NCAR

Customizing the CAM output: the built-namelist utility

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CAM run script

In the CAM run script :
`/blhome/$logname/tutorial/run_test01.csh`

Building and running CAM takes place in four steps:

- Configure
- Build model
- Build the namelist
- Execute model

How to modify the namelist
to customize the CAM output files

Model namelists

The build-namelist utility builds the namelists which specify run-time options for the CAM.

These namelist files are needed to execute cam. They are in the run directory:

`/ptmp/$logname/test01`

- `atm_in`
- `drv_in`
- `ice_in`
- `lnd_in`
- `ocn_in`

Example of namelist variables

In: `/ptmp/$logname/test01/atm_in`

```
&phys_ctl_nl
 deep_scheme           = 'ZM'
 eddy_scheme           = 'HB'
 microp_scheme          = 'RK'
 shallow_scheme         = 'Hack'
 srf_flux_avg          = 0
/
&solar_inparm
 solar_const           = 1361.27
/
&cam_inparm
 absems_data           = '/fs/cgd/csm/inputdata/atm/cam/rad/abs_ems_factors_fastvx.c030508.nc'
 bnd_topo              = '/fs/cgd/csm/inputdata/atm/cam/topo/USGS-gtopo30_4x5_remap_c050520.nc'
 ch4vmr         = 1760.0e-9
 co2vmr         = 367.0e-6
 dtime          = 1800
 f11vmr         = 653.45e-12
 f12vmr         = 535.0e-12
 fft_flt              = 1
 n2ovmr         = 316.0e-9
 ncdata         = '/fs/cgd/csm/inputdata/atm/cam/inic/fv/cami_0001-01-01_4x5_L26_c060608.nc'
 npr_yz         = 8,2,2,8
 prescribed_aero_datapath              = '/fs/cgd/csm/inputdata/atm/cam/chem/trop_mozart_aero/aero'
 prescribed_aero_file          = 'aero_1.9x2.5_L26_2000clim_c090420.nc'
 prescribed_aero_specifier             = 'sulf:SO4', 'bcar1:CB1', 'bcar2:CB2', 'ocar1:OC1', 'ocar2:OC2', 'sslt1:SSLT01', 'sslt2:SSLT02',
  'sslt3:SSLT03', 'sslt4:SSLT04', 'dust1:DST01', 'dust2:DST02', 'dust3:DST03', 'dust4:DST04'
 prescribed_aero_type          = 'CYCLICAL'
 prescribed_aero_ymd           = 20000101
 prescribed_ozone_datapath             = '/fs/cgd/csm/inputdata/atm/cam/ozone'
 prescribed_ozone_file         = 'ozone_1.9x2.5_L26_2000clim_c090420.nc'
 prescribed_ozone_name          = 'O3'
 prescribed_ozone_type         = 'CYCLICAL'
 prescribed_ozone_ymd          = 20000101
/
```

Syntax is important:

Use: “/” and “&”

Don’t use comments:

```
#  co2vmr   = 367.0e-6
```

NB: In this example, we only show a few variables. See atm_in for the complete list

Modify namelists in the CAM script

In the CAM script: `/blhome/$logname/tutorial/run_test01.csh`

```
## --- Build the namelist
echo "Building the namelist in $blddir"
cd $blddir                    || echo "cd $blddir failed" && exit 1

# Add some options to the namelist by creating a small file called namelist_options
# with the options we want:
cat <<EOF >! namelist_options
&camexp
   stop_n          = 12,
   stop_option       = 'nmonths',
   npr_yz          = 8,2,2,8,
/
EOF

## Build the namelists
## using the build-namelist tool, some command-line options and our options file
$cfgdir/build-namelist -s \
   -case $case \
   -runtype $runtype \
   -infile namelist_options \
   || echo "build-namelist failed" && exit 1
```

This is where we are going to modify the namelist

Info about build-namelist and namelist variables

Two places to look:

1. On the web

http://www.ccsm.ucar.edu/models/atm-cam/docs/usersguide/

- Chapter 2: Description of the build-namelist utility
- Appendix B: complete list of CAM namelist variables

2. In the model code:

$camroot/models/atm/cam/bld/namelist_files

- namelist_definition.xml: definition of all the namelist variables
- namelist_defaults_cam.xml: default values for the namelist variables

namelist_definition.xml

Each namelist variable is defined in an <entry> element.

- id: The variable's name.
- type: integer, logical, real or char*n
- category: assigned for organizing the documentation.
- group: the namelist group that the variable is declared in.
- valid_values: for variables that have only a number of allowed values.

