

# EPIC GitHub Tutorial (Part 2): Contributing to UFS/EPIC Repositories



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<https://github.com/NOAA-EPIC/training-github>

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# Welcome!

- This is Part 2 of the EPIC GitHub Tutorial on Contributing to UFS/EPIC Repositories
- View Part 1: <https://epic.noaa.gov/tutorials/?playlist=afde205&video=9e65c0d>
- All the materials and tutorial presentations (Part 1 and Part 2) could be found at  
<https://github.com/NOAA-EPIC/training-github>
- Get all the materials and tutorial presentations (Part 1, Part 2):

```
git clone https://github.com/NOAA-EPIC/training-github.git
cd ./training-github
```

- The directory ./training-github/ will contain all of the materials for the tutorial.



# Recap of the Part 1: Git and GitHub Basics

- Basic Git and GitHub terms and concepts introduced
- Basic Git configurations and commands discussed
- Example given on setting up a SSH key pair for GitHub authentication
- A new local repository was created, initialized, pushed to GitHub
- Modifications made, committed, local changes tracked, logs viewed
- A new branch made, different branches compared
- Started topic: public GitHub repositories, forks and clones



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# GitHub Tutorial Part 2: Working with Remote Repositories

- UFS/EPIC Public Repositories, Forks and Clones
- Branches and Tags
- Git Workflow: from Local Spaces to Remote Repos
- Fetching and Merging Remote Branches
- Resolve Merge conflicts
- Making Pull Requests
- GitHub Issues and Discussions



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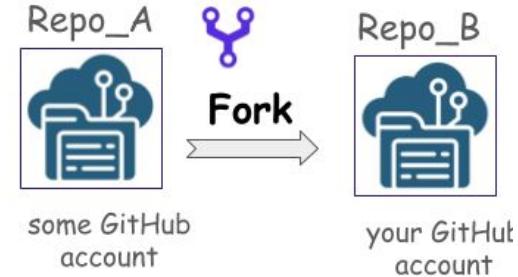
# Common GitHub repositories used by UFS community

- <https://github.com/ufs-community/ufs-weather-model>
- <https://github.com/ufs-community/ufs-srweather-app>
- [https://github.com/ufs-community/land-DA\\_workflow](https://github.com/ufs-community/land-DA_workflow)
- <https://github.com/ufs-community/uwtools>
- [https://github.com/ufs-community/UFS\\_UTILS](https://github.com/ufs-community/UFS_UTILS)
- [https://github.com/ufs-community/ccpp-physics \(forked from NCAR/ccpp-physics\)](https://github.com/ufs-community/ccpp-physics)
- [https://github.com/hafs-community/HAFS \(forked from hafs-communityHAFS\)](https://github.com/hafs-community/HAFS)
- [https://github.com/ufs-community/global-workflow-AR \(NOAA-EMC/global-workflow\)](https://github.com/ufs-community/global-workflow-AR)
- <https://github.com/NOAA-EMC/UPP>
- <https://github.com/noaa-oar-arl/NEXUS>
- <https://github.com/NOAA-EMC/AQM-utils>
- <https://github.com/JCSDA/spack-stack>



# GitHub Repositories: Forks and Clones

- **fork:** a separate copy of another existing repository
  - created in a remote location, e.g., GitHub account
  - could be synced with the primary repository
  - contribute to your fork not affecting the original repo
- **clone:** a linked local copy of an existing repository
  - a repository code is downloaded to your local machine
  - done through the command ‘git clone’
  - references to an original target/remote repository



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# GitHub Repositories: Forks and Clones

This screenshot shows the GitHub fork interface for the `NOAA-EPIC/training-github` repository. The main repository page is visible, showing the README.md file. A red circle highlights the 'Fork' button in the top right corner of the repository card. A red dashed box highlights the 'Create a new fork' link in the 'Existing forks' dropdown menu.

Creating a fork of a repository, e.g., GitHub, creates a copy of the repository for your own use.

This screenshot shows the GitHub repository for `natalie-perlin/training-github`. The repository card indicates it is a fork of `NOAA-EPIC/training-github`, with a red circle highlighting this information. A large blue arrow points from the left screenshot to this forked repository card.

