Using the CSIRO Mk3L climate system model
Part 4: Consolidation and next steps

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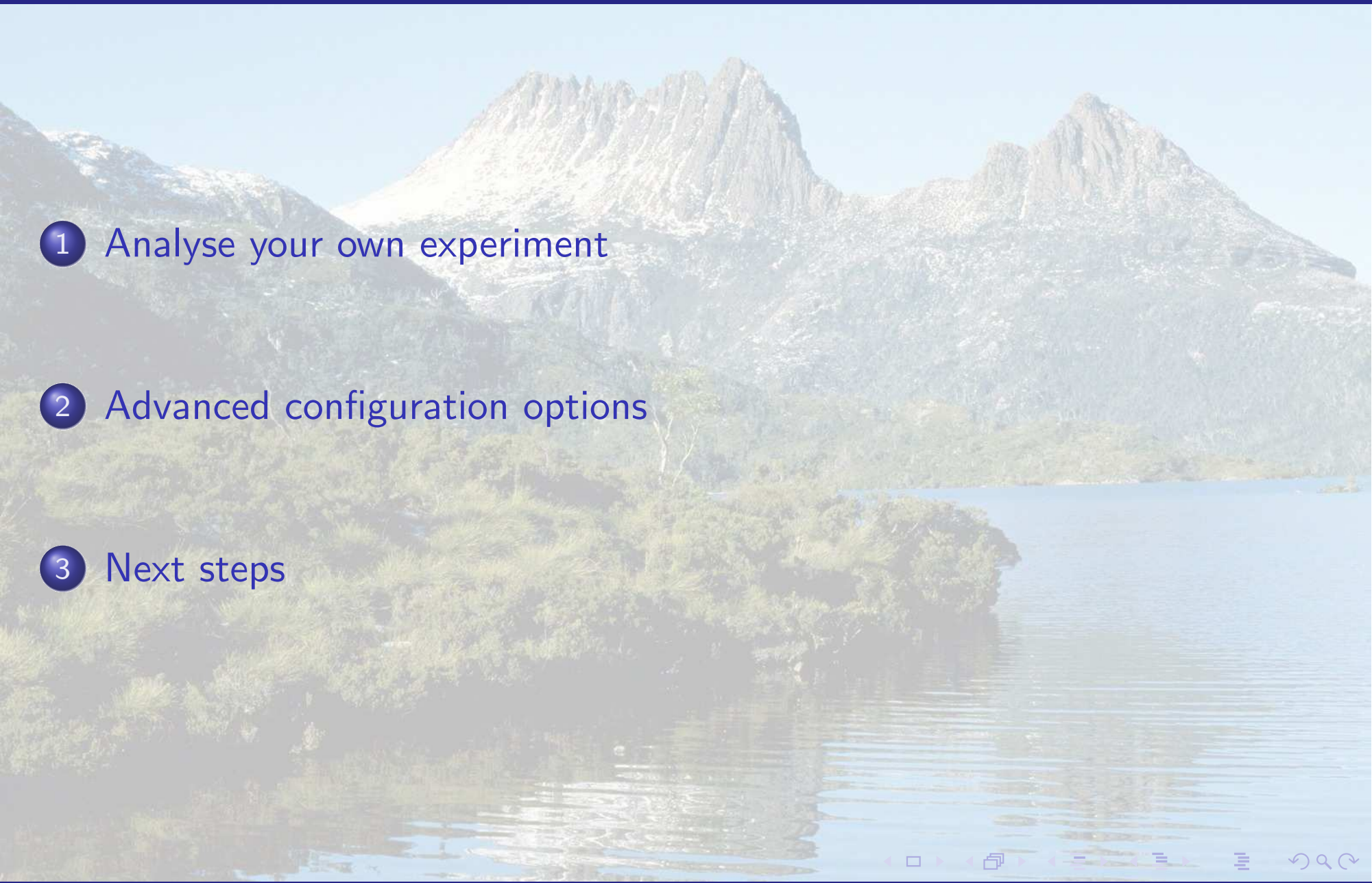

1. Analyse your own experiment

Analyse your own experiment

- Analyse the output of your experiment.
- Did it work? If not, why not?
- Use Ferret to plot the output of the model.
- Generate some GIF images and copy the files back to your local machine.
- If it worked, maybe you could run additional experiments?
- If it didn't work, fix it and try again.

More advanced Ferret commands

- Datasets and variable definitions:

```
use stsc_exp01.nc
use stsc_exp04.nc
let dt = tsc[d=2] - tsc[d=1]
```

- Setting up the plot window:

`set window n`	Send graphics to window `n`
`set window/size=1.0`	Resize window to `1.0` of full
`set window/aspect=0.7`	Change aspect ratio to `0.7`

More advanced Ferret commands

- Plot layout:

`set viewport ll`	Lower left of window [also: `lr`, `ul`, `ur`]
`set viewport left`	Left half of window [also: `right`]
`set viewport upper`	Upper half of window [also: `lower`]

- Colour palettes:

`palette blue_darkred`	User colour palette `blue_darkred`
`spawn Fpalette '*'`	List all available palettes
`go try_palette blue_darkred`	Display palette `blue_darkred`

More advanced Ferret commands

- Customising plots:

`shade/set_up/`*options* *data*	Set up a plot
ppl commands	Customise the plot using `ppl`
`ppl shade`	Generate the plot

- `fill`, `plot` and `shade` options:

`shade/levels=2d`	Use a spacing of 2 between levels
`shade/levels=2dc`	Ditto, with the levels centred around zero
`shade/hlimits=0:10:1`	Horizontal axis range and interval
`shade/vlimits=0:10:1`	Vertical axis range and interval
`shade/title="..."`	Set the plot title to ...

