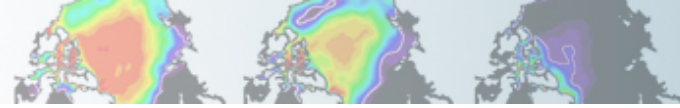


Community Land Model & Biogeochemistry: Friday Lab session

Sam Levis and Keith Lindsay

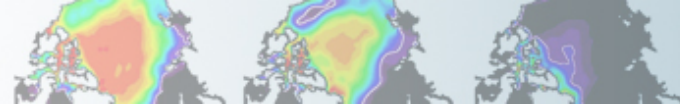
National Center for Atmospheric Research



Exercise A: Basic clm usage

Goal: Run the CLM4.5SP on yellowstone
at $\sim 1^\circ$ lat/lon resolution for 5 days
while cycling prescribed Qian atm data

If you have not memorized the
4 steps for starting a CESM simulation,
let's do that now!



Exercise A: Basic clm usage

COMPSETS are shortcuts designed for specific cases... treat them as **starting points for all cases**
"I" compsets run the clm/datm (no ice/no ocean)

<u>Short Name</u>	<u>Description of 3 out of the many available COMPSETS</u>
I	CLM4.0SP, Qian et al. atmosphere, 2000 pfts, CO ₂ , aerosol _{dep}
I1850CLM45	CLM4.5SP, Qian et al. atmosphere, 1850 pfts, CO ₂ , aerosol _{dep}
I20TRCRUCLM45BGC	CLM4.5BGC, CRU atm., 1850-2005 pfts, aerosol _{dep} + N _{dep}

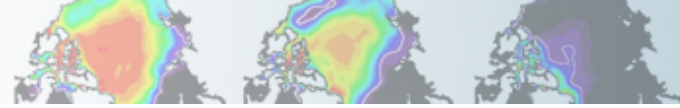
SP = Satellite Phenology; BGC = Biogeochemistry

In Exercise A you will try the I1850CLM45 compset

In Exercise B you will try the I20TRCRUCLM45BGC compset

How to auto-resubmit runs: RESUBMIT to > 0 in env_run.xml before run ends

Manual resubmit: CONTINUE_RUN to TRUE in env_run.xml before run begins



B. Differences between compsets => how to customize a case

Goal: Create case **with a different compset**; note that **you ended up with different settings => see how you may also change settings manually** for a case not supported by an existing compset

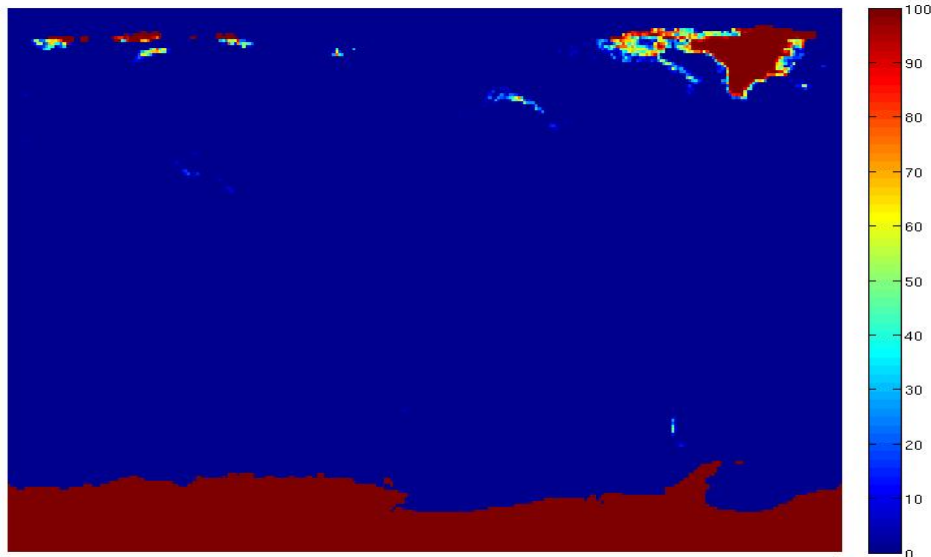
In Exercise B you will try the I20TRCRUCLM45BGC compset