# GitHub Repositories: Forks and Clones

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# GitHub Repositories: Forks and Clones

- **fork:** a separate copy of another existing repository

- **create** [Natalie@MacbookPro:~]\$ git clone https://github.com/NOAA-EPIC/training-github.git  
Cloning into 'training-github'...  
remote: Enumerating objects: 16, done.  
remote: Counting objects: 100% (16/16), done.  
remote: Compressing objects: 100% (13/13), done.  
remote: Total 16 (delta 3), reused 0 (delta 0), pack-reused 0  
Receiving objects: 100% (16/16), 9.95 MiB | 1.52 MiB/s, done.
- **clone** Resolving deltas: 100% (3/3), done.

- **clone:** a copy of a repository
  - **a remote** [Natalie@MacbookPro:~]\$ cd training-github  
[Natalie@MacbookPro:~/training-github]\$ git remote -v  
origin https://github.com/NOAA-EPIC/training-github.git (fetch)  
origin https://github.com/NOAA-EPIC/training-github.git (push)
  - **done** [Natalie@MacbookPro:~/training-github]\$ git branch  
\* main
  - **reference** [Natalie@MacbookPro:~/training-github]\$



# Contributing to an open-source GitHub repository

1. **FORK** the original repository to your GitHub account
2. **CLONE** your repository to a local machine
3. Make changes to your cloned repository
4. **PUSH** them to your GitHub repository: it then will be synced to your changes
5. Create a **PULL REQUEST** (PR) to merge your changes with the original repository: it means making a request to the repository owner and telling them “Please check my changes and merge them if you like it”



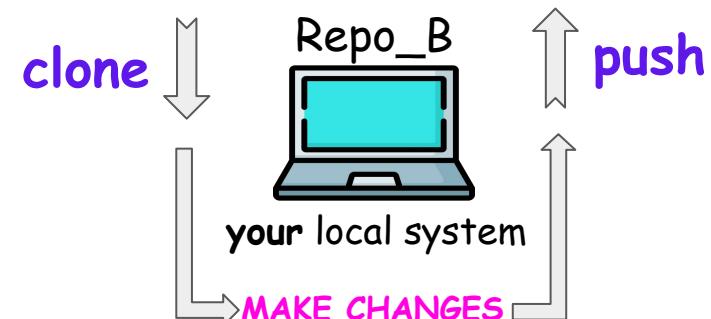
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# Contributing to an open-source GitHub repository



pull request  
←————→  
fork



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# GitHub Repositories: Branches and Tags

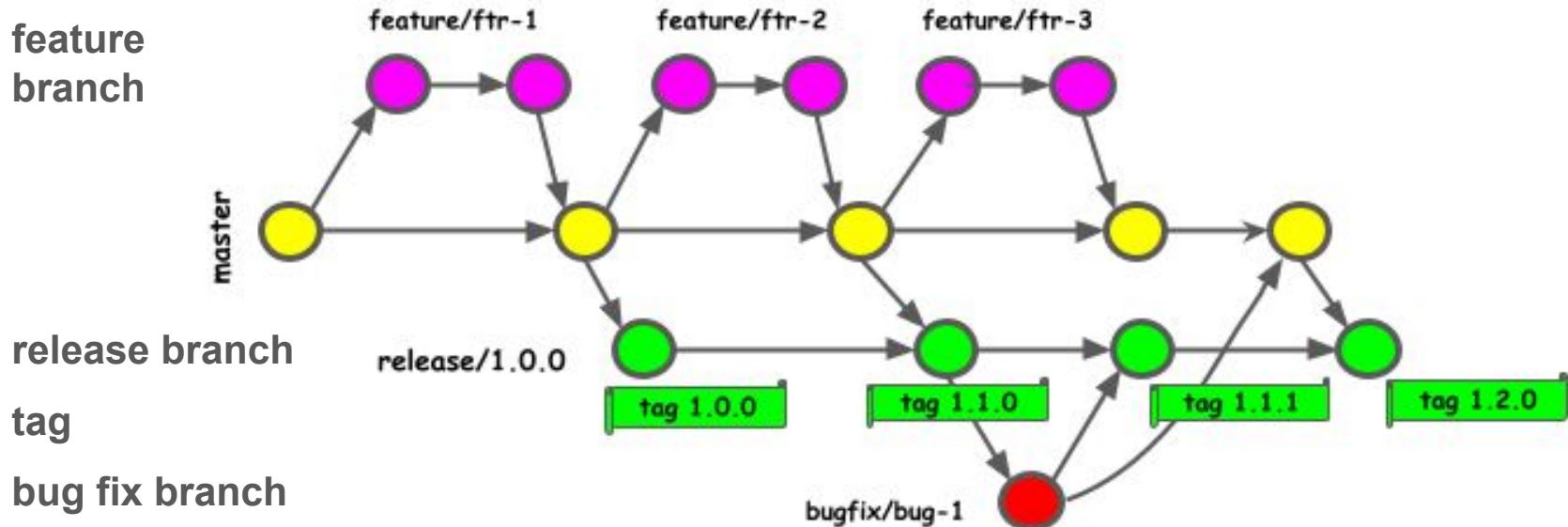
## Branches:

- used for concurrent development, bug fixes, implementation *features*
- can be moved or deleted
- often expected to be merged back into original branch
- *feature branches* could have a long span

## Tags:

- mark specific points in history to capture software versions
- typically used to mark stable points that correspond to specific releases
- *permanent* and don't change after they are created
- used to label a specific *commit*

# GitHub Repositories: Branches and Tags

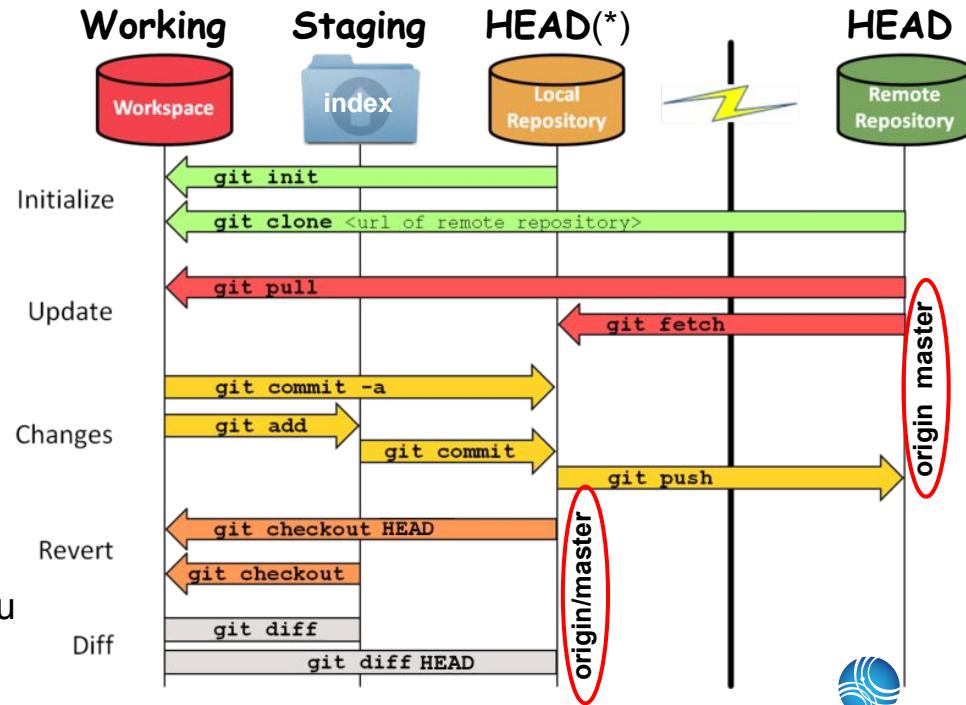


# Git workflow: from local spaces to remote repos

Local Git has **three** stages:

- **Working area** -  
your local directory,  
all untracked, unstaged,  
locally deleted files
- **Staging area:**  
what needs to be committed,  
does not need to be committed,  
any new files to be added/removed
- **Local repository (HEAD\*):**  
committed changes,  
latest checked out version of the  
remote repository

