Global biome patterns of the Middle and Late Pleistocene

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Directory listing of folder deposited:

```
ASCII_Grids.7z
LPJ-GUESS_outputs.7z
211_Global_Biome_Maps_with_Legend_&_Title_slide.pdf
Biome_assignments_V1.12_211_Pleistocene_plus_RCP_time-slices.csv
Biome_extents_V1.12_211_Pleistocene_plus_RCP_time-slices_Americas
Biome_extents_V1.12_211_Pleistocene_plus_RCP_time-slices_Asia-Beringia
Biome_extents_V1.12_211_Pleistocene_plus_RCP_time-slices_Europe
Biome_extents_V1.12_211_Pleistocene_plus_RCP_time-slices_Global
Global_biome_pattern_dissimilarity_matrix__211_Pleistocene_plus_RCP_time-slices
LPJ_cells_Pleistocene_plus_RCP_ice-
      free_land_fractions___sorted_to_match_LPJ_output_files.csv
PFT_CMass_by_biome_V1.12_211_Pleistocene_plus_RCP_time-slices
README.md
Readme_first.pdf
```

The first two items listed are compressed folders, the third is a .pdf slideshow of the global biome maps for the 211 simulations made, the remainder are individual files, including this file in two formats (README.md and Readme_first.pdf). Descriptions are given below of the eight individual data files, followed by descriptions of the two folders and of the individual files therein.

The .pdf slideshow **211_Global_Biome_Maps_with_Legend_&_Title_slide.pdf** is self-explanatory and can be viewed using Adobe Acrobat®. It has a header page, listing the paper title and authors, a Legend page, listing the biomes and other land covers shown on the maps and showing the colour shading used for each, and 211 global biome maps, one per page, beginning at 800 ka, progressing to 0 ka and ending with maps for the four RCP scenarios for which simulations were made.

The biomisation method used in the present study was published by Allen *et al*. (2020) and subsequently also applied by Huntley *et al*. (2021).

Allen, J.R.M., Forrest, M., Hickler, T., Singarayer, J.S., Valdes, P.J. & Huntley, B. (2020). Global vegetation patterns of the past 140,000 years. *Journal of Biogeography*, 47, 2073-2090. doi 10.1111/jbi.13930

Huntley, B., Allen, J.R.M., Forrest, M., Hickler, T., Ohlemüller, R., Singarayer, J.S. & Valdes, P.J. (2021). Projected climatic changes lead to biome changes in areas of previously constant biome. *Journal of Biogeography*, 48, 2418-2428. doi 10.1111/jbi.14213

Datasets related to these two papers can be found at: https://doi.org/10.5061/dryad.2fqz612mk and https://doi.org/10.5061/dryad.f4qrf j6w6 respectively.

Biome_assignments_V1.12_211_Pleistocene_plus_RCP_time-slices.csv

A comma-delimited file. Header line names the fields given on each subsequent line. Subsequent 68,665 lines give biome assignments for half-degree grid cells for 210 GCM experiments plus the 'present', as listed in the header line. Four GCM projected future experiments are followed by the 'present' and then by 206 palaeoclimate experiments, each identified by the time slice (ka – i.e. thousands of years before present) to which it relates. Biomes assigned are indicated by an integer numeric code, as shown in the table overleaf.

Fields:

Cell-ID.....Sequence number for grid cell (0 – 68,664).

Lon.....Longitude of centre of grid cell (decimal degrees east of Greenwich Meridian).

Lat.....Latitude of centre of grid cell (decimal degrees north of Equator).

RCP8.57 .....potential biome assignment for 2100 under RCP8.5 emissions scenario (RCP8.57 GCM experiment).

RCP8.55 .....potential biome assignment for 2050 under RCP8.5 emissions scenario (RCP8.55 GCM experiment).

RCP4.57 .....potential biome assignment for 2100 under RCP4.5 emissions scenario (RCP4.57 GCM experiment).

RCP4.55 .....potential biome assignment for 2050 under RCP4.5 emissions scenario (RCP4.55 GCM experiment).

000k.....biome assignment for 'present' (i.e. 1901–30).

001k.....biome assignment for 1 kyr BP.