Example:

```
<entry id="co2vmr" type="real"  catagory="ghg_cam”
group="cam_inparm" valid_values="" >
CO2 volume mixing ratio.  This is used as the time invariant
surface value of CO2 if no time varying values are specified.
Default: 3.550e-4
</entry>
```

namelist_defaults_cam.xml

The default values for the namelist variables are set in:
namelist_defaults_cam.xml:

For instance the values of the GHG for 2000 are set to:

```
<!-- GHG values for 2000 -->
<co2vmr>367.0e-6</co2vmr>
<ch4vmr>1760.0e-9</ch4vmr>
<n2ovmr>316.0e-9</n2ovmr>
<f11vmr>653.45e-12</f11vmr>
<f12vmr>535.0e-12</f12vmr>
```

How to change the CAM history file

There are zillions of options.

Here we will cover:

- How to change the output frequency
- How to output extra history files
- How to output extra variables
- How to output a set of columns
- How to use run with observed SSTs instead of climatological SSTs

Change the output frequency

The default history file from CAM is a monthly average. We can change the output frequency with the namelist variable **nhtfrq**:

For instance to change the history file from monthly average to daily average, we set the namelist variable:

```
nhtfrq = -24
```

If NHTFRQ=0, the file will be a monthly average
If NHTFRQ >0, frequency is input as number of timesteps.
If NHTFRQ <0, frequency is input as number of hours.

To control the number of timestep in the history file, we can use the variable **mfilt.** For instance, to specify that we want one time sample on each history file, we set the namelist variable:

```
mfilt = 1
```

Create several history files

You can output up to 6 history files: “h0”, “h1”, …, “h5”.
The file “h0” contains the default variables (in the code: “call add_default”), this includes the variables necessary for the AMWG package.
For the files “h1” to “h5”, the user has to specify the variables to output.

We can use the namelist variables **fincl1**, .., **fincl6** to control the list of fields in the history files **h0** **h5**

- The added fields must be in Master Field List (= fields that can be written to the history files). See the Master Field List in the user’s guide Chap 3.

- Using a ":" following a field gives the averaging flag for the output field. Valid flags are: I for instantaneous, A for average, M for minimum, and X for maximum.

Create several history files

For instance, on the top of the monthly history file “h0”, if we want to output a file “h1” with instantaneous values of T, Q, U, V and OMEGA every 3 hour, we can use:

```
fincl2    = 'T:I','Q:I','U:I','V:I’,‘OMEGA:I’
nhtfrq    = 0, -3
```

Notice that it is equivalent to:

```
fincl2     = 'T:I','Q:I','U:I','V:I’, ‘OMEGA:I’
nhtfrq(1) = 0
nhtfrq(2) = -3
```

NB: If you plan to run the AMWG diagnostic package, it is recommended to leave the “h0” file untouched and to add extra history files.

Use observed SSTs instead of climatological SSTs

In the previous, we forced CAM with climatological SSTs:

```
bndtvs      = '/fs/cgd/csm/inputdata/atm/cam/sst/
      sst_HadOIBl_bc_4x5_clim_c061031.nc'
sstcyc = .true.
```

If we want to force CAM with observed SSTs (AMIP run), we can use the namelist variables:

```
bndtvs      = '/fs/cgd/csm/inputdata/atm/cam/sst/
sst_HadOIBl_bc_4x5_1949_2005_c061031.nc'
sstcyc = .false.
stream_year_first    = 1949
stream_year_last     = 2005
start_ymd            = 20000101
ncdata  = '/fs/cgd/csm/inputdata/atm/cam/inic/fv/
cami_0001-01-01_4x5_L26_c060608.nc'
```

Exercices (1)

• test01: control run

• test02: Output 1 month of daily averages. Write one history file for every day of the month.

• test 03: On the top of the monthly history file “h0”, output:
 - one “h1” file with instantaneous values of T, Q, U and V every 3 hour.
 - one “h2” file with time-average values of T, Q, U and V every 24 hour.
Write one h1 file for every day of the month and write a single h2.

• test04: 2-year run with observed SSTS starting on Jan 01, 1999.

• test05: output a h1 history with your favorite set of variables over the storm track area. (hint: use FINCL1LONLAT, FINCL2LONLAT, …)

Exercices (2)

• test06: change the greenhouse gases from present day to pre-industrial values. The GHG volume mixing ratio for 1850 are:
CO2 : 284.7e-6
CH4: 791.6e-9
N2O: 275.68e-9
F11: 12.48e-12
F12: 0.0

Some recommendations

For each case, keep a copy of your script (and of your user source modifications if applicable).

For instance, for test02:

rename the CAM script:
`/blhome/$logname/tutorial/run_test02.csh`

in the script, change the case name:
```
set case = test02
```

when you run the script, it automatically creates a user mods directory:
`/blhome/$logname/tutorial/mods_test02`

by default your rundir directory (with your namelists, executable and history files, etc) will be in:
`/ptmp/$logname/test02`

For reference

As an example, I did the exercises above.

My scripts are in:

```
/blhome/hannay/tutorial
```

My run directories are:

```
/ptmp/hannay/test01
/ptmp/hannay/test02
/ptmp/hannay/test03
/ptmp/hannay/test04
/ptmp/hannay/test05
/ptmp/hannay/test06
```