

Exercise Overview

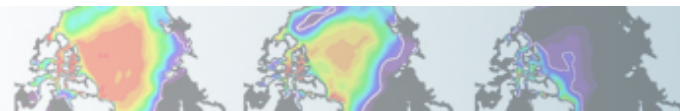


- Exercise 1: Namelist modification
 Customize your history output

- Exercise 2: Namelist + Code modification
 Add a new output field to the code

- Exercise 3: Change a tuning parameter

- Don't forget the quiz ! (You can complete the previous day quizzes too)



Exercise 1: Customizing history files



Create a case called “b1850_high_freq” using the compset B1850 at f19_g17 resolution.

Set the run length to 1 month.

In addition to the monthly history file “h0”, output:

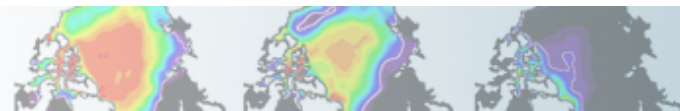
- “h1” file with instantaneous values of T, Q, U and V every 24 hour.
- “h2” file with time-average values of T, Q, U and V every 3 hour.

Set your namelist so that you output:

- a single h1 file with all the daily output for the month.
- multiple h2 file, one for every day of the month.

It means you will have one h1 file with 31 timesteps and you will have thirty-one h2 files with 8 timesteps each).

(Hint: - Use namelist variables: *nhtfrq*, *mfilt*, *fincl*. Look at the online documentation for these variables)



Exercise 1: Check your solution



When your run is completed,

(1) Check that your archive directory contains the files:

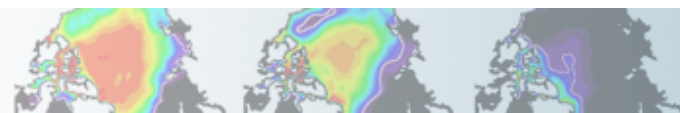
h0 files	<code>b1850_high_freq.cam.h0.0001-01.nc</code>
h1 files	<code>b1850_high_freq.cam.h0.0001-01.nc</code>
h2 files	<code>b1850_high_freq.cam.h2.0001-01-01-00000.nc</code> <code>b1850_high_freq.cam.h2.0001-01-02-00000.nc</code> ... <code>b1850_high_freq.cam.h2.0001-02-01-00000.nc</code>

(2) Compare the contents of the h1 and h2 files using “ncdump”.

```
ncdump -h b1850_high_freq.cam.h1.0001-01-01-00000.nc  
ncdump -h b1850_high_freq.cam.h2.0001-01-01-00000.nc
```

Look at the variables attributes. What is the difference between the 2 files ?

(3) Check the number of timesteps in the h1 and the h2 files.
Look at the sizes of the files.





Exercise 2: Add an output field

Create a case called “b1850_T750” using the compset B1850 at f19_g17 resolution.
Add an output field for the temperature at 750 mbar.
Output daily values of T750 and T500 in the “h1” history file.
Set the namelist to output a single h1 for the run.
Make a 1-month run.

Hint:

- Use T500 as a template for your changes.
- Find the subroutine containing T500 using `grep -r T500 *`

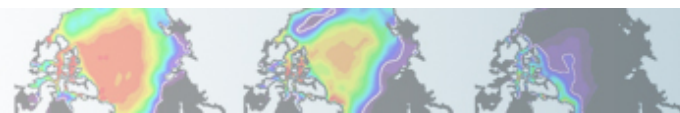
Check your solution

When the run is completed,

- check the field T750 and T500 are in the file h1
- create a file with the difference between T750-T500 (*)
- look at the difference with `ncview`.