⋮

796k.....biome assignment for 796 ka BP.

800k.....biome assignment for 800 ka BP.

Biome assignment codes

Code	Acronym	Biome
0	No biome assigned, i.e. no ice-free land area in the grid cell at that time.	
1	Des	Desert
2	Tun	Tundra
3	TrEF	Tropical Evergreen Forest
4	TrRF	Tropical Raingreen Forest
5	Sav	Savanna
6	TrG	Tropical Grassland
7	TeMxF	Temperate Mixed Forest
8	TeSF	Temperate Summergreen Forest
9	TeBEF	Temperate Broad-leaved Evergreen Forest
10	BPk	Boreal Parkland
11	TePk	Temperate Parkland
12	WTeWo	Warm Temperate Woodland
13	TeSh	Temperate Shrubland
14	BENF	Boreal Evergreen Needle-leaved Forest
15	BWo	Boreal Woodland
16	BSNF	Boreal Summergreen Needle-leaved Forest
17	BSBF	Boreal Summergreen Broad-leaved Forest
18	ShT	Shrub Tundra
19	St	Steppe
20	TeNEF	Temperate Needle-leaved Evergreen Forest
21	Se-des	Semi-desert
22	UNC	Unclassified

Biome_extents_V1.12_211_Pleistocene_plus_RCP_time-slices_…

Four fixed format files, one for the entire globe (…_Global) and one each for three longitudinal slices: …_Americas – 135° W – 30° W, comprising North America, except for Alaska and western Yukon, most of Greenland, except the extreme east, and South America, plus associated islands, including those in the Caribbean; …_Europe – 30° W – 65° E – comprising north-easternmost Greenland, Iceland, Eurasia west of the Urals, the Arabian Peninsula and Africa, plus associated islands, including most of the mid-Atlantic islands; and …_Asia-Beringia – 65° E – 135° W, comprising Eurasia from the Urals eastwards, Alaska and eastern Yukon, the Indian sub-continent, south-east Asia and Australasia, plus associated islands, including Japan, the Malay archipelago, the Philippines, Hawaii and most Pacific islands.

Each file begins with a header line identifying the biomes for which data are given in each of 21 columns (columns 2 – 22), using the biome acronyms given above, a column giving values for unclassified grid cells (UNC) and, where relevant, a final 'Total' column. This is followed by three pairs of blocks of data, relating in turn to:

Extent of each biome:

Extents.....global/regional extent (10^3 km^2);

% Ext .....global/regional extent as a fraction of the contemporary total global land area (%);

Number of grid cells assigned to each biome:

n cells .....number of half-degree grid cells occupied globally/regionally;

% cells .....fraction of all global/regional grid cells with some ice-free land area occupied (%);

Total carbon mass of each biome:

CMass .....global/regional biomass (kg carbon); and

% CMass .....fraction of total global/regional biomass (%)

of the 21 biomes, plus unclassified grid cells, and also the total across biomes in the cases of values not expressed as fractions (%).

Each block begins with a line identifying the nature of the data presented, followed by 211 rows of data, each row commencing with the experiment identifier, occupying the first 8 character positions, followed by 22 values, or 23 values in cases where a total is given, each occupying 11 characters, with the first commencing in character position 9.

Data values are given as real numbers to three decimal places (Extents, % Ext, % cells and % Cmass), integers (n cells) or in exponential format (CMass).

Blocks within each pair are separated by a blank line; pairs of blocks are separated by two blank lines.

This multi-block file can be read in R using the standard read.table() function with the 'fill' argument set to TRUE.

Data in the Extents block of the …_Global file were used to generate Figure 6 of Huntley *et al*. (2023), whilst the Total column of the CMass block was used to draw the Global C-Mass line in Figure 7 of that paper.

Global_biome_pattern_dissimilarity_matrix__211_Pleistocene_plus_RCP_time-slices

A fixed-format file containing the 211 row x 211 column square–symmetric global biome pattern dissimilarity matrix. A header line identifies the columns, and each row begins with its identifier; identifiers are as before, i.e. RCP8.57, RCP8.55, RCP4.57, RCP4.55, 000k, 002k,…796k, 800k. Row identifiers occupy the first 7 characters of each row; dissimilarity values occupy 9 characters each, with the decimal point in the 5th column, values being given to four decimal places.

