UNIVERSITY OF EXETER

Other things you might want to know about Isca (FAQs) - ICTP day 2

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Some little things

- In the **submission** scripts, there is an option to provide an email address.
    - Argo will email you when the job starts and when it finishes (can be useful)
- I have added the lecture notes from yesterday to the ictp-isca-workshop-2018 repository. Download it from GitHub if you like.
- **How long will the model take to run my experiment?**
- **How does the model know to run one month at a time?**
- **How is the fortran code structured? (What subroutine is calling what?)**
- **What is 'spin-up'?**
- **How do I know whether I have seasons or not?**
- **How do I know whether it's an aquaplanet or not?**
    - **How do I add land?**

- **How does the model know to run one month at a time?**
  - Yesterday, I said the model runs one month at a time.
  - How does it know to do that?

```
'main_nml':{
 'days'   : 30,
 'hours'  : 0,
 'minutes': 0,
 'seconds': 0,
 'dt_atmos':720,
 'current_date' : [1,1,1,0,0,0],
 'calendar' : 'thirty_day'
},
```

Tells model to run for 30 days

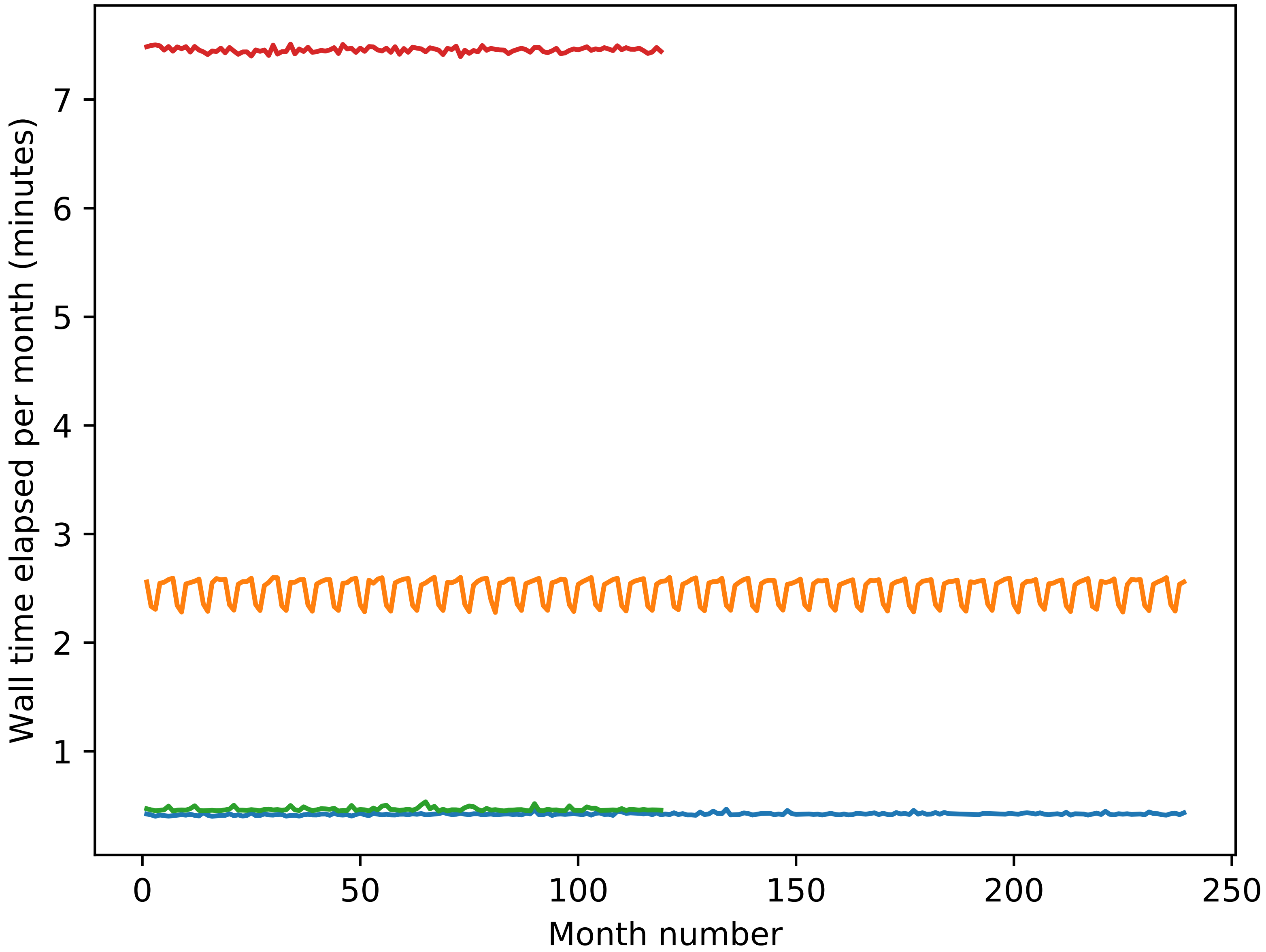
360-day calendar (30 day months)