(*) For instance, you can use `ncap2`

```
ncap2 -s 'T750_minus_T500=T750-T500' b1850_T750.cam.h1.0001-01-01-00000.nc T750-T500.nc
```





Exercise 3: Modify a parameter, dcs

In the tuning lecture, we talked about the parameter dcs:

<http://www.cesm.ucar.edu/events/tutorials/2018/files/Specialized-hannay.pdf>

Create a case called “b1850_dcs” using the compset B1850 at f19_g17 resolution. Locate the parameter Dcs and change from the default value:

micro_mg_dcs = 500.D-6 to micro_mg_dcs = 250.D-6

Make a 1-month run.

Hint: The trick is going to locate where is micro_mg_dcs

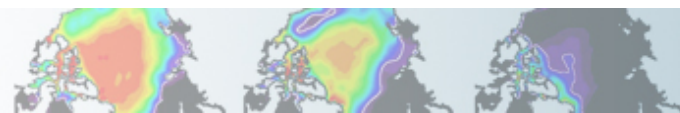
Compare to the first run: b1850_high_freq.

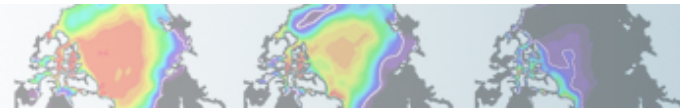
You can use ncdiff and ncview to look at the difference between the 2 runs.

```
ncdiff /glade/scratch/$user/archive/b1850_dcs/atm/hist/b1850_dcs.cam.h0.0001-01.nc  
/glade/scratch/$user/archive/b1850_high_freq/atm/hist/b1850_high_freq.cam.h0.0001-01.nc  
diff.nc
```

```
ncview diff.nc
```

How does this affect the LWCF ?





Quizzes

At the end of the practical, please go to the online course and take the quiz.

<http://www.cesm.ucar.edu/events/tutorials/2018/quizzes.html>

To answer the questions, you can use documentation, ask questions to others or to the helper. Indeed you are strongly encouraged to do all the above. This is the way you will use CESM in the future.

How are you graded ? You can take the quizzes as many times as you want, I only retain your highest score. But please try to understand your mistakes.

If you cannot complete the quiz by the end of the practical session, you have until August 17 to complete the quizzes. If you get a perfect score, you will get a certificate of awesomeness.

“Special prize” for those who get a perfect score before Friday morning!!!



U.S. DEPARTMENT OF
ENERGY

Office of
Science

Solutions to the exercises



At the request of previous year students, I am providing the solution.

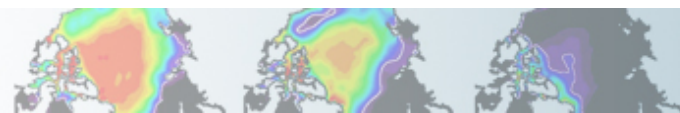
My own recommendation:

DON'T LOOK AT THE SOLUTIONS DURING THE LAB !!!

I believe:

- You will only learn if you try the exercises by yourself.
- You will only learn if you do mistakes.
- Copy/paste will teach you little, indeed.
- Your best bet is to try, do mistakes, ask your neighbor, interact with each others, look at the documentation, try to understand what is wrong...

But this is my own opinion, and I am too old to believe I know the Truth.
So do what is best for you. Go to the next page at your own risk 😊



**If you are sure you want to continue,
click on the button...**



Solution to exercise 1

Point to the prebuilt code (These instructions are for tcsh shell. If you use another shell, modify accordingly)

```
setenv CESM_BLD_TEMPLATE /glade/p/cesm/tutorial/templates/cesm2.0.0_b1850/bld
```

Create a new case

```
cd /glade/p/cesm/tutorial/cesm2.0.0_tutorial/cime/scripts
```

```
./create_newcase --case ~/cases/b1850_high_freq --compset B1850 --res f19_g17
```

Case setup

```
cd ~/cases/b1850_high_freq
```

```
./case.setup
```

Edit the user_nl_cam and add the lines:

```
nhtfrq = 0, -24, -3
```

```
mfilt = 1, 31, 8
```

```
fincl2 = 'T:I','Q:I','U:I','V:I'
```

```
fincl3 = 'T','Q','U','V'
```

Change run length

```
./xmlchange STOP_N=1,STOP_OPTION=nmonths
```

Build and submit

```
qcmd -- ./case.build
```

```
./case.submit
```

Solution to exercise 1

When your run is completed

(1) Check that your archive directory:

```
cd /glade/scratch/$user/archive/b1850_high_freq/atm/hist
ls
```

(2) Compare the contents of the h1 and h2 files using “ncdump”.

