



Developing a Unified Workflow for Convection Allowing Applications of the FV3

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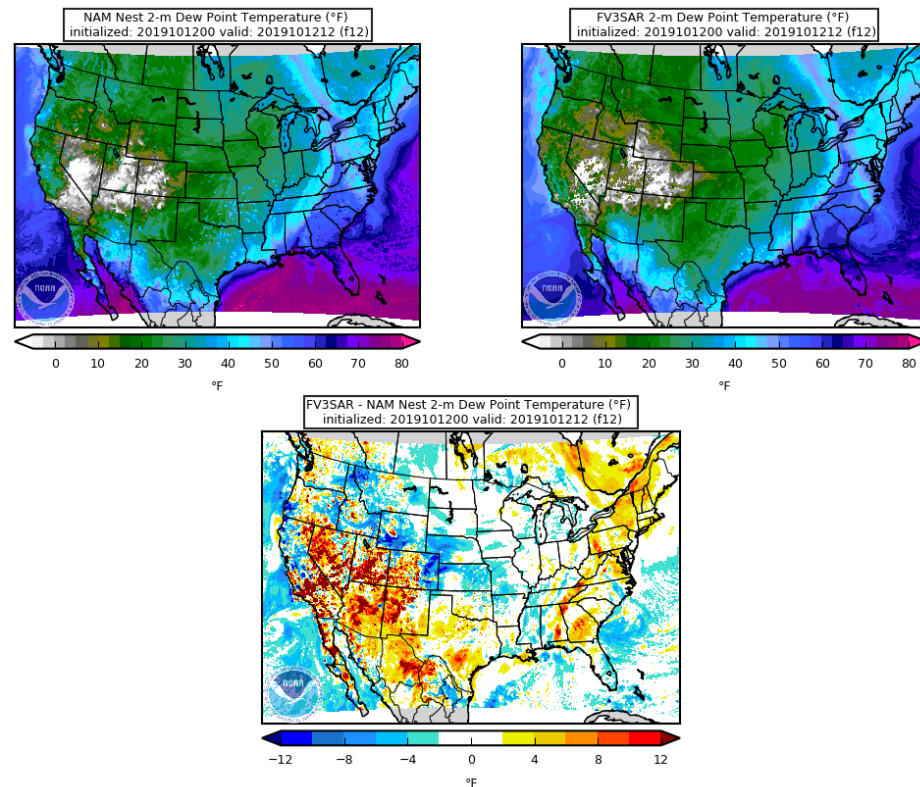
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⁸NCAR/DTC

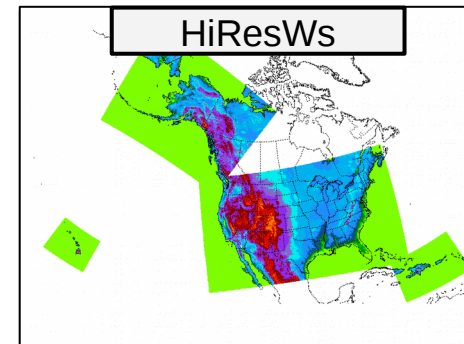
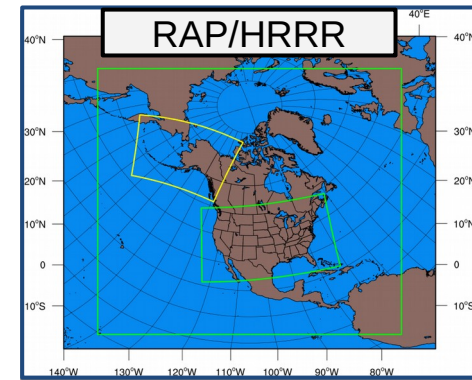
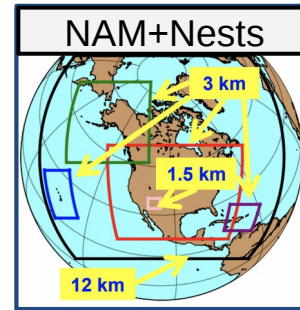
Outline

- Research and Operational NWP under the Unified Forecast System
- Why is a unified workflow desirable?
- How?
- Ongoing work and future plans



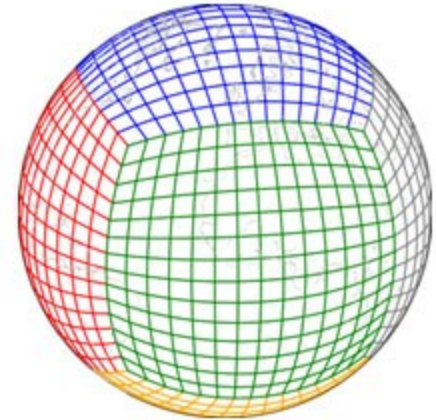
Current Status of Convection-Allowing Models