Each time 'run' command is executed, it runs for the number of days defined in 'main_nml'

```
exp.run(1, use_restart=False, num_cores=NCORES)
for i in range(2,241):
    exp.run(i, num_cores=NCORES)
```

Runs for 240 sets of N days

- **How long will the model take to run my experiment?**



T21 grey

T21 RRTM

T21 Held-Suarez

T42 RRTM

All with 16 cores
With 8 cores, grey rad runs ~ 50% slower

Isca/src/extra/python/scripts/modified_time_script.py

Add your experiment folder names to the 'exp_dir_list' near the bottom of the script, then run with python.

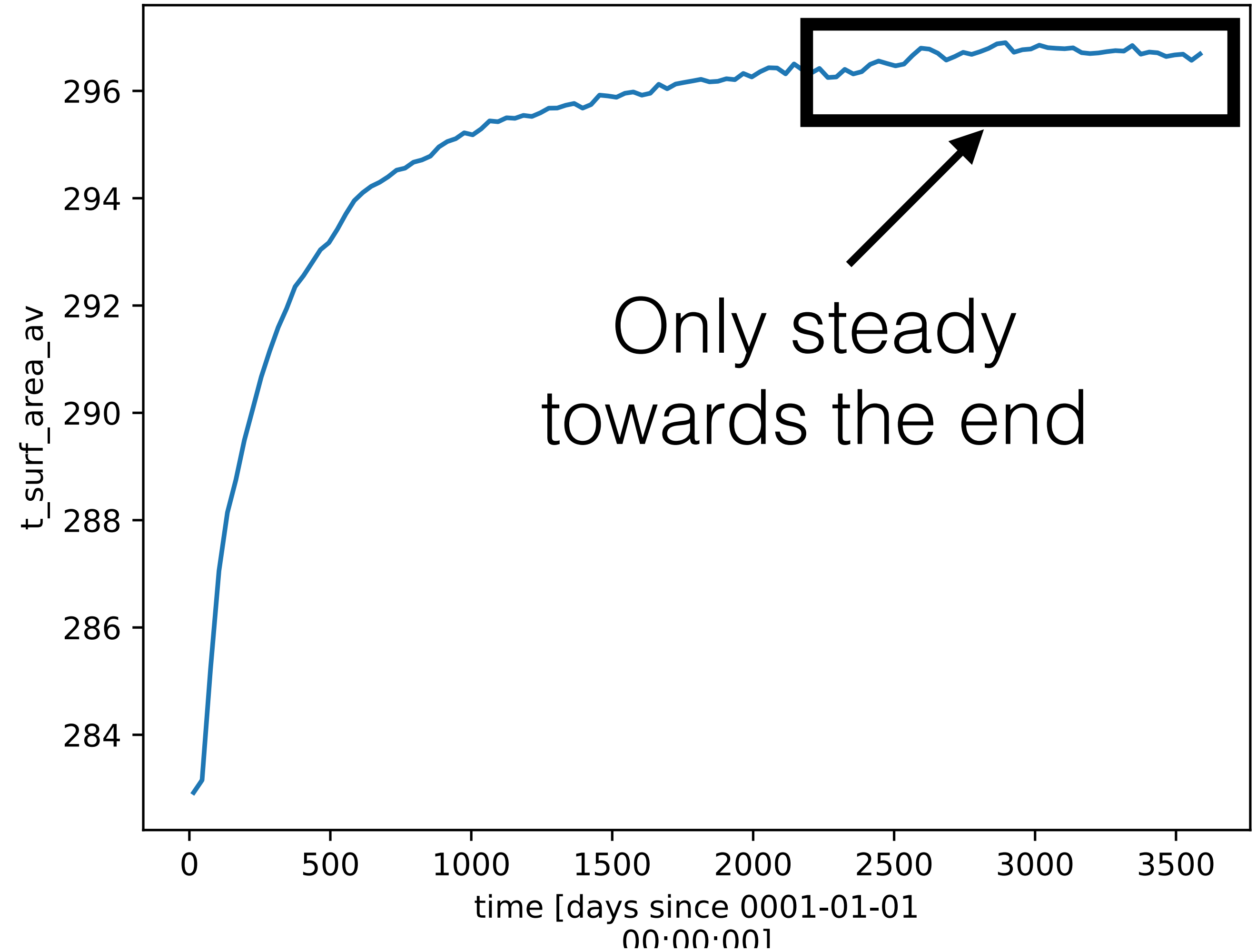
- **How is the Fortran code structured?**

