CESM Exoplanet Build

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**Building on the Hyak cluster at the University of Washington.** Familiarity with checking out, building, and running CESM is assumed. Analogously this describes how to build and run the model on a user-defined machine. Please refer to the publicly available CESM user’s guide for more detail. Users of other systems must be aware to change the relevant ccsm\_utils files, paths to data in the namelists, and paths to the new radiative transfer data currently hardcoded within several new SourceMods files.

1. Checkout model version cesm1.2.1 onto your machine
2. Download and place the tar file, *ExoCAM\_cesm1.2.1.tar*, found at the <https://wiki.ucar.edu/display/etcam/Extraterrestrial+CAM>, onto your machine.
3. Locate the input data. For Hyak users, data are located in folder /gscratch/vsm/wolfet/exofiles. For users of other systems, new initial files are included in the tar file.
4. Place the following new system files as follows …

../cesm1\_2\_1/scripts/ccsm\_utils/Machines/mkbatch.hyak

../cesm1\_2\_1/scripts/ccsm\_utils/Machines/env\_mach\_specific.hyak

../cesm1\_2\_1/scripts/ccsm\_utils/Machines/config\_compilers.xml

../cesm1\_2\_1/scripts/ccsm\_utils/Machines/config\_machines.xml

../cesm1\_2\_1/scripts/ccsm\_utils/Case.template/config\_compsets.xml

1. Create a new folder in scratch to place your cesm cases
2. Create a new case.

create\_newcase –case /gscratch/vsm/wolfet/cases/mynewcase –res f45\_f45 –mach hyak –compset E2000C4AQI

In this example, I place all my cases in /gscratch/vsm/wolfet/cases, horizontal resolution is 4ºx5º finite volume dynamical core, and component set with aquaplanet and sea ice included. This is our “standard” configuration.

1. Place new SourceMods files into $CASEROOT/SourceMods/..
2. Place new namelist files into $CASEROOT
3. Issue command…

xmlchange CAM\_CONFIG\_OPTS="-usr\_src $PWD/SourceMods/src.cam/radtrans\_n42\_h2o -phys cam4 -nlev 40"

This sets the physics to CAM4, the number of levels to 40, and selects radiative transfer with 42 spectral intervals H2O only. (Other option is for 28 bins, H2O, CO2, CH4, *radtrans\_n28\_highco2*).

1. Make appropriate changes to env\_mach\_pes.xml for processor counts.
2. Make any additional changes to SourceMods files or namelist files as desired
3. Within $CASEROOT directory, issue command *cesm\_setup* to setup the model.
4. Within $CASEROOT directory, issue comment *$CASE.build* to build the model.
5. Within $CASEROOT directory, issue command *$CASE.run* to run the model.
6. For building subsequent cases that require only simple changes to parameters, I recommend using the *create\_clone* function.

“Supported” modifications to your simulations.

SourceMods/src.share/exoplanet\_mod.F90

SourceMods/src.share/shr\_const\_mod.F90

These files contain the bulk physical constants for interest for changing the planetary properties. In general, the primary control for constants of interest have been migrated into exoplanet\_mod.F90. These parameters are described in the code.

Important for our current project, note…

do\_exo\_synchronous 🡪 switch for synchronous rotation, always .true.

exo\_ndays 🡪 length of day in Earth days

exo\_scon 🡪 solar constant in Wm-2

exo\_solar\_file 🡪 solar spectral input file

Other notes:

Changing the atmospheric constituents and thus the dry pressure of the atmosphere requires one to also create an accompanying new initial conditions file, at the new pressure.

Changing gravity and planetary radius are presently reside in shr\_const\_mod.F90.

Notes for Hyak users: Setting the run length and time

Hyak wishes us to use the 12 core processors. See settings in mkbatch.hyak.

On 72 cores (6 nodes) --- ~9.3 simulated years/day, ~185 pe-hrs/simulated\_year

On 48 cores (4 nodes) --- ~6.7 simulated years/day, ~172 pe-hrs/simulated\_year

\*note these value are prone to small variations.

In general, simulations need ~30 to 45 years to reach equilibrium. I run the simulations in 15 year chunks.

xmlchange STOP\_N=15

xmlchange STOP\_OPTION=nyears

xmlchange REST\_N=1

xmlchange REST\_OPTION=nyears

To continue the run

xmlchange CONTINUE\_RUN=TRUE

and then simply submit the run again as usual.

Note, initial files for the exobuild are found under my hyak/vpl directories

/gscratch/vsm/wolfet/exofiles

/gscratch/vsm/wolfet/cesm\_inputdata

Other users should have, at minimum, read only access to these directories and data files. Let me know if there is a problem.