- Cover CONUS + OCONUS in a large variety of capacities
 - NAM + Nests
 - HRRR CONUS and Alaska
 - HiRes Windows
- There is a need/desire to consolidate the NCEP production suite
- The Finite Volume Cubed Sphere (FV3) dynamical core was chosen for the Unified Forecast System (UFS)



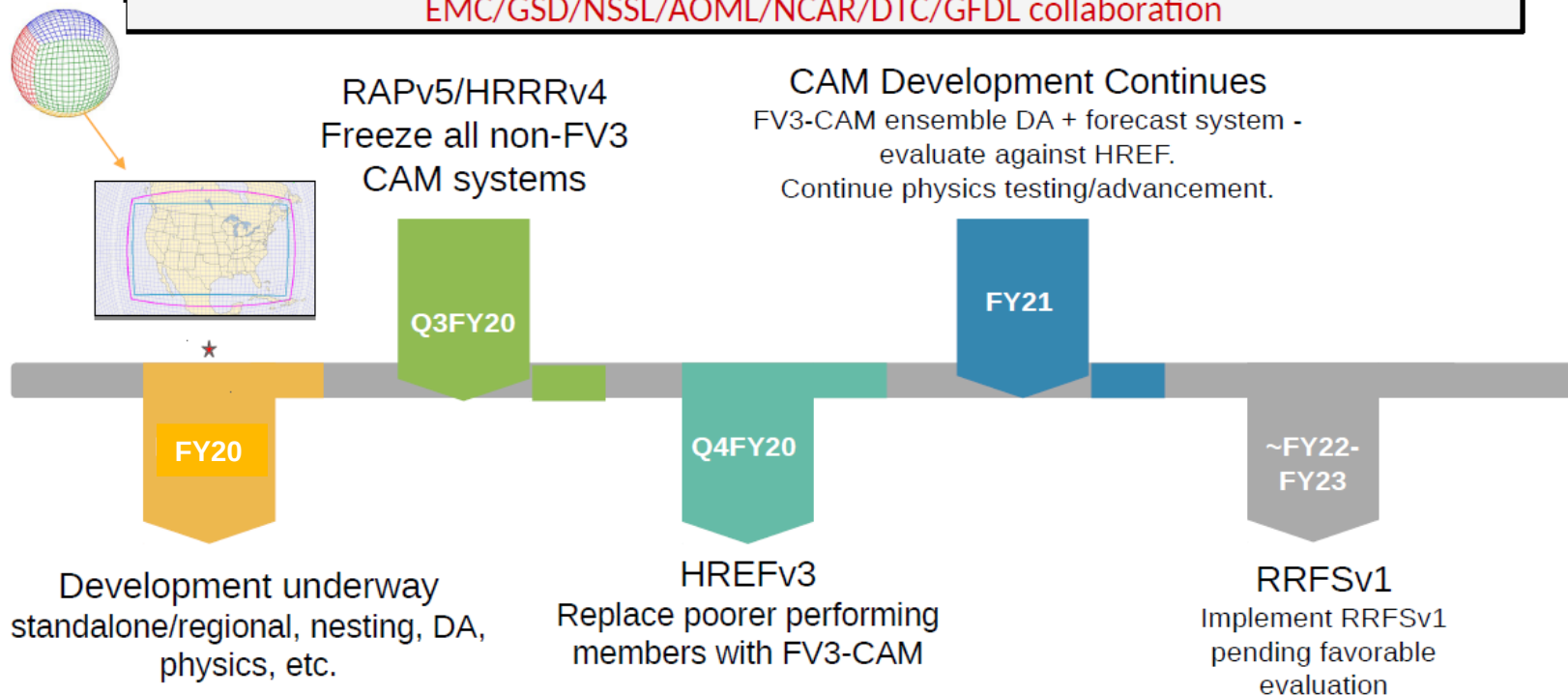
Limited Area FV3 model

- EMC has developed a limited area modeling capability for the UFS using the FV3 dynamical core
 - Convection-allowing model (CAM) running routinely at 3-km resolution over CONUS, AK, HI, PR, Guam
- Limited area FV3 will form the basis of the Rapid Refresh Forecast System (RRFS)
 - Convection-allowing, ensemble-based data assimilation and prediction system
 - Single-core (FV3-based)
 - Will feature at least an hourly update cadence



FV3-CAM Timeline → RRFS

Rapid Refresh Forecast System → To replace HREF, SREF, RAP, HRRR, NAM + nests, HiResWs
EMC/GSD/NSSL/AOML/NCAR/DTC/GFDL collaboration





Origin of Regional FV3 Workflows

- Two workflows for running the limited area FV3
- Operations-compliant workflow
 - Developed by EMC
 - Based on current operational systems, adheres to operational implementation standards
- Research workflow
 - Developed by research community (GSD, DTC, NSSL)
 - Flexible/innovative/intuitive
- Operational and research workflows are similar... but also different
- Goal is to merge the two workflows → unified workflow

Why merge the workflows?