Look at the variables attributes. What is the difference between the 2 files ?

```
ncdump -h b1850_high_freq.cam.h1.0001-01-01-00000.nc
```

```
time = UNLIMITED ; // (31 currently)

float Q(time, lev, lat, lon) ;
  Q:mdims = 1 ;
  Q:units = "kg/kg" ;
  Q:long_name = "Specific humidity" ;
float T(time, lev, lat, lon) ;
  T:mdims = 1 ;
  T:units = "K" ;
  T:long_name = "Temperature" ;
float U(time, lev, lat, lon) ;
  U:mdims = 1 ;
  U:units = "m/s" ;
  U:long_name = "Zonal wind" ;
float V(time, lev, lat, lon) ;
  V:mdims = 1 ;
  V:units = "m/s" ;
  V:long_name = "Meridional wind" ;
```

```
ncdump -h b1850_high_freq.cam.h2.0001-01-01-00000.nc
```

```
time = UNLIMITED ; // (8 currently)

float Q(time, lev, lat, lon) ;
  Q:mdims = 1 ;
  Q:units = "kg/kg" ;
  Q:long_name = "Specific humidity" ;
  Q:cell_methods = "time: mean" ;
float T(time, lev, lat, lon) ;
  T:mdims = 1 ;
  T:units = "K" ;
  T:long_name = "Temperature" ;
  T:cell_methods = "time: mean" ;
float U(time, lev, lat, lon) ;
  U:mdims = 1 ;
  U:units = "m/s" ;
  U:long_name = "Zonal wind" ;
  U:cell_methods = "time: mean" ;
float V(time, lev, lat, lon) ;
  V:mdims = 1 ;
  V:units = "m/s" ;
  V:long_name = "Meridional wind" ;
  V:cell_methods = "time: mean" ;
```

Solution to exercise 1

(3) Check the number of timesteps in the h1 and the h2 files.

Look at the sizes of the files.

h1 => 31 timestep. In the netcdf file, time = UNLIMITED ; // (31 currently)

h2 => 8 timesteps. See in the netcdf file, time = UNLIMITED ; // (8 currently)

Check size of the files

```
du -ks -h /glade/scratch/$user/archive/b1850_high_freq/atm/hist
```

```
234M  b1850_high_freq.cam.h0.0001-01.nc
```

```
210M  b1850_high_freq.cam.h1.0001-01-01-00000.nc
```

```
7.0M  b1850_high_freq.cam.h1.0001-02-01-00000.nc
```

```
55M   b1850_high_freq.cam.h2.0001-01-01-00000.nc
```

```
55M   b1850_high_freq.cam.h2.0001-01-02-00000.nc
```

```
...
```

```
55M   b1850_high_freq.cam.h2.0001-01-31-00000.nc
```

```
7.0M  b1850_high_freq.cam.h2.0001-02-01-00000.nc
```

The February files are smaller
because there is only 1 timestep

Solution to exercise 2

Point to the prebuilt code (These instructions are for tcsh shell. If you use another shell, modify accordingly)

```
setenv CESM_BLD_TEMPLATE /glade/p/cesm/tutorial/templates/cesm2.0.0_b1850/bld
```

Create a new case

```
cd /glade/p/cesm/tutorial/cesm2.0.0_tutorial/cime/scripts
```

```
./create_newcase --case ~/cases/b1850_T750--compset B1850 --res f19_g17
```

Case setup

```
cd ~/cases/b1850_T750
```

```
./case.setup
```

Locate the file where T500 is computed and copy it SourceMods/sc

```
cp /glade/p/cesm/tutorial/cesm2.0.0_tutorial/components/cam/src/physics/cam/cam_diagnostics.F90  
SourceMods/src.cam
```