LPJ_cells_Pleistocene_plus_RCP_ice-free_land_fractions___sorted_to_match_LPJ_output_files.csv

A comma-delimited file. Header line names the fields given on each subsequent line. Subsequent 68,665 lines give, for each half-degree grid cell, the overall area (km^2) and ice-free land fractions (%) for the 211 biome simulations (for details of how these values were estimated, see Supplementary Information, Appendix S1, of Huntley *et al.*, 2023). Note that the Cell-ID field is specific to this file and does not provide a cross reference into any other file.

Fields:

1. Cell-ID.....Sequence number for grid cell; integer (values in the range 0 – 68,664).
2. Lon.....Longitude of centre of grid cell; signed real value with two decimal places (decimal degrees east of Greenwich Meridian).
3. Lat.....Latitude of centre of grid cell; signed real value with two decimal places (decimal degrees north of Equator).
4. Area.....Overall area of grid cell; real value with two decimal places (km^2).

5 – 215.....Ice-free land fractions (%) for 211 biome simulations; '0' if ice-free land fraction is zero, non-zero values given as real numbers with two decimal places.

PFT_CMass_by_biome_V1.12_211_Pleistocene_plus_RCP_time-slices

A fixed format file. File comprises 22 pairs of blocks of data, i.e. 44 blocks of data in all. Each pair of blocks relates to a biome, or to the unclassified grid cells. The first block of each pair gives the global total biomass (kg carbon), and the second the fractional biomass (%), for each of the 20 individual plant functional types used in the LPJ-GUESS simulations, the overall sum of the individual plant functional type values, and summed values for 11 aggregates of plant functional types.

Each block begins with a line identifying the biome, using the acronyms given above, and either 'CMass' or '% CMass', according to whether biomass or fractional biomass values are given in the block. A header line for the columns then follows, indicating for columns 2 – 33 the plant functional type, overall total or aggregate total given in the column. The header line is followed by 211 rows of data, each row commencing with the simulation identifier, as described above, occupying the first 8 character positions, followed by 32 values, each occupying 11 characters, with the first commencing in character position 9.

Data values are given in exponential format (CMass) or as real numbers to three decimal places (% Cmass). Note that in the case of the % CMass values for unclassified grid cells, some rows of values as given as 'NaN' (i.e. 'not a number'); these values relate to time slices for which no grid cells were unclassified and hence the total CMass for unclassified grid cells was zero, resulting in division by zero when percentage values were calculated.

Pairs of blocks are separated by two blank lines, with one blank line between the two blocks in each pair.

This multi-block file can be read in R using the standard read.table() function with the 'fill' argument set to TRUE.

Acronyms used for plant functional types (PFTs) and PFT aggregates are listed in the table overleaf.

Acronyms used for plant functional types and aggregates

Acronym	Plant Functional Type
BNE	Boreal Needle-leaved Evergreen Tree
BINE	Shade-intolerant Boreal Needle-leaved Evergreen Tree
BNS	Boreal Needle-leaved Summergreen Tree
BIBS	Shade-intolerant Boreal Broad-leaved Summergreen Tree
TeNE	Temperate Needle-leaved Evergreen Tree
TeBS	Temperate Broad-leaved Summergreen Tree
TeIBS	Shade-intolerant Temperate Broad-leaved Summergreen Tree
TeBE	Temperate Broad-leaved Evergreen Tree
TrBE	Tropical Broad-leaved Evergreen Tree
TrIBE	Shade-intolerant Tropical Broad-leaved Evergreen Tree
TrBR	Tropical Broad-leaved Raingreen Tree
BESh	Boreal Evergreen Shrub
BSSh	Boreal Summergreen Shrub
TeESh	Temperate Evergreen Shrub
TeRSh	Temperate Raingreen Shrub
TeSSh	Temperate Summergreen Shrub
TrESh	Tropical Evergreen Shrub
TrRSh	Tropical Raingreen Shrub
C3G	C3 Grass
C4G	C4 Grass
	PFT Aggregate
B-tree	Sum of Boreal Trees (BNE + BINE + BNS + BIBS)
Te-tree	Sum of Temperate Trees (TeNE + TeBS + TeIBS + TeBE)
Tr-tree	Sum of Tropical Trees (TrBE + TrIBE + TrBR)
B-shrub	Sum of Boreal Shrubs (BESh + BSSh)
Te-shrub	Sum of Temperate Shrubs (TeESh + TeRSh + TeSSh)
Tr-shrub	Sum of Tropical Shrubs (TrESh + TrRSh)
BE_tree	Sum of Boreal Evergreen Trees (BNE + BINE)
BS_tree	Sum of Boreal Summergreen Trees (BNS + BIBS)
TeE_tree	Sum of Temperate Evergreen Trees (TeNE + TeBE)
TeS_tree	Sum of Temperate Summergreen Trees (TeBS + TeIBS)
TrE_tree	Sum of Tropical Evergreen Trees (TrBE + TrIBE)

