

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

Practical 4: GENIE – Introduction and Sensitivity Experiments

Instructor: Kevin Oliver

You will be carrying out a wide range of experiments with the teaching version of the GENIE earth system model, developed by The Open University, in your course project. see <http://www.genie.ac.uk> for the GENIE home page.

The purpose of this practical is to get you started with GENIE. Next, we will practice more advanced experiments.

1. Getting Started & Basic Information

Click on this and a control panel should open on the screen. You will see a map of the world on the right. In the top left corner, there are a set of buttons:

- “Show guidelines”
- “Adjust parameters”
- “Adjust emissions” - you can ignore this until tomorrow
- “Open results folder”
- “Adjust fire map” - you can ignore this for the entire course

Below these are three further buttons, to start, stop and reset experiments. Further controls allow you to set “Number of years to simulate”, whether annual averages are plotted in time series, whether the map shows changes from an initial state, and which variable is shown as a time series in the bottom left hand space. Below the map are yet further controls:

- to “Choose a parameter to display”
- the layer (from 1-8, if an ocean variable is chosen)
- whether ocean currents (“Show velocities”) or atmospheric wind are shown
- an option for selecting a global (rather than plan) view

2. Looking at default model data

The results that appear by default are obtained from a long spin-up experiment. The model Earth System is very near to equilibrium – i.e., rates of change with time are very small. Before you carry out any experiments, have a good look at the many different model fields. In particular, focus on physical climate variables:

- Ocean temperature, salinity and currents (at each of 8 levels in the ocean)
- Air Temperature and Specific Humidity
- Precipitation and Evaporation



- Atmospheric Winds
- Sea Ice Concentration and Thickness

Consider some basic features:

- Land-Ocean contrasts
- Longitudinal contrasts in ocean variables
- Variation (of T, S) with depth in the Ocean

Also look at the ocean topography to get an impression of model resolution.

3. Short Sensitivity Experiments: Model Parameters

Now run some short (10-year) experiments to appreciate what happens to various climate variables when you change various key model parameters, one at a time. Start by viewing the developing time series. Note the seasonal cycle. Be patient – the model takes about a minute to complete 10 years. Then repeat the experiment, selecting “Annual averages” & “Show change”. From now on, select these options.

4. Longer Sensitivity Experiments: Reaching new quasi- equilibria

Now run progressively longer (50-200 year) experiments to see how different variable fields equilibrate at different rates. Consider in particular different levels in the ocean, from uppermost (level 8) to lowermost (level 1). Run a series of 200-year experiments with a range of parameter settings. Observe differences, between experiments, in progress towards quasi- equilibration.

5. Output data

Look in the Results folders you have created. Note that the average of the NH and SH average air temperature is T_{bar} , the global mean air temperature – a useful number in forthcoming experiments.

Look at the value of T_{bar} in year 200 from each of the longer experiments in 4. Collect these values together. Obtain a value for T_{bar} from the initial state with default parameters (by running it for a year to produce some data). Take the differences as experimental T_{bar} minus initial T_{bar} .

You should have an interesting scatter of differences (both positive and negative), reflecting changes of global mean climate in response to changes in parameterized physics. We will collect these differences together and plot a histogram, showing the number of occurrences per difference class. This crude equivalent of a probability distribution function might tell us something about the uncertainty of model climate associated with uncertainty in model parameters (as reflected by your random choices).

6. Post-processing

Finally (and perhaps while longer experiments are running), consider your options (matlab, excel) for post-processing some interesting time series data. You will need to decide on a personal strategy to post-process results in the assignment.



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