FV3GFS Workflow How-To

How to clone, build, set up and run the FV3GFS with Rocoto

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Document information - v3.0

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Version 3.0 changes (December 12th, 2017):

- Add information and instructions for forecast-only experiments.
- Small textual fixes.

Version 2.0 changes (December 5th, 2017):

- Updated “Important pages and documentation”. Added point-of-contact information for sub-modules.
- Updated to use fv3gfs git master instead of merge-update branch.
- Updated access and clone instructions.
- New supported resolution initial condition information.
- Removed “--machine” from setup_expt.py instructions. No longer needed in command.
- Updated sample screenshot of Rocoto viewer.

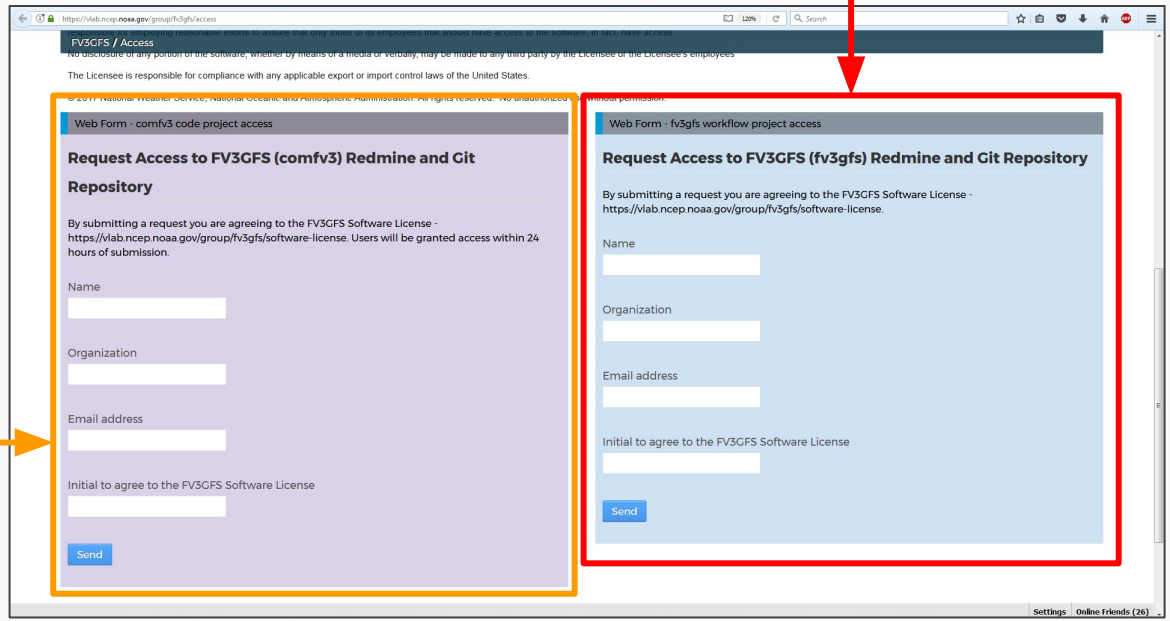
Important pages and documentation

- FV3GFS home on VLab: https://vlab.ncep.noaa.gov/group/fv3gfs
  - How-to wiki in FV3GFS community: https://vlab.ncep.noaa.gov/group/fv3gfs/run-the-fv3gfs
- FV3GFS code Redmine page:
  - https://vlab.ncep.noaa.gov/redmine/projects/comfv3
- FV3GFS workflow & super-structure Redmine page:
  - https://vlab.ncep.noaa.gov/redmine/projects/fv3gfs
- FV3GFS sub-module Redmine pages:
  - NEMSfv3gfs (POC: Sam Trahan): https://vlab.ncep.noaa.gov/redmine/projects/nemsfv3gfs
  - Comfv3 (POC: Jun Wang): https://vlab.ncep.noaa.gov/redmine/projects/comfv3
  - GSI (POC: Mark Potts): https://vlab.ncep.noaa.gov/redmine/projects/comgsi
- CROW VLab community (see what the CROW team is working on):
  - https://vlab.ncep.noaa.gov/group/crow
- Workflow documentation (from FV3GFS)
  - http://www.emc.ncep.noaa.gov/gc_wmb/tmcguinness/fv3gfs/html