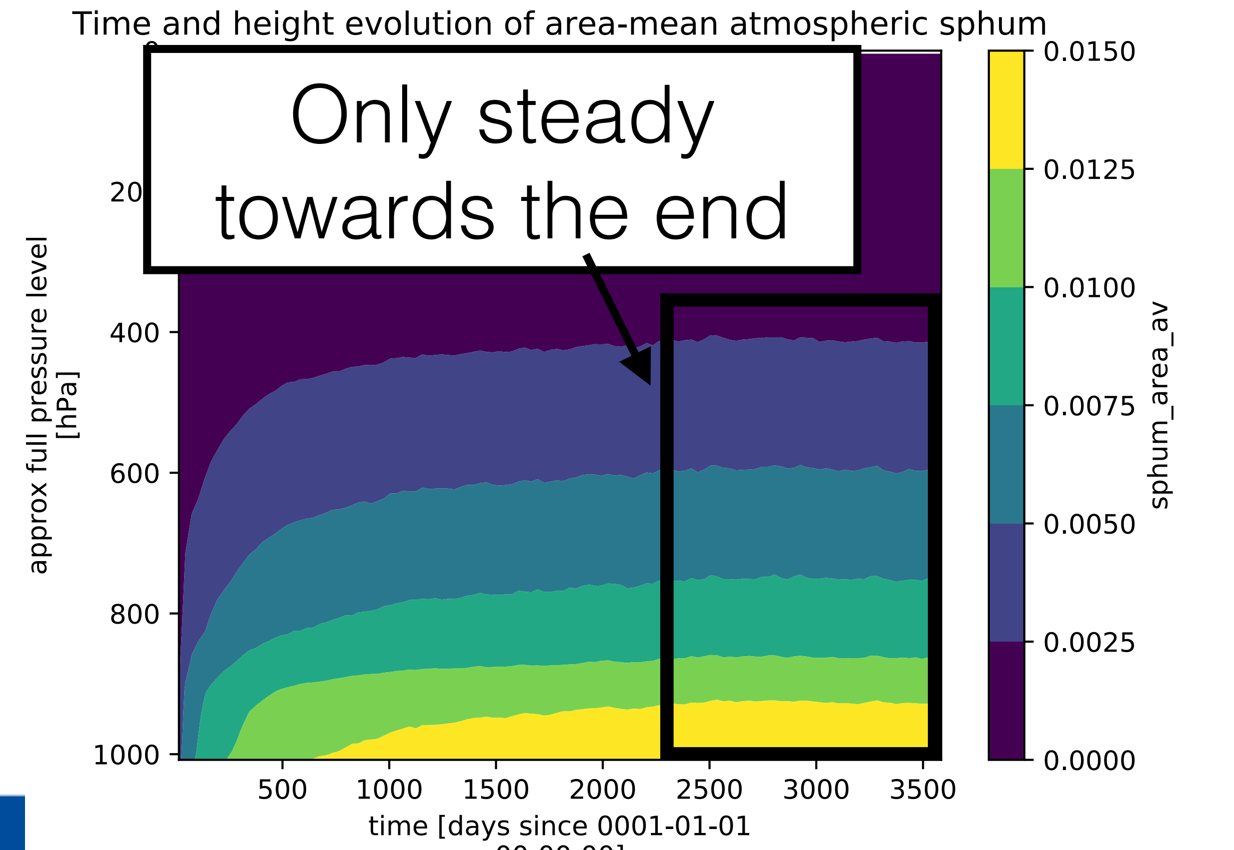
- In Isca repo on the ‘pre_ictp_mods’ branch, there is an Excel document called ‘Isca_fortran_code_structure.xlsx’.

