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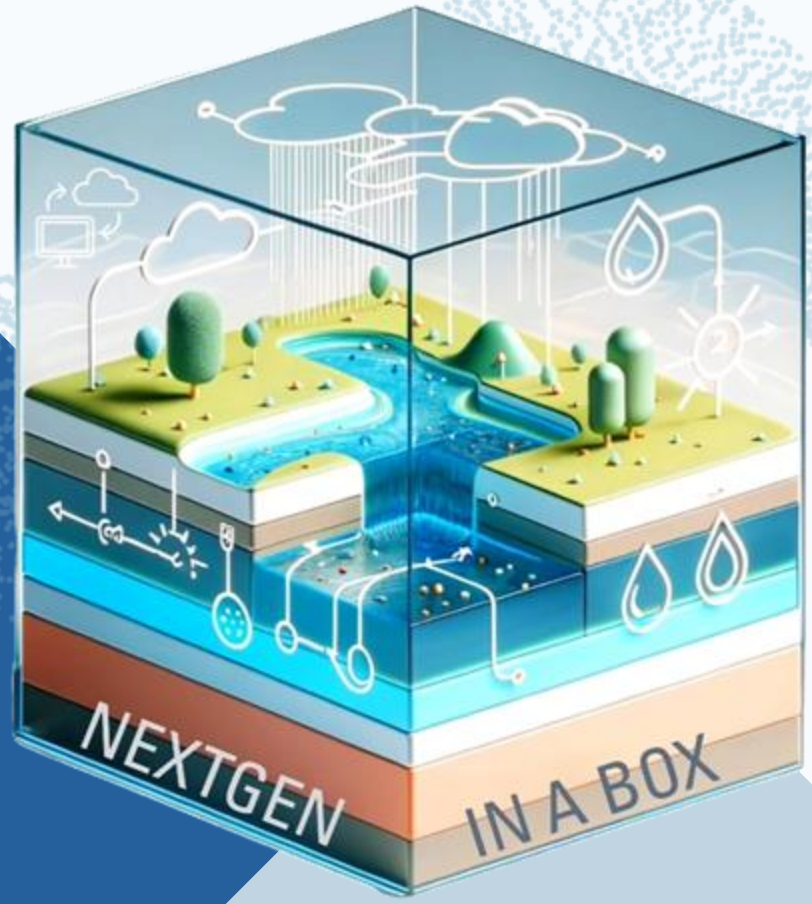
THE UNIVERSITY OF ALABAMA | Alabama Water Institute

Navigating the NextGen Ecosystem and NextGen In A Box (NGIAB):

Advancing Hydrologic Modeling through Community-Driven Development

A. Patel, J. Cunningham
The University of Alabama

Z. Wills
Lynker



Agenda

- Introduction
- NextGen EcoSystem
- NGIAB EcoSystem
- Hands-on demo
- Q&A – (10 mins)

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DevCon25 NextGen Track Workshop Schedule

Day 1 Session 1 - Navigating the NextGen Ecosystem and NextGen In A Box (**NGIAB**) (Arpita Patel, Zach Wills, Josh Cunningham)

Day 1 Session 2 - BMI Basics for NextGen (Keith Jennings, Chad Perry)

Day 2 Session 1 - Output Visualization through Tethys and evaluation customization using TEEHR (Sam Lamont, Gio)

Day 2 Session 2 - NextGen Calibration Workshop (Sifan Koriche, Shahab Alam, Josh C, Xia Feng)

Day 3 Session 1 - NextGen Research **DataStream**: How to Contribute to Improving NextGen Forecasts (Jordan Laser)

Day 3 Session 2 - Community **HydroFabric** (Mike Johnson)

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Principal Investigators

Steve Burian

Jeffrey Carver

Purushotham Bangalore

Arpita Patel

James Halgren

PROJECT	TITLE	PRINCIPAL INVESTIGATORS
P3	Community Water Model Infrastructure, Stewardship, and Integration	**Steve Burian**, Jeff Carver, Purushotham Bangalore, James Halgren
P29	Community Accessible Development: NextGen Water Resources Modeling Framework in the CIROH Research to Operations Hybrid Cloud	**Jeff Carver**, **Purushotham Bangalore**, James Halgren, Arpita Patel
P43	Community NextGen Tools and Frameworks Training and Documentation	**Jeff Carver**, Purushotham Bangalore, James Halgren, Arpita Patel
P44	Advancing Community NextGen and NextGen In A Box (NGIAB) - Paving the Pathway to Operations	**Arpita Patel**, Jeff Carver, Purushotham Bangalore, James Halgren

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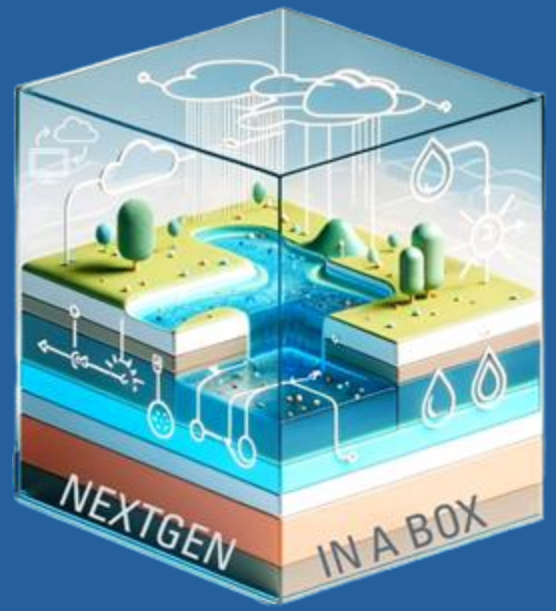
Partners

UA OIT	
2i2c	
Google Cloud	Sponsor
AWS	Sponsor
NSF	
Lynker	



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Community NextGen UA Team

Arpita Patel

James Halgren

Benjamin Lee

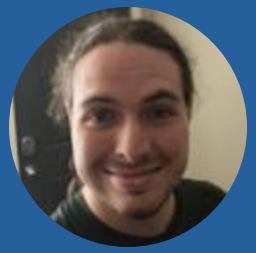
Josh Cunningham

Trupesh Patel

Shahab Alam

Sifan Koriche

Jonathan Frame



Chad Perry

Xia Feng

Manjila Singh

Nia Minor

Savalan Neisary

Quinn Lee

Hari Jajula

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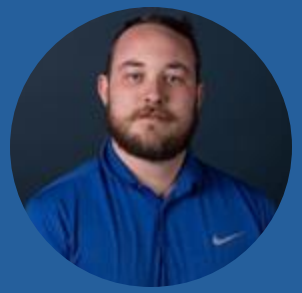
Community NextGen Partner Team

Nels Frazier(Lynker)



Zach Wills(Lynker)

Keith Jennings (UVM)

Jordan Laser(Lynker)

Mike Johnson(Lynker)

Josh Sturtevant
(Lynker)

Matthew Denno
(RTI)

Sam Lamont
(RTI)

Giovanni Romero
(Aquaveo)

Dan Ames
(BYU)

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Community NextGen Partner Team

David Tarboton (USU)

Furqan Baig (USU)

Pabitra Dash (USU)

Ayman Nassar (USU)

Anthony Castronova (CUAHSI)

Irene Garousi-Nejad (CUAHSI)

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Next Generation Water Resources Modeling Framework (NextGen)

- NextGen developed by the NOAA OWP at the National Water Center
- A model-agnostic, standards-based framework for water resources modeling that enables seamless coupling and interoperability between different hydrological models and modules.
- Designed to provide multi-model hydrologic prediction advances for the National Water Model (NWM)
- NWM provides hydrologic predictions for **over 2.7 million river** reaches across the US.

NextGen GitHub Repository:
GitHub: NOAA-OWP/ngen

NextGen Wiki:
GitHub: NOAA-OWP/ngen/wiki

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Why NextGen?

Core Features:

- Model Interoperability - Sequential sharing of states/fluxes between models
- Standards-Based - Ensures consistency and compatibility
- Model-Agnostic - Integrates any model regardless of origin
- Multi-Language Support - C++, C, Fortran, Python

NextGen GitHub Repository:
GitHub: NOAA-OWP/ngen
NextGen Wiki:
GitHub: NOAA-OWP/ngen/wiki

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NGIAB (NextGen In A Box)

ready-to-run, containerized, and cloud-friendly version of the NextGen Water Resources Modeling Framework.

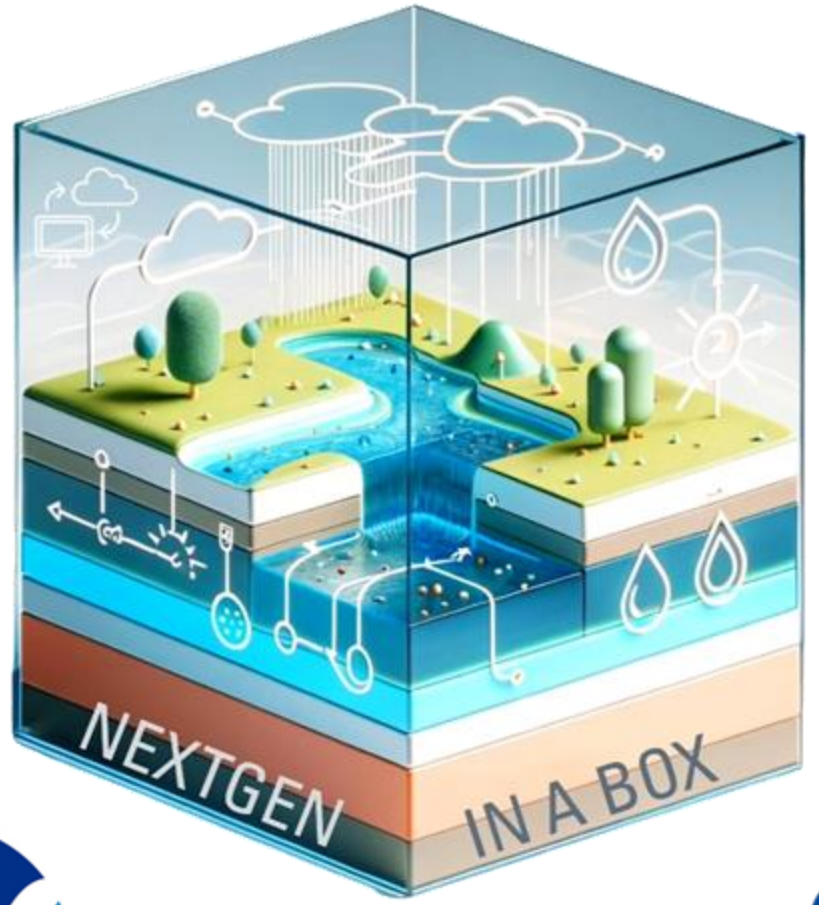
Developed by CIROH & Lynker

1. Open-source

2. Community tool

3. Accelerate Research

4. Pathway towards R2O



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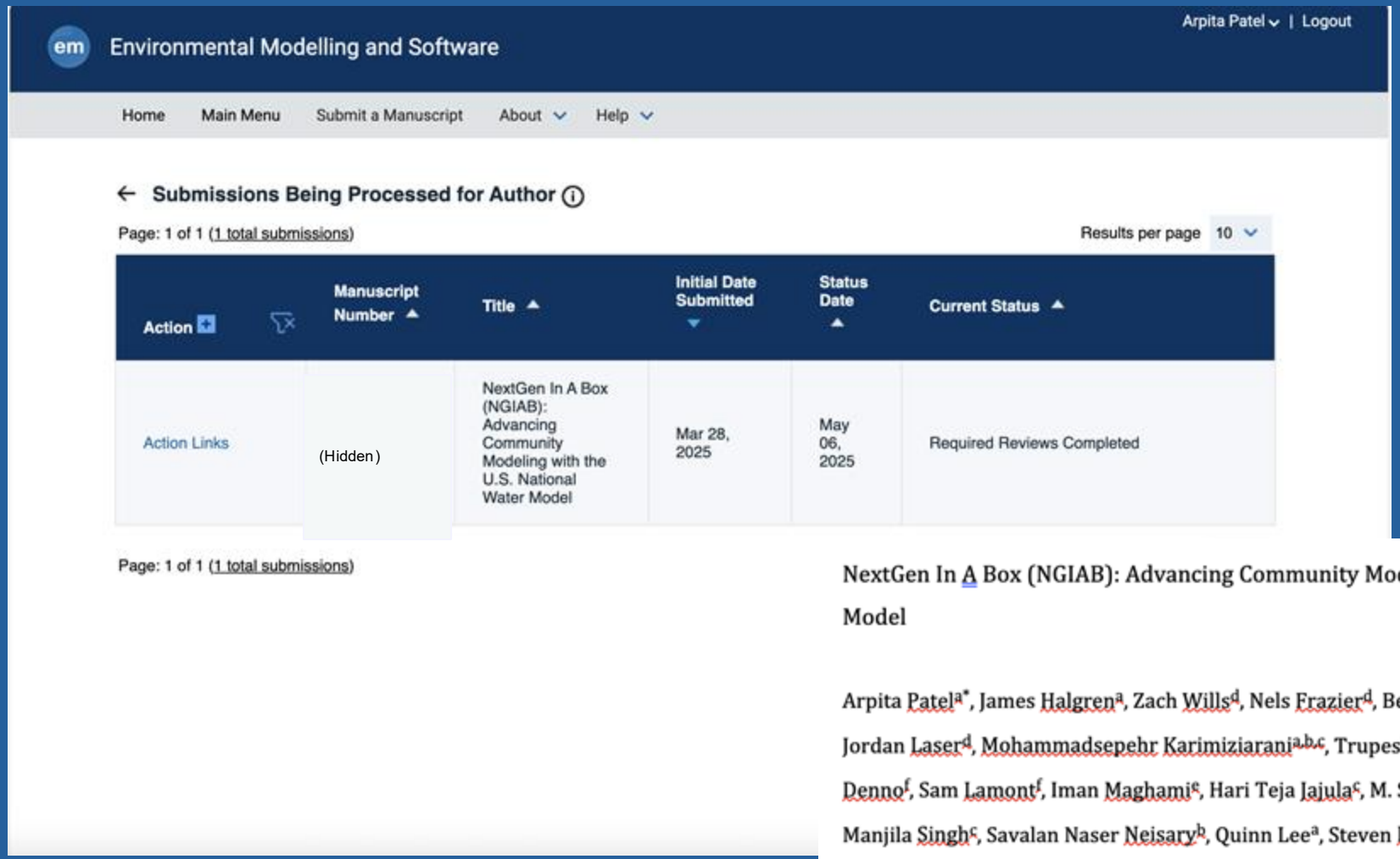
NOAA

