The Coastal Modeling Framework

Code development and infrastructure

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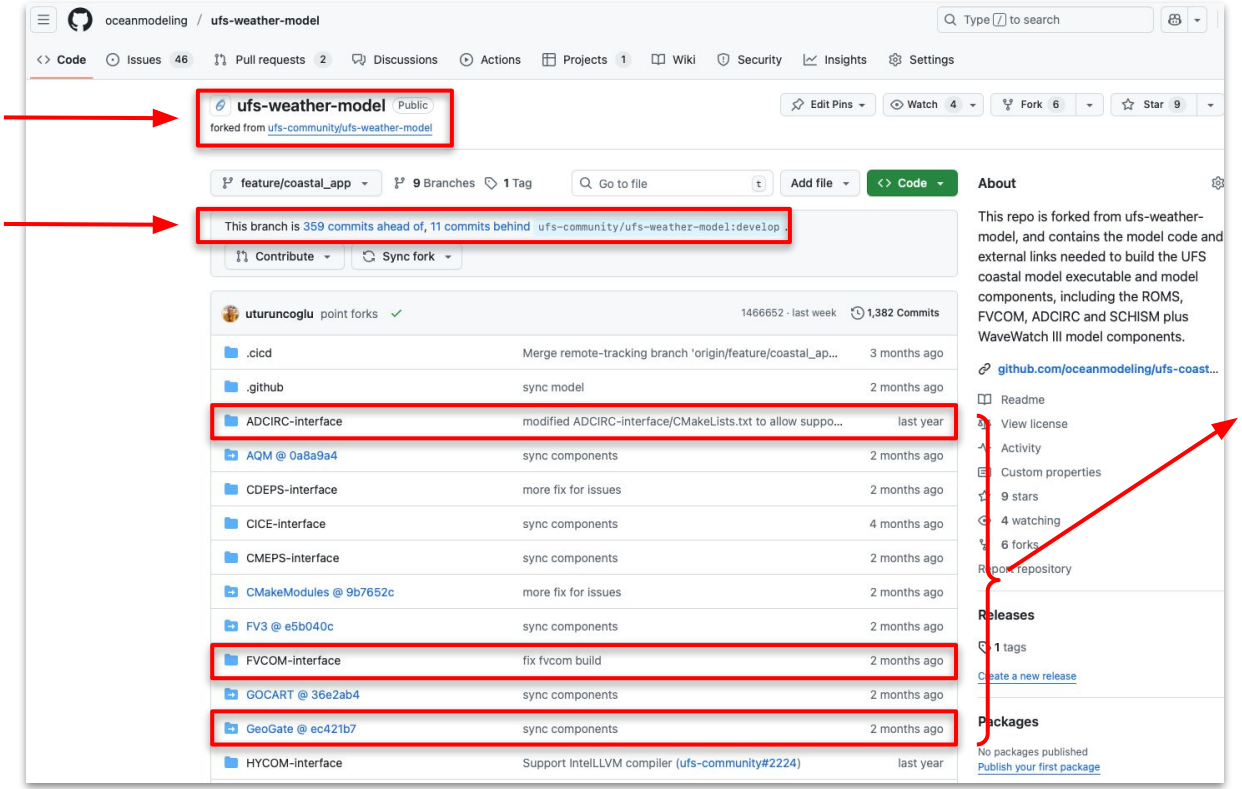
UFS Coastal

It is a fork of UFS WM

There is no any formal schedule but synced with UFS WM head of develop every couple of months



It includes additional components:

ADCIRC
FVCOM
PaHM
ROMS
SCHISM

GeoGate

Slightly modified components:

CMEPS
CDEPS
CICE
WW3

Forks for sub-components (shared with UFS WM)

- CMEPS
  - It includes new coupling mode called as *coastal*. There is a plan to merge it with *ufs* coupling mode once UFS Coastal development is mature enough.
- CDEPS
  - One additional data mode called as *atmmesh* and also minor modification in ERA5 data mode (missing variables are added for CICE coupling)
- WW3
  - It has additional support to build WW3 tools and also running standalone WW3 configurations under UFS Coastal
- CICE6
  - Modification for updating open boundaries for regional coupling (PR #174, CICE fork PR #2)