Gain access to ‘fv3gfs’ project on VLDS - needed to clone fv3gfs git repository

- Visit FV3GFS VLab community ‘Access’ page and submit form on right for fv3gfs project access: https://vlab.ncep.noaa.gov/group/fv3gfs/access

- If you haven’t requested access to the fv3gfs sub-module projects yet (NEMSfv3gfs, comfv3, and GSI) do so now as well. They are needed to checkout FV3 and GSI codes within the workflow:
  - NEMSfv3gfs: Sam Trahan
  - comfv3: Jun Wang
  - GSI POC: Mark Potts



How to set up and run the FV3GFS w/ Rocoto

1. Clone workflow
2. Build system
3. Set up run
4. Start run
5. Monitor run
6. Additional instructions and utilities

Clone & Checkout Branch

Prior to cloning make sure your gerrit access is set up.

> git clone ssh://$USER@vlab.ncep.noaa.gov:29418/fv3gfs ← $USER = first.last
> cd fv3gfs
> git branch ← not required, command will show what you have checked out
* master ← by default you now have the master only

You now have a cloned copy of the fv3gfs git repository, which currently includes a copy of the master.

To checkout a branch or tag in your clone:

> git checkout BRANCH_NAME

The “checkout” command will checkout BRANCH_NAME and switch your clone to that branch. Example:

> git checkout merge-update ← checkout merge-update branch into clone
> git branch
* merge-update ← now your clone is the merge-update branch
  master

Build global_shared codes

> cd global_shared.v15.0.0/sorc
> sh checkout.sh
> sh build_all.sh cray[theia]

You now have compiled copies of system executables in the global_shared.v15.0.0/exec folder.

SURGE-slogin2 > ls ../exec/

filter_topo	global_chgres_GSM	ml01rg2.x	radmon_bcoef	syndat_getjtbul
fregrid	global_cycle	nemsio_cvt	radmon_bcor	syndat_maksynrc
fregrid_parallel	make_hgrid	nemsio_get	radmon_time	syndat_qctropcy
fv3nc2nemsio.x	make_hgrid_parallel	nemsio_read	regrid_nemsio	tave.x
gettrk	make_solo_mosaic	nst_mask_namchg	relocate_mv_nvortex	vint.x
global_chgres	mkgfsnemsioctl	radmon_angle	supvit	

The codes housed in the gdas.v15.0.0 and gfs.v15.0.0 sorc folders are not currently being used and aren't required to be built. However, they can be built with their respective build_all.sh scripts.

FV3GFS initial conditions

Cycled experiments:

- Initial conditions currently set up for use on WCOSS_C and Theia:
  - C384 deterministic & C192 ensemble *(default supported settings)*
    - idates: 2015113000, 2016100100, 2017073118
  - C192 deterministic & C96 ensemble (available for 2017073118 only)

- Paths (--icsdir):
  - Theia: /scratch4/NCEPDEV/global/noscrub/glopara/ICS
  - WCOSS_C: /gpfs/hps3/emc/global/noscrub/emc.glopara/ICS

Forecast-only experiments:

- Place pre-prepared ICs in folders with following format: $ICSDIR/$CDATE/gfs/C$RES/INPUT
- Set ICSDIR in config.base prior to running setup_workflow_fcstonly.py. Learn about setup scripts in following slides.