NWC | NATIONAL WATER CENTER

OWP
OFFICE OF WATER PREDICTION

NGIAB Journal Research Paper (under review)!



em Environmental Modelling and Software

Arpita Patel | Logout

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Page: 1 of 1 (1 total submissions)

Results per page 10

Action	Manuscript Number	Title	Initial Date Submitted	Status Date	Current Status
Action Links	(Hidden)	NextGen In A Box (NGIAB): Advancing Community Modeling with the U.S. National Water Model	Mar 28, 2025	May 06, 2025	Required Reviews Completed

Page: 1 of 1 (1 total submissions)

NextGen In A Box (NGIAB): Advancing Community Modeling with the U.S. National Water Model

Arpita Patel[a*], James Halgren[a], Zach Wills[d], Nels Frazier[d], Benjamin Lee[a], Joshua Cunningham[a], Jordan Laser[d], Mohammadsepehr Karimiziarani[a,b,c], Trupesh Patel[a,c], Giovanni Romero[h], Matthew Denno[f], Sam Lamont[f], Iman Maghami[e], Hari Teja Jajula[c], M. Shahabul Alam[a], Sifan A. Koriche[a], Manjila Singh[c], Savalan Naser Neisary[b], Quinn Lee[a], Steven Burian[a,b], Fred L. Ogden[g], Purushotham Bangalore[c], Jeffrey C. Carver[c], Daniel P. Ames[e]

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NextGen Ecosystem

Introduction to NextGen

The U.S. National Water Model (NWM) provides hydrologic predictions for over 2.7 million river reaches across the United States (Cosgrove et al., 2024). **The Next Generation Water Resources Modeling Framework (NextGen) is an advancement of the NWM**, setting the stage for a more flexible modeling approach. NextGen promotes model interoperability and standardizes data workflows, allowing the integration of various hydrologic models tailored to specific regional processes, providing key flexibility needed for future success with continental-scale modeling. The NextGen framework continues to undergo testing, improvements, and updates through research efforts at the NOAA Cooperative Institute for Research to Operations in Hydrology (CIROH).

NOAA's National Water Model: Advancing operational hydrology through continental-scale modeling

Brian Cosgrove, David Gochis, Trey Flowers, Aubrey Dugger, Fred Ogden, Tom Graziano, Ed Clark, Ryan Cabell, Nick Casiday, Zhengtao Cui, Kelley Eicher, Greg Fall, Xia Feng, Katelyn Fitzgerald, Nels Frazier, Camaron George, Rich Gibbs, Liliana Hernandez, Donald Johnson, Ryan Jones, Logan Karsten, Henok Kefelegn, David Kitzmiller, Haksu Lee, Yuqiong Liu, Hassan Mashriqui, David Mattern, Alyssa McCluskey, James L. McCreight, Rachel McDaniel, Alemayehu Midekisa, Andy Newman, Linlin Pan, Cham Pham, Arezoo RafieeiNasab, Roy Rasmussen, Laura Read, Mehdi Rezaeianzadeh, Fernando Salas, Dina Sang, Kevin Sampson, Tim Schneider, Qi Shi, Gautam Sood, Andy Wood, Wanru Wu, David Yates, Wei Yu, Yongxin Zhang ... See fewer authors

First published: 12 January 2024 | https://doi.org/10.1111/1752-1688.13184 | Citations: 19

Paper No. JAWR-23-0005-P of the *Journal of the American Water Resources Association* (JAWR).
Discussions are open until six months from publication: .

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NextGen Framework

- The NextGen Water Resources Modeling Framework (NextGen) is developed by

  NOAA OWP at **the National Water Center**
  - Enhance the forecasting of **flooding and drought**
  - Improve water resource management
  - Protect lives, property, and the environment
  - Multimodel computational framework for **NWM (National Water Model)**

- NextGen GitHub Repository: GitHub: NOAA-OWP/ngen
- NextGen Wiki: GitHub: NOAA-OWP/ngen/wiki

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Community NextGen Ecosystem - NGIAB and other extensions!

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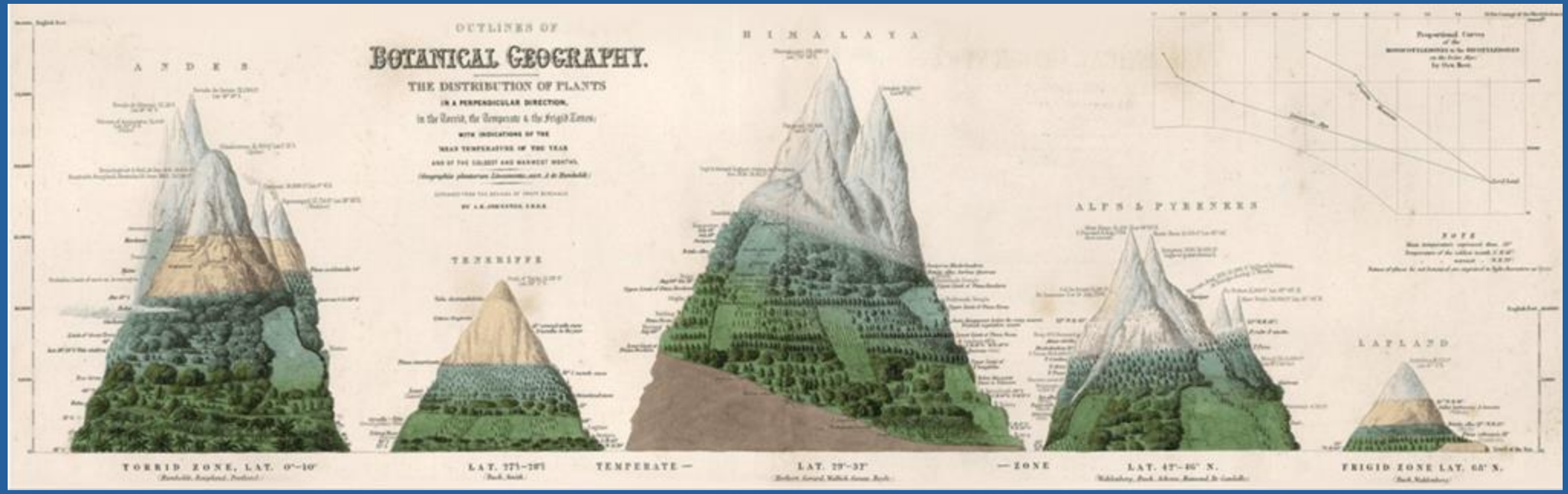
Modeling with NextGen

- Modeling is a layered concept!
  - Landscapes
  - Relationships
  - Interfaces

Landscape




```
~/Documents/projects/AWI/NGIAB_data_preprocess> open ~/Downloads/conus_nextgen.gpkg | query db "SELECT * FROM gpkg_contents"
```

#	table_name	data_type	identifier	description	last_change	min_x	min_y	max_x	max_y	srs_id
0	flowpaths	features	flowpaths		2024-10-02T21:39:27.356Z	-2355820.00	310953.68	2255727.43	3163261.04	5070
1	divides	features	divides		2024-10-02T21:40:02.814Z	-2356125.00	209715.00	2258235.00	3506235.00	5070
2	lakes	features	lakes		2024-10-02T21:40:03.033Z	-2306232.85	329124.79	2240264.20	3149850.05	5070
3	pois	attributes	pois		2024-10-02T21:40:34.220Z					0
4	hydrolocations	attributes	hydrolocations		2024-10-02T21:40:35.451Z					0
5	flowpath-attributes	attributes	flowpath-attributes		2024-10-02T21:40:43.663Z					0
6	flowpath-attributes-ml	attributes	flowpath-attributes-ml		2024-10-02T21:40:53.358Z					0
7	network	attributes	network		2024-10-02T21:42:24.445Z					0
8	nexus	features	nexus		2024-10-02T21:42:40.611Z	-2355820.00	299145.00	2255727.43	3163920.00	5070
9	divide-attributes	attributes	divide-attributes		2024-10-02T21:43:31.277Z					0

Hydrofabric:
Relates the landscape into data

.gpkg file that quantifies the relationship between segments of the landscape

https://www.lynker-spatial.com

```
~/Documents/projects/AWI/NGIAB_data_preprocess> open ~/Downloads/conus_nextgen.gpkg | query db "SELECT * FROM gpkg_contents"
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6	flowpath-attributes-ml	attributes	flowpath-attributes-ml		2024-10-02T21:40:53.358Z					0
7	network	attributes	network		2024-10-02T21:42:24.445Z					0
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9	divide-attributes	attributes	divide-attributes		2024-10-02T21:43:31.277Z					0

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Realization file maps the model(s) onto the Hydrofabric

.json file that defines what mathematics to run in each segment, or all segments


```
            "main_output_variable": "z",
            "init_config": "/dev/null",
            "allow_exceed_end_time": true,
            "fixed_time_step": false,
            "model_params": {
                "sloth_ice_fraction_schaake(1,double,m,node)": "0",
                "sloth_ice_fraction_xinanjiang(1,double,1,node)": "0",
                "sloth_soil_moisture_profile(1,double,1,node)": "0"
            },
            "library_file": "/dmod/shared_libs/libslothmodel.so",
            "registration_function": "none"
        }
    },
    {
        "name": "bmi_fortran",
        "params": {
            "name": "bmi_fortran",
            "model_type_name": "NoahOWP",
            "main_output_variable": "QINSUR",
            "init_config": "config/cat_config/NOAH-OWP-M/noah-owp-modular-init-{{id}}.namelist.input",
            "allow_exceed_end_time": true,
            "fixed_time_step": true,
            "variables_names_map": {
                "PRCPNONC": "precip_rate",
                "Q2": "SPFH_2maboveground",
                "SFCTMP": "TMP_2maboveground",
                "UU": "UGRD_10maboveground",
                "VV": "VGRD_10maboveground",
                "LWDN": "DLWRF_surface",
                "SOLDN": "DSWRF_surface",
                "SFCPRS": "PRES_surface"
            },
            "library_file": "/dmod/shared_libs/libsurfacebmi.so"
        }
    },
    {
        "name": "bmi_c",
        "params": {
            "name": "bmi_c",
            "model_type_name": "CFE",
            "main_output_variable": "Q_OUT",
            "init_config": "config/cat_config/CFE/CFE_{{id}}.ini",
            "allow_exceed_end_time": true,
            "fixed_time_step": false,
            "variables_names_map": {
                "atmosphere_water__liquid_equivalent_precipitation_rate": "QINSUR",
                "water_potential_evaporation_flux": "EVAPOTRANS",
                "ice_fraction_schaake": "sloth_ice_fraction_schaake",
                "ice_fraction_xinanjiang": "sloth_ice_fraction_xinanjiang",
                "soil_moisture_profile": "sloth_soil_moisture_profile"
            },
            "library_file": "/dmod/shared_libs/libcfebmi.so.1.0.0",
            "registration_function": "register_bmi_cfe"
        }
    },
    {
```


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Relationships

Each cat-# can get a “stack” of models

Add models easily following the same format

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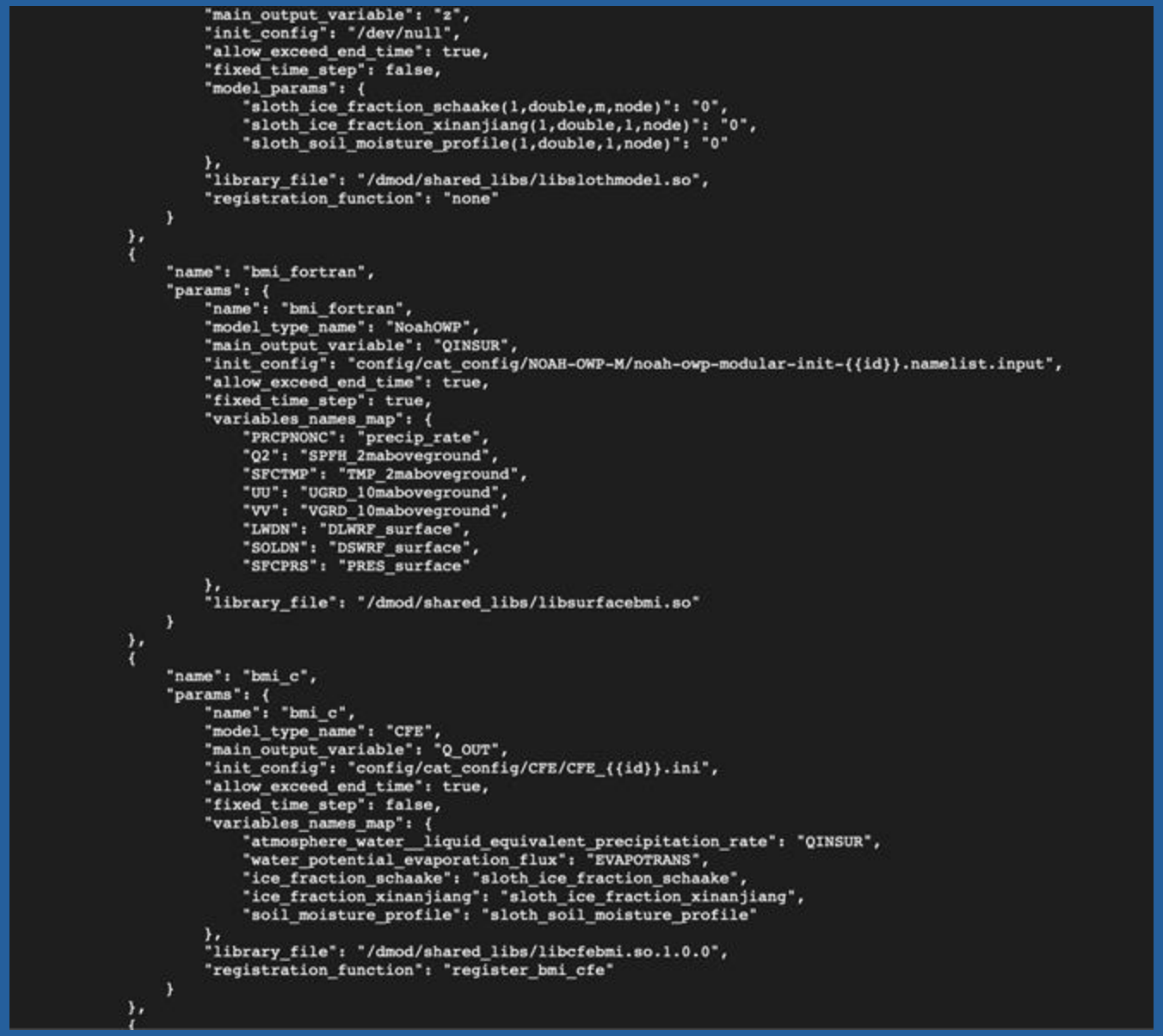
Relationships

Contains variable name maps from one model to the next, and/or Parameter values inline or a file

Runs top → bottom