LPJ-GUESS_outputs.7z

This zipped archive uncompresses to a folder, LPJ-GUESS_outputs, containing two sub-folders, C-Mass_files and LAI_files.

C-Mass_files

A folder containing 211 .csv files, one for each simulation. File names begin with a string that identifies the simulation, four characters followed by 'DV' in the case of time-slice simulations (e.g. 000kDV) or 'RCPn.5n' in the case of potential future simulations. This is then followed by the string '_cmass_Total_Global_1cell_90yr_2022_6.csv', this string identifying the particular LPJ-GUESS simulation run series that generated the output. Each comma-delimited file has a header line naming the 36 fields given on each subsequent line, followed by 68,665 lines, one for each grid cell, grid cells being in a consistent order corresponding to their order in **Biome_assignments_V1.12_211_Pleistocene_plus_RCP_time-slices.csv**. The first 4 fields give the grid cell longitude, latitude, area and ice-free fraction (%) for the time slice. Fields 5 – 36 give the above-ground vascular plant biomass (expressed as 'carbon mass') of the 20 individual plant functional types used in the LPJ-GUESS simulations, the overall sum of the individual plant functional type values, and summed values for 11 aggregates of plant functional types.

Fields:

Lon..... Longitude of lower-left corner of grid cell (decimal degrees east of Greenwich Meridian).

Lat..... Latitude of lower-left corner of grid cell (decimal degrees north of Equator).

area..... Overall area of grid cell (km^2).

'simulation identifier'.....Ice-free land fraction for that simulation (%). Note that the ice-free land fractions for 000k are used for the RCP4.5 and RCP8.5 simulations.

BNE ..... Boreal Needle-leaved Evergreen Tree biomass (kg carbon).

BINE ..... Shade-intolerant Boreal Needle-leaved Evergreen Tree (kg carbon).

BNS ..... Boreal Needle-leaved Summergreen Tree (kg carbon).

BIBS..... Shade-intolerant Boreal Broad-leaved Summergreen Tree (kg carbon).

TeNE..... Temperate Needle-leaved Evergreen Tree (kg carbon).

TeBS..... Temperate Broad-leaved Summergreen Tree (kg carbon).

TeIBS..... Shade-intolerant Temperate Broad-leaved Summergreen Tree (kg carbon).

TeBE..... Temperate Broad-leaved Evergreen Tree (kg carbon).

TrBE..... Tropical Broad-leaved Evergreen Tree (kg carbon).

TrIBE..... Shade-intolerant Tropical Broad-leaved Evergreen Tree (kg carbon).

TrBR ..... Tropical Broad-leaved Raingreen Tree (kg carbon).

C3G ..... C3 Grass (kg carbon).

C4G ..... C4 Grass (kg carbon).

TeESh..... Temperate Evergreen Shrub (kg carbon).

TeRSh..... Temperate Raingreen Shrub (kg carbon).

TeSSh..... Temperate Summergreen Shrub (kg carbon).

TrESh..... Tropical Evergreen Shrub (kg carbon).

TrRSh ..... Tropical Raingreen Shrub (kg carbon).

BESh..... Boreal Evergreen Shrub (kg carbon).

BSSh..... Boreal Summergreen Shrub (kg carbon).

Total..... Sum of all plant functional types (kg carbon).