More advanced Ferret commands

- `ppl` commands:

`ppl labset`	Sets character heights for labels
`ppl axlsze`	Sets axis label heights
`ppl shakey`	Controls the shade key
`ppl axlint`	Sets numeric label interval for axes
`ppl xfor`	Sets format of x-axis numeric labels
`ppl yfor`	Sets format of y-axis numeric labels
`ppl xlab`	Sets label of x-axis
`ppl ylab`	Sets label of y-axis

More advanced Ferret commands

- Other commands:

`go margins`	Adjust the margins surrounding a plot
`go remove_logo`	Remove the Ferret logo
`go unlabel n`	Remove label `n` (`n` ≥ 4)
`go land`	Overlay continental boundaries

- Much, much, much more at:

`http://ferret.pmel.noaa.gov/Ferret/documentation/users-guide`

Ferret scripts

- It is not necessary to re-type Ferret commands every time you want to generate a plot.
- Instead, you can write a Ferret *script*.
- A script contains:
  - a series of Ferret commands
  - comment lines (lines beginning with `!`)
- A Ferret script can be identified by a file name ending in `.jnl`.
- To run a script, use the go command.
- For example, to run a script called `plot.jnl` you type:

```
yes? go plot
```

Exercise 1: Ferret scripts and plotting

- Log in to katana and get the course material for today:

```
cd
tar zxvf /srv/scratch/z3210932/week4.tar.gz
```

- This contains three Ferret scripts.
- Load and run Ferret. Now run each script by typing e.g.

```
yes? go plot1
```

- What happens?
- Examine each script using `less` or `nano`. See how the new Ferret commands that you have learnt today are being used.
- Try editing some of the scripts to generate new plots.

Getting files from katana

- Mount your H drive by entering the command:

  `network`

- You will need to enter your zPass. This creates the directory:

  `~/hdrive`

- Your can copy/move files to this directory.
- The contents of this directory can be accessed in two ways:
  - from within Windows (as the H: drive)
  - online via `http://myfiles.unsw.edu.au`
- To access files online via the UNSW File System, you will need to log in using your zNumber and zPass. You will then find the contents of your H drive under `My Home Drive`.

2. Advanced configuration options

Summary: Basic configuration options

- What we've covered so far:
  - How to configure the model via the control file
  - How to change the atmospheric CO_2 concentration by generating a new auxiliary file
  - How to apply freshwater hosing
- This enables you to vary:
  - the epoch
  - the solar constant
  - the atmospheric CO_2 concentration
  - the freshwater flux into the ocean
  - which model statistics are saved

Advanced configuration options

- There are three other ways of configuring aspects of the model:
  - Modify the other auxiliary files
  - Modify the restart file(s)
  - Modify the source code

Auxiliary files: atmosphere model

- Bottom boundary conditions:
  - Sea surface temperatures (`ssta.nc`)
  - Ocean currents (`ocuv.nc`)
  - Topography (`psrk.nc`)
  - Albedo (`albedo.nc`)
  - Vegetation and soil types (`sib*.nc`)
- Radiative boundary conditions:
  - CO_2 transmission coefficients (`co2_datafile`)
  - Ozone mixing ratios (`amip2o3.dat`)

Auxiliary files: ocean model

- Upper boundary conditions:
  - Sea surface temperatures (`sst.nc`)
  - Sea surface salinities (`sss.nc`)
  - Surface wind stresses (`stress.nc`)
- Bottom boundary conditions:
  - Bathymetry (`orest.nc` – restart file)

Auxiliary files: coupled model

- Bottom boundary conditions:
  - Topography (`psrk.nc`, `landrun21`)
  - Bathymetry (`orest.nc`)
  - Albedo (`albedo.nc`)
  - Vegetation and soil types (`sib*.nc`)
- Radiative boundary conditions:
  - CO_2 transmission coefficients (`co2_datafile`)
  - Ozone mixing ratios (`amip2o3.dat`)
- Freshwater hosing (`hosemask`)
- Flux adjustments (`dtm.nc`, `*cor.nc`)

Auxiliary files: coupled model

- Bottom boundary conditions:
  - Topography (`psrk.nc`, `landrun21`)
  - Bathymetry (`orest.nc`)
  - Albedo (`albedo.nc`)
  - Vegetation and soil types (`sib*.nc`)
- Radiative boundary conditions:
  - CO_2 transmission coefficients (`co2_datafile`)
  - Ozone mixing ratios (`amip2o3.dat`)
- Freshwater hosing (`hosemask`)
- Flux adjustments (`dtm.nc`, `*cor.nc`)

Examples of advanced configuration

- Applying anomalies within the atmosphere and ocean models:
  - modify the SSTs, SSSs, currents, wind stresses
- Applying anomalies within the coupled model:
  - modify the flux adjustments
- Configuring the model for a different era:
  - modify the topography and bathymetry
  - modify the albedo, and the vegetation and soil types
  - modify the epoch, solar constant, CO_2 transmission coefficients, ozone mixing ratios
  - issues with restart files, spin-up procedures and flux adjustments

3. Next steps

Next steps

- Get a copy of Mk3L. Apply for an account on the subversion server:

`http://www.tpac.org.au/resources/csiro-mk3l-source-code/`

- Run Mk3L on katana, on your PC, on your laptop...
- Experiment with the model and get to know it.
- Subscribe to the mailing list:

`https://www.lists.unsw.edu.au/mailman/listinfo/mk3l-users`

Next steps

- Ask questions:

Mk3L users mailing list	`mk3l-users@lists.unsw.edu.au`
Me	`s.phipps@unsw.edu.au`

- Share your experiences with other users.
- Share your enhancements to the model.
- Remember what a privilege it is to be a climate system modeller.
- With great power comes great responsibility.
- Have fun!