```
            "main_output_variable": "z",
            "init_config": "/dev/null",
            "allow_exceed_end_time": true,
            "fixed_time_step": false,
            "model_params": {
                "sloth_ice_fraction_schaake(1,double,m,node)": "0",
                "sloth_ice_fraction_xinanjiang(1,double,1,node)": "0",
                "sloth_soil_moisture_profile(1,double,1,node)": "0"
            },
            "library_file": "/dmod/shared_libs/libslothmodel.so",
            "registration_function": "none"
        }
    },
    {
        "name": "bmi_fortran",
        "params": {
            "name": "bmi_fortran",
            "model_type_name": "NoahOWP",
            "main_output_variable": "QINSUR",
            "init_config": "config/cat_config/NOAH-OWP-M/noah-owp-modular-init-{{id}}.namelist.input",
            "allow_exceed_end_time": true,
            "fixed_time_step": true,
            "variables_names_map": {
                "PRCPNONC": "precip_rate",
                "Q2": "SPFH_2maboveground",
                "SFCTMP": "TMP_2maboveground",
                "UU": "UGRD_10maboveground",
                "VV": "VGRD_10maboveground",
                "LWDN": "DLWRF_surface",
                "SOLDN": "DSWRF_surface",
                "SFCPRS": "PRES_surface"
            },
            "library_file": "/dmod/shared_libs/libsurfacebmi.so"
        }
    },
    {
        "name": "bmi_c",
        "params": {
            "name": "bmi_c",
            "model_type_name": "CFE",
            "main_output_variable": "Q_OUT",
            "init_config": "config/cat_config/CFE/CFE_{{id}}.ini",
            "allow_exceed_end_time": true,
            "fixed_time_step": false,
            "variables_names_map": {
                "atmosphere_water__liquid_equivalent_precipitation_rate": "QINSUR",
                "water_potential_evaporation_flux": "EVAPOTRANS",
                "ice_fraction_schaake": "sloth_ice_fraction_schaake",
                "ice_fraction_xinanjiang": "sloth_ice_fraction_xinanjiang",
                "soil_moisture_profile": "sloth_soil_moisture_profile"
            },
            "library_file": "/dmod/shared_libs/libcfebmi.so.1.0.0",
            "registration_function": "register_bmi_cfe"
        }
    },
    {
```

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Hierarchy of Effect

HydroFabric	Denotes the physical landscape Always changing	Amalgamated Standardized
Model Selection	Denotes physical processes Code, not Data	Easily Testable Region Specific (e.g. snow models)
Parameter Coupling	Ensuring that the correct output of the upper model is coupled to the lower model in a way that makes sense	
Calibration	Parameter values for specific areas are heterogeneous based on what data has been collected and when, and the availability of that data	Not a responsibility of the hydrofabric, which may or may not contain placeholder values for your catchments

Basic Sequence

1

Select Hydrofabric

2

Select Models

3

Run and Evaluate

4

Iterate through each layer

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Progressive Sequence

1

Select HydroFabric from a known event

2

Run new basic sequence for the event period

3

Evaluate performance against existing forecast

4

Experiment with timing, volume, runtime (lead time) etc.

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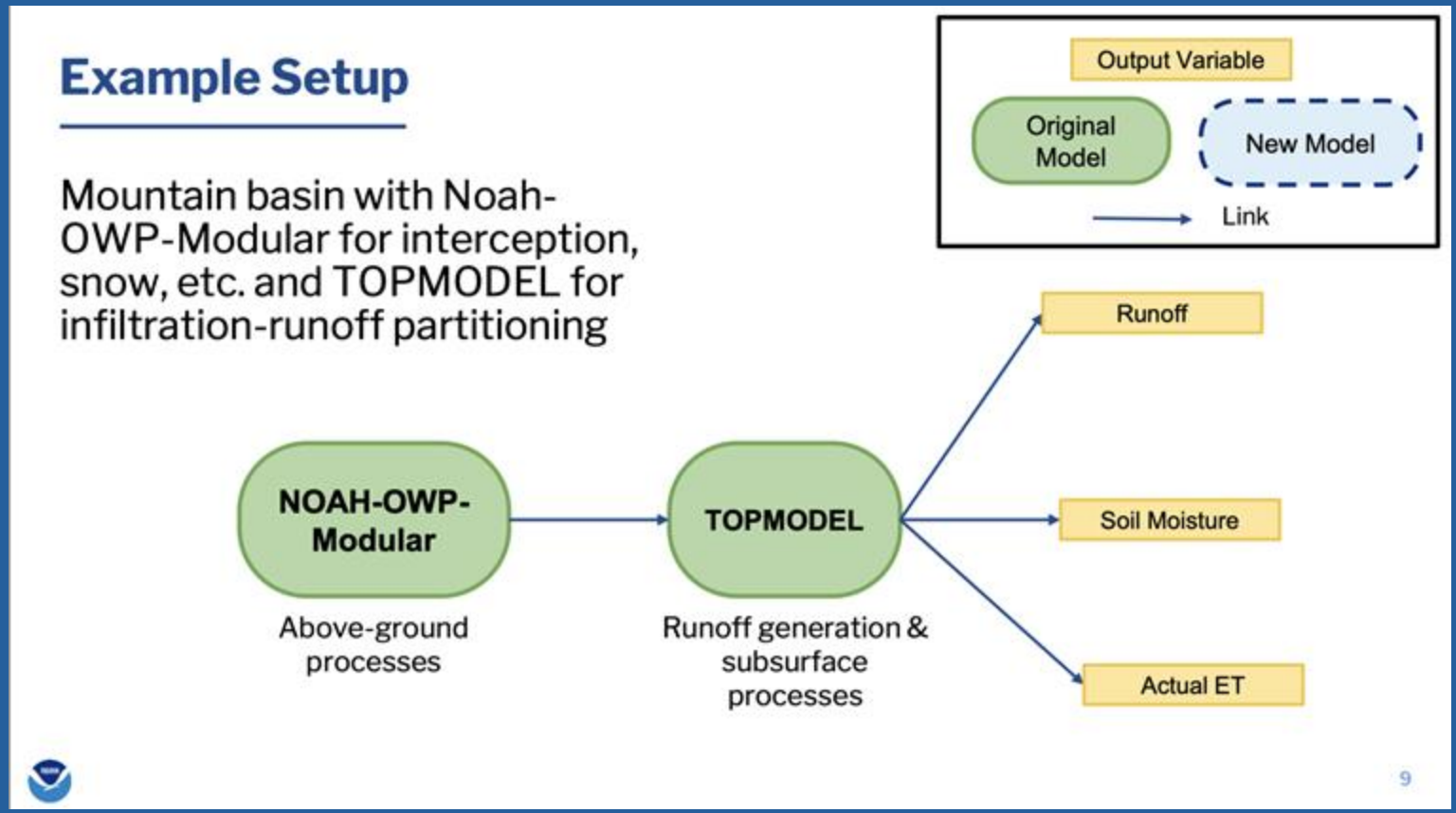
Example Progressive Sequence

Keith Jennings AMS 2024



Improving Operational Hydrologic Prediction using Mosaiced Model Formulations with the Next Generation Water Resources Modeling Framework.

Starting point for mountain basin

(more at: https://github.com/NOAA-OWP/OWP-Presentations)

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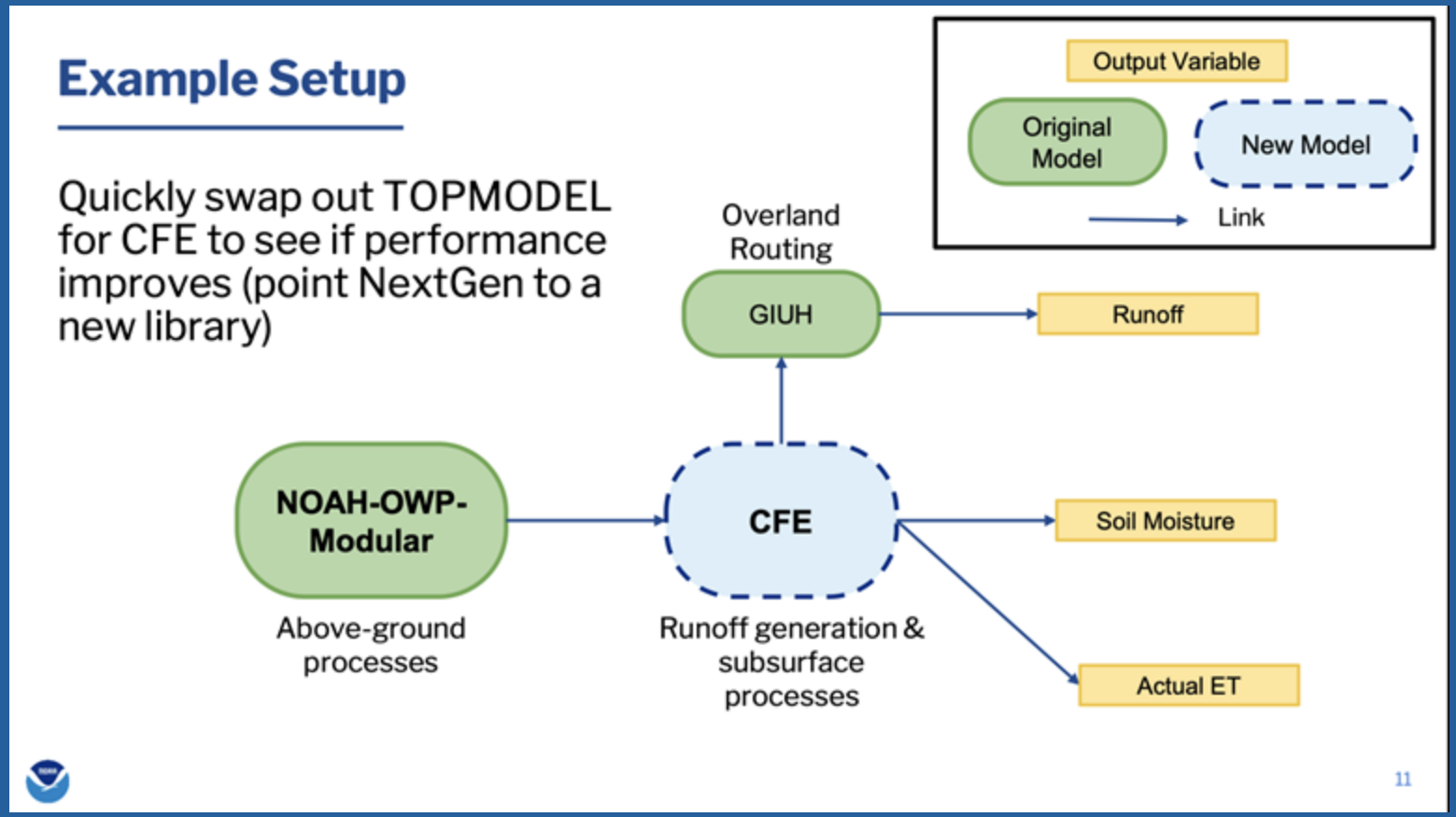
Example Progressive Sequence



Keith Jennings AMS 2024

Improving Operational Hydrologic Prediction using Mosaiced Model Formulations with the Next Generation Water Resources Modeling Framework.

Improved point for mountain basin

(more at: https://github.com/NOAA-OWP/OWP-Presentations)

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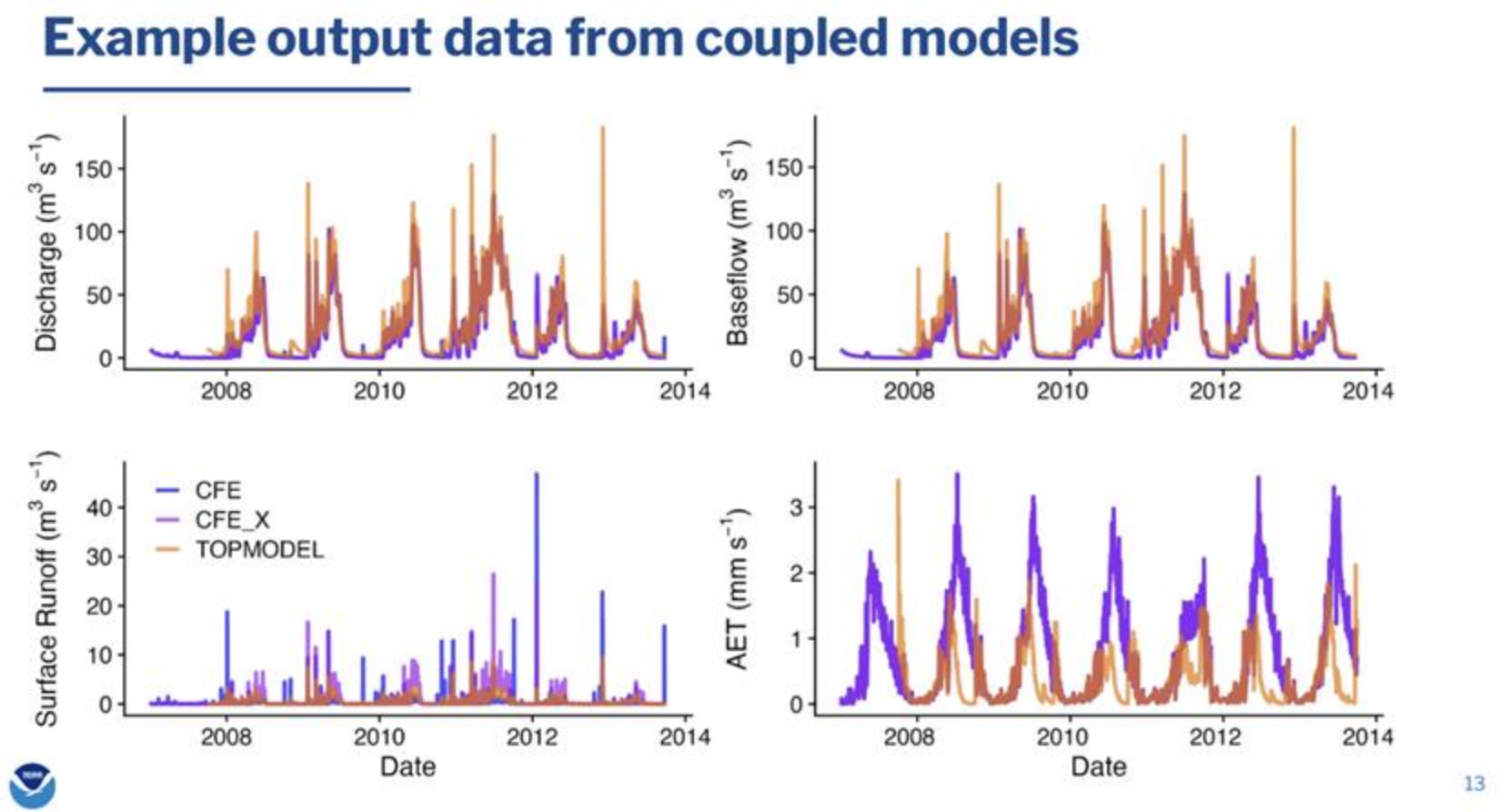
Example Progressive Sequence



Keith Jennings AMS 2024

Improving Operational Hydrologic Prediction using Mosaiced Model Formulations with the Next Generation Water Resources Modeling Framework.

Improved point for mountain basin

(more at: https://github.com/NOAA-OWP/OWP-Presentations)

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Combinatorial Connections

Combinations with repetition:

If we have N elements out of which we want to choose K elements and it is allowed to choose one element more than once, then number of ways are given by:

$$^{N+K-1}C_K = \frac{(N+K-1)!}{(K)!(N-1)!}$$

In this case we have **N** *models* out of which we are searching for the correct combination of models aligned to the correct catchment (and later perhaps the best timestep).

So each *correct* "stack of models" is a **K** elements selected from **N** *models*.

Iterating and Selecting for the correct models through the realization file should take the sequence of "model, order, coupling, parameters".

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Creativity in the sequence

At present, SLoTH does not read any configuration file (an empty string should be provided to `Initialize()`, and it will be ignored--though this feature is expected to be added!). Instead, configuration of tautologies is done by setting values--any variable and value set on the model will become a new output variable of SLoTH.