Edit the file SourceMods/src.cam/cam_diagnostics.F90 and add the lines:

```
!++ add a variable for T750
```

```
call addfld ('T750',          horiz_only,  'A', 'K','Temperature at 750 mbar pressure surface')
```

```
!++ add a variable for T750
```

```
if (hist_fld_active('T750')) then
```

```
  call vertinterp(ncol, pcols, pver, state%pmid, 75000._r8, state%t, p_surf, &  
    extrapolate='T', ps=state%ps, phis=state%phis)
```

```
  call outfld('T750      ', p_surf, pcols, lchnk )
```

```
end if
```

Solution to exercise 2

```
# Change run length
./xmlchange STOP_N=1,STOP_OPTION=nmonths
```

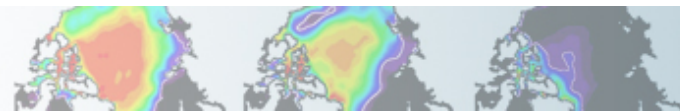
```
## Build and submit
qcmd -- ./case.build
./case.submit
```

Check your solution

When the run is completed,
- check the field T750 and T500 are in the file h1

```
cd /glade/scratch/$user/archive/b1850_T750/atm/hist/
ncdump -h b1850_T750.cam.h1.0001-01-01-00000.nc
```

```
float T500(time, lat, lon) ;
    T500:units = "K" ;
    T500:long_name = "Temperature at 500 mbar pressure surface" ;
    T500:cell_methods = "time: mean" ;
float T750(time, lat, lon) ;
    T750:units = "K" ;
    T750:long_name = "Temperature at 750 mbar pressure surface" ;
    T750:cell_methods = "time: mean" ;
```



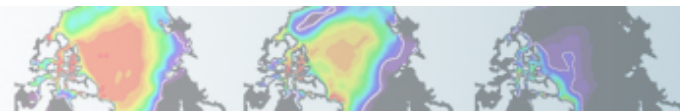
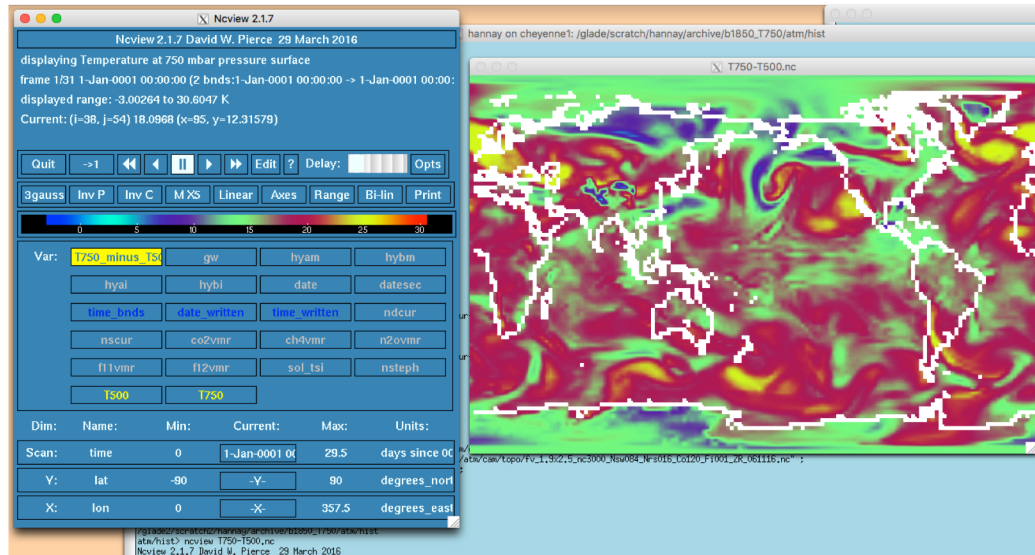
Solution to exercise 2

```
# create a file with the difference between T750-T500
```

```
cd /glade/scratch/$user/archive/b1850_T750/atm/hist/  
ncap2 -s 'T750_minus_T500=T750-T500' b1850_T750.cam.h1.0001-01-01-00000.nc T750-T500.nc
```

```
# look at the difference between T750-T500 with ncview.
```

```
cd /glade/scratch/$user/archive/b1850_T750/atm/hist/  
ncview T750-T500.nc
```



