.a-1
Flag for total deposition	Number	1: observed deposition (modeled EMEP, NADP or NDDN) 2: corrected observed deposition 3: corrected modeled deposition
Total deposition	Number	Deposition value gC.m-2.a-1

Use
- The field 'Plot' is linked to the field [1_Site_information][Plot_name]. Only plot names already registered in the level 1 table can be entered in this level 4 table.

Source
Interpolated grided maps based on ground observations (EMEP, NADP and NDDN) of several N-species are available for Western Europe and the conterminous USAHolland *et al.* 2005b. Total wet deposition for the USA and Europe was computed as the sum of aqueous NO_3^- and NH_4^+ fields. Total N deposition for Western Europe was computed as the sum of wet and dry deposition where dry deposition was the sum of NO_2, NH_4^+, HNO_3 and NO_3^-. However, only the sum of nitric acid and particulate nitrate was measured Holland *et al.* 2005a, therefore, their relative fields represent end-members assuming only one N-species. In our calculation of the dry deposition we took the average value of nitric acid and particulate nitrate. Additional data for 1993 for the rest of the globe were derived from model simulationsGalloway *et al.* 2004; Dentener 2006; estimates of wet N deposition were then derived from modelled values of total N deposition, based on a correlation (seeMagnani *et al.* 2007) between measured total and wet deposition values from Western Europe.

Contributions
Sebastiaan Luyssaert

4_Stand_soil_composition_IGBP_DIS

4_Stand_soil_composition_IGBP_DIS		
Plot	Text	Plot name according to table '1_Site_information'
Sand	Number	Volume % of sand
Silt	Number	Volume % of silt
Clay	Number	Volume % of clay

Use
- The field 'Plot' is linked to the field [1_Site_information][Plot_name]. Only plot names already registered in the level 1 table can be entered in this level 4 table.

- The spatial resolution is 5 minutes.

- Mass percentages were converted to volumetric percentages by dividing the mass percentage by the bulk density i.e. 1.19 g.cm-3 for sand and 0.94 g.cm-3 for clay. The percentage silt was calculated as the difference of the volumetric percentage sand and clay from 100 %.

Source
Global_Soil_Data_Task 2000

Contributions
Martin Jung

Queries

0_Individual_xxx_number of years

0_ Individual_GPP_NEP_Reco_number_of_years 0_ Individual_NPP_components_number_of_years 0_Individual_Rs_Rh_Ra_number_of_years		
Plot	Text	[3_Estimate_xxx][Plot]
Begin year	Number	[3_Estimate_xxx][Begin Year]
End year	Number	[3_Estimate_xxx][End Year]
Years xxx	Number	IIf (IsNull([3_Estimate_xxx][xxx]) = True, Null, IIf ([3_Estimate_xxx][Begin year] = 9999, 1, [3_Estimate_xxx][End year] - [3_Estimate_xxx][Begin year] + 1))
xxx	Number	[3_Estimate_xxx][xxx]
Methodology	Number	[3_Estimate_xxx][Methodology]
Source	Text	[3_Estimate_xxx][Source]

Use
- xxx denotes a C-flux i.e. GPP, NEP, Reco, NPP, Ra, Rh or Rs.

- This query calculates the number of years during which a single observation/entry was measured. Number of years is used in higher level queries. This query has no stand-alone use

- Calculate the number of years. If the begin year is not known (9999) then the time series is considered to be 1 year long. Else, the difference between the begin and end year is calculated.

Query by
Sebastiaan Luyssaert

1_Individual_xxx_with uncertainty

1_Individual_ GPP_NEP_Reco _with uncertainty 1_Individual_ NPP _with uncertainty 1_Individual_ Rs_Rh_Ra _with uncertainty		
Plot	Text	[1_Site_information][Plot name]
Begin year	Number	[0_Individual_xxx_number_of_years][Begin year]
End year	Number	[0_Individual_xxx_number_of_years][End year]
Years xxx	Number	[0_Individual_xxx_number_of_years][Years xxx]
xxx	Number	[0_Individual_xxx_number_of_years][xxx]
xxx_Std	Number	IIf (IsNull ([0_Individual_xxxx_number_of_years][xxx]) = True, Null, INITIAL VARIABILITY (see Table 3) * [2_Methodology_xxxx][xxx_method] / Sqr([0_Individual_xxxx_number_of_years][Years xxx]))
xxx_weight_1	Number	IIf (IsNull ([0_Individual_xxxx_number_of_years][xxx]) = True, Null, (INITIAL VARIABILITY (see Table 3) * [2_Methodology_xxxx][xxx_method] / Sqr([0_Individual_xxxx_number_of_years][Years xxx]))^2)
Methodology	Number	[0_Individual_xxxx_number_of_years][Methodology]
Source	Text	[0_Individual_xxxx_number_of_years][Source]