```
auto s = new Sloth();
double v = 0.0;
s.SetValue("adouble", &v);
// ^ Creates a new, single, type double output variable named `adouble` that will always be 0.
```

This is especially well suited to take advantage of ngen's `model_param` mechanism, as you can create SLoTH variables directly in the realization config; variables set using `model_params` as if they were configuration settings will become output variables with the set value.

Updating parameters for models from assimilated ground station data would need:

Add config file input to Initialize(),

Pipe station data from SLoTH to any parameter in the model stack in the same BMI-coupled pattern

Still runs top->bottom and couples the same way as model -> model

DA example

Realization SLoTH relationship

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Why NextGen In a Box (NGIAB)?

Containerized Solution

- Run anywhere
- **Pre-compiled images** available in Docker Hub

Cloud Friendly Nature

- Reduces the **research time**
- Easily configure **multiple models**
- **Multi-cloud** compatible

Simplifies NextGen Access

- Reduces **learning curve** for NextGen framework
- Compare **model performance**
- Facilitates accessibility and **accelerates modeling**

Collaborative Modeling Tool

- **Easy to use**
- **Reproducible** research outcomes
- Increases **collaboration** among researchers

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NGIAB Data Preprocess

This tool prepares data to run a NextGen simulation by creating a run package that can be used with NGIAB.

- Uses Hydrofabric 2.2
- Repo : https://github.com/CIROH-UA/NGIAB_data_preprocess
- Easy Map based tool to create CFE-based NextGen realizations with all necessary inputs.

Commands:

1. uvx --from ngiab_data_preprocess cli -i gage-10154200 -sfr --start 2017-09-01 --end 2018-09-01 --source aorc
2. uvx --from ngiab_data_preprocess map_app

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NGIAB's Core Purpose & Benefits

Simplified Access to NextGen

- Lowers the barrier to entry for using the powerful NextGen framework

Accelerated Research & Flexible

- Helps researchers reduce time spent on setup and configuration
- Runs anywhere from local laptop to HPC to Cloud

Reproducible Research

- NGIAB promotes reproducible research outcomes through its standardized environment

Collaboration & Community Contribution

- Collaborative modeling tool designed to increase collaboration
- Enables contribution to the National Water Model.

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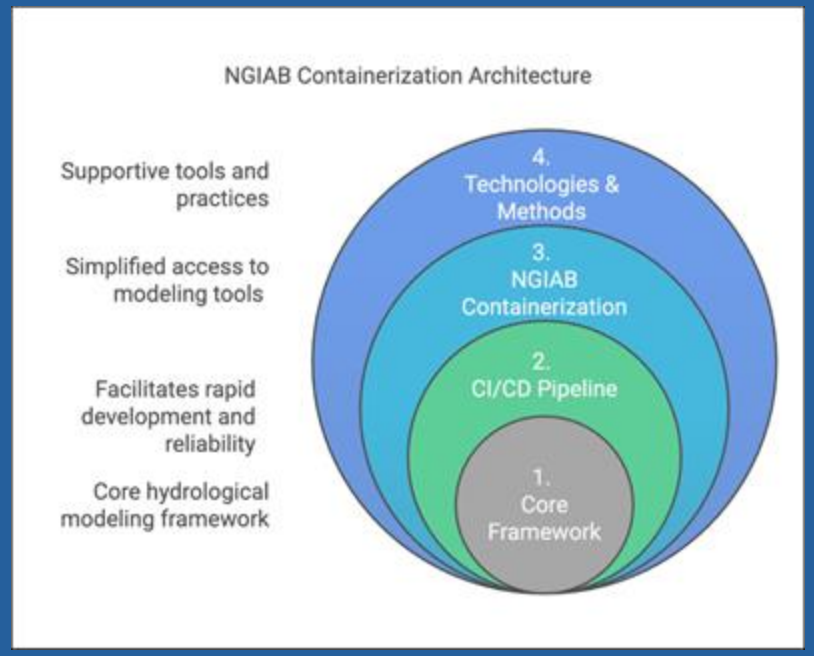
NextGen In a Box (NGIAB)



Open-Source Technologies

- GitHub
- GitHub Actions - CI/CD yaml files
- Docker - Dockerfile
- Singularity
- Shell Scripting

Provides seamless model coupling and interoperability via the BMI standard within NextGen.

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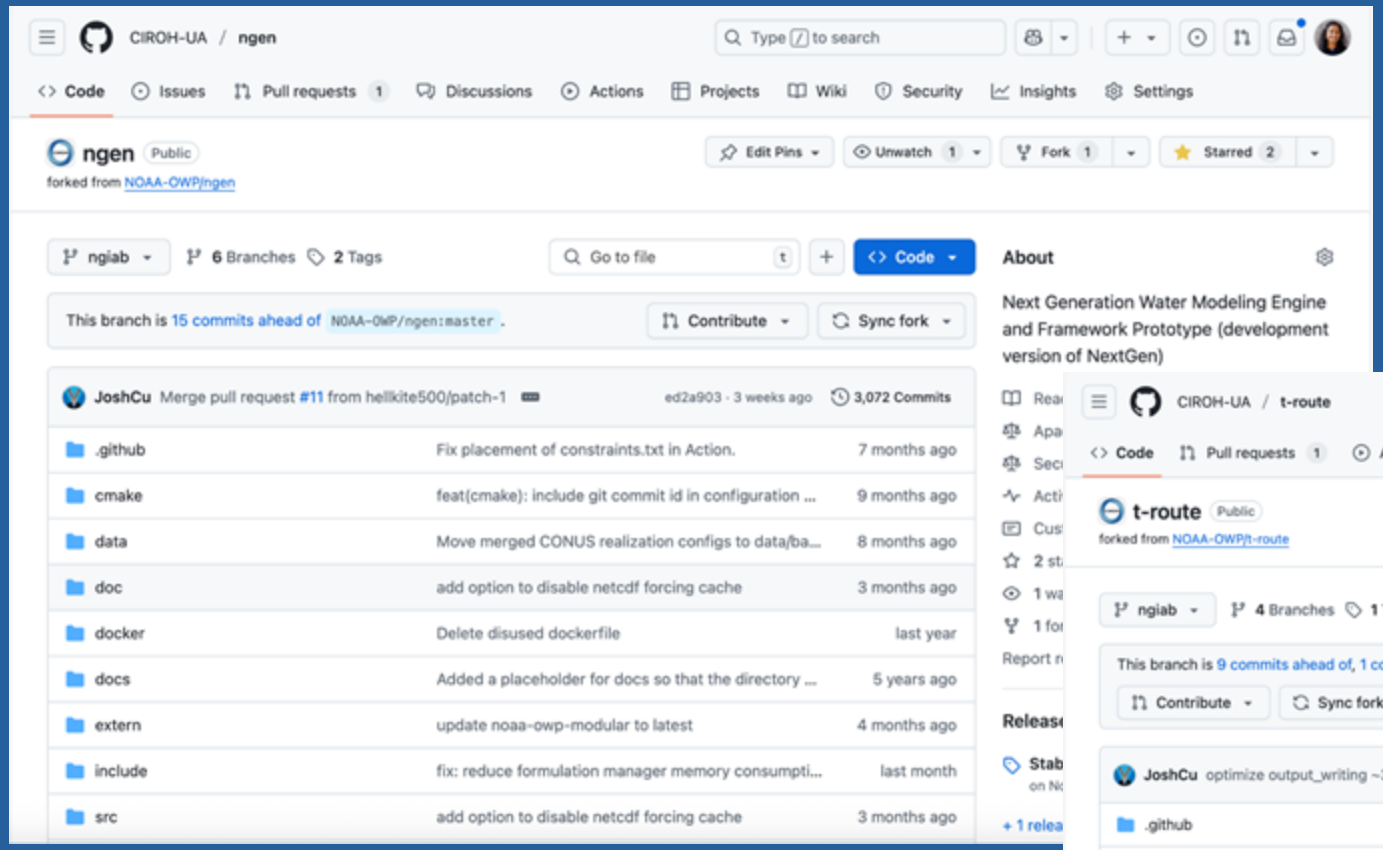
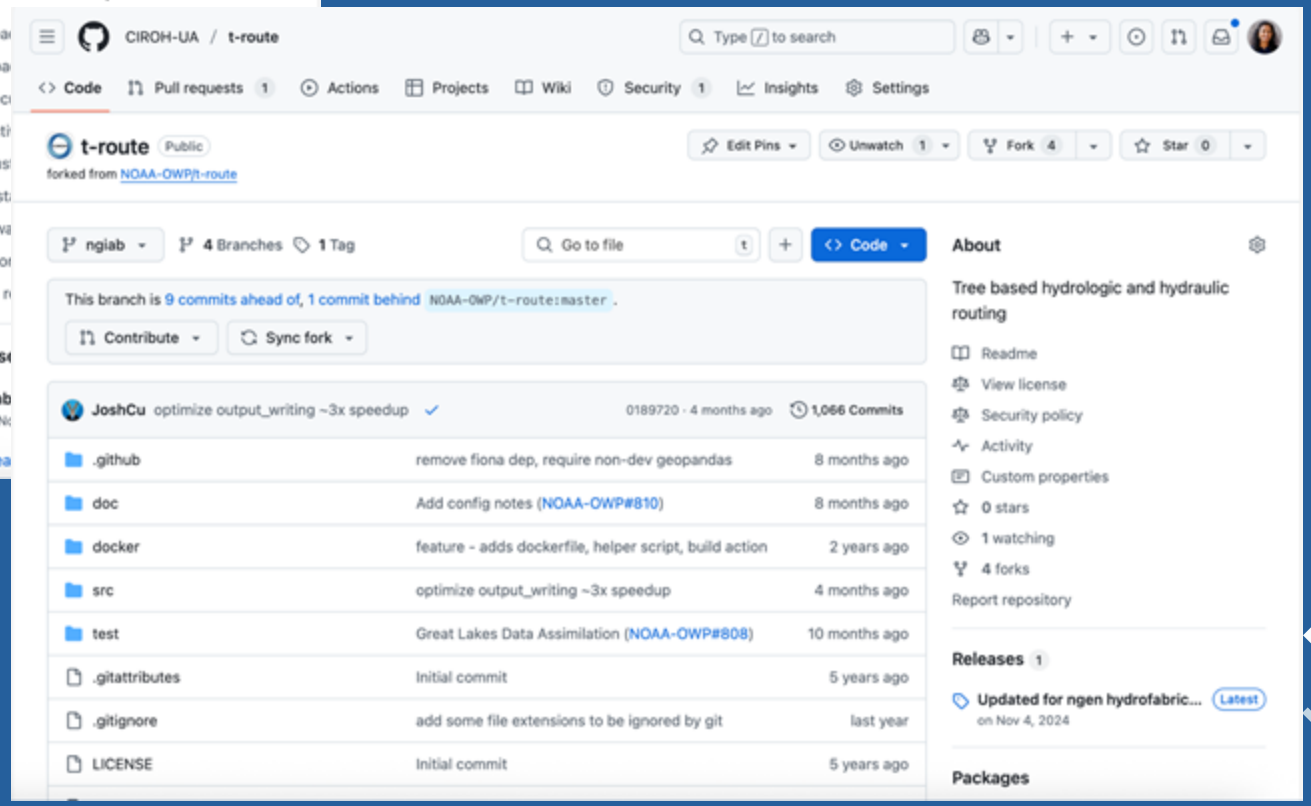
NextGen Community ngen and t-route Forks



https://github.com/CIROH-UA/ngen

https://github.com/CIROH-UA/t-route



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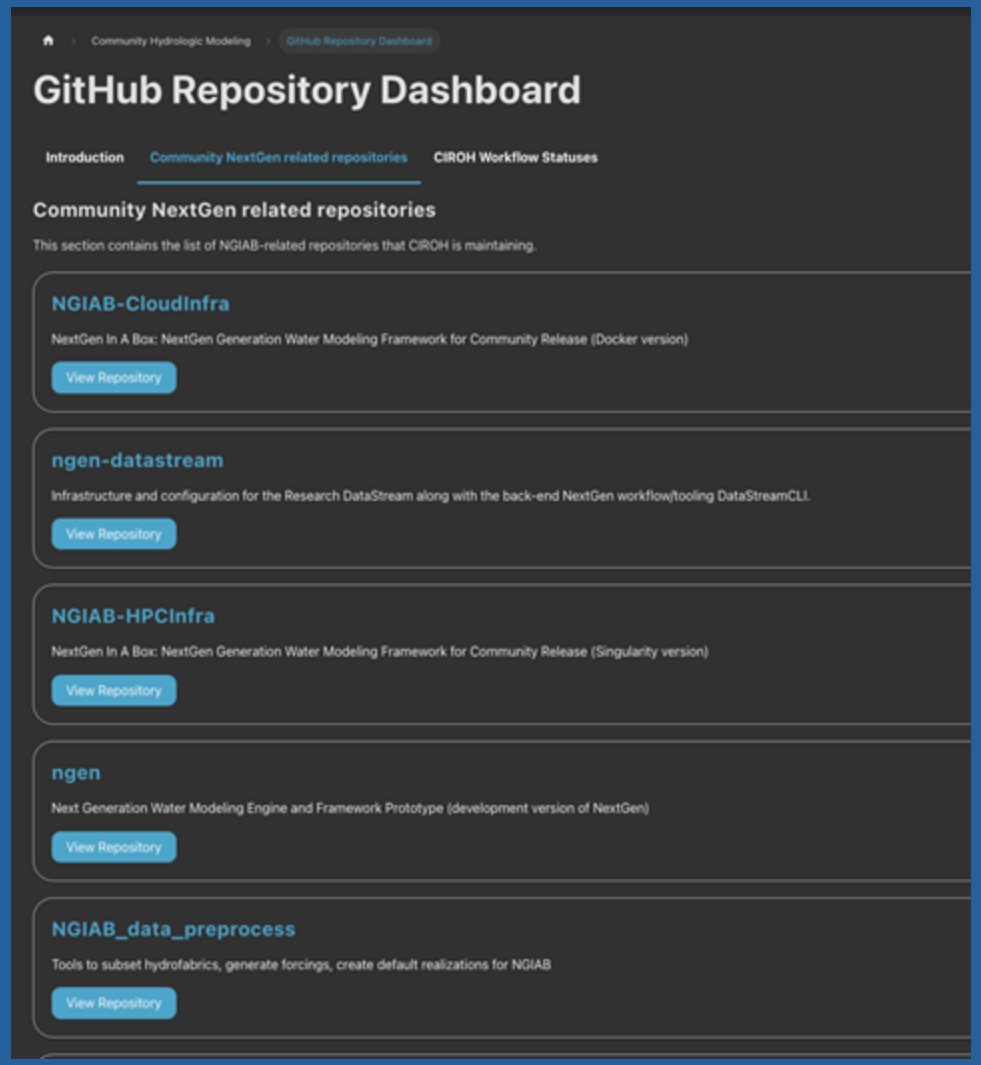
Community NextGen related Repos



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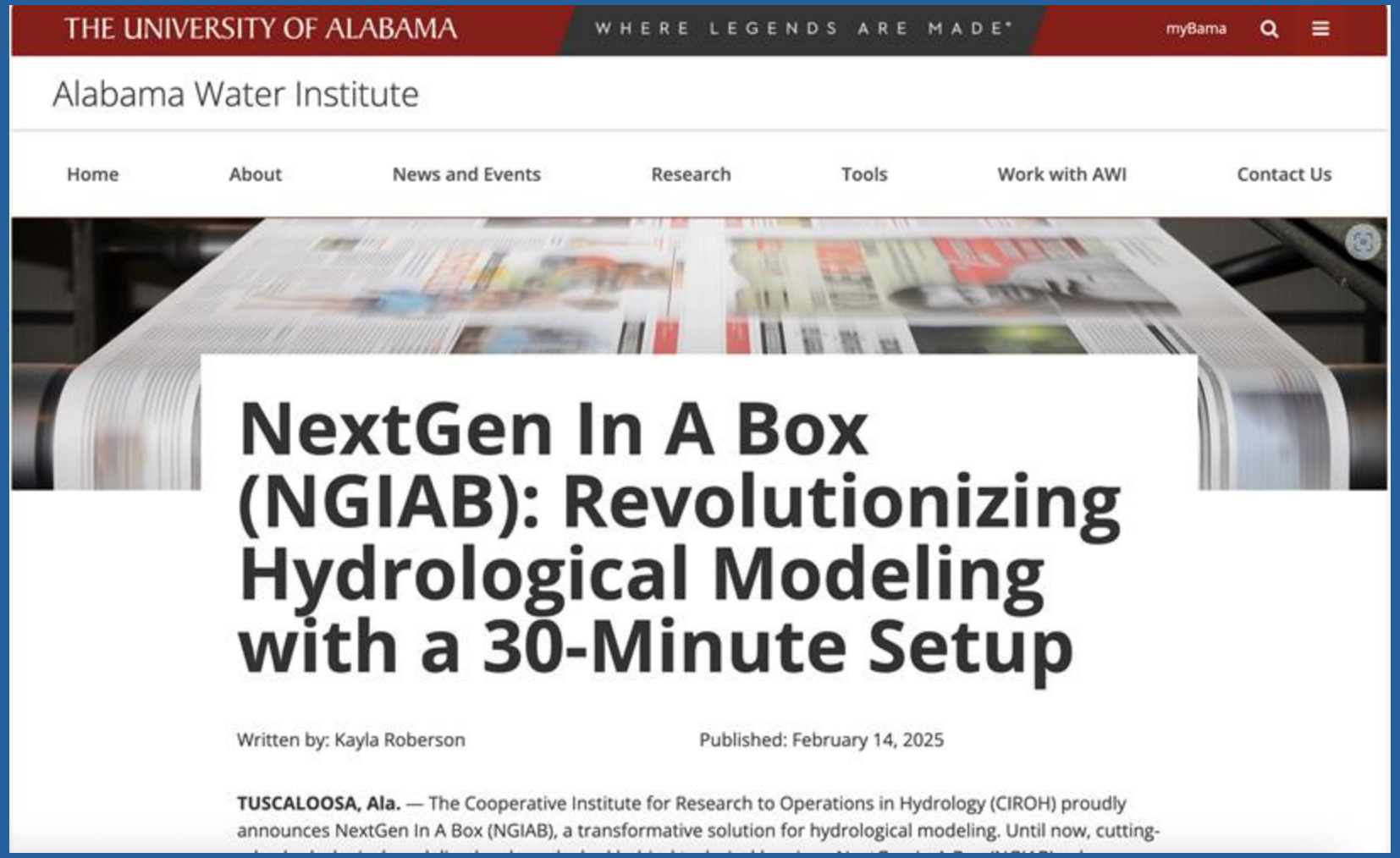
NGIAB AWI UA News!



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Alabama Water Institute