- It shows you a simple representation of the code structure:
  - Which subroutines are calling which subroutines
  - A simple explanation of what each subroutine does…

Atmos_model	*atmos_model.F90*					
	atmosphere	*atmosphere.f90*				
		idealized_moist_phys	*idealized_moist_phys.F90*			
			qe_moist_convection	*qe_moist_convection.F90*		
			lscale_cond	lscale_cond.F90		
			two_stream_gray_rad_down	two_stream_gray_rad.F90		
			surface_flux	surface_flux.F90		
				mo_drag	monin_obukhov.F90	
			two_stream_gray_rad_up	*two_stream_gray_rad.F90*		
			vert_turb_driver			
				diffusivity	*diffusivity.F90*	
					pbl_depth	*diffusivity.F90*
					diffusivity_pbl	*diffusivity.F90*
			gcm_vert_diff_down	*vert_diff.F90*		
			mixed_layer	*mixed_layer.F90*		
		spectral_dynamics	*spectral_dynamics.F90*			
		compute_pressures_and_heights	*press_and_geopot.F90*			
		spectral_diagnostics	*spectral_dynamics.F90*			

- **What is spin-up?**
  - The model will start from a resting state - will take some time to reach equilibrium.
  - Can check this will the time-variation with my analysis scripts. For example,
  - af.global_average_lat_lon(dataset, 't_surf')
  - dataset.t_surf_area_av.plot.line()
  - When does it reach a steady state, or a steady seasonal cycle?





- **How do I know whether I have seasons or not?**

Example experiments:

- Project 1 - Seasons
- Project 2 - No seasons
- Project 3 - No seasons
- Project 4 - Seasons
- Project 5 - No seasons
- Project 6 - Seasons
- Project 7 - No seasons
- Project P1 - No seasons
- Project P2 - No seasons

```
'rrtm_radiation_nml': {
    'do_read_ozone':True,
    'ozone_file':'ozone_1990',
    'solr_cnst': 1360., #s set
    'dt_rad': 4320, #Use 4320
    'solday':90,
},
```