Use
- xxxx denotes a C-flux i.e. GPP, NEP, Reco, NPP, Ra, Rh or Rs.

- This query calculates the variability accounting for length of the observation and the method that was used to measure the c-flux. The uncertainty is used in higher level queries. The query has no stand-alone use

- Table 3. Variability (g C m^{-2} yr^{-1}) of a component flux determined by expert judgment and assuming the absence of measurements.

Component flux	Prior	Variability
GPP	Latitude	500 + 7.1 * (70 – Latitude)
NPP	Latitude	350 + 2.9 * (70 – Latitude)
NEP	-	350 if Latitude > 23 700 if Latitude < 23
Re	Latitude	500 + 7.1 * (70 – Latitude)
Rs	Latitude	200 + 8.6 * (70 – Latitude)
Rh	Latitude	100 + 2.9 * (70 – Latitude)
Ra	Latitude	100 + 4.3 * (70 – Latitude)

- For more details see Luyssaert *et al.* 2007

- This level 1 query is linked to the level 0 query '0_Individual_xxxx_number_of_years' and to the level 1 table 'Site_information' and the level 2 table '2_Methodology_xxxx'

Queryn by
Sebastiaan Luyssaert

1_Individual_Stand_description

1_Individual_Stand_description		
Plot	Text	[4_Stand_description_observed][Plot]
Year of Establishment	Number	IIf (IsNull([4_Stand_description_observed]![Stand age]) = 1, Null, [4_Stand_description_observed][End year]-[4_Stand_description_observed][Stand age])

Use
- The year of establishment can be used to calculate the age of the forest at the time that the C-flux was measured in higher level queries

Query by
Sebastiaan Luyssaert

2_Intermediate_xxxx_sum_of_weights_per_year

2_Intermediate_GPP_NEP_Reco_sum_of_weights_per_year_weights 2_Intermediate_NPP_components_sum_of_weights_per_year_weights 2_Intermediate_Rs_Rh_Ra_sum_of_weights_per_year_weights		
Plot name	Text	[1_Site_information][Plot name]
Begin year	Number	[1_Individual_xxx_with_uncertainty][Begin year]
End_year	Number	[1_Individual_xxx_with_uncertainty][End year]
Intermediate_xxx	Number	Sum([1_Individual_xxx_with_uncertainty][xxx] *[1_Individual_xxx_with_uncertainty][xxx_weight_1])
Intermediate_Var_xxx	Number	Sum(([1_Individual_xxx_with_uncertainty][xxx_Std]^2) *([1_Individual_xxx_with_uncertainty][NEP_weight_1]^2))

Use
- xxxx denotes a C-flux i.e. GPP, NEP, Reco, NPP, Ra, Rh or Rs.

- This query calculates intermediate results at the site and year level that are used in the higher level queries. The query has no stand-alone use.

- This level 2 query is linked to the level 0 query ‘0_Individual_xxxx_number_of_years’ and to the level 1 table ‘Site_information’

