

EcoGENIE:

A practical course in global ocean ecosystem modelling

Lesson 4: Ecology in a paleo-ocean

1. The Paleocene-Eocene Thermal Maximum. In this practical we are going to look at the ocean as it *might* have been just over 55 million years ago - in short a lot warmer, and with a somewhat different continental configuration and hence ocean circulation [see Ridgwell and Schmidt, 2010, Gibbs et al., 2015].

We are going to make the rather strong assumption that the ecosystem is structured according to exactly the same rules as in the modern ocean, and simply run the model in the new (i.e. old) environment.

To do this, simply evaluate the following text at the terminal command line ...

```
qsub -j y -o cgenie_log -V -S /bin/bash
runmuffin.sh cgenie.eb_go_gs_ac_bg_eg.p0055c.BASES / BSS.p0055c.8P8Z.SPIN 10
EXAMPLE.p0055c.RidgwellSchmidt2010.SPIN1
```

Note: This simulation does not include iron as a limiting nutrient. The spatial distribution of bioavailable iron sources is highly uncertain even in the modern ocean, and we simply do not have enough information to justify using iron in this ancient world. Bear that in mind when thinking about your results.

2. A very different world ... Using what you have learnt from the previous lessons, and your own resourcefulness, see what you can find out about the Paleocene-Eocene ecosystem.

In this warmer world ...

- What has happened to the mean plankton size in different regions?
- What has happened to the fundamental niches in different size classes?
- What has happened to the realised niches?
- Is the system more or less productive?
- Has carbon export gone up or down?
- ...?

See what you can find out about the two systems and think about the mechanisms that might be responsible for the differences ...

References

- S. J. Gibbs, P. R. Bown, A. Ridgwell, J. R. Young, A. J. Poulton, and S. A. O’Dea. Ocean warming, not acidification, controlled coccolithophore response during past greenhouse climate change. *Geology*, 44 (1):59 – 62, 2015. doi: 10.1130/G37273.1.
- Andy Ridgwell and Daniela N. Schmidt. Past constraints on the vulnerability of marine calcifiers to massive carbon dioxide release. *Nature Geoscience*, 3(3):196–200, March 2010. ISSN 1752-0894. URL <http://dx.doi.org/10.1038/ngeo755>.