Research Workflows

Custom script
Run what you need
Straightforward
Everyone has their own

Operational Workflows

Script 1 → Script 2 → Script 3
Error checking and reporting
Resilient
Complex dependencies
Strict standards

Innovation!



Operations?



Process involves
considerable effort in re-
engineering/implementing

Why merge the workflows?

- NOAA and the research community work on different machines
 - WCOSS, Hera, Jet, Cheyenne, Odin, university clusters



- Development systems don't have all the utilities/files of the operational system
- But operational environments are often more strict
- R&D is always ongoing, and merging the workflows gives users the option to run in an operational framework
- Merging Ops and R&D workflows leads to more straightforward collaboration across developers and enables transition of innovations to operations

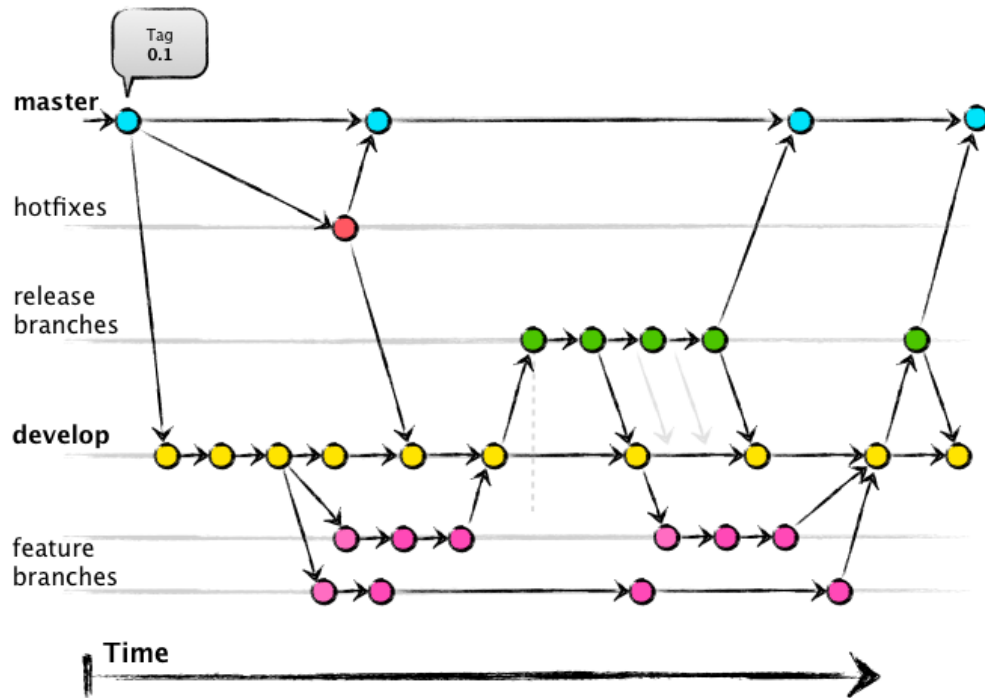


About the Workflows

- The regional_workflow repository is on GitHub:
- https://github.com/NOAA-EMC/regional_workflow
- Branch names adhere to Gitflow
 - **develop branch: operational workflow**
 - **community_develop branch: research workflow**
- Operational and research workflows both utilize the **Rocoto workflow manager**
- High frequency of commits vs. low frequency of commits
- Some jobs are unique to one workflow, while others are shared between both
 - User can create their own computational domain in the research workflow

Gitflow

- Branch names adhere to Gitflow
 - **develop branch: operational workflow**
 - **community_develop branch: research workflow**
- Development occurs in feature branches, changes are then merged back to develop branch
- Release branches are created off the develop branch, and are eventually merged with the master branch (ops)



[Code](#) [Issues 20](#) [Pull requests 1](#) [Projects 0](#) [Wiki](#) [Security](#) [Insights](#)

No description, website, or topics provided.