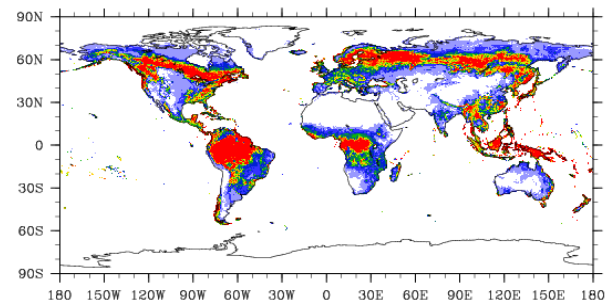
C. Understand & modify CLM input data

Goal: Learn what inputs the clm needs and what they look like

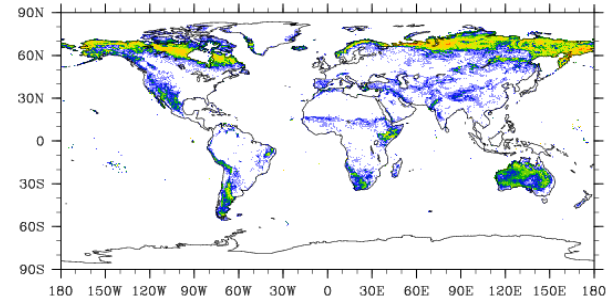
% glacier



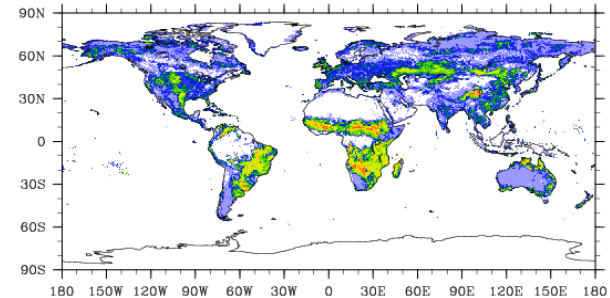
(a) Current Day (2000) Tree PFTs



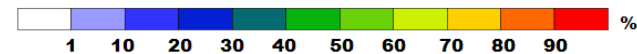
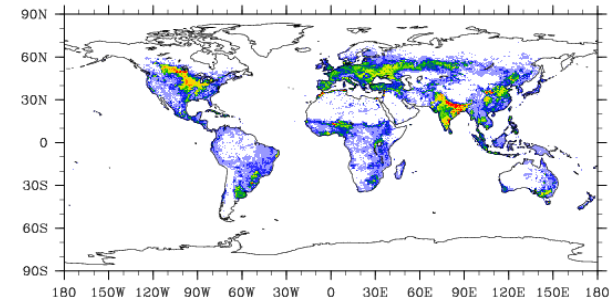
(c) Current Day (2000) Shrub PFTs

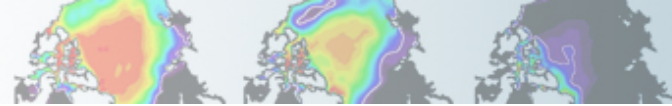


(e) Current Day (2000) Grass PFTs



(g) Current Day (2000) Crop PFT





Exercise A detailed steps

1) Create the case...

```
cd /glade/p/cesm/tutorial/cesm1_2_2.tutorial/scripts
./create_newcase -case <your path>/i.day5.a -compset I1850CLM45 -mach yellowstone -res f09_g16
./create_newcase -help # for documentation
./create_newcase -list compsets (OR) grids (OR) machines # for available options
```

2) Set up the case...

```
cd <your path>/i.day5.a
# You need not change env_build.xml for this case to work, but now would be the time to make such changes
./cesm_setup
```

3) Add hist_nhtfrq and set to -24 (i.e., 24 hrs) in the clm namelist to get daily avg output instead of the default monthly...

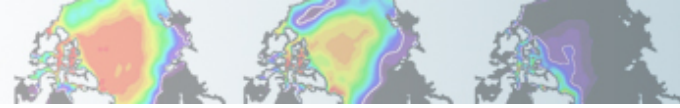
```
$EDITOR user_nl_clm
```

4) Build the case and compile the code...

```
./i.day5.a.build
```

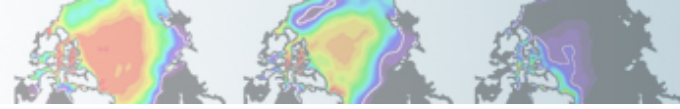
5) Submit the run and proceed to Exercise (B)...

```
# You need not change env_run.xml for this case to work but now would be the time to make such changes
i.day5.a.submit # AFTER THE TUTORIAL, to charge to the right account, add the line #BSUB -U yourACCTnumber near the top of i.day5.a.run
bjobs # to see the $jobID and whether the job is pending or running
bkill $jobID # if necessary;
# run executes in /glade/scratch/$USER/i.day5.a
# output moves to /glade/scratch/$USER/archive/i.day5.a when run ends
# outside the context of this tutorial I might have named this case clm45sp_1degcesm1.2.0_1850qian
```