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NextGen In A Box (NGIAB): Revolutionizing Hydrological Modeling with a 30-Minute Setup

Written by: Kayla Roberson Published: February 14, 2025

TUSCALOOSA, Ala. — The Cooperative Institute for Research to Operations in Hydrology (CIROH) proudly announces NextGen In A Box (NGIAB), a transformative solution for hydrological modeling. Until now, cutting-

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NextGen Standards and Guidelines

Technical guidance for the inclusion of models/modules in the NextGen Water Resources Modeling Framework

Fred Ogden, Nels Frazier, Keith Jennings, Jonathan Frame, Wouter Knoben, Tadd Bindas, Yalan Song, Irene Garousi-Nejad, Jeffrey Carver, Andy Wood, Anthony Castronova, Arpita Patel, Shahabul Alam, Sifan A. Koriche, Junwei Guo, Cyril Thébault, Raymond J. Spiteri, Ahmad J. Khattak, James Halgren, Patrick J. Clemins, Mukesh Kumar, and Martyn Clark

1. Introduction

NOAA/OWP started development of the "Next Generation Water Resources Modeling Framework" (nicknamed "NextGen") to provide flexible options to experiment with representations of the hydrologic cycle in a model-agnostic framework. The NextGen Framework is a model-agnostic, standards-based, model interoperability software tool that allows explicit coupling of models through the sequential sharing of computed states and/or fluxes between different domain science models or modules. The intent is that NextGen empowers the broader science and applications community to collaborate on water resources modeling problems.

Identification of general design requirements for the NextGen Framework occurred during Interagency meetings held 26-28 October, 2020, involving NOAA, USGS, USACE, USBR, and DOE. These design requirements resulted from discussions around the question "What features would a useful modeling framework possess?" Resulting design requirements included the following:

- Maximum flexibility - as models, data sources, and needs evolve, the framework supports changes and additions
- Model agnostic
- Common architecture to avoid duplication and promote interoperability
- Open source development
  - Promote code reuse and development efficiency
  - Authoritative repository for federal water models
  - Ease/encourage participation by partners and community
- Apply standards where applicable and necessary
  - Coding, coupling
  - Data and metadata
  - Model verification/validation and test data
- Friendly to domain scientists and engineers to facilitate community development
  - Avoid wholesale rewriting of domain science code
  - Encourage and ease adoption
- Sharing models, data, and results
  - Library of model codes and data sets
  - Evaluation tools
- Establish and maintain a glossary and define terms to communicate clearly across disciplinary boundaries
- Use mature open source libraries where appropriate
- Multi-language support (C++, C, Fortran, Python)

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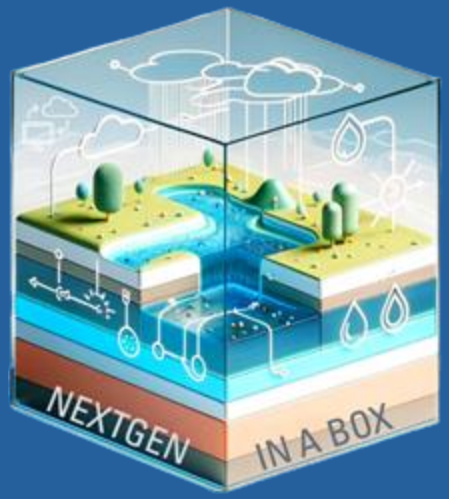
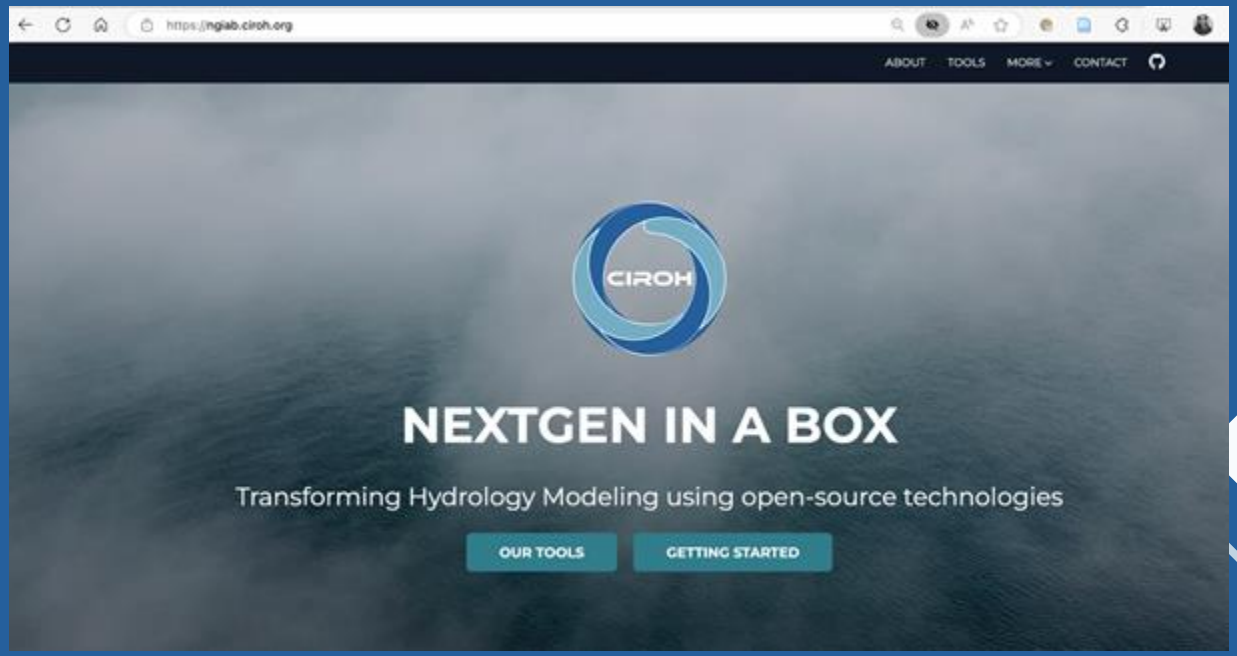
NGIAB Product Portfolio website

ngiab.ciroh.org





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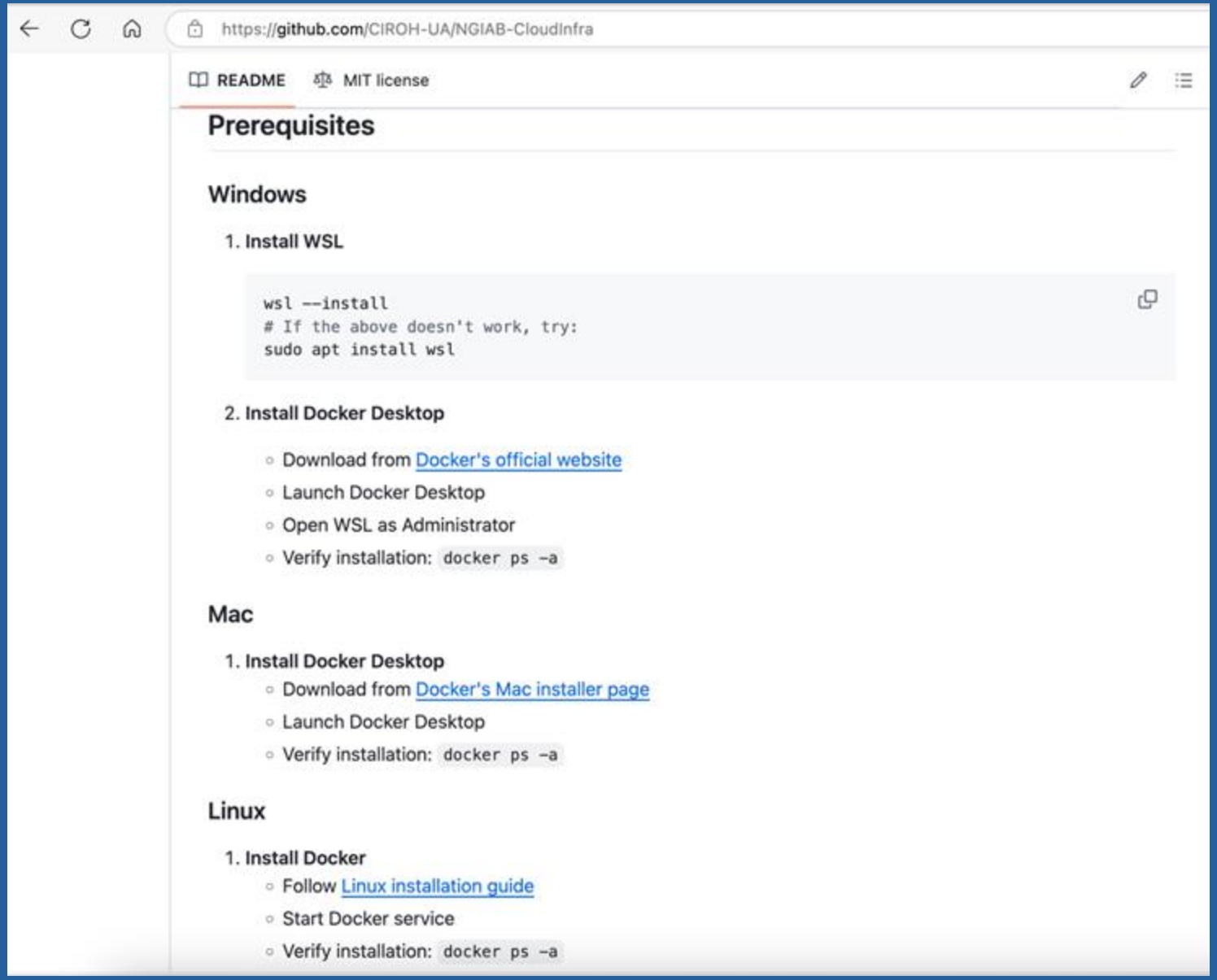
NGIAB Prerequisites to run locally!



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NGIAB Sample Data - CFE, Noah-OWP, LSTM

https://github.com/CIROH-UA/NGIAB-CloudInfra

README | MIT license

1. Set Up Project Directory

