

# Deploying Cloud-Based Automated Continuous Integration to Assist in the Community Development of GFDL's Finite Volume Cubed-Sphere Dynamical Core

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## Introduction

Automated testing of contributions made to the GFDL Finite-Volume Cubed Sphere Dynamical Core (FV3) public repository is paramount for ensuring the integrity of the many earth-system models and forecasting applications using FV3 as a dynamical core. We have designed a continuous integration (CI) approach for the FV3 dynamical core GitHub repository.

## Our Process

- Configure the NOAA Parallel Works cloud gateway for communication with GitHub as a self-hosted runner
- Configure a NOAA Parallel Works cloud cluster exclusively for the FV3 CI. We use a Microsoft Azure HPC cluster running an AMD64 architecture containing 96 compute nodes.
- Install a NOAA-GFDL Singularity container on the FV3 CI cluster ensuring that this is stored in a permanent file storage directory.
- Revise existing build and test scripts to work inside of the cloud/container environment.
- Develop an API to communicate with the NOAA Parallel Works cloud gateway. The API will start and shut down the FV3 CI cluster as well as execute checkout, build, and test scripts on the FV3 CI cluster.
- Generate a GitHub workflow YAML file. We specify that the workflow runs on our self-hosted runner for all Pull Requests targeting the main branch and executes the FV3 CI API.



# 1

## COMMUNITY CONTRIBUTIONS

Pull Request is made to the GitHub repository.



# 2

## AUTOMATED CI TESTING TRIGGERS

GitHub runner uses API to launch testing through Parallel Works on the cloud.



# 3

## PULL REQUEST SHOWS RESULTS

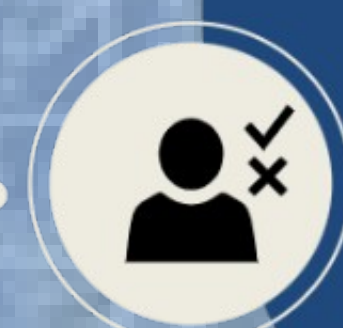
The status of the CI tests is shown on the PR.



# 4

## SUBJECT MATTER EXPERT REVIEW

Reviewer will request changes or approve code.  
If changes are made, the CI tests will re-trigger.



# 5

## CODE IS MERGED

Once approved by the reviewer, a code manager will merge the PR.



## Actions pipeline defined by the workflow YAML file

### Job 1: Checkout

Step 1 start cluster and checkout code

### Job 2: Build

Needs: Checkout

Step 1 shallow-water configuration

Step 2 hydrostatic configuration

Step 3 non-hydrostatic configuration

### Job 3: Test

Needs: Checkout, Build

Step 1 test configuration 1

Step 2 test configuration 2

Step 3 test configuration 3

Step 4 test configuration 4 and beyond

### Job 4: Shutdown

Needs: Checkout, Build, Test  
if: always

Step 1 Shutdown Cluster

## Conclusion

Implementing a continuous integration workflow in the GFDL FV3 Dynamical Core required adapting the existing build and test system for more general use, configuring a cloud computing platform, and using GFDL containers. This has enhanced the code review process and ensures the integrity of the code.