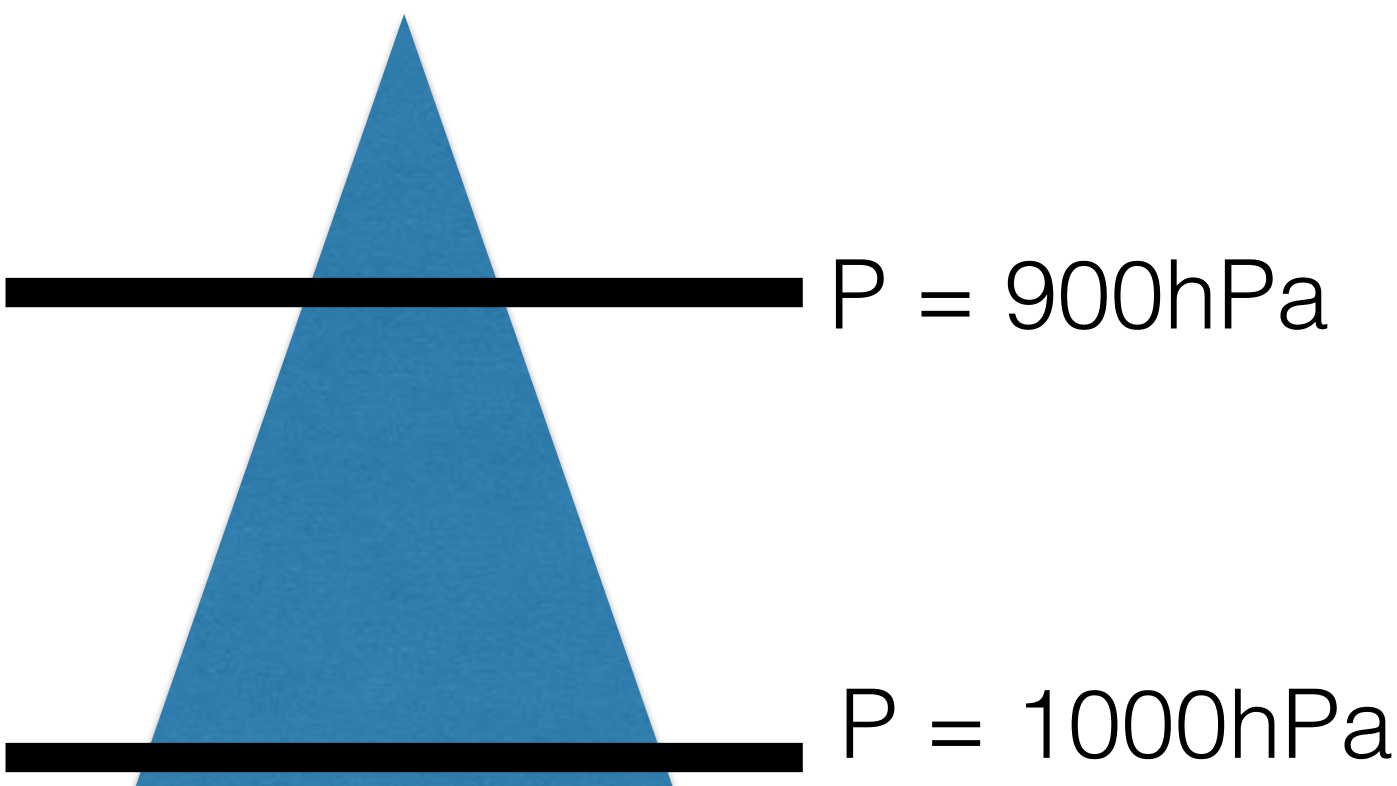
- If solday=90 is set, then it tells the radiation to run day 90 insolation every day (equinox)
- Same in grey and RRTM namelists
- If solday is not set, then you'll have seasons
- To add seasons, remove the solday namelist entry