```
mkdir -p NextGen/ngen-data
cd NextGen/ngen-data
```

2. Download Sample Data

Option 1: AWI-009 input data (realization file includes - SLOTH, NoahOWP, CFE) - calibrated realization file for Provo River near Woodland, UT

```
wget https://ciroh-ua-ngen-data.s3.us-east-2.amazonaws.com/AWI-009/AWI_16_10154200_009.tar.gz
tar -xf AWI_16_10154200_009.tar.gz
```

Option 2: AWI-007 input data (realization file includes - SLOTH, NoahOWP, CFE)

```
wget https://ciroh-ua-ngen-data.s3.us-east-2.amazonaws.com/AWI-007/AWI_16_2863657_007.tar.gz
tar -xf AWI_16_2863657_007.tar.gz
```

Option 3: AWI-008 input data (realization file includes - SLOTH, Demostration LSTM)

```
wget --no-parent https://ciroh-ua-ngen-data.s3.us-east-2.amazonaws.com/AWI-008/AWI_16_2863806_
tar -xf AWI_16_2863806_008.tar.gz
```

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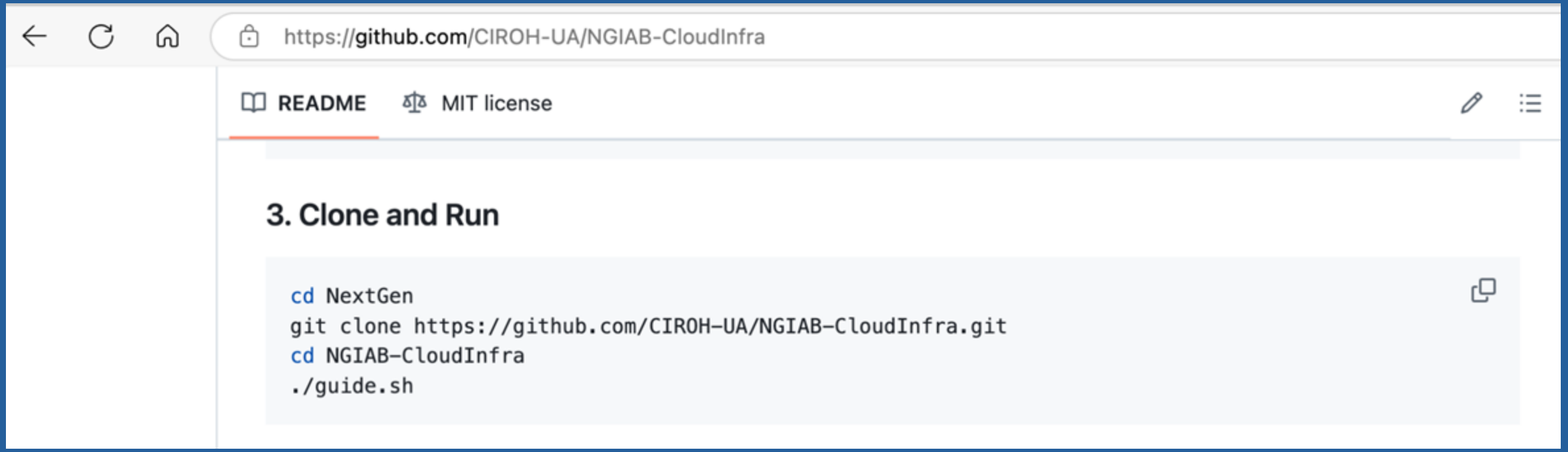
NGIAB Run



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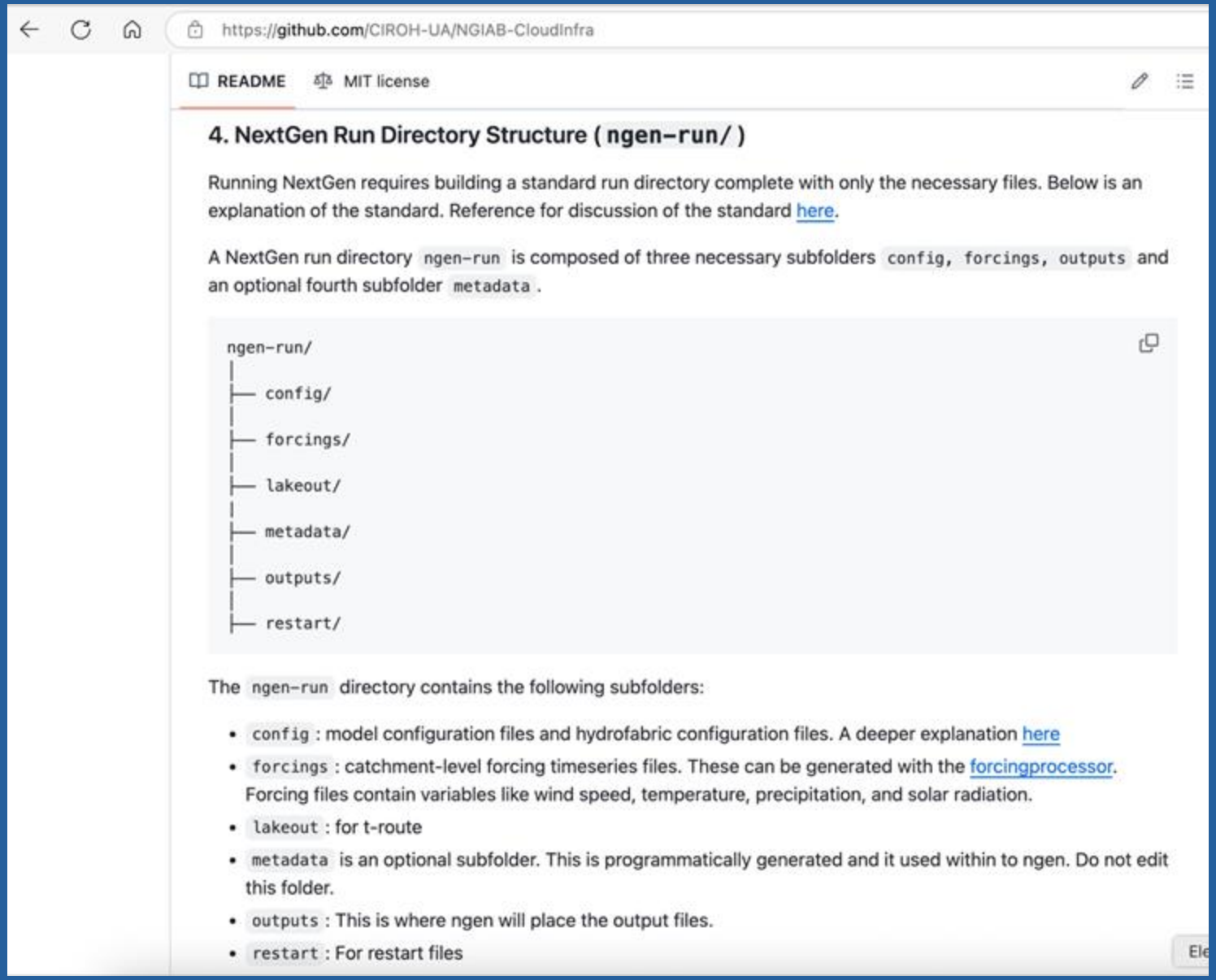
ngen-run directory structure



https://github.com/CIROH-UA/NGIAB-CloudInfra

README MIT license

4. NextGen Run Directory Structure (`ngen-run/`)

Running NextGen requires building a standard run directory complete with only the necessary files. Below is an explanation of the standard. Reference for discussion of the standard here.

A NextGen run directory `ngen-run` is composed of three necessary subfolders `config, forcings, outputs` and an optional fourth subfolder `metadata` .

