# Access to HadCM3 Transient Deglaciation

# Description

The simulations extend from 23kyrBP to 2kyrAP with the 23-0kyrBP following the PMIP protocol (Ivanovic et al., 2016). Currently, the default setup is that the future part of the simulation uses CO2/CH4/N2O concentrations constant at 1950 levels. However, there are equivalent simulations using RCP2.6/4.5/6.0/8.5 gas concentration changes. Please contact us if you would like to use them.

The simulations were made in steps which varied between 500 to 4000 year steps. Specifically, 23000-22000BP, 22000-21000BP, then every 500 years to 2000BP, with the final segment being 4000 years long. At each step change, the land-sea mask, land ice mask, river routing, and bathymetry are changed in accord with the ICE6GC reconstruction (henceforth ‘Peltier 6GC’). These changes do create a small “jump” in the climate. To try and minimise some of these aspects, each simulation is 550 years long (or 1050 or 4050) so that we can examine the overlaps. All other forcings are smoothly changed. In general, the jumps are small except at 8yrBP where changes in the Hudson bay and related fresh-water issues cause a noticeable slowing of the AMOC for a century or so.

There are currently 4 simulations that cover the whole period

1. deglg: no ice sheet melt water forcing applied to surface ocean (*melt-uniform* in PMIP4 last deglaciation protocol), and Russian rivers draining to the south during glacial times.
2. deglh: As deglg but with melt water from the [deglaciating] ice sheets included, using melt water (volume, timing and routing) consistent with the Peltier 6GC ice sheet reconstructions (*melt-routed* in PMIP4 protocol).
3. degli: As deglg but with Russian rivers draining to the Arctic
4. deglj: As deglh but with Russian rivers draining to the Arctic

**If you want to analyse only one simulation, then deglh is probably the most relevant/important simulation.**

In addition, we have a set of partial simulations which reproduce the TRACE-like simulation melt water forcing. These are all based on Russian rivers draining to the South during the glacial (i.e. comparable to deglg and deglh). The TRACE-like simulations are all from 20k to 13k, and do not change the land-sea mask, land-ice mask, river routing and bathymetry and are the following:

1. tejem: No melt water (*melt-uniform*)
2. tejen: As tejem but using TRACE-A freshwater scenario
3. tejeo: As tejem but using TRACE-B freshwater scenario
4. tejep: As tejen but meltwater is 50% smaller
5. tejeq: As tejen but no meltwater input into Gulf.

And finally we have a set of simulation using constant or a few forcings varying only. These were simpler to setup because the landsea mask was not changing and were typically run in 5000 year intervals, and extend from 23kyrBP to 2kyrAP (25000 years in total). They all use rivers to Arctic (not quite sure we decided to do it that way), and use melt-uniform. The simulations are:

1. forcr: 0kyr BP Land-sea mask, 0kyr orbit, varying GHGs, 0kyr global salinity
2. forcs: 21kyr BP Land-sea mask, 21kyr orbit, 21kyr GHGs, 21kyr global salinity
3. forct: 19kyr BP Land-sea mask, 19kyr orbit, 19kyr GHGs, 19kyr global salinity
4. forcu: 16kyr BP Land-sea mask, 16kyr orbit, 16kyr GHGs, 16kyr global salinity
5. forcv: 12kyr BP Land-sea mask, 12kyr orbit, 12kyr GHGs, 12kyr global salinity
6. forcw: 0kyr BP Land-sea mask, varying orbit, varying GHGs, varying global salinity
7. forcx: 0kyr BP Land-sea mask, varying orbit, varying GHGs, 0kyr global salinity
8. forcy: 0kyr BP Land-sea mask, varying orbit, 0kyr GHGs, 0kyr global salinity
9. forcz: 0kyr BP Land-sea mask, 0kyr orbit, 0kyr GHGs, 0kyr global salinity

Since all of the long simulations are in multiple parts, we have produced a set of netcdf files which combine all of the individual experiments into one continuous record. These are big files so I have mainly produced files with single months/seasons in them (e.g. all DJF or all Jan). I have also produced 10-year and 100-year running mean files.  So, for instance,

**deglg.vn1\_0.precip\_mm\_srf.monthly.ANN.001.nc**       is every year annual mean precip from -23ka to +2.05ka   (total of 25050 time intervals)

**deglg.vn1\_0.precip\_mm\_srf.monthly.ANN.010.nc**      as above but 10 year running means.

**deglg.vn1\_0.precip\_mm\_srf.monthly.ANN.100.nc**       as above but 100 year running means.

Note that the 10 and 100 year running means are still 25050 time intervals long since they are running means rather than decadal/century averages.

If you want decadal and century averages, these files are called 010yr and 100yr. i.e.

**deglg.vn1\_0.precip\_mm\_srf.monthly.ANN.010yr.nc**   (2505 decades)

**deglg.vn1\_0.precip\_mm\_srf.monthly.ANN.100yr.nc** (250 centuries)

We have also produced a second set of files which are calculated relative to the 100 year mean from 1900-2000 (i.e. centred on 1950). These are:

**deglg.precip\_mm\_srf.monthly.ANN.001.anom.nc** etc.

We have created these files for JAN, JUL, DJF, JJA and ANN (5 in total). However, if other months are required then this is simple to produce.