(\*) HEAD - symbolic reference to the branch you  
are working on, or rather, most recent commit



# Git workflow: from local spaces to remote repos

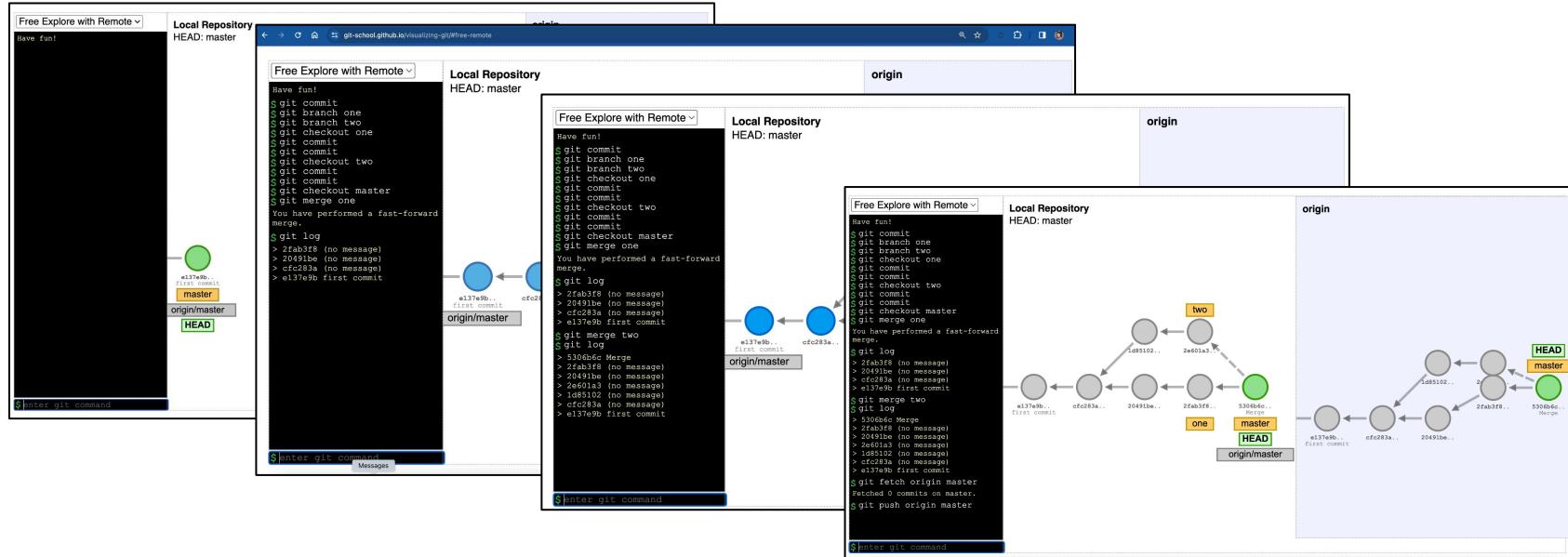
- Use an online workflow visualizer tool: <https://git-school.github.io/visualizing-git>:
  - **case 1:** divergent local branches, merge, update the remote repo
  - **case 2:** divergent local branches, detached HEAD, rebase, merge, bring upstream branch changes, update the remote repo
- Use an existing authoritative repository to test real-case scenarios
  - fetch and merge remote branches, update a fork repository
  - introduce your changes, merge, resolve merge conflicts
  - make a pull request (PR) into the authoritative repository
- Test out a PR, give feedback, make a PR into another developer's code



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# Visualization cases: case 1 (<https://git-school.github.io/visualizing-git>)