```
ngen-run/
├── config/
├── forcings/
├── lakeout/
├── metadata/
├── outputs/
└── restart/
```

The `ngen-run` directory contains the following subfolders:

- `config` : model configuration files and hydrofabric configuration files. A deeper explanation here
- `forcings` : catchment-level forcing timeseries files. These can be generated with the forcingprocessor. Forcing files contain variables like wind speed, temperature, precipitation, and solar radiation.
- `lakeout` : for t-route
- `metadata` is an optional subfolder. This is programmatically generated and it used within to ngen. Do not edit this folder.
- `outputs` : This is where ngen will place the output files.
- `restart` : For restart files

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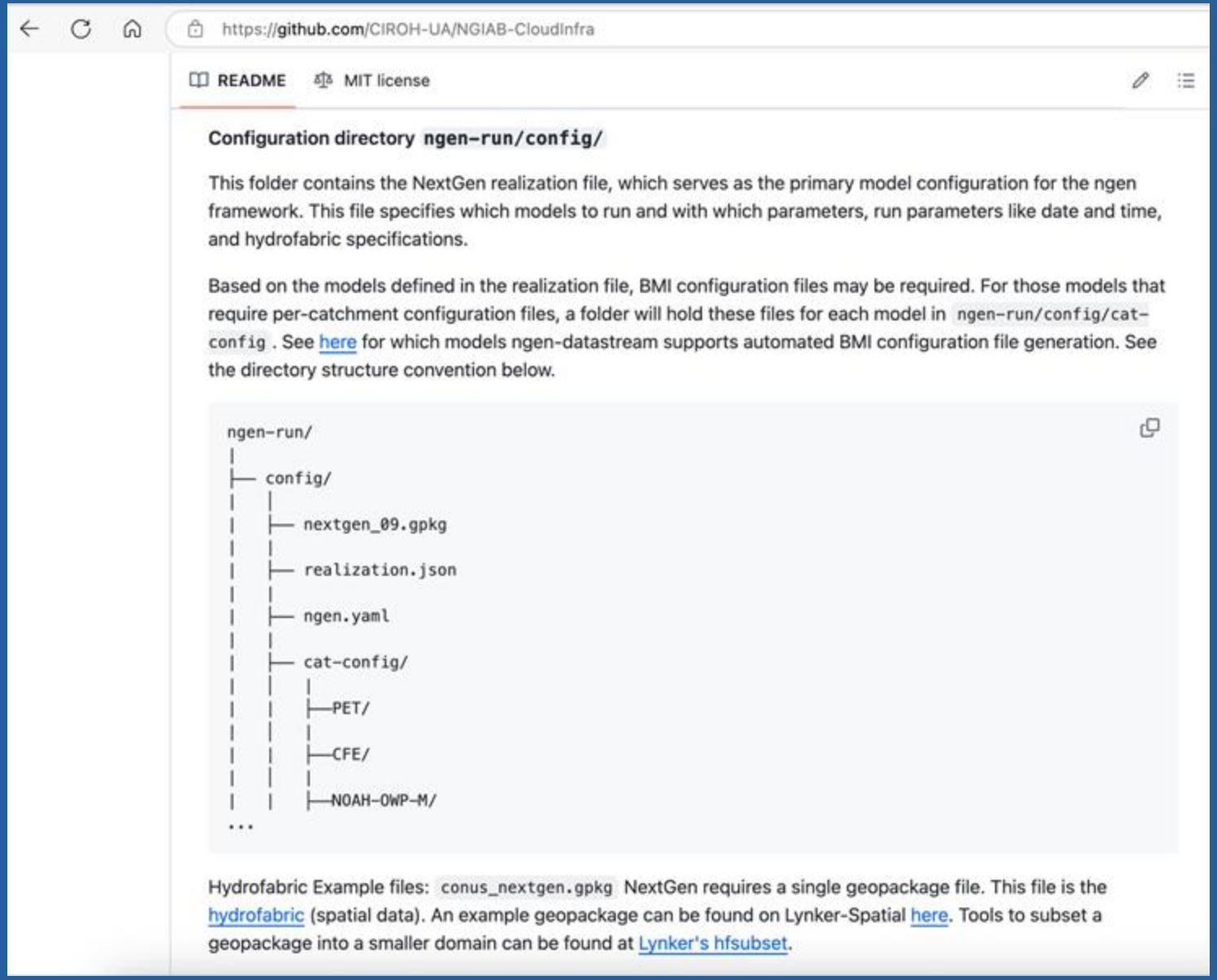
ngen-run/config directory structure



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NGIAB Dockerfile

https://github.com/CIROH-UA/NGIAB-CloudInfra/blob/main/docker/Dockerfile

Files

main

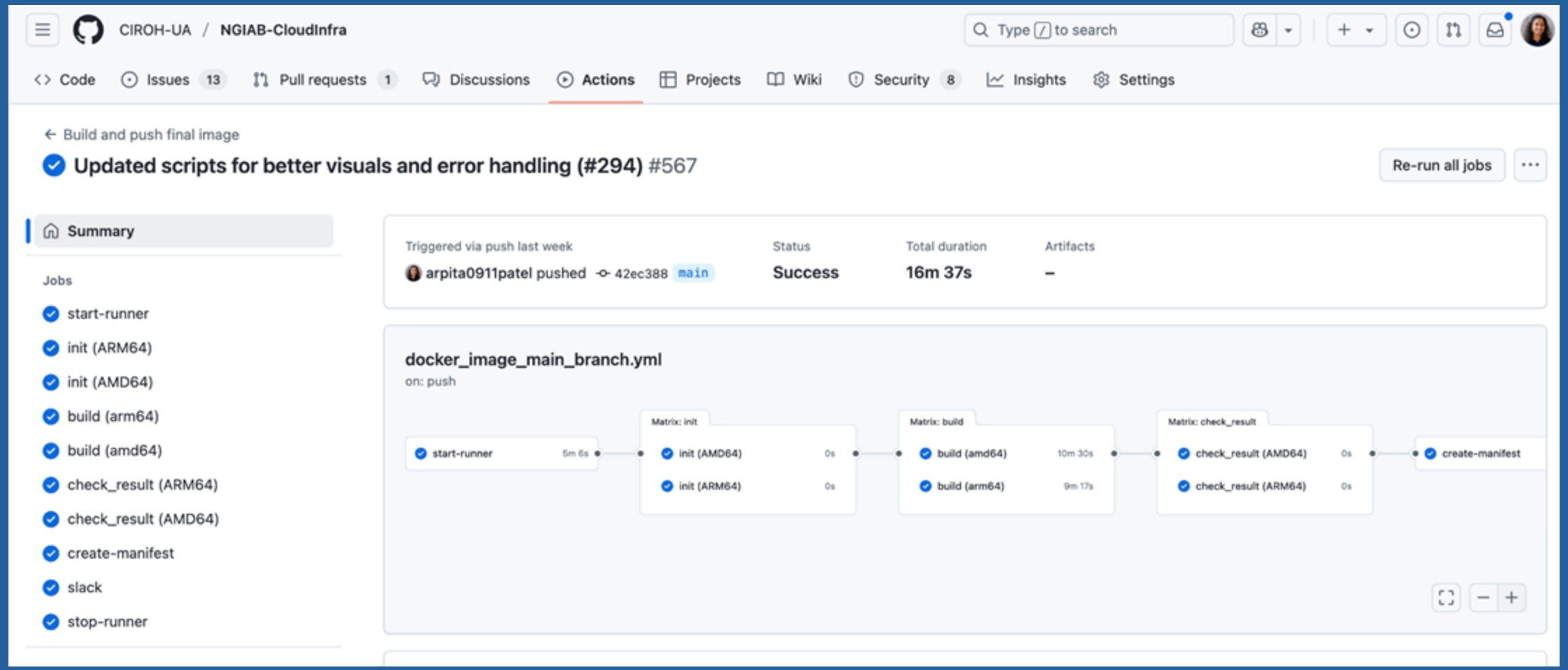
Go to file t

- .github
- config
- docker
  - Dockerfile
  - HelloNGEN.sh
- docs
- image
- terraform
- .gitignore
- LICENSE
- README.md
- contribute.md
- guide.sh
- runTeehr.sh
- viewOnTethys.sh

Code | Blame | 209 lines (161 loc) · 8.04 KB