For some atmosphere variables, we have also produced files with all months (i.e. 300000 months). These are generally large files and have only been produced for a few variables. We currently cannot produce these for ocean fields because the arrays are simply too large. We need to rewrite our processing code and have not had time yet.

These all-month files are called: e.g.

**deglg.vn1\_0.precip\_mm\_srf.monthly.MON.001.nc**

## Currently Available Variables.

I have created these compilation files for:

**Atmosphere Variables:**

1. Surface air temperature (temp\_mm\_1\_5m). Includes MON files.
2. Surface Temperature (temp\_mm\_srf). Includes MON files.
3. Precipitation (precip\_mm\_srf). Includes MON files.
4. Total Evaporation (totalEvap\_mm\_srf).
5. Specific Humidity at 1.5m (q\_mm\_1\_5m).
6. Mean sea level pressure (p\_mm\_msl). Includes MON files.
7. Surface pressure (p\_mm\_srf).
8. Downward solar at surface (downSol\_Seaice\_mm\_s3\_srf).
9. Downward longwave at surface (ilr\_mm\_s3\_srf).
10. 500 hPa height (ht\_mm\_p\_500).
11. Zonal wind at 10m (u\_mm\_10m).
12. Meridional wind at 10m (v\_mm\_10m).
13. Zonal wind at 850 hPa (u\_mm\_p\_850). Includes MON files.
14. Meridional wind at 850 hPa (v\_mm\_p\_850). Includes MON files.
15. Sea ice concentration on atmos. grid (iceconc\_mm\_srf)
16. Sea ice depth on atmos. Grid (icedepth\_mm\_srf)

**Ocean Variables:**

1. Sea Surface Temperature (temp\_mm\_uo). Includes MON files.
2. Potential Temperature at 5m (top level) (salinity\_ym\_dpth\_5). ANN only.
3. Potential Temperature at 666m (salinity\_ym\_dpth\_666). ANN only.
4. Potential Temperature at 2731m (salinity\_ym\_dpth\_2731). ANN only.
5. Salinity at 5m (top level) (salinity\_ym\_dpth\_5). ANN only.
6. Salinity at 666m (salinity\_ym\_dpth\_666). ANN only.
7. Salinity at 2731m (salinity\_ym\_dpth\_2731). ANN only.
8. Zonal ocean flow at 5m (top level) (ucurrTot\_ym\_dpth\_5). ANN only.
9. Zonal ocean flow at 666m (ucurrTot\_ym\_dpth\_666). ANN only.
10. Zonal ocean flow at 2731m (ucurrTot\_ym\_dpth\_2731). ANN only.
11. Meridional ocean flow at 5m (top level) (ucurrTot\_ym\_dpth\_5). ANN only.
12. Meridional ocean flow at 666m (ucurrTot\_ym\_dpth\_666). ANN only.
13. Meridional ocean flow at 2731m (ucurrTot\_ym\_dpth\_2731). ANN only.
14. Atlantic Meridional Overturning Circulation (merid\_Atlantic\_ym\_dpth) ANN only
15. Global Meridional Overturning Circulation (merid\_Global\_ym\_dpth) ANN only

**Forcing Variables:**

1. downward solar at TOA (downSol\_mm\_TOA)
2. orographic height (ht\_mm\_srf)
3. waterflux (anomSaltFlux\_ym\_uo) ANN only

I could very simply produce these set of files for many more variables that we keep online (listed at end) and ultimately even larger list kept on tape.

I use an ncl script to create these files so it is both very simple to do, and to add more variables, seasons, running averages etc.  It does take some time (days) to run.

I have done a few quick quality control checks on the monthly data we have online, and all seem to be OK but most files have not been checked.

Note that the HadCM3 model uses a staggered grid so velocity fields are not on the same grid as other variables. They are in between the “normal” grid and have one less latitude.

# Access to files

**Please see our Access Policy at the bottom of the page.**

Files can be accessed from:

<https://www.paleo.bristol.ac.uk/HadCM3B_transient21k/>

This shows a list of all sets of simulations.

Within each folder, there is a set of version folders (as of Mar 2021 only version is vn1\_0).

Within these folders, there are further folders for each climate variable.

Within each variable folder, there are the different time/anomaly sampling folders

And within these folders is the actual data.

It is probably best just to explore the structure, but an example for the JJA surface air temperature, for the decadally sampled anomaly from 1950 values is:

<https://www.paleo.bristol.ac.uk/HadCM3B_transient21k/deglg/vn1_0/temp_mm_1_5m/010yr_anom/deglg.vn1_0.temp_mm_1_5m.monthly.JJA.010yr_anom.nc>

You can download the data manually or use the wget command to script it.

# Access Policy

We are happy to make all data available, but in the first instance, we would like the option to be co-author of any papers arising from these runs. All of the simulations were run on the University of Bristol HPC but the simulations were designed by the three of us.