Set up experiment - part 1a - cycled experiment

Run setup_expt.py script to create EXPDIR and COMROT:

> cd gfs_workflow.v15.0.0/ush

> ./setup_expt.py --pslot $PSLOT --configdir $CONFIGDIR --idate $IDATE --edate $EDATE --icsdir $ICSDIR --comrot $COMROT --expdir $EXPDIR

- $PSLOT is the name of your experiment
- $CONFIGDIR is the path to the /config folder under the copy of the system you're using (i.e. ../gfs_workflow.v15.0.0/config/)
- $IDATE is the initial start date of your run (first cycle CDATE, YYYYMMDDCC)
- $EDATE is the ending date of your run (YYYYMMDDCC) and is the last cycle that will complete
- $ICSDIR is the path to the ICs for your run. See prior slide for paths.
- $COMROT is the path to your experiment output directory. *DO NOT include PSLOT folder at end of path*, it'll be built for you.
- $EXPDIR is the path to your experiment directory where your configs will be placed and where you will find your workflow monitoring files (i.e. rocoto database and xml file). *DO NOT include PSLOT folder at end of path*, it will be built for you.

See later slide for forecast-only experiment setup information and examples.

Set up experiment - part 1a - cycled experiment

Example setup_expt.py on WCOSS_C:

SURGE-slogin1 > ./setup_expt.py --pslot fv3demo --configdir
/gpfs/hps3/emc/global/noscrub/Kate.Howard/git/fv3gfs/gfs_workflow.v15.0.0/config --idate 2017073118
--edate 2017080106 --icsdir /gpfs/hps3/emc/global/noscrub/emc.glopara/ICS --comrot /gpfs/hps2/ptmp/Kate.Howard
--expdir /gpfs/hps3/emc/global/noscrub/Kate.Howard/para_gfs

SDATE = 2017-07-31 18:00:00
EDATE = 2017-08-01 06:00:00

EDITED: /gpfs/hps3/emc/global/noscrub/Kate.Howard/para_gfs/fv3demo/config.base as per user input.
DEFAULT: /gpfs/hps3/emc/global/noscrub/Kate.Howard/para_gfs/fv3demo/config.base.default is for reference only.
Please verify and delete the default file before proceeding.

SURGE-slogin1 >

Set up experiment - part 1a - cycled experiment

What happens if I run setup_expt.py again for an experiment that already exists:

SURGE-slogin1 > ./setup_expt.py --pslot fv3demo --configdir /gpfs/hps3/emc/global/noscrub/Kate.Howard/git/fv3gfs/gfs_workflow.v15.0.0/config --idate 2017073118 --edate 2017080106 --icsdir /gpfs/hps3/emc/global/noscrub/emc.glopara/ICS --comrot /gpfs/hps2/ptmp/Kate.Howard --expdir /gpfs/hps3/emc/global/noscrub/Kate.Howard/para_gfs

COMROT already exists in /gpfs/hps2/ptmp/Kate.Howard/fv3demo

Do you wish to over-write COMROT [y/N]: y

EXPDIR already exists in /gpfs/hps3/emc/global/noscrub/Kate.Howard/para_gfs/fv3demo

Do you wish to over-write EXPDIR [y/N]: y

SDATE = 2017-07-31 18:00:00
EDATE = 2017-08-01 06:00:00

EDITED: /gpfs/hps3/emc/global/noscrub/Kate.Howard/para_gfs/fv3demo/config.base as per user input.
DEFAULT: /gpfs/hps3/emc/global/noscrub/Kate.Howard/para_gfs/fv3demo/config.base.default is for reference only.
Please verify and delete the default file before proceeding.

Your COMROT and EXPDIR will be deleted and remade. Be careful with this!

Set up experiment - part 1b - forecast-only experiment

Run setup_expt_fcstonly.py script to create EXPDIR and COMROT:

> cd gfs_workflow.v15.0.0/ush

> ./setup_expt_fcstonly.py --pslot $PSLOT --configdir $CONFIGDIR --idate $IDATE --edate $EDATE --res $RES --gfs_cyc $GFS_CYC --comrot $COMROT --expdir $EXPDIR

- $PSLOT is the name of your experiment
- $CONFIGDIR is the path to the /config folder under the copy of the system you're using (i.e. ../gfs_workflow.v15.0.0/config/)
- $IDATE is the initial start date of your run (first cycle CDATE, YYYYMMDDCC)
- $EDATE is the ending date of your run (YYYYMMDDCC) and is the last cycle that will complete
- $RES is the resolution of the forecast (i.e. 768 for C768)
- $GFS_CYC is the forecast frequency (0 = none, 1 = 00z only [default], 2 = 00z & 12z, 4 = all cycles)
- $COMROT is the path to your experiment output directory. *DO NOT include PSLOT folder at end of path*, it'll be built for you.
- $EXPDIR is the path to your experiment directory where your configs will be placed and where you will find your workflow monitoring files (i.e. rocoto database and xml file). *DO NOT include PSLOT folder at end of path*, it will be built for you.