UFS Coastal RTs

- UFS Coastal inherits RT framework from UFS WM
- Includes additional UFS Coastal specific RTs to test the capability
  - There is at least one DATM coupled test for each new ocean model component
  - + coupled configurations like
    - DATM+SCHISM-WW3
    - DATM-DOCN-CICE and DATM-SCHISM-CICE (will be available soon)
  - The existing RTs are ported from old *CoastalApp*
    - BUT, we are in a transition to move more realistic configurations
      - *Duck NC* case is used for SCHISM coupled configurations (PR #179)
  - Runs in every PR to the UFS Coastal

Main philosophy to maintain UFS Coastal

- Since nothing is pushed to UFS WM level -> ***RULE #1: DO NOT DIVERGE***
  - ***Keep changes very minimal*** in the UFS Coastal (or WM) infrastructure
  - ***RULE #2: CAREFUL TESTING*** if we need to change any component shared with UFW WM - tests need to pass
    - As an example, we tested modifications for new regional CICE configuration with global fully coupled S2S configuration
    - ***RULE #3: ISOLATE CHANGES*** as much as possible and create PR/s in the authoritative repositories if it is possible -> sync fork
  - ***RULE #4: REGULARLY SYNC WITH UFS WM*** authoritative repository
    - It involves fixing issues that are raised in the merge process (i.e. *use_cmeps* flag added to WW3 coupling interface was creating issue in UFS Coastal)

Challenges - Model Level

- **Challenge:** *UFS WM is evolving too fast. Actually it is a good thing for UFS WM*, BUT
  - Nothing is exposed to UFS WM in terms of UFS Coastal development
  - It is hard to test UFS Coastal with every PR that goes into UFS WM. There is no enough bandwidth (human+compute) in UFS Coastal team
- **Possible solutions?**
  - Automated testing capability (GitHub CI/CD, Jenkins)
  - More frequent and regular sync with UFS WM
    - Minimize the issues -> requires more work to fix conflicts/issues
  - Pushing existing development in UFS Coastal to UFS WM
    - This requires commitment from component developers (hard to achieve)
    - + requires decision in management level

Challenges - Component Level

- **Challenge:** *Lack of testing in the component side*
  - The development in the component side is ongoing independently without enough testing with UFS Coastal (i.e. changes that is not backward compatible)
  - The component developers are not following best practices in terms of code development (“cap” and model) -> merge code without testing
  - It leads compile time and/or runtime issues in the UFS Coastal
  - Component developers does not have enough bandwidth to maintain the code
- **Possible solutions?**
  - Providing an easy to use work/testing environment (possible integrated with CI/CD) to component developers to test their model easily with UFS Coastal
    - Able to update component -> run -> report about results

Challenges - External users/collaborators

- **Challenge:** *Request for help to bring new model configurations*
  - Might require experience in multiple model components (incl. coupling layer) and model infrastructure (RTs system etc.)
  - Requires vast amount of time to find the issues and fix them
  - Lack of experience in managing/working on multi-component GitHub repositories
- **Possible solutions?**
  - Tightly engaging with the community by providing training about overall infrastructure (incl. git and RT framework), components and their coupling layers
  - Sharing training videos and make those accessible by the community
  - Existing tests could be used as a reference -> need more diverse and realistic test cases defined under UFS Coastal

Challenges - Application Level

- **Challenge:** *keep components of the application synced + supporting more configs.*
  - It uses UWTools as a workflow manager
  - Issues/changes in the model and/or workflow manager might break the application
  - Lack of regular testing in the application level -> porting is also challenging
- **Possible solutions?**
  - Need to develop robust automated testing capability (GitHub CI/CD, Jenkins) in the application layer too
  - Encourage users to test and use application -> not the model
  - Shared input data and configurations through the cloud -> AWS
  - Document workflow and test cases in a clear and understandable way

Questions?

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You could also create discussion in our GitHub repository for further question/s and collaboration:

https://github.com/oceanmodeling/ufs-weather-model/discussions