B-tree..... Sum of Boreal Trees (BNE + BINE + BNS + BIBS) (kg carbon).

Te-tree ..... Sum of Temperate Trees (TeNE + TeBS + TeIBS + TeBE) (kg carbon).

Tr-tree..... Sum of Tropical Trees (TrBE + TrIBE + TrBR) (kg carbon).

B-shrub ..... Sum of Boreal Shrubs (BESh + BSSh) (kg carbon).

Te-shrub..... Sum of Temperate Shrubs (TeESh + TeRSh + TeSSh) (kg carbon).

Tr-shrub ..... Sum of Tropical Shrubs (TrESh + TrRSh) (kg carbon).

BE_tree..... Sum of Boreal Evergreen Trees (BNE + BINE) (kg carbon).

BS_tree..... Sum of Boreal Summergreen Trees (BNS + BIBS) (kg carbon).

TeE_tree..... Sum of Temperate Evergreen Trees (TeNE + TeBE) (kg carbon).

TeS_tree..... Sum of Temperate Summergreen Trees (TeBS + TeIBS) (kg carbon).

TrE_tree..... Sum of Tropical Evergreen Trees (TrBE + TrIBE) (kg carbon).

LAI_files

A folder containing 211 .csv files, one for each simulation. File names begin with a string that identifies the simulation, four characters followed by 'DV' in the case of time-slice simulations (e.g. 000kDV) or 'RCPn.5n' in the case of potential future simulations. This is then followed by the string '_lai_Total_Global_1cell_90yr_2022_6.csv', this string identifying the particular LPJ-GUESS simulation run series that generated the output. Each comma-delimited file has a header line naming the 34 fields given on each subsequent line, followed by 68,665 lines, one for each grid cell, grid cells being in a consistent order corresponding to their order in **Biome_assignments_V1.12_211_Pleistocene_plus_RCP_time-slices.csv**. The first 2 fields give the longitude and latitude of the grid cell. Fields 3 – 34 give the leaf area index (leaf area per unit ground area – m^2 m^{-2} – i.e. no units) of the 20 individual plant functional types used in the LPJ-GUESS simulations, the overall sum of the individual plant functional type values, and summed values for 11 aggregates of plant functional types.

Fields:

Lon..... Longitude of lower-left corner of grid cell (decimal degrees east of Greenwich Meridian).

Lat..... Latitude of lower-left corner of grid cell (decimal degrees north of Equator).

BNE ..... Boreal Needle-leaved Evergreen Tree biomass.

BINE ..... Shade-intolerant Boreal Needle-leaved Evergreen Tree.

BNS ..... Boreal Needle-leaved Summergreen Tree.

BIBS..... Shade-intolerant Boreal Broad-leaved Summergreen Tree.

TeNE..... Temperate Needle-leaved Evergreen Tree.

TeBS..... Temperate Broad-leaved Summergreen Tree.

TeIBS..... Shade-intolerant Temperate Broad-leaved Summergreen Tree.

TeBE..... Temperate Broad-leaved Evergreen Tree.

TrBE..... Tropical Broad-leaved Evergreen Tree.

TrIBE..... Shade-intolerant Tropical Broad-leaved Evergreen Tree.

TrBR ..... Tropical Broad-leaved Raingreen Tree.

C3G ..... C3 Grass.

C4G ..... C4 Grass.

TeESh..... Temperate Evergreen Shrub.

TeRSh..... Temperate Raingreen Shrub.

TeSSh..... Temperate Summergreen Shrub.

TrESh..... Tropical Evergreen Shrub.

TrRSh ..... Tropical Raingreen Shrub).

BESh..... Boreal Evergreen Shrub.

BSSh..... Boreal Summergreen Shrub.

Total..... Sum of all plant functional types.

B-tree..... Sum of Boreal Trees (BNE + BINE + BNS + BIBS).

Te-tree ..... Sum of Temperate Trees (TeNE + TeBS + TeIBS + TeBE).

Tr-tree..... Sum of Tropical Trees (TrBE + TrIBE + TrBR).

B-shrub ..... Sum of Boreal Shrubs (BESh + BSSh).

