Information on obtaining and using GENIE

Information and documentation about the GENIE earth simulator can be found on the project wiki site:

https://source.ggy.bris.ac.uk/wiki/GENIE

For further information and the relevant password to obtain the code please contact the GENIE project team:

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After you have obtained a username and password follow the weblink below to download the code.
https://source.ggy.bris.ac.uk/wiki/GENIE_GENIELab#Downloads

System requirements and additional prerequisites

Note that in addition to the source code, GENIE makes use of several applications and packages. You must have the following list of prerequisites installed on your computer, before you can run GENIE:

- Python.
- Perl (for the automatically generated documentation).
- GNU make.
- The BASH shell.
- The NetCDF libraries. See the using netCDF page for more information about downloading and installing netCDF.
- A C++ compiler, such as that from the GNU Compiler Collection (GCC).
- A Fortran compiler (including support for Fortran90). Compilers which are known to work with GENIE include: Intel, PGI, Pathscale, Sun, GNU gfortran, g95

GENIE can also be built for Windows platforms with a suitable build environment.

Follow link below for information on creating a build environment in Windows.
https://source.ggy.bris.ac.uk/wiki/GENIE_WindowsCompilation#Prerequisites



SOES6006 Climate Dynamics

GENIE Practical 2 – Equilibrium Climate Sensitivity & Transient Climate Change

Instructor: Kevin Oliver

You will now be carrying out a wide range of forced experiments with the GENIE earth system model, designed to investigate:

- Equilibrium Climate Sensitivity
- Transient Climate Change

The forcing is prescribed as CO_2 emissions. The purpose of this practical is to let you experience the kind of experiments and analysis that are necessary in the Assignment 3b, which will be set at the end of the practical.

1. CO_2 forcing: short idealized experiments

Run short (100-year) experiments to see what happens when CO_2 is emitted to the atmosphere. Try a range of emission scenarios:

- a symmetric peak (e.g., specify a large value in year 10 and zero in year 20)
- a continuous non-zero value (e.g., a non-zero in year 0 and year 100)
- a linear increase (e.g., a large value in year 100)

Observe what happens to the anomaly of the variable you have chosen to plot (start with air temperature). Observe the lengthening time series of annually averaged anomalies in selected variables. Note differences between the three experiments suggested above. At the end of each experiment, look in the results folder at the time series of atmospheric CO_2 concentration. What has happened?

2. CO_2 forcing: adjustment to new quasi-equilibrium climate

Now run longer (500-year) experiments in which at least three differing levels of constant emissions are specified. At the end of each experiment, note the global mean air temperature increase (as in GENIE Practical 1) and the atmospheric CO_2 concentration. Plot air temperature change as a function of CO_2 concentration. What sort of relationship emerges?



Recall the concept of equilibrium climate sensitivity, as the temperature increase under doubled CO_2. From the data you have obtained, estimate the climate sensitivity of the default version of GENIE. How does this compare to the ranges of climate sensitivity that were summarized in AR4?

3. CO_2 forcing: more realistic scenarios and transient climate response

Now run 200-year experiments that mimic the greenhouse gas emissions associated with the industrial revolution and subsequent global development, spanning 1800-2000. Some guideline ("checkpoint") estimates of the total global emissions, in Gtonnes of carbon, are as follows:

Year	GENIE Year	GENIE Year (revised for 370 ppmv at 2000)	Global Emissions (GTonnes C)
1800	0	0	0.008
1825	25	5	0.017
1850	50	30	0.054
1875	75	55	0.188
1900	100	80	0.534
1925	125	95	0.975
1950	150	120	1.630
1975	175	145	4.615
2000	200	200	6.745

For more the complete dataset from which these selected estimates are taken, see http://cdiac.ornl.gov/trends/emis/glo.html

Specified at 25-year intervals, the above emissions give ~340 ppmv at 2000 (observations are ~370 ppmv). Bringing forward the 1825-1900 emissions rates by 20 years and bringing forward the 1925-75 emissions by 30 years (see above) – you should get ~370 ppmv in 2000.

For the specified emissions that lead to the more correct CO_2 concentration in 2000, observe selected time series and evolving anomaly maps (in particular air temperature). From the results folder, extract the time series of atmospheric CO_2 concentration. Plot this and compare it with the historic time series of CO_2. How well does model CO_2 compare with observed CO_2? Also extract the time series of NH and SH air temperature. Combine these to get global mean air temperature and subtract the initial value to get the anomaly (global warming). How well does model global warming compare to observed global warming in 2000?

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