Namelist (Ind_in) from Exercise A

```
&clm_inparm
albice = 0.60,0.40
co2_ppmv = 284.7
co2_type = 'constant'
create_crop_landunit = .false.
dtime = 1800
fatmIndfrc = '/glade/p/cesmdata/cseg/inputdata/share/domains/domain.Ind.fv0.9x1.25_gx1v6.090309.nc'
finidat = '/glade/p/cesmdata/cseg/inputdata/Ind/clm2/initdata_map/clmi.I1850CRUCLM45SP.0521-01-01.0.9x1.25_g1v6_simyr1850_c130506.nc'
fpftcon = '/glade/p/cesmdata/cseg/inputdata/Ind/clm2/pftdata/pft-physiology.c130503.nc'
fsnowaging = '/glade/p/cesmdata/cseg/inputdata/Ind/clm2/snicardata/snicar_drdr_bst_fit_60_c070416.nc'
fsnowoptics = '/glade/p/cesmdata/cseg/inputdata/Ind/clm2/snicardata/snicar_optics_5bnd_c090915.nc'
fsurdat = '/glade/p/cesmdata/cseg/inputdata/Ind/clm2/surfdata_map/surfdata_0.9x1.25_simyr1850_c130415.nc'
hist_nhtfrq = -24
maxpatch_glcmech = 0
more_vertlayers = .false.
nsegspc = 20
urban_hac = 'ON'
urban_traffic = .false.
/
&ndepdyn_nml
/
&popd_streams
/
&light_streams
/
&clm_hydrology1_inparm
/
&clm_soilhydrology_inparm
/
```



Exercise B detailed steps

1) Create the case...

```
cd /glade/p/cesm/tutorial/cesm1_2_2.tutorial/scripts
./create_newcase -case <your path>/i.day5.b -compset I20TRCRUCLM45BGC -mach yellowstone -res f09_g16
# outside the context of this tutorial I might have named this case clm45bgc_1degcesm1.2.0_histcru
```

2) Note differences between this case and the case created in (A)

```
cd <your path>
diff i.day5.b i.day5.a | more
```

3) Set up the case as you learned in (A) step 2

4) Now compare the /CaseDoc directories

```
diff i.day5.b/CaseDocs i.day5.a/CaseDocs | more
```

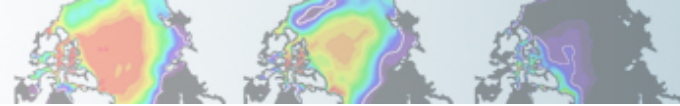
5) Discuss the differences in the context of potentially changing settings manually for cases not supported by existing compsets.

Your discussion may include the topic of different input data for different cases. Exercise (C) focuses on clm's input data.

6) Before proceeding to (C), change hist_nhtfrq to -24 in the clm namelist and build and run this case as you learned in (A) steps 3, 4, and 5.

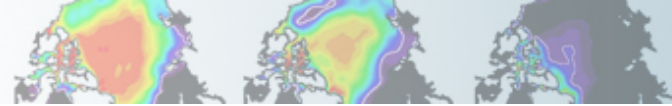
Look (e.g. with ncview) at history files generated by this run versus the run in (A). Do you notice differences? Discuss differences in the list of output fields.

...Proceed to (C) if waiting for the run to complete.