Set up experiment - part 2 - check and adjust base settings before proceeding

- Review the contents of your EXPDIR, you should have configs within it now.
- Open config.base in EXPDIR and adjust as needed (i.e. change EDATE to run a shorter/longer experiment). Definitely double check ACCOUNT, HPSS_PROJECT, HOMEDIR, STMP, PTMP, NOSCRUB, MYBASE_SVN variables.

  > vi $EXPDIR/$PSLOT/config.base

  If running forecast-only experiment change ICSDIR to your the location of your prepared ICs. See slide 8 for more details on preparing ICSDIR.
- Review the contents of your COMROT, you should have initial file folders setup with symlinks to initial conditions. More on this in next slide...

Set up experiment - part 2 - state of COMROT after running setup_expt.py

After running setup_expt.py your COMROT will be setup with initial conditions. The COMROT folder is divided into CDUMP.date folders and then further divided by cycle within. The workflow is currently setup to start a half cycle with the first jobs being gdas fcst and gdas efmn (EnKF forecast job).

```
SURGE-slogin1 > pwd
/gpfs/hps2/ptmp/Kate.Howard/fv3demo

SURGE-slogin2 > ls -l
total 0
drwxr-xr-x 3 Kate.Howard g01 512 Dec  5 17:37 enkf.gdas.20170731
drwxr-xr-x 3 Kate.Howard g01 512 Dec  5 17:37 gdas.20170731

SURGE-slogin2 > ls -l gdas.20170731/18/
total 0
lrwxrwxrwx 1 Kate.Howard g01 75 Dec  5 17:37 INPUT -> /gpfs/hps3/emc/global/noscrub/emc.glopara/ICS/2017073118/C384/control/INPUT
lrwxrwxrwx 1 Kate.Howard g01 72 Dec  5 17:37 gdas.t18z.abias -> /gpfs/hps3/emc/global/noscrub/emc.glopara/ICS/2017073118/gdas.t18z.abias
lrwxrwxrwx 1 Kate.Howard g01 76 Dec  5 17:37 gdas.t18z.abias_air -> /gpfs/hps3/emc/global/noscrub/emc.glopara/ICS/2017073118/gdas.t18z.abias_air
lrwxrwxrwx 1 Kate.Howard g01 75 Dec  5 17:37 gdas.t18z.abias_pc -> /gpfs/hps3/emc/global/noscrub/emc.glopara/ICS/2017073118/gdas.t18z.abias_pc
lrwxrwxrwx 1 Kate.Howard g01 74 Dec  5 17:37 gdas.t18z.radstat -> /gpfs/hps3/emc/global/noscrub/emc.glopara/ICS/2017073118/gdas.t18z.radstat
```

Set up experiment - part 3

Run workflow setup script from gfs_workflow.v15.0.0/fv3gfs/ush folder:

Cycled experiment:

> ./setup_workflow.py --expdir $EXPDIR/$PSLOT/

Forecast-only experiment:

> ./setup_workflow_fcstonly.py --expdir $EXPDIR/$PSLOT/

```
SURGE-slogin1 > ./setup_workflow.py --expdir /gpfs/hps3/emc/global/noscrub/Kate.Howard/para_gfs/fv3demo
sourcing config.prep
sourcing config.anal
sourcing config.fcst
...
sourcing config.epos
sourcing config.earc
```

Set up experiment - part 3

- You will now have a rocoto xml jobcard in your EXPDIR ($PSLOT.xml)

```
SURGE-slogin1 > pwd
/gpfs/hps3/emc/global/noscrub/Kate.Howard/para_gfs/fv3demo
SURGE-slogin1 > ls
config.anal   config.base.default  config.efcs  config.eupd  config.fv3ic  config.prep       config.vrfy
config.arch   config.earc          config.eobs  config.fcst  config.getic  config.prepbufr   fv3demo.crontab
config.base   config.ecen          config.epos  config.fv3   config.post   config.resources  fv3demo.xml
```

- You now also have a crontab file generated for you based on your experiment setup. More on this in a later slide...