Query by
Sebastiaan Luyssaert

3_Intermediate_xxx_per_year

3_Intermediate_GPP_NEP_Reco_per_year 3_Intermediate_NPP_components_per_year 3_Intermediate_Rs_Rh_Ra_per_year		
Plot	Text	[1_Site_information][Plot name]
Begin year	Number	[2_Intermediate_xxx_sum_of_weights_per_year][begin year]
End year	Number	[2_Intermediate_xxx_sum_of_weights_per_year] [end year]
Weighted_xxx_per_year	Number	IIf(IsNull([2_Intermediate_xxx_sum_of_weights_per_year] [Intermediate_Var_xxx]) = True, Null, [2_Intermediate_xxx_sum_of_weights_per_year] [Intermediate_xxx]/[2_Intermediate_xxx_sum_of_weights_per_year] [Intermediate_Var_xxx])
Weighteg_Std_xxx_per_year	Number	IIf(IsNull([2_Intermediate_xxx_sum_of_weights_per_year][Intermediate_Var_xxx]) = True, Null, Sqr(1/ [2_Intermediate_xxx_sum_of_weights_per_year] [Intermediate_Var_xxx]))
Weight_xxx_2	Number	IIf(IsNull([2_Intermediate_xxx_sum_of_weights_per_year][Intermediate_Var_xxx]) = True, Null, 1/([2_Intermediate_xxx_sum_of_weights_per_year] [Intermediate_Var_xxx]/[2_Intermediate_xxx_sum_of_weights_per_year][Intermediate_Var_xxx]^2))

Use
- xxx denotes a C-flux i.e. GPP, NEP, Reco, NPP, Ra, Rh or Rs.

- This query calculates the weighted mean for the C-flux and the weighted std at the site and year level. The query has no stand-alone use.

- This level 3 query is linked to the level 1 table ‘Site_ and level 2 query ‘2_Intermediate_ xxx_sum_of_weights_per_year’

Written by
Sebastiaan Luyssaert

4_Intermediate_xxx_sum_of_weights_per_site

4_Intermediate_GPP_NEP_Reco_sum_of_weights_per_site 4_Intermediate_NPP_components_sum_of_weights_per_site 4_ Intermediate_Rs_Rh_Ra_sum_of_weights_per_site		
Plot	Text	[1_Site_information][Plot name]
Min of Begin year	Number	Min([3_Intermediate_GPP_NEP_Reco_per_year][begin year])
Max of End year	Number	Max([3_Intermediate_GPP_NEP_Reco_per_year][end year])
Intermediate xxx	Number	Sum([3_Intermediate_xxx_per_year] [Weighted_xxx_per_year]*[3_Intermediate_xxx_per_year][Weight _xxx_2])
Intermediate Var xxx	Number	Sum(([3_Intermediate_xxx_per_year][Weighted_Std_xxx]^2) *[3_Intermediate_xxx_per_year][Weight_xxx_2]^2)

Use
- xxx denotes a C-flux i.e. GPP, NEP, Reco, NPP, Ra, Rh or Rs.

- This query calculates the intermediate results at the site level. The query has no stand-alone use.

- This level 4 query is linked to the level to the level 1 table ‘Site_ and level 3 query ‘3_Intermediate_xxx_per_year’

Written by
Sebastiaan Luyssaert

5_Grouped_xxx_with uncertainty

5_Grouped_GPP_NEP_Reco_with_uncertainty 5_Grouped_NPP_components_with_uncertainty 5_Grouped__Rs_Rh_Ra_with_uncertainty		
Plot	Text	[1_Site_information][Plot name]
Min of Begin year	Number	[4_Intermediate_GPP_NEP_Reco_sum_of_weights_per_site][min of begin year]
Max of End year	Number	[4_Intermediate_GPP_NEP_Reco_sum_of_weights_per_site][max of end year]
xxx	Number	IIf(IsNull([4_Intermediate_xxx_sum_of_weights_per_site][Intermediate_Var_xxx]) = True, Null, ([4_Intermediate_xxx_sum_of_weights_per_site][Intermediate_NEP]/[4_Intermediate_xxx_sum_of_weights_per_site][Intermediate_Var_xxx]))
Xxx_uncertainty	Number	IIf(IsNull([4_Intermediate_xxx_sum_of_weights_per_site][Intermediate_Var_xxx])= True, Null,1.96*Sqr(1/[4_Intermediate_xxx_sum_of_weights_per_site][Intermediate_Var_xxx]))

Use
- xxx denotes a C-flux i.e. GPP, NEP, Reco, NPP, Ra, Rh or Rs.

- This query calculates the uncertainty for the weighted mean for the C-flux at the site level. The query contains end products. These products can be used in a level 6 query without additional calculations.

- This level 5 query is linked to the level 4 query
'4_Intermediate_xxx_sum_of_weights_per_site'

Written by
Sebastiaan Luyssaert

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Contributions

Workshop 15.6.2006

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