Te-shrub..... Sum of Temperate Shrubs (TeESh + TeRSh + TeSSh).

Tr-shrub ..... Sum of Tropical Shrubs (TrESh + TrRSh).

BE_tree..... Sum of Boreal Evergreen Trees (BNE + BINE).

BS_tree..... Sum of Boreal Summergreen Trees (BNS + BIBS).

TeE_tree ..... Sum of Temperate Evergreen Trees (TeNE + TeBE).

TeS_tree ..... Sum of Temperate Summergreen Trees (TeBS + TeIBS).

TrE_tree..... Sum of Tropical Evergreen Trees (TrBE + TrIBE).

Ascii_Grids.7z

This zipped archive uncompresses to a folder, Ascii_Grids, containing four sub-folders: Ice; Ice_fraction; Land; and Ocean.

Ice

A folder containing 207 .asc files, one for each time slice. File names comprise the time slice age followed by '_ice.asc' (e.g. '002ka_ice.asc'). Files are in ArcGIS ASCII grid format, the first six lines defining their *x* and *y* dimensions (i.e. numbers of columns and of rows respectively), their geographical extent, the cell size and the value used for no data. Subsequent lines list the values for cells in the order defined for an ArcGIS ASCII grid file, i.e. 'row-major' order, the first row being the topmost (i.e. northernmost) row; this is alternatively referred to as 'English reading order', i.e. left to right and top to bottom. Values are space-delimited.

See:
http://resources.esri.com/help/9.3/arcgisengine/java/GP_ToolRef/spatial_analyst_tools/esri_ascii_raster_format.htm

Grid cells are 0·1 x 0·1 degrees (i.e. 6-minute cells).

Data values are 0 or 1, the former indicating an interpolated ice-fraction value less than 5% and the latter an interpolated ice-fraction value greater than or equal to 5%. Ice-fraction values are interpolated from half-degree ice-fraction values computed from the simulated ice-sheet thickness data of de Boer (2014; see de Boer *et al.*, 2014); further details are given in the Supplementary Information to Huntley *et al* (2023).

First 10 lines of one such file:

```
ncols 3600
nrows 1800
xllcorner -180.0
yllcorner -90.0
cellsize 0.1
NODATA_value  0
 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
```

Ice_fraction

A folder containing 207 .asc files, one for each time slice. File names comprise the time slice age followed by '_icefr.asc' (e.g. '002ka_icefr.asc'). Files are in ArcGIS ASCII grid format, the first six lines defining their *x* and *y* dimensions (i.e. numbers of columns and of rows respectively), their geographical extent, the cell size and the value used for no data. Subsequent lines list the values for cells in the order defined for an ArcGIS ASCII grid file, i.e. 'row-major' order, the first row being the topmost (i.e. northernmost) row; this is alternatively referred to as 'English reading order', i.e. left to right and top to bottom. Values are space-delimited.

See:
http://resources.esri.com/help/9.3/arcgisengine/java/GP_ToolRef/spatial_analyst_tools/esri_ascii_raster_format.htm

Grid cells are 0·1 x 0·1 degrees (i.e. 6-minute cells).

Data values are real numbers, given to one decimal place, in the range 0·0 to 100·0, and are interpolated ice-fraction values. Ice-fraction values are interpolated from half-degree ice-fraction values computed from the simulated ice-sheet thickness data of de Boer (2014; see de Boer *et al.*, 2014); further details are given in the Supplementary Information to Huntley *et al* (2023).

First 10 lines of one such file:

```
ncols 3600
nrows 1800
xllcorner -180.0
yllcorner -90.0
cellsize 0.1
NODATA_value  0.0
   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0
   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0
   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0
   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0   0.0
```

Land

A folder containing 207 .asc files, one for each time slice. File names comprise the time slice age followed by '_land.asc' (e.g. '002ka_land.asc'). Files are in ArcGIS ASCII grid format, the first six lines defining their *x* and *y* dimensions (i.e. numbers of columns and of rows respectively), their geographical extent, the cell size and the value used for no data. Subsequent lines list the values for cells in the order defined for an ArcGIS ASCII grid file, i.e. 'row-major' order, the first row being the topmost (i.e. northernmost) row; this is alternatively referred to as 'English reading order', i.e. left to right and top to bottom. Values are space-delimited.