[92 commits](#)[7 branches](#)[2 releases](#)[10 contributors](#)Branch: [develop](#)[New pull request](#)[Find file](#)[Clone or download](#)

BenjaminBlake-NOAA Changes to run with latest NEMSfv3gfs master code (#122) ...		Latest commit 000f0d2 3 days ago
doc/user_guide	Initial commit of the basic files necessary to build a Users Guide (#32)	3 months ago
exec	Feature/buildport (#24)	3 months ago
jobs	Changes to run with latest NEMSfv3gfs master code (#122)	3 days ago
manageExternals	Add manage externals (#28)	3 months ago
modulefiles	Final set of changes for port to Hera (#112)	12 days ago
parm	Changes to run with latest NEMSfv3gfs master code (#122)	3 days ago
rocoto	Changes to support OCONUS domains and chgres cube on WCOSS	9 days ago
scripts	Changes to support OCONUS domains and chgres cube on WCOSS	9 days ago
sorc	Changes to support OCONUS domains and chgres cube on WCOSS	9 days ago
ush	Changes to support OCONUS domains and chgres cube on WCOSS	9 days ago
util/ush	Commit VLab repository	4 months ago
Externals.cfg	Changes to support OCONUS domains and chgres cube on WCOSS	9 days ago
README.md	Merge feature/merge_comm_to_emc into develop (#71)	2 months ago
update_fork.pl	fix commit	3 months ago

Ops Workflow



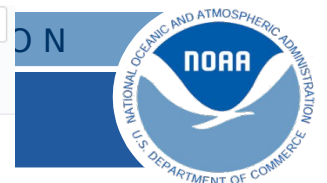
N A

NOAA-EMC / regional_workflow

Watch 16

Star 4

Fork 17



<> Code

Issues 20

Pull requests 1

Projects 0

Wiki

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No description, website, or topics provided.

977 commits

7 branches

2 releases

10 contributors

Branch: community_deve...

View #125

Find file

Clone or download

This branch is 977 commits ahead, 92 commits behind development.

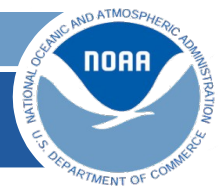
#125 Compare

JeffBeck-NOAA Merge pull request #124 from JeffBeck-NOAA/community_develop

Latest commit 2a9da60 2 days ago

doc	Remove .gitignore file from Latex.	3 months ago
docs/user_guide_sphinx	Change workflow base directory name in docs from fv3sar_workflow to r...	2 months ago
env	Merge branch port2dell back to the master. This branch contains prima...	last year
fix	Split GSD namelist template into two to accomodate RUC LSM soil level...	16 days ago
jobs	Change the way cycle-dependent tasks determine whether the pre-proces...	9 days ago
manageExternals	Add manage_externals to the community_develop branch	2 months ago
modulefiles	Commit to add Hera support	last month
regional	Change path to fix_am on Hera for build_regional	6 days ago
scripts	Merge branch 'community_develop' of https://github.com/NOAA-EMC/regio...	2 days ago
src	Add README.md file with steps to update code, build and run the workf...	last month
tests	Change some workflow global variable names to be uppercase. Not yet t...	11 days ago
ush	Merge pull request #121 from JeffBeck-NOAA/community_develop	3 days ago
Externals.cfg	Point manage_externals to the GitHub version of EMC_post (now working...	17 days ago
README.md	Add line breaks to README.md file	10 days ago
update_fork.pl	Change branch name to community_develop in the update_fork.pl script	3 months ago

R&D
Workflow



Job Sequence

Research Workflow only

1 make_grid_orog

Create grid and orography files for user-specified domain

2 make_sfc_climo

Regrid climatology fields onto the model grid

3 get_input

Retrieve external model data needed to run downstream jobs

Both workflows

4/1 make_ic

Generate initial conditions

5/2 make_bc

Generate boundary conditions

6/3 forecast

Run the full model forecast

7/4 post

Post process the forecast model output

Operational workflow only

5 archive

Archive post processed output

6 cleanup

Scrub working directories and all unneeded files

Merge Process for the Unified Workflow



- FV3 code sprint took place the week of 15-19 July in Boulder, CO
 - Initiated the process of merging the ops and R&D workflows
- The develop branch of the regional_workflow repository was **frozen on 10 October**
- Community_develop branch now has capability to run in an operations-compliant framework
- Capability will be tested on operational HPC in the coming weeks



Conclusion

- Progress is continuing on merging the ops and R&D workflows after the July code sprint
- Unified workflow will be used for running the Rapid Refresh Forecast System
- Scientific + technical challenges remain
 - Must ensure capabilities in one workflow are retained in the unified workflow
 - How to get effective 'good' spread from a single core CAM ensemble?
- Strong collaborative effort between NOAA and non-NOAA agencies
- Longer term plan to run the workflow on the cloud for R&D (not operations) has been approved

Thanks! Questions?

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