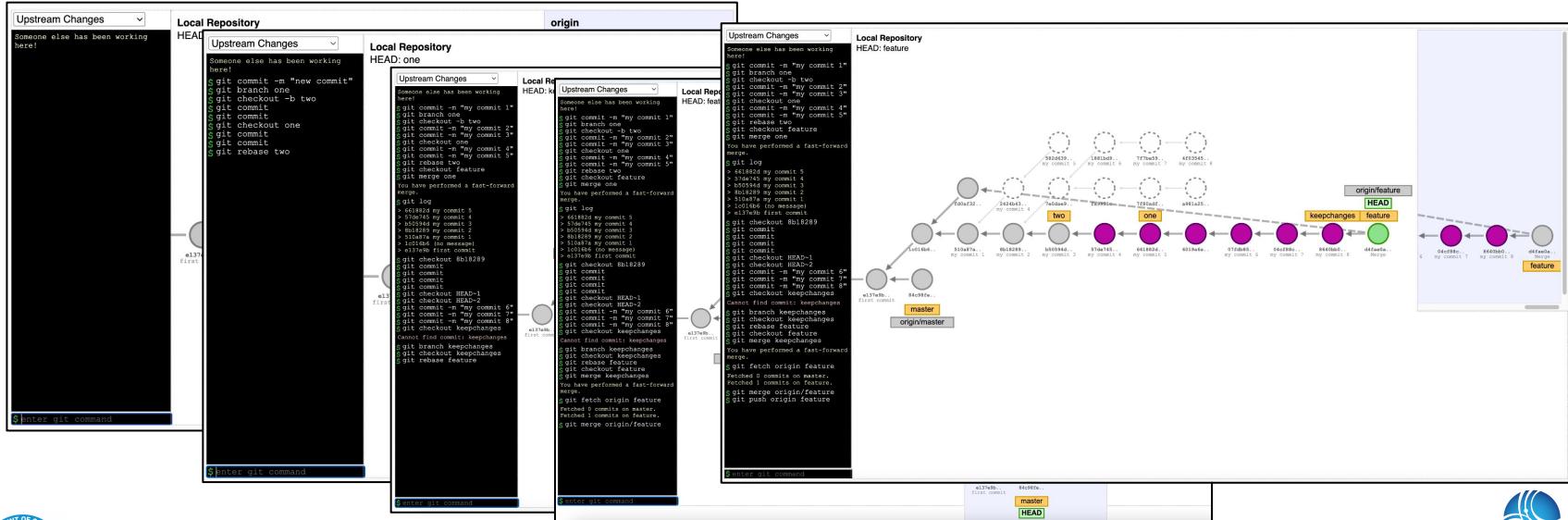
case 1: divergent local branches, merge, update the remote repo



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# Visualization cases: case 2 (<https://git-school.github.io/visualizing-git>)

**case 2:** divergent local branches, rebase, detached HEAD, merge, bring upstream branch changes, update the remote repo



# General steps to contribute to remote repos

1. Create a fork of the authoritative repo in your GitHub account (**dashboard**)
2. Clone the repository into your local machine

```
git clone git@github.com:<your-fork-repo>
```

3. Add an upstream authoritative repository for the reference and updates

```
git remote add upstream <url-of-the-authoritative-repo>
```

4. Checkout your repository's branch to work on: `git checkout master`

5. Fetch any changes from the authoritative repository:

```
git fetch upstream master
```

6. Merge in the changes to the master branch into your working reference

```
git merge upstream/master
```

7. Push your changes back to GitHub: `git push origin master`

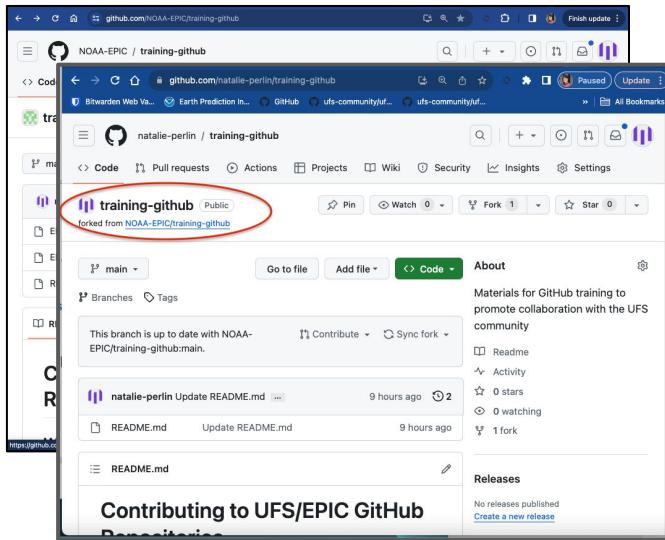
8. Create a pull request (PR) into the authoritative repository (**dashboard**)