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# Easy to Create Time Series Data

tekmg.GBMlitCarb\_snp\_srf.monthly.nc

tekmg.iceconc\_mm\_srf.monthly.nc

tekmg.solar\_mm\_s3\_srf.monthly.nc

tekmg.GBMvegCarb\_snp\_srf.monthly.nc

tekmg.icedepth\_mm\_srf.monthly.nc

tekmg.temp\_mm\_1\_5m.monthly.nc

tekmg.agewater\_ym\_dpth\_1501.annual.nc

tekmg.ilr\_mm\_s3\_srf.monthly.nc

tekmg.temp\_mm\_srf.monthly.nc

tekmg.agewater\_ym\_dpth\_2731.annual.nc

tekmg.lh\_mm\_srf.monthly.nc

tekmg.temp\_mm\_uo.monthly.nc

tekmg.agewater\_ym\_dpth\_301.annual.nc

tekmg.longwave\_mm\_s3\_srf.monthly.nc

tekmg.temp\_ym\_dpth\_2731.annual.nc

tekmg.agewater\_ym\_dpth\_3962.annual.nc

tekmg.merid\_Atlantic\_ym\_dpth.annual.nc

tekmg.temp\_ym\_dpth\_5.annual.nc

tekmg.anomSaltFlux\_ym\_uo.annual.nc

tekmg.merid\_Global\_ym\_dpth.annual.nc

tekmg.temp\_ym\_dpth\_666.annual.nc

tekmg.clrskyDownSol\_mm\_s3\_srf.monthly.nc

tekmg.merid\_Indian\_ym\_dpth.annual.nc

tekmg.totCloud\_mm\_ua.monthly.nc

tekmg.clrskyUpSol\_mm\_s3\_TOA.monthly.nc

tekmg.merid\_Pacific\_ym\_dpth.annual.nc

tekmg.totalEvap\_mm\_srf.monthly.nc

tekmg.csilr\_mm\_s3\_srf.monthly.nc

tekmg.mixLyrDpth\_mm\_uo.monthly.nc

tekmg.u\_mm\_10m.monthly.nc

tekmg.csolr\_mm\_s3\_TOA.monthly.nc

tekmg.olr\_mm\_s3\_TOA.monthly.nc

tekmg.u\_mm\_p\_200.monthly.nc

tekmg.downSol\_Seaice\_mm\_s3\_srf.monthly.nc

tekmg.p\_mm\_msl.monthly.nc

tekmg.u\_mm\_p\_850.monthly.nc

tekmg.downSol\_mm\_TOA.monthly.nc

tekmg.p\_mm\_srf.monthly.nc

tekmg.ucurrTot\_mm\_dpth\_5.monthly.nc

tekmg.fracPFTs\_mm\_srf\_01.monthly.nc

tekmg.precip\_mm\_srf.monthly.nc

tekmg.ucurrTot\_ym\_dpth\_2731.annual.nc

tekmg.fracPFTs\_mm\_srf\_02.monthly.nc

tekmg.q\_mm\_1\_5m.monthly.nc

tekmg.ucurrTot\_ym\_dpth\_5.annual.nc

tekmg.fracPFTs\_mm\_srf\_03.monthly.nc

tekmg.salinity\_mm\_dpth\_5.monthly.nc

tekmg.ucurrTot\_ym\_dpth\_666.annual.nc

tekmg.fracPFTs\_mm\_srf\_04.monthly.nc

tekmg.salinity\_ym\_dpth\_2731.annual.nc

tekmg.upSol\_mm\_s3\_TOA.monthly.nc

tekmg.fracPFTs\_mm\_srf\_05.monthly.nc

tekmg.salinity\_ym\_dpth\_5.annual.nc

tekmg.v\_mm\_10m.monthly.nc

tekmg.fracPFTs\_mm\_srf\_06.monthly.nc

tekmg.salinity\_ym\_dpth\_666.annual.nc

tekmg.v\_mm\_p\_200.monthly.nc

tekmg.fracPFTs\_mm\_srf\_07.monthly.nc

tekmg.sh\_mm\_hyb.monthly.nc

tekmg.v\_mm\_p\_850.monthly.nc

tekmg.fracPFTs\_mm\_srf\_08.monthly.nc

tekmg.sm\_mm\_soil.monthly.nc

tekmg.vcurrTot\_mm\_dpth\_5.monthly.nc

tekmg.fracPFTs\_mm\_srf\_09.monthly.nc

tekmg.snowdepth\_mm\_srf.monthly.nc

tekmg.vcurrTot\_ym\_dpth\_2731.annual.nc

tekmg.ht\_mm\_p\_500.monthly.nc

tekmg.soilCarbon\_mm\_srf.monthly.nc

tekmg.vcurrTot\_ym\_dpth\_5.annual.nc

tekmg.ht\_mm\_srf.monthly.nc

tekmg.soiltemp\_mm\_soil.monthly.nc

tekmg.vcurrTot\_ym\_dpth\_666.annual.nc