Solution to exercise 3

Point to the prebuilt code (These instructions are for tcsh shell. If you use another shell, modify accordingly)

```
setenv CESM_BLD_TEMPLATE /glade/p/cesm/tutorial/templates/cesm2.0.0_b1850/bld
```

Create a new case

```
cd /glade/p/cesm/tutorial/cesm2.0.0_tutorial/cime/scripts
```

```
./create_newcase --case ~/cases/b1850_dcs --compset B1850 --res f19_g17
```

Case setup

```
cd ~/cases/b1850_dcs
```

```
./case.setup
```

Edit user_nl_cam

```
cd ~/cases/b1850_dcs
```

Replace `micro_mg_dcs = 500.D-6` by `micro_mg_dcs = 200.D-6`

Change run length

```
./xmlchange STOP_N=1,STOP_OPTION=nmonths
```

Build and submit

```
qcmd -- ./case.build
```

```
./case.submit
```

Solution to exercise 3

create a file with the difference between LWCF

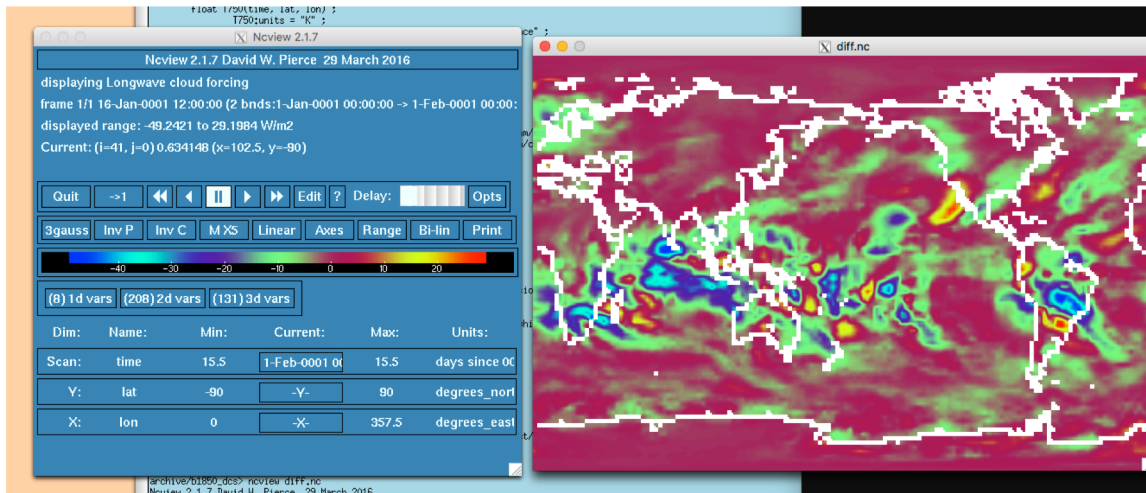
Compare to the first run: b1850_high_freq.

You can use ncdiff and ncview to look at the difference between the 2 runs.

```
cd /glade/scratch/$user/archive/b1850_dcs
ncdiff /glade/scratch/$user/archive/b1850_dcs/atm/hist/b1850_dcs.cam.h0.0001-01.nc
/glade/scratch/$user/archive/b1850_high_freq/atm/hist/b1850_high_freq.cam.h0.0001-01.nc
diff.nc
```

```
ncview diff.nc
```

How does this affect the LWCF ?



This affect the tropics
where LWCF is large

1-month run is too short
to look at results