# Git workflow example with an existing authoritative repo

An existing repository: <https://github.com/NOAA-EPIC/training-github>

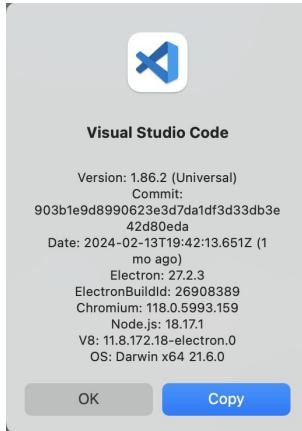
- o fetch and merge remote branches, update a fork repository



```
git clone git@github.com:<repo-fork>
cd <training-github>
git remote add upstream <authoritative-repo>
git remote -v
git checkout master
# make changes, commit them to a master branch
# fetch any updates from the authoritative repository:
git fetch upstream
git merge upstream/master
git log --oneline
git push origin master
```

# Git workflow example with an existing authoritative repo

We could use a GUI code editor,  
such as Visual Studio Code



The screenshot shows a Mac OS X desktop environment. In the foreground, a terminal window is open with the command 'git log' or a similar command, displaying a list of commits from a GitHub repository named 'training-github'. The commits are listed in reverse chronological order, starting with 'Initial commit' and ending with the most recent commit. In the background, a code editor window for Visual Studio Code is visible, showing the same 'README2' file with the same five commits. The code editor's status bar at the bottom shows the path '/Users/natalie/Downloads/training-github' and the current file 'README2'.

```
git log
dc91e01 Initial commit
6851ca Update README.md
27d98dd Update README.md
daaa25d Added GitHub Tutorial Part 1 files, pdf and pptx
4cba347 (origin/master, origin/HEAD, master) Update README.md
d3c850d second commit
175c441 first commit
d5735b5 (two) third commit
eefd59d fourth commit
fb61b36 (one) Merge branch 'two' into one
42b2f4d fifth commit
762ef34 (upstream/master) Create README2
903b1e9d8990623e3d7da1d3d33db3e
42d80eda
Date: 2024-02-13T19:42:13.651Z (1
mo ago)
Electron: 27.2.3
ElectronBuildId: 26908389
Chromium: 118.0.5993.159
Node.js: 18.17.1
V8: 11.8.172.18-electron.0
OS: Darwin x64 21.6.0
```

## Git workflow example 2 with an existing authoritative repo

- An existing authoritative repository: <https://github.com/NOAA-EPIC/training-github>
  - introduce your changes, merge, resolve merge conflicts

```
git clone git@github.com:<repo-fork>
git remote add upstream <authoritative-repo>
git remote -v
git checkout master
git checkout -b feature
# create a file README2, line: # first commit
git add README2
git commit -m "first commit"
git branch one
git checkout -b two
```



## Git workflow example 2 (continued)

- An existing authoritative repository: <https://github.com/NOAA-EPIC/training-github>
  - introduce your changes, merge, resolve merge conflicts

```
git branch  
# Add a line to README2 file: # second commit  
git commit -am "second commit"  
# Add a line to README2 file: # third commit  
git commit -am "third commit"  
git checkout one  
# Add a line to README2 file: # fourth commit  
git commit -am "fourth commit"  
# Add a line to README2 file: # fifth commit  
git commit -am "fifth commit"  
git branch  
git merge two
```

```
# solve merge conflicts using a text editor!!  
git commit -am "merge with two"  
git branch  
git checkout feature  
git merge one  
git log --oneline  
git fetch upstream master  
git merge upstream/master  
git checkout upstream/master  
git commit -am "merge with upstream"  
git push origin feature
```



# Git workflow example: submit a pull request

- An existing authoritative repository: <https://github.com/NOAA-EPIC/training-github>
  - make a pull request (PR) into the authoritative repository (\*)

The screenshot shows the GitHub interface for the repository 'nathalie-perlin / training-github'. The repository is a fork of 'NOAA-EPIC/training-github'. The main page displays recent activity, including a push from 'nathalie-perlin' and several commits from 'EPIC\_GitHub\_Tutorial'. The 'Compare & pull request' button is highlighted with a red circle.