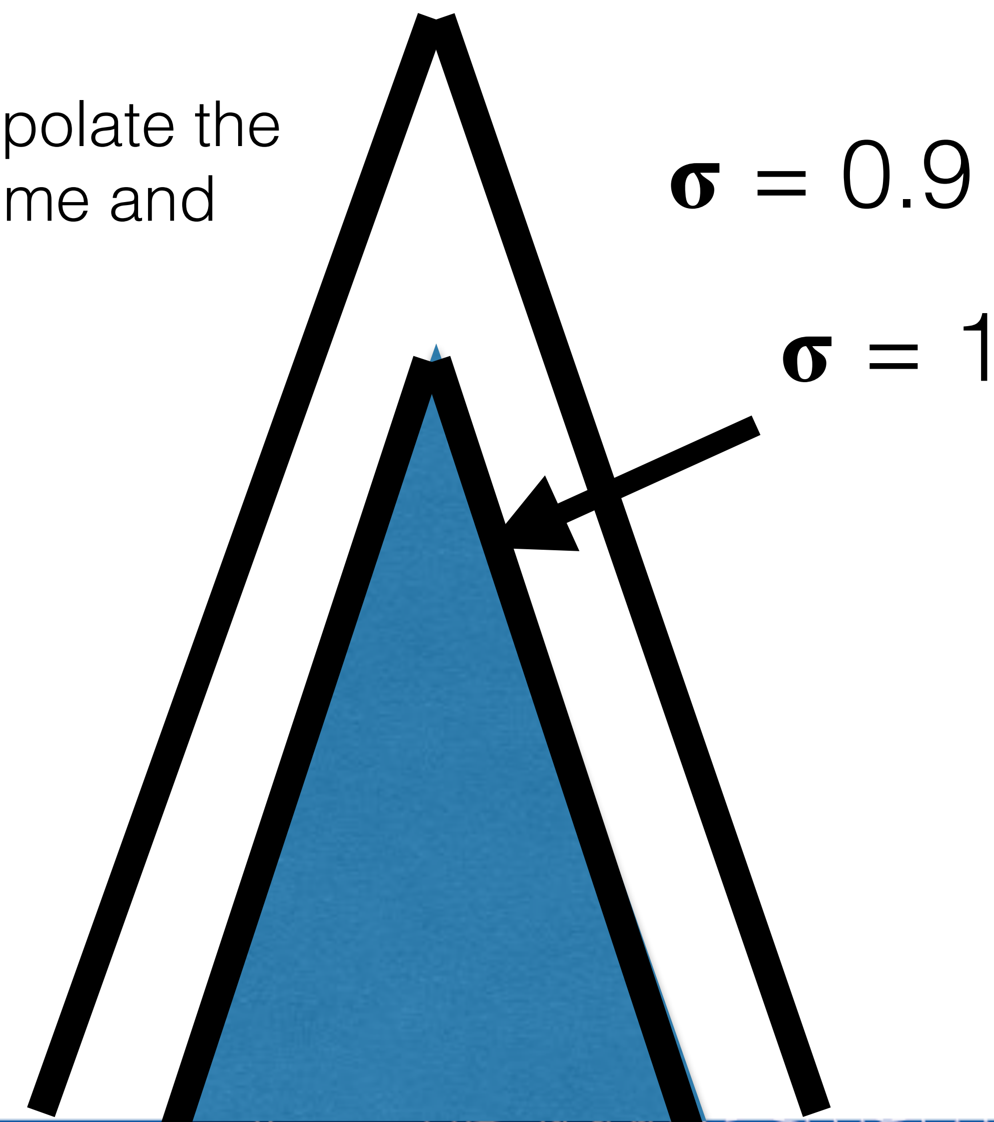
- **How do I know whether it's an aquaplanet or not?**
  - By default, Isca has no land - is an aquaplanet
  - In the mixed_layer.f90 `land_option='none'` is default
- **How do I add land?**
  - Look at e.g. project 3, as it has land
  - Step 1: Add a land mask to the 'input_files' list near the top of your run script
  - Step 2: Include the namelist entries with 'land' in the name in the relevant namelists
    - 3 in 'idealized_moist_phys_nml', 3 in 'mixed_layer_nml'
  - Step 3: add 'ocean_topog_smoothing':0.8 to 'spectral_dynamics_nml'
  - Step 4: Add the 'spectral_init_cond_nml' namelist as part of your namelist (this will add topography to the model)

- The factors that set the land-sea contrast are:
    - ‘land_roughness_prefactor’ - how much rougher is the land than the ocean?
    - ‘land_h_capacity_prefactor’ - how much lower is the land’s heat capacity than the ocean?
    - ‘land_albedo_prefactor’ - how much greater is the land albedo than the ocean albedo?
- The real-world land masks are provided in the Isca repo in Isca/input/land_masks
- If you want to make idealised land / topography - talk to me and I’ll show you how.

What about the output?

- The atmospheric output data is provided on so-called '**sigma levels**' (terrain-following coordinates)
- **σ = atmospheric_pressure / surface_pressure**
- On an **aquaplanet**, there's very little difference
- Makes a big difference with topography…
- If your simulation has topography, you'll need to interpolate the data onto pressure levels before analysing it - talk to me and I'll show you how.





A quick note on q-fluxes

- The evolution equation for the mixed-layer temperature is the following:

$$C_{\mathrm{m}} \frac{\partial T}{\partial t} = \mathrm{SW} + \mathrm{LW} - \mathrm{sensible} - \mathrm{latent} + \nabla \cdot \boldsymbol{Q}$$

- In ‘mixed_layer.f90’ this looks like:

```
corrected_flux = - net_surf_sw_down - surf_lw_down + alpha_t * CP_AIR + alpha_lw - ocean_qflux
```

- So `ocean_qflux` actually corresponds to $\nabla \cdot \boldsymbol{Q}$

- So your `ocean_qflux` field should **integrate to zero over the globe**, because the area integral of a divergence is zero

- The q-flux input files I have given you will integrate to zero

- But **be careful if you add land that this remains true**, otherwise you’ll have a net source or sink of energy in the mixed-layer.