```
1   FROM rockylinux:9.1 AS base
2   ENV TROUTE_REPO=CIROH-UA/t-route
3   ENV TROUTE_BRANCH=ngiab
4   ENV NGEN_REPO=CIROH-UA/ngen
5   ENV NGEN_BRANCH=ngiab
6
7   # Install final dependencies to make sure ngen is build and deployed with matching versions
8   # Needed here for build caching
9   RUN echo "max_parallel_downloads=10" >> /etc/dnf/dnf.conf
10  RUN dnf update -y && \
11      dnf install -y epel-release && \
12      dnf config-manager --set-enabled crb && \
13      dnf install -y \
14      vim libgfortran sqlite \
15      bzip2 expat udunits2 zlib \
16      mpich hdf5 netcdf netcdf-fortran netcdf-cxx netcdf-cxx4-mpich
17
18  FROM base AS build_base
19  # no dnf update to keep devel packages consistent with versions installed in base
20  RUN echo "max_parallel_downloads=10" >> /etc/dnf/dnf.conf
21  RUN dnf install -y epel-release && \
22      dnf config-manager --set-enabled crb && \
23      dnf install -y \
24      sudo gcc gcc-c++ make cmake ninja-build tar git gcc-gfortran libgfortran sqlite sqlite-devel \
25      python3 python3-devel python3-pip \
26      expat-devel flex bison udunits2-devel zlib-devel \
27      wget mpich-devel hdf5-devel netcdf-devel \
28      netcdf-fortran-devel netcdf-cxx-devel lld
29
30
31
32  FROM build_base AS boost_build
```

NGIAB Continuous Integration (CI)



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Uses AWS Lambda to start/stop runners

NGIAB Product Site ngiab.ciroh.org

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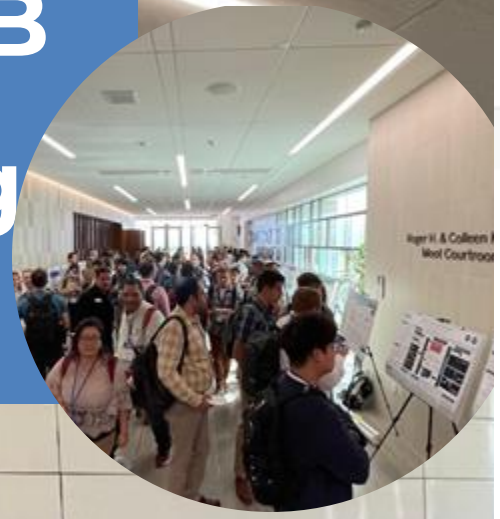
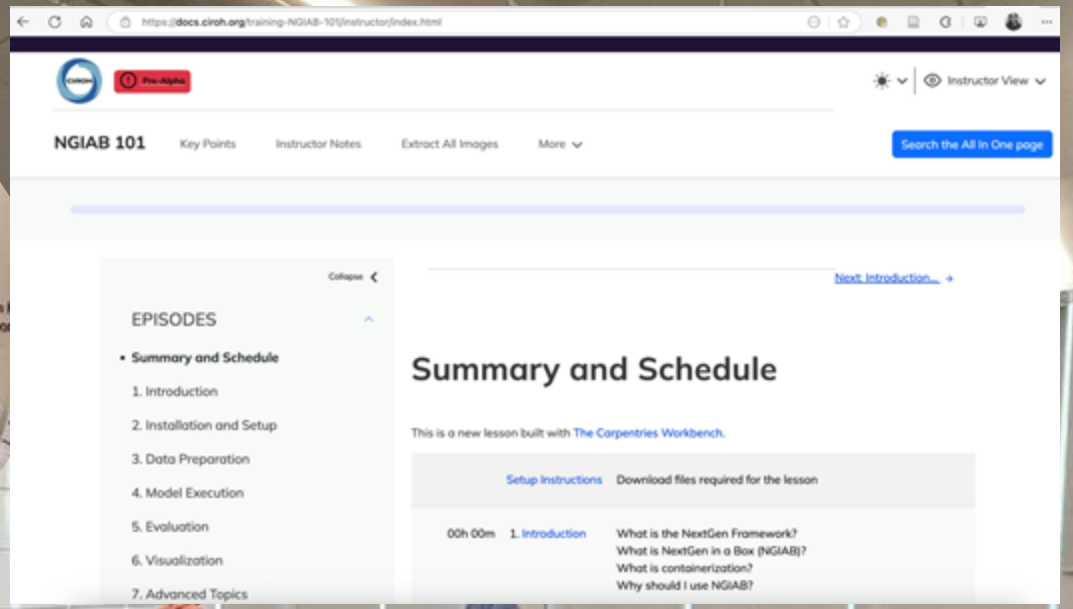
NEW NGIAB 101 Training Module!





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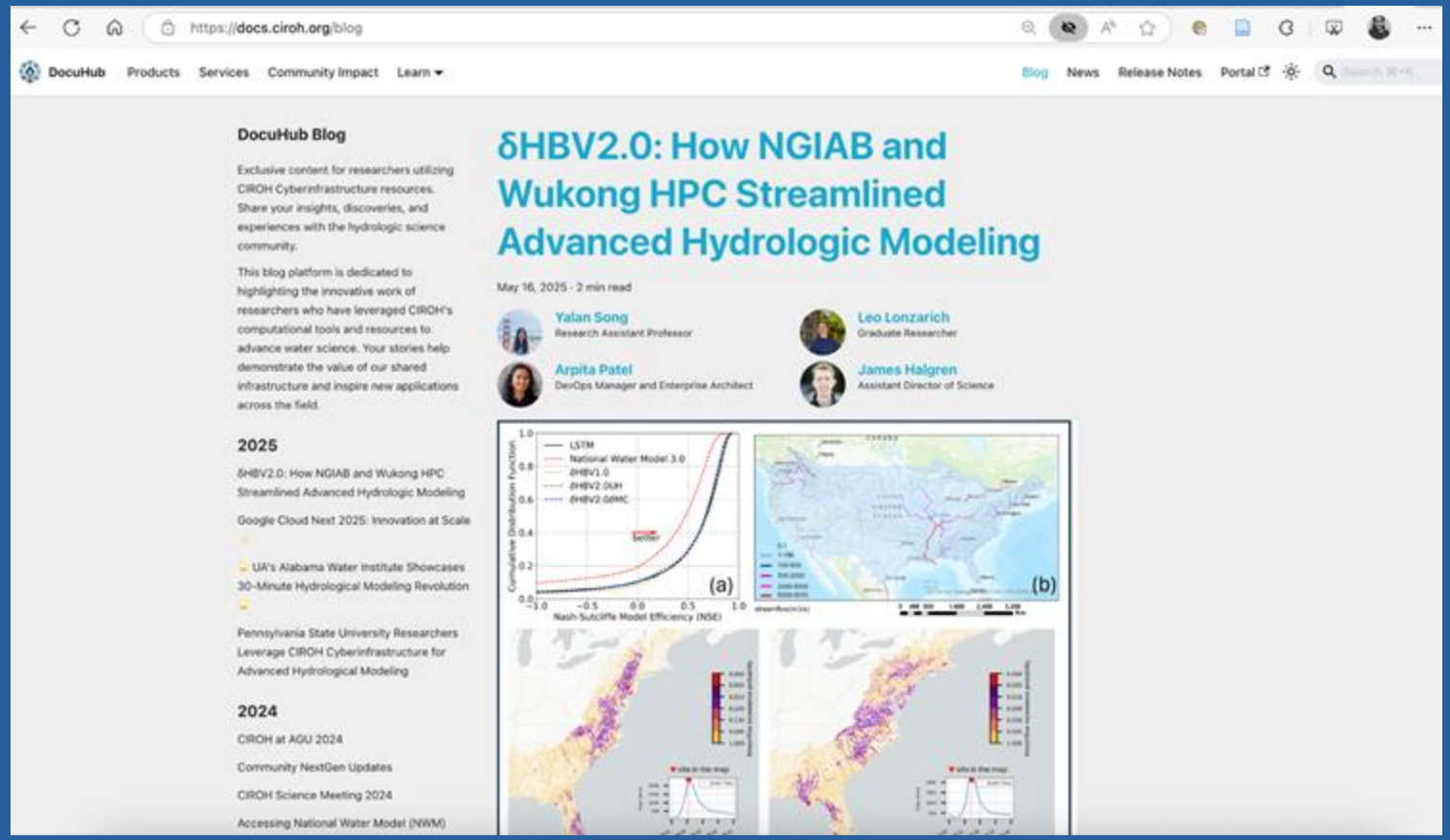
https://docs.ciroh.org/training-NGIAB-101/

How NGIAB accelerates research?



Thanks to NGIAB, users don't have to worry about tricky setups or whether the model will run correctly. NGIAB ensures that our models are compatible everywhere and, most importantly, that they run exactly as designed, consistently and faithfully, every single time, no babysitting required. This means users get the full power of advanced modeling, without the headaches.

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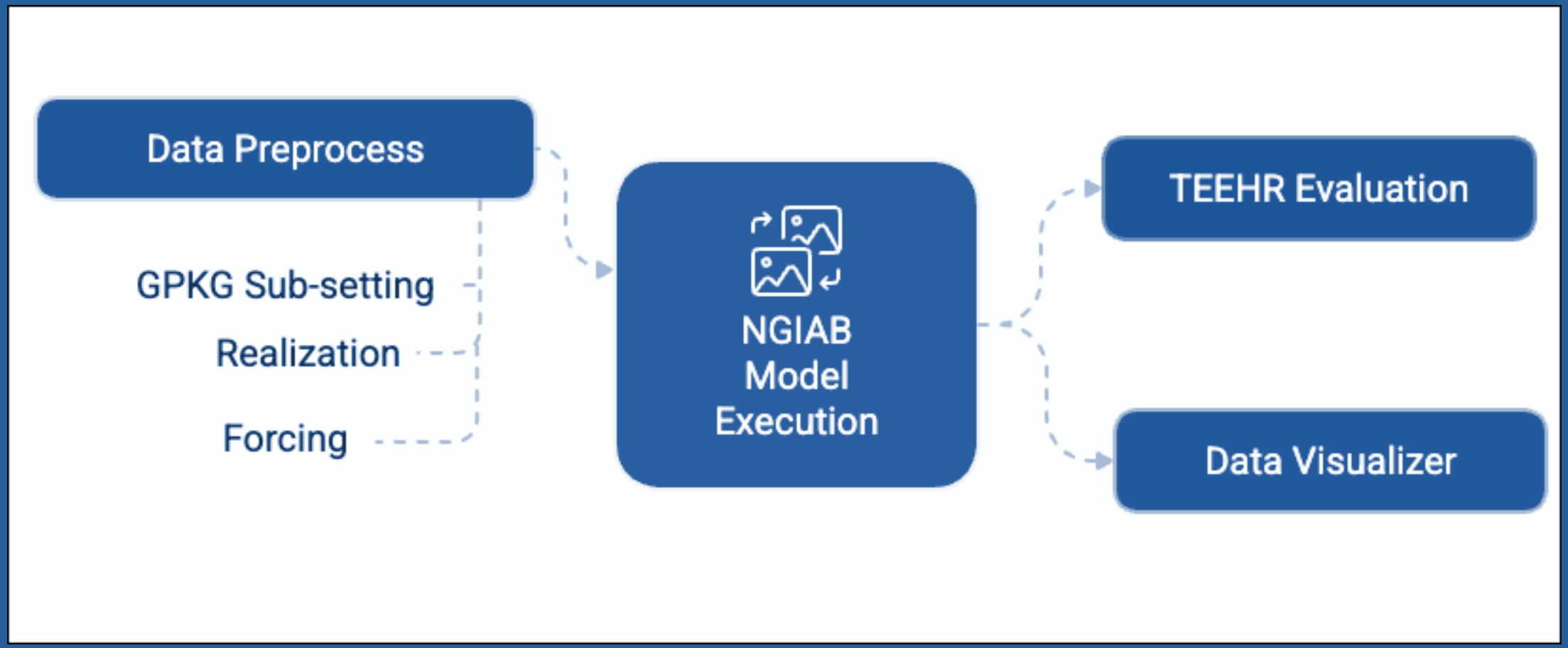
NGIAB Extensions



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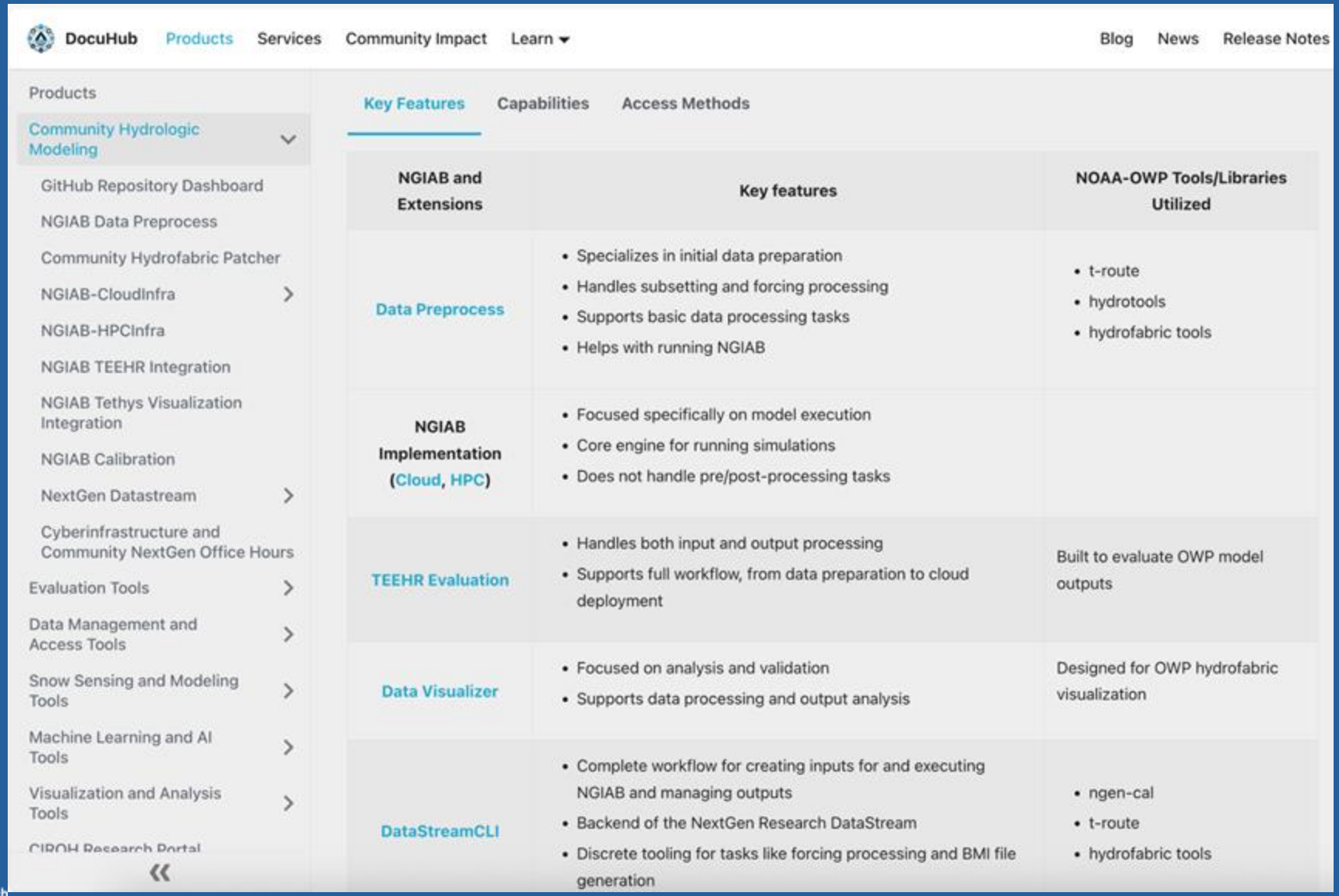
NGIAB and Extensions - Features



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NGIAB and Extensions - Capabilities

Capability	Data Preprocess	TEEHR Evaluation	Data Visualizer	DataStreamCLI	NGIAB-Cal
GUI	✅	-	✅	-	-
Hydrofabric Subsetting	✅	-	✅ (view only)	✅🔨	-
NetCDF Forcing Processing	-	✅	-	✅🔨	-
Zarr Forcing Processing	✅	✅	-	-	-
Forcing Metadata Generation	✅	-	-	✅🔨	-
NextGen BMI Configuration File Generation	✅	-	-	✅🔨	-
Directory and File Format Validation	🔨	-	-	✅🔨	-
NextGen Execution via NGIAB	✅	-	-	✅	-
Execution Metadata Generation	🔨	-	-	✅🔨	-
Calibration	-	-	-	-	✅
Evaluation	-	✅🔨	🔨 (displays TEEHR results)	✅	-
Visualization	-	🔨 (metrics visualization)	✅	-	-

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NGIAB and Extensions - Access Methods

Key Features | Capabilities | Access Methods

Access method	Data Preprocess	NGIAB Implementation (Cloud, HPC)	TEEHR Evaluation	Data Visualizer	DataStreamCLI	NGIAB-Cal
Docker	-	✅	✅	✅	✅	✅
Python Package (pip/uv)	✅	✅	✅	-	-	✅
Web Interface	✅	-	-	✅	-	-
Notebook (ipynb)	-	-	✅	-	-	-
Singularity (HPC)	-	✅	-	-	-	-

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NGIAB Empowers Hydrologic Forecasting Researchers

Local Machine

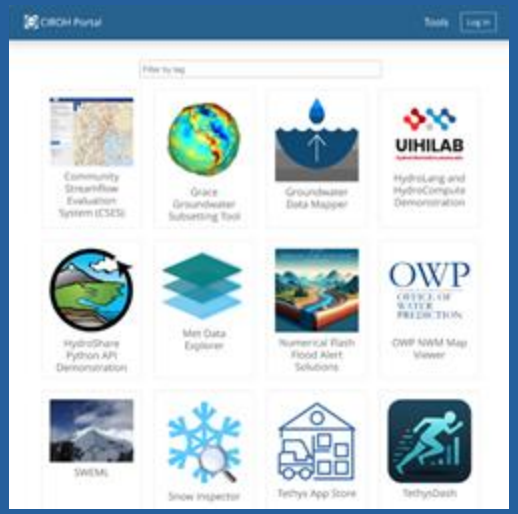
Cloud

HPC

AnyWhere! (JetStream VM, CIROH JupyterHub e.g.)

DOCUHUB

docs.ciroh.org



portal.ciroh.org

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