

Climate Modelling Project

Proposal (due March 10th at 9pm)

Presentation (during class on March 31st)

Project report (due April 21st at 9pm)

The Project

Scope of the project: approximately 30-40 hours of focussed work (plus 6 hours of write-up).

Expectations: answer an interesting research question (or questions) using new analysis of climate model results (GCM or climlab) based on analysis code or simulations beyond those given to you in the class labs/assignments. Present your (preliminary) findings to the class, and produce a comprehensive project report, due 21st April at 9pm. Rubric for each of these can be found here:

<https://www.dropbox.com/scl/fo/au7d4b9akghgo5weohtk3/h?dl=0&rlkey=g1sp7ps9lj7ov1ydaf9kx6n1n>

Project ideas

If you already have an idea of your project, great! If not, no problem – look through the ideas below, and feel free to talk to the instructors to help develop your ideas.

Undergraduates

If you have an idea of a general topic you'd like to work on, please talk to the instructors, and we can see if we can help you turn that into a concrete project proposal. If you don't have any ideas, here are some that you can choose from (or adapt if the idea inspires you). More than one of you can work on the same project (although we expect to see different analysis, results and reports!).

- 1) transient and equilibrium climate sensitivity in cmip6 models
- 2) regional comparisons of sea-ice, precip, hydrological cycle across models
- 3) analysis of aquaplanet runs in the cfmip experiments (cloud forcing model intercomparison project)
- 4) analysis of the CESM large ensemble simulations to understand the role of natural/internal variability, vs forced climate trends
- 5) analysis of the climate of Last Glacial Maximum CESM simulations (when an ice sheet covered north America)
- 6) analysis of the climate of CESM altered topography experiments (e.g. the World without any mountains, but still with land)

Graduates

Two main approaches:

1. Use the climlab simplified climate model to test and answer idealized research questions in a 1D (column) or 2D (longitudinal cross-section) setting.
 - Clouds/aerosols/GHGs at different heights
 - Impacts of meridional advection/diffusion
2. Analyse simulations from GCMs (fully coupled, or atmosphere/ocean only depending on your interest), to answer research questions about:
 - Impacts of anthropogenic climate change
 - Impacts of volcanoes
 - Natural (internal) variability of the climate system
 - Impacts of COVID19 brief reduction in emissions
 - Impacts of geoengineering
3. Or....? If you already have experience running complex climate models (whether regional or global), you are welcome to design a project around that. If you don't have experience already, we don't recommend trying to get a new model running in the time you have! But feel free to discuss any other ideas you have with us – we want this project to be interesting and useful to you, so happy to help you brainstorm.

The Proposal

Purpose

The purpose of the proposal is to set you up to have a successful project by making sure you have a problem that is interesting and of the correct difficulty, and will be achievable in the time that you have left. The proposal should be written for the instructors. If the project proposed is not good or if there are not enough details we will bounce it back to you for more work – this is an iterative process, but please talk to us sooner rather than later if you aren't sure about anything.

Parts

1. **Research Questions:** What are the research questions you are going to answer? Why are they interesting? How does it fit into known science? (about a paragraph each)
2. **Where did the problem come from?** Where did the idea come from? Who have you discussed it with (e.g. your supervisor? One of the instructors?) What are the key references? This information helps us evaluate the complexity of your proposed project.

3. **What is the method you will use to answer your research questions?** What model or data are you going to use? What experience do you have with this? Will you alter the model, and if so how? How will you access the data? What analysis will you perform on the output (either from your model, or output from previously run climate model data that you will access (e.g. CMIP or LENS)?
4. **Risk management?** Are the risks/barriers that might lead to you not being able to complete your project and answer your research questions? What is an alternative direction your project could take if necessary?
5. **Operations:** How are you going to organize your code and data?

Grading: you will be given the opportunity to iterate on this proposal until you have full marks. The goal is to help set you up for a successful project.

The Presentation

During class time on March 31st (because our last class, on April 7th, falls on Good Friday!), you will give a short (~10 minute) presentation on your project. You are not expected to have final results by this point, so you will be graded on the presentation, not the results. Your presentation should include all these elements:

- background to the topic plus motivation
- your research questions
- some of your methodology
- preliminary results (or what you expect your results to be if that's where your project is at)
- conclusions

Grading rubric:

https://www.dropbox.com/scl/fo/au7d4b9akghgo5weohtk3/h?dl=0&preview=presentation_rubric.pdf&rlkey=g1sp7ps9lj7ov1ydaf9kx6n1n

The Project Report

Grading rubric:

https://www.dropbox.com/scl/fo/au7d4b9akghgo5weohtk3/h?dl=0&preview=projects_rubric.pdf&rlkey=g1sp7ps9lj7ov1ydaf9kx6n1n