The screenshot shows the 'Open a pull request' dialog box. It allows users to compare changes between two branches. The 'base repository' is set to 'NOAA-EPIC/training-github' and the 'head repository' is set to 'nathalie-perlin/training-github'. The 'compare' dropdown is set to 'feature:feature'. The dialog also includes fields for adding a title, description, reviewers, assignees, labels, and projects.

(\*) - you may need to address any comments, resolve conversations, complete requested changes by PR Reviewers!



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# Local repository: keep it synched with the remote!

- An existing authoritative repository: <https://github.com/NOAA-EPIC/training-github>
- Remember to sync your primary (master) branch with that from the original repo!

The figure consists of three side-by-side screenshots of a GitHub repository interface, illustrating the synchronization process between a local fork and an upstream repository.

- Screenshot 1:** Shows the repository page for "training-github" (forked from NOAA-EPIC/training-github). The "master" branch is selected. A red box highlights the status message: "This branch is 1 commit behind NOAA-EPIC/training-github:master".
- Screenshot 2:** Shows the same repository page after clicking the "Sync fork" button. A red box highlights the status message: "This branch is 1 commit behind NOAA-EPIC/training-github:master". Below the message, a call-to-action button is circled in red: "Update branch".
- Screenshot 3:** Shows the repository page after the synchronization is complete. The status message now reads: "This branch is up to date with NOAA-EPIC/training-github:master". The commit history on the right shows multiple commits from "natalie-perlin" and "EPIC\_GitHub\_Tutorial\_Part2\_Slides".



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## Git workflow example: testing another user's pull request (PR)

```
git clone git@github.com:<user-fork>/ufs-srweather-app.git  
cd ufs-srweather-app  
git remote add upstream git@github.com:ufs-community/ufs-srweather-app.git  
# checkout a specific PR from the upstream branch:  
  
git pull upstream pull/<PR#>/head:PRtest  
git checkout PRtest  
  
# Test the PR, build, run the code  
# Comment on the PR on specific issues, files, or specific lines  
# Make your own pull request into original PR-author's repository to suggesting your own changes
```

[develop] Streamline SRW App's interface to  
MET/METplus #1005

Edit <> Code ▾

Open

gsketefian wants to merge 105 commits into [ufs-community:develop](#) from [gsketefian:feature/metplus\\_conf\\_templates](#) 



# Perusing Public Repositories

- Check out a few different repositories with submodules:

```
git clone --recursive <url-repo>
```

```
git clone --recurse-submodules <url-repo>
```

```
git clone <url-repo>
```

```
cd <repo>
```

```
git submodule update -remote
```

```
git clone --recurse-submodules https://github.com/jcsda/spack-stack.git
```

```
git clone --recursive https://github.com/ufs-community/ufs-weather-model.git
```

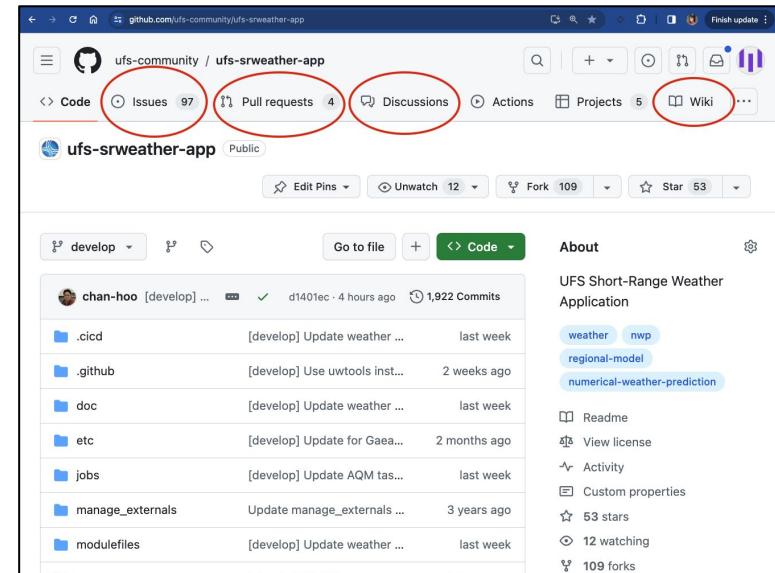


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# Perusing Public Repositories