Namelist (Ind_in) from Exercise B

```
&clm_inparm
albice = 0.60,0.40
co2_type = 'diagnostic'
create_crop_landunit = .false.
dtime = 1800
fatmIndfrc = '/glade/p/cesmdata/cseg/inputdata/share/domains/domain.Ind.fv0.9x1.25_gx1v6.090309.nc'
finidat = '/glade/p/cesmdata/cseg/inputdata/Ind/clm2/initdata_map/clmi.11850CRUCLM45BGC.0241-01-01.0.9x1.25_g1v6_simyr1850_c130531.nc'
fpftcon = '/glade/p/cesmdata/cseg/inputdata/Ind/clm2/pftdata/pft-physiology.c130503.nc'
fpftdyn = '/glade/p/cesmdata/cseg/inputdata/Ind/clm2/surfdata_map/surfdata.pftdyn_0.9x1.25_rcp8.5_simyr1850-2100_c130415.nc'
fsnowaging = '/glade/p/cesmdata/cseg/inputdata/Ind/clm2/snicardata/snicar_drdt_bst_fit_60_c070416.nc'
fsnowoptics = '/glade/p/cesmdata/cseg/inputdata/Ind/clm2/snicardata/snicar_optics_5bnd_c090915.nc'
fsurdat = '/glade/p/cesmdata/cseg/inputdata/Ind/clm2/surfdata_map/surfdata_0.9x1.25_simyr1850_c130415.nc'
hist_nhtfrq = -24
maxpatch_glcmecc = 0
more_vertlayers = .false.
nsegspc = 20
spinup_state = 0
urban_hac = 'ON'
urban_traffic = .false.
/
&ndepdyn_nml
model_year_align_ndep = 1850
ndepmapalgo = 'bilinear'
stream_fldfilename_ndep = '/glade/p/cesmdata/cseg/inputdata/Ind/clm2/ndepdata/fndep_clm_hist_simyr1849-2006_1.9x2.5_c100428.nc'
stream_year_first_ndep = 1850
stream_year_last_ndep = 2005
/
&popd_streams
model_year_align_popdens = 1850
popdensmapalgo = 'bilinear'
stream_fldfilename_popdens = '/glade/p/cesmdata/cseg/inputdata/Ind/clm2/firedata/clmforc.Li_2012_hdm_0.5x0.5_AVHRR_simyr1850-2010_c130401.nc'
stream_year_first_popdens = 1850
stream_year_last_popdens = 2010
/
&light_streams
lightngmapalgo = 'bilinear'
stream_fldfilename_lightng = '/glade/p/cesmdata/cseg/inputdata/atm/dtm7/NASA_LIS/clmforc.Li_2012_climo1995-2011.T62.Infm_c130327.nc'
stream_year_first_lightng = 0001
stream_year_last_lightng = 0001
/
&clm_hydrology1_inparm
/
&clm_soilhydrology_inparm
/
&ch4par_in
fin_use_fsat = .true.
/
```



Exercise C detailed steps

1) In /CaseDocs from Exercises A and/or B look at Ind_in (clm's namelist) for lists of input files to be read by the clm

Go to the directories containing these input files and view the data with ncview, ncdump, or other appropriate method
Discuss. Notice the pft-physiology file because you will use it in step 2.

2) Create a case like the one in Exercise A but with a different case name (could use ./create_newcase OR ./create_clone commands)

Make a copy of the pft-physiology file in the case directory and modify a parameter in the pft-physiology file

```
ncdump pft-physiology-file.nc | more      # to see the contents; a leaf reflectance (e.g., rholvis) may be a good parameter to change
chmod u+w pft-physiology-file.nc        # if you need to change file permission from read-only to read-write
```

Use nco, ncl, matlab, idl, fortran, ncdump/ngen, etc. to modify the pft-physiology file
E.g. modify and save the following ncl script to filename.ncl and type ncl filename.ncl:

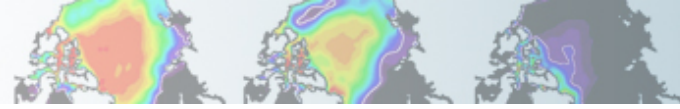
```
begin
a = addfile("/$casedir/pft-physiology-file.nc","w")      # in this line modify the path and the filename as needed
arr = a->varname                                         # variable name in pft-physiology file; assuming variable is one-dimensional
arr(1) = 0.8d                                           # NCL is 0-based, so this modifies the 2nd entry to 0.8 in double precision
a->varname = arr                                         # writes variable back to file with new value(s)
end
```

3) Set up the case, change the clm namelist to point to the new pft-physiology file and to write daily output, then build and run

Compare history output against that generated in (A). The ncdiff command may help you see differences between the two history files more easily: ncdiff <case2>.clm2.h0.0001-01-01-00000.nc <case1>.clm2.h0.0001-01-01-00000.nc Case2minusCase1.nc
Do you see differences? E.g. in the variable FSR?

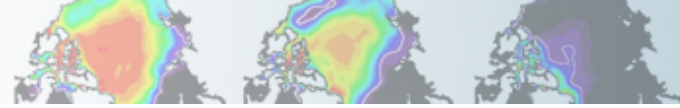
4) In /CaseDocs look at files such as datm.streams.txt.*.Precip for the list of input files to be read by the datm

Go to the directories containing these files and view the data with ncview ...Discuss



Don't forget:

ALWAYS look for answers in the CLM User's Guide FIRST!



D. BGC slides and coupled model BGC exercise

by Keith Lindsay