See:
http://resources.esri.com/help/9.3/arcgisengine/java/GP_ToolRef/spatial_analyst_tools/esri_ascii_raster_format.htm

Grid cells are 0·1 x 0·1 degrees (i.e. 6-minute cells).

Data values are 0 or 1, the former indicating a mean (adjusted) elevation less than contemporary eustatic sea level and the latter a mean (adjusted) elevation greater than or equal to contemporary eustatic sea level. Mean elevations are computed as the mean of the elevations given by the ETOPO1 dataset for the 1-minute grid cells of that dataset that are partially or completely within the 6-minute grid cell, the grid cells of ETOPO1 being 'grid registered', i.e. cells are centred on the grid lines of a 1-minute grid. ETOPO1 elevations are adjusted for grid cells within the areas of the ice-sheet simulations of de Boer *et al*. (2014) using the difference in simulated bedrock elevation between that for the relevant time slice and that for the present (de Boer, 2014). Eustatic sea levels were extracted from the de Boer *et al*. (2014) supplementary data file 41467_2014_BFncomms3999_MOESM164_ESM.xlsx (downloaded 5th March 2019 from https://www-nature-com.ezphost.dur.ac.uk/articles/ncomms3999#Sec17).

First 10 lines of one such file:

```
ncols 3600
nrows 1800
xllcorner -180.0
yllcorner -90.0
cellsize 0.1
NODATA_value  0
 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
```

Ocean

A folder containing 211 .asc files, one for each time slice. File names comprise the time slice age followed by '_ocean.asc' (e.g. '002ka_ocean.asc'). Files are in ArcGIS ASCII grid format, the first six lines defining their *x* and *y* dimensions (i.e. numbers of columns and of rows respectively), their geographical extent, the cell size and the value used for no data. Subsequent lines list the values for cells in the order defined for an ArcGIS ASCII grid file, i.e. 'row-major' order, the first row being the topmost (i.e. northernmost) row; this is alternatively referred to as 'English reading order', i.e. left to right and top to bottom. Values are space-delimited.

See:
http://resources.esri.com/help/9.3/arcgisengine/java/GP_ToolRef/spatial_analyst_tools/esri_ascii_raster_format.htm

Grid cells are 0·1 x 0·1 degrees (i.e. 6-minute cells).

Data values are 0 or 1, the former indicating a mean (adjusted) elevation greater than or equal to contemporary eustatic sea level and the latter a mean (adjusted) elevation less than contemporary eustatic sea level. Mean elevations are computed as the mean of the elevations given by the ETOPO1 dataset for the 1-minute grid cells of that dataset that are partially or completely within the 6-minute grid cell, the grid cells of ETOPO1 being 'grid registered', i.e. cells are centred on the grid lines of a 1-minute grid. ETOPO1 elevations are adjusted for grid cells within the areas of the ice-sheet simulations of de Boer *et al*. (2014) using the difference in simulated bedrock elevation between that for the relevant time slice and that for the present (de Boer, 2014). Eustatic sea levels were extracted from the de Boer *et al*. (2014) supplementary data file 41467_2014_BFncomms3999_MOESM164_ESM.xlsx (downloaded 5th March 2019 from https://www-nature-com.ezphost.dur.ac.uk/articles/ncomms3999#Sec17).

First 10 lines of one such file:

```
ncols 3600
nrows 1800
xllcorner -180.0
yllcorner -90.0
cellsize 0.1
NODATA_value  0
 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
```

References

de Boer, B. (2014) 5 million year output of ice-sheet thickness, surface and bedrock elevation. MacMillan.

de Boer, B., Lourens, L.J. & van de Wal, R.S.W. (2014) Persistent 400,000-year variability of Antarctic ice volume and the carbon cycle is revealed throughout the Plio-Pleistocene. *Nat Commun*, **5**

Huntley, B., Allen, J.R.M., Forrest, M., Hickler, T. Ohlemüller, R., Singarayer, J.S. & Valdes, P.J. (2023) Global biome patterns of the Middle and Late Pleistocene. *Journal of Biogeography*. doi: 10.1111/jbi.14619