- Submitting issues - “**Issues**”
- Reaching out for help through discussions - “**Discussions**”
- Checking out and testing existing PRs - “**Pull Requests**”
- Navigating documentation - “**Wiki**”, look for links to **readthedocs.io**, such as  
<https://ufs-weather-model.readthedocs.io/>  
<https://ufs-srweather-app.readthedocs.io/>



# Perusing Public Repositories

The image shows three screenshots of a GitHub repository interface for the `ufs-community / ufs-srweather-app` repository.

- Screenshot 1:** Shows the Issues page with 97 open issues. A search bar at the top has the query `is:issue is:open`. The sidebar on the left lists several issues with titles like `create_symlink_to`, `Users guide needs t`, and `[SRW-AQM] Need to`.
- Screenshot 2:** Shows the Pull requests page with 4 open pull requests. A search bar at the top has the query `is:pr is:open`. The sidebar on the left lists pull requests with titles like `[develop] Port SRW-AQM to C`, `[develop] Feature/cicd metric`, and `[develop] Replace manage_ex`.
- Screenshot 3:** Shows the Discussions page. At the top, there is a red circle around the "New discussion" button. Below it, a post titled "Announcement: UFS Short-Range Weather Application 10/31/2023" is shown. The sidebar on the left lists categories: Announcements, Enhancements, General, and Ideas.

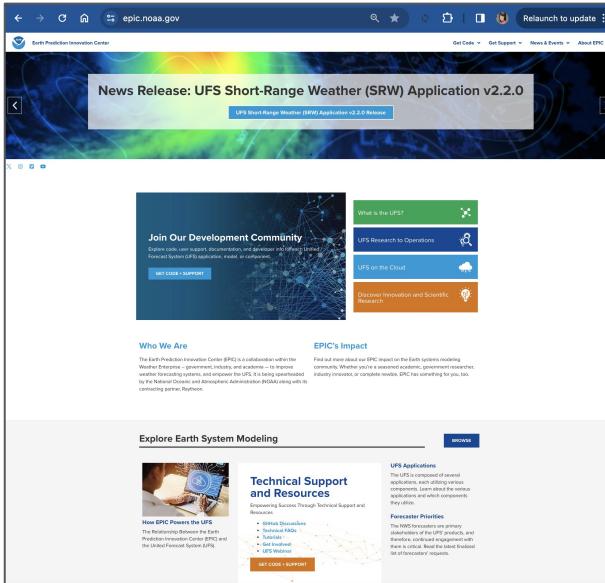
**Right Panel:** A larger screenshot of the repository's main page (Home). It features a prominent "Welcome to the UFS Short-Range Weather (SRW) Application Wiki!" header. Below it, a detailed announcement about the SRW App v2.2.0 release is provided, along with links to the User's Guide and NOAA EPIC website. The sidebar on the right contains sections for Home, Supported Platforms and Compilers, Getting Started, Releases, and Announcements.

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# Happy Modeling and Contributing to UFS!

- <https://epic.noaa.gov/>
- <https://github.com/ufs-community>



A screenshot of the GitHub organization page for "ufs-community" at https://github.com/ufs-community. The page shows several repositories: "ufs-weather-model" (UFS Weather Model, Fortran, 126 stars), "ccpp-physics" (UFS fork for CCPP, Fortran, 233 stars), "uwtools" (Workflow tools for UFS, Python, 143 stars), and "ufs-srweather-app" (UFS Short-Range Weather Application, Python, 53 stars). The page also displays discussions and a list of contributors.



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