Start the run

- Make sure the rocoto module is loaded: module load rocoto
- Start your run from within your EXPDIR:

  > rocotorun -d $PSLOT.db -w $PSLOT.xml

- The first jobs of the run should now be queued and starting (depending on machine traffic). How exciting!

- You'll now have a "logs" folder in both your COMROT and EXPDIR. More on this in next slides...

Log folders and files

- There is now a ‘log’ folder in both your EXPDIR and COMROT folders.
- The EXPDIR log folder contains workflow log files:

```
SURGE-slogin1 > pwd
/gpfs/hps3/emc/global/noscrub/Kate.Howard/para_gfs/fv3demo
SURGE-slogin2 > ls -l logs/
total 128
-rw-r--r-- 1 Kate.Howard global 536 Dec  5 17:43 2017073118.log
```

- The COMROT log folder contains log files for each job of the run (previously known as dayfiles). See next slide for more...

Log folders and files

COMROT log files are divided into folders for each cycle:

```
SURGE-slogin1 > pwd
/gpfs/hps2/ptmp/Kate.Howard/fv3demo

SURGE-slogin2 > ls -l logs/
total 0
drwxr-xr-x 2 Kate.Howard g01 512 Dec  5 17:43 2017073118

SURGE-slogin2 > ls -l logs/2017073118/
total 12288
-rw-r--r-- 1 Kate.Howard g01 338032 Dec  5 17:45 gdasefcs01.log
-rw-r--r-- 1 Kate.Howard g01 338043 Dec  5 17:45 gdasefcs02.log
-rw-r--r-- 1 Kate.Howard g01 388420 Dec  5 17:45 gdasfcst.log
```

Setup experiment cron job

After running setup_workflow.py you should also have a generated crontab file in your EXPDIR.

Set this crontab:

> **> crontab $PSLOT.crontab**

Warning, this will overwrite your existing crontab on your login node. You can alternatively open the crontab file and copy the actual cron command to add to your existing crontab file.

Check it was set correctly:

> **> crontab -l**

Optional: Setup symlink to viewer utility for ease of use

- Within your EXPDIR set up a symbolic link to the viewer:

  > ln -s $BASE_SUPER/gfs_workflow.v15.0.0/fv3gfs/ush/rocoto_viewer.py rocoto_viewer.py

  ...where $BASE_SUPER is the top of the copy of the fv3gfs clone you are using.

- You'll now have a linked copy of rocoto_viewer.py in your EXPDIR.

- Alternatively you could place a copy in your ~/bin folder for use anywhere on the machine. It's up to you!

Monitor experiment using viewer

- Issue the following command while in EXPDIR*:

  > ./rocoto_viewer.py -d $PSLOT.db -w $PSLOT.xml

- Viewer will yell at you if the window is not wide enough to display all of the experiment information columns.

* Note: the viewer requires the full path to the database and xml files if you are not in your EXPDIR when you invoke it. Similarly, the generated crontab file includes that full paths for the rocotorun command, as well as the experiment database and xml files.

The Rocoto Viewer - crash course

Cycle in first column:

YYYYMMDDCCmm

YYYY=year, MM=month, DD=day
CC=cycle, mm=minute

Task in second column:

< = group/meta-task indicator
Click "**x**" while selecting group task to expand/collapse

States:
QUEUED, RUNNING,
SUCCEEDED, FAILED, DEAD

Example screenshot of the viewer during the first half cycle shortly after the gdasfcst job completed. The gdasefmn metatask is expanded ("x" key) to show the two gdasefcs## subtasks.

Viewer accepts mouse and keyboard inputs. Click "h" for help menu and more options.

c = get information on selected job
r = rewind (rerun) selected job
R = run rocotorun

-> = right arrow key, advance viewer forward to next cycle
<- = left arrow key, advance viewer backward to previous cycle
Q = quit/exit viewer

The Rocoto Viewer - Advanced features

- Select multiple tasks at once (i.e. for rewinding)
  - Click “Enter” on a task to select it, click on other tasks or use the up/down arrows to move to other tasks and click “Enter” to select them as well.
  - When you next choose “r” for rewinding the pop-up window will now ask if you are sure you want to rewind all those selected tasks.
- <r> - Rewind entire group or cycle
  - Group - While group/metatask is collapsed (<) click “r” to rewind whole group/metatask.
  - Cycle - Use up arrow to move selector up past the first task until the entire left column is highlighted. Click “r” and the entire cycle will be rewound.
- <b> - Boot
  - rocotoboot command, will force task to run, ignores dependencies.
  - Click “b” while selecting a task or tasks. Choose “Y” similar to rewind prompt and selected tasks will be booted.
  - Use only if absolutely necessary!

Contents of COMROT and file naming convention

Example COMROT folders after a 2.5 cycle run:

SURGE-slogin2 > ls
enkf.gdas.20170731 enkf.gdas.20170801 gdas.20170731 gdas.20170801 gfs.20170801 logs vrfyarch

COMROT structure:

- The COMROT is no longer one flat folder holding everything (hooray!). It is now more similar to how NCO structures their /com folder in production.
- It is broken down by CDUMP (gdas, gfs, enkf.gdas), date (YYYYMMDD), and cycle (CC) directories.
- Log files (formerly known as dayfiles) are now held in a separate ‘logs’ folder at top of COMROT.
- Files for verification and archival are now held in a separate ‘vrfyarch’ folder at top of COMROT.

File naming convention:

- A production-like naming convention is now being employed ($CDUMP.t$CCz.$FILETYPE).
- The parallel naming convention ($FILETYPE.$CDUMP.$CDATE) is being retired to meet EE2 standards.
- All utilities scripts (i.e. chgres) will use the prod-like naming convention so you will need to rename prior parallel output).

Contents of COMROT (gdas.20170731/18)

```
SURGE-slogin2 > ls -l gdas.20170731/18/
total 7361928
lrwxrwxrwx 1 Kate.Howard g01        75 Dec  5 17:37 INPUT ->
/gpfs/hps3/emc/global/noscrub/emc.glopara/ICS/2017073118/C384/control/INPUT
drwxr-xr-x 2 Kate.Howard g01      4096 Dec  5 17:47 RESTART
lrwxrwxrwx 1 Kate.Howard g01        72 Dec  5 17:37 gdas.t18z.abias ->
/gpfs/hps3/emc/global/noscrub/emc.glopara/ICS/2017073118/gdas.t18z.abias
lrwxrwxrwx 1 Kate.Howard g01        76 Dec  5 17:37 gdas.t18z.abias_air ->
/gpfs/hps3/emc/global/noscrub/emc.glopara/ICS/2017073118/gdas.t18z.abias_air
lrwxrwxrwx 1 Kate.Howard g01        75 Dec  5 17:37 gdas.t18z.abias_pc ->
/gpfs/hps3/emc/global/noscrub/emc.glopara/ICS/2017073118/gdas.t18z.abias_pc
-rw-r--r-- 1 Kate.Howard g01 608722964 Dec  5 17:44 gdas.t18z.atmf000.nemsio
-rw-r--r-- 1 Kate.Howard g01 608722964 Dec  5 17:45 gdas.t18z.atmf003.nemsio
-rw-r--r-- 1 Kate.Howard g01 608722964 Dec  5 17:45 gdas.t18z.atmf006.nemsio
-rw-r--r-- 1 Kate.Howard g01 608722964 Dec  5 17:46 gdas.t18z.atmf009.nemsio
-rw-r--r-- 1 Kate.Howard g01 181244765 Dec  5 17:49 gdas.t18z.pgrb2.0p25.f000
-rw-r--r-- 1 Kate.Howard g01     16214 Dec  5 17:49 gdas.t18z.pgrb2.0p25.f000.idx
-rw-r--r-- 1 Kate.Howard g01 227262085 Dec  5 17:51 gdas.t18z.pgrb2.0p25.f003
-rw-r--r-- 1 Kate.Howard g01     24672 Dec  5 17:51 gdas.t18z.pgrb2.0p25.f003.idx
-rw-r--r-- 1 Kate.Howard g01 230895899 Dec  5 17:53 gdas.t18z.pgrb2.0p25.f006
-rw-r--r-- 1 Kate.Howard g01     24673 Dec  5 17:53 gdas.t18z.pgrb2.0p25.f006.idx
-rw-r--r-- 1 Kate.Howard g01 232746569 Dec  5 17:54 gdas.t18z.pgrb2.0p25.f009
-rw-r--r-- 1 Kate.Howard g01     24677 Dec  5 17:54 gdas.t18z.pgrb2.0p25.f009.idx
-rw-r--r-- 1 Kate.Howard g01  58158730 Dec  5 17:49 gdas.t18z.pgrb2.0p50.f000
-rw-r--r-- 1 Kate.Howard g01     16010 Dec  5 17:49 gdas.t18z.pgrb2.0p50.f000.idx
-rw-r--r-- 1 Kate.Howard g01  72429410 Dec  5 17:51 gdas.t18z.pgrb2.0p50.f003
-rw-r--r-- 1 Kate.Howard g01     24374 Dec  5 17:51 gdas.t18z.pgrb2.0p50.f003.idx
-rw-r--r-- 1 Kate.Howard g01  73510837 Dec  5 17:53 gdas.t18z.pgrb2.0p50.f006
-rw-r--r-- 1 Kate.Howard g01     24375 Dec  5 17:53 gdas.t18z.pgrb2.0p50.f006.idx
-rw-r--r-- 1 Kate.Howard g01  73999248 Dec  5 17:54 gdas.t18z.pgrb2.0p50.f009
-rw-r--r-- 1 Kate.Howard g01     24378 Dec  5 17:54 gdas.t18z.pgrb2.0p50.f009.idx
-rw-r--r-- 1 Kate.Howard g01  18208653 Dec  5 17:49 gdas.t18z.pgrb2.1p00.f000
-rw-r--r-- 1 Kate.Howard g01     15868 Dec  5 17:49 gdas.t18z.pgrb2.1p00.f000.idx
-rw-r--r-- 1 Kate.Howard g01  22431753 Dec  5 17:51 gdas.t18z.pgrb2.1p00.f003
-rw-r--r-- 1 Kate.Howard g01     24230 Dec  5 17:51 gdas.t18z.pgrb2.1p00.f003.idx
-rw-r--r-- 1 Kate.Howard g01  22706872 Dec  5 17:53 gdas.t18z.pgrb2.1p00.f006
-rw-r--r-- 1 Kate.Howard g01     24232 Dec  5 17:53 gdas.t18z.pgrb2.1p00.f006.idx
-rw-r--r-- 1 Kate.Howard g01  22824981 Dec  5 17:54 gdas.t18z.pgrb2.1p00.f009
-rw-r--r-- 1 Kate.Howard g01     24233 Dec  5 17:54 gdas.t18z.pgrb2.1p00.f009.idx
-rw-r--r-- 1 Kate.Howard g01  34032854 Dec  5 17:49 gdas.t18z.pgrbf00
-rw-r--r-- 1 Kate.Howard g01  40667146 Dec  5 17:51 gdas.t18z.pgrbf03
-rw-r--r-- 1 Kate.Howard g01  40652330 Dec  5 17:53 gdas.t18z.pgrbf06
-rw-r--r-- 1 Kate.Howard g01  40815788 Dec  5 17:54 gdas.t18z.pgrbf09
-rw-r--r-- 1 Kate.Howard g01 547623484 Dec  5 17:49 gdas.t18z.pgrbq00
-rw-r--r-- 1 Kate.Howard g01 655353800 Dec  5 17:51 gdas.t18z.pgrbq03
-rw-r--r-- 1 Kate.Howard g01 655955746 Dec  5 17:53 gdas.t18z.pgrbq06
-rw-r--r-- 1 Kate.Howard g01 657337304 Dec  5 17:54 gdas.t18z.pgrbq09
lrwxrwxrwx 1 Kate.Howard g01        74 Dec  5 17:37 gdas.t18z.radstat ->
/gpfs/hps3/emc/global/noscrub/emc.glopara/ICS/2017073118/gdas.t18z.radstat
-rw-r--r-- 1 Kate.Howard g01 138027404 Dec  5 17:44 gdas.t18z.sfcf000.nemsio
-rw-r--r-- 1 Kate.Howard g01 138027404 Dec  5 17:45 gdas.t18z.sfcf003.nemsio
-rw-r--r-- 1 Kate.Howard g01 138027404 Dec  5 17:45 gdas.t18z.sfcf006.nemsio
-rw-r--r-- 1 Kate.Howard g01 138027404 Dec  5 17:46 gdas.t18z.sfcf009.nemsio
-rw-r--r-- 1 Kate.Howard g01  14502858 Dec  5 17:48 gdas.t18z.sfluxgrbf000.grib2
-rw-r--r-- 1 Kate.Howard g01      6150 Dec  5 17:48 gdas.t18z.sfluxgrbf000.grib2.idx
-rw-r--r-- 1 Kate.Howard g01  15273279 Dec  5 17:50 gdas.t18z.sfluxgrbf003.grib2
-rw-r--r-- 1 Kate.Howard g01      6796 Dec  5 17:50 gdas.t18z.sfluxgrbf003.grib2.idx
-rw-r--r-- 1 Kate.Howard g01  15862633 Dec  5 17:52 gdas.t18z.sfluxgrbf006.grib2
-rw-r--r-- 1 Kate.Howard g01      6801 Dec  5 17:52 gdas.t18z.sfluxgrbf006.grib2.idx
-rw-r--r-- 1 Kate.Howard g01  15763687 Dec  5 17:53 gdas.t18z.sfluxgrbf009.grib2
-rw-r--r-- 1 Kate.Howard g01      6801 Dec  5 17:53 gdas.t18z.sfluxgrbf009.grib2.idx
-rw-r--r-- 1 Kate.Howard g01 130253958 Dec  5 17:48 pgrbm000.gdas.2017073118.grib2
-rw-r--r-- 1 Kate.Howard g01    153328 Dec  5 17:48 pgrbm000.gdas.2017073118.grib2.idx
-rw-r--r-- 1 Kate.Howard g01 146767789 Dec  5 17:50 pgrbm003.gdas.2017073118.grib2
-rw-r--r-- 1 Kate.Howard g01    171890 Dec  5 17:50 pgrbm003.gdas.2017073118.grib2.idx
-rw-r--r-- 1 Kate.Howard g01 148899436 Dec  5 17:51 pgrbm006.gdas.2017073118.grib2
-rw-r--r-- 1 Kate.Howard g01    171946 Dec  5 17:51 pgrbm006.gdas.2017073118.grib2.idx
-rw-r--r-- 1 Kate.Howard g01 149467229 Dec  5 17:53 pgrbm009.gdas.2017073118.grib2
-rw-r--r-- 1 Kate.Howard g01    171918 Dec  5 17:53 pgrbm009.gdas.2017073118.grib2.idx
```

Build workflow documentation using doxygen

Within the gfs_workflow.v15.0.0/fv3gfs/docs folder:

> ./compile

You will now have new folders called “html” and “latex”:

```
SURGE-slogin2 > ls -l
total 408
-rwxr-xr-x 1 Kate.Howard global    641 Aug 21 15:26 compile
-rw-r--r-- 1 Kate.Howard global 102968 Aug 21 15:26 doxyfile
drwxr-sr-x 3 Kate.Howard global   8192 Sep 19 18:15 html
drwxr-sr-x 2 Kate.Howard global   4096 Sep 19 18:15 latex
-rw-r--r-- 1 Kate.Howard global   8155 Aug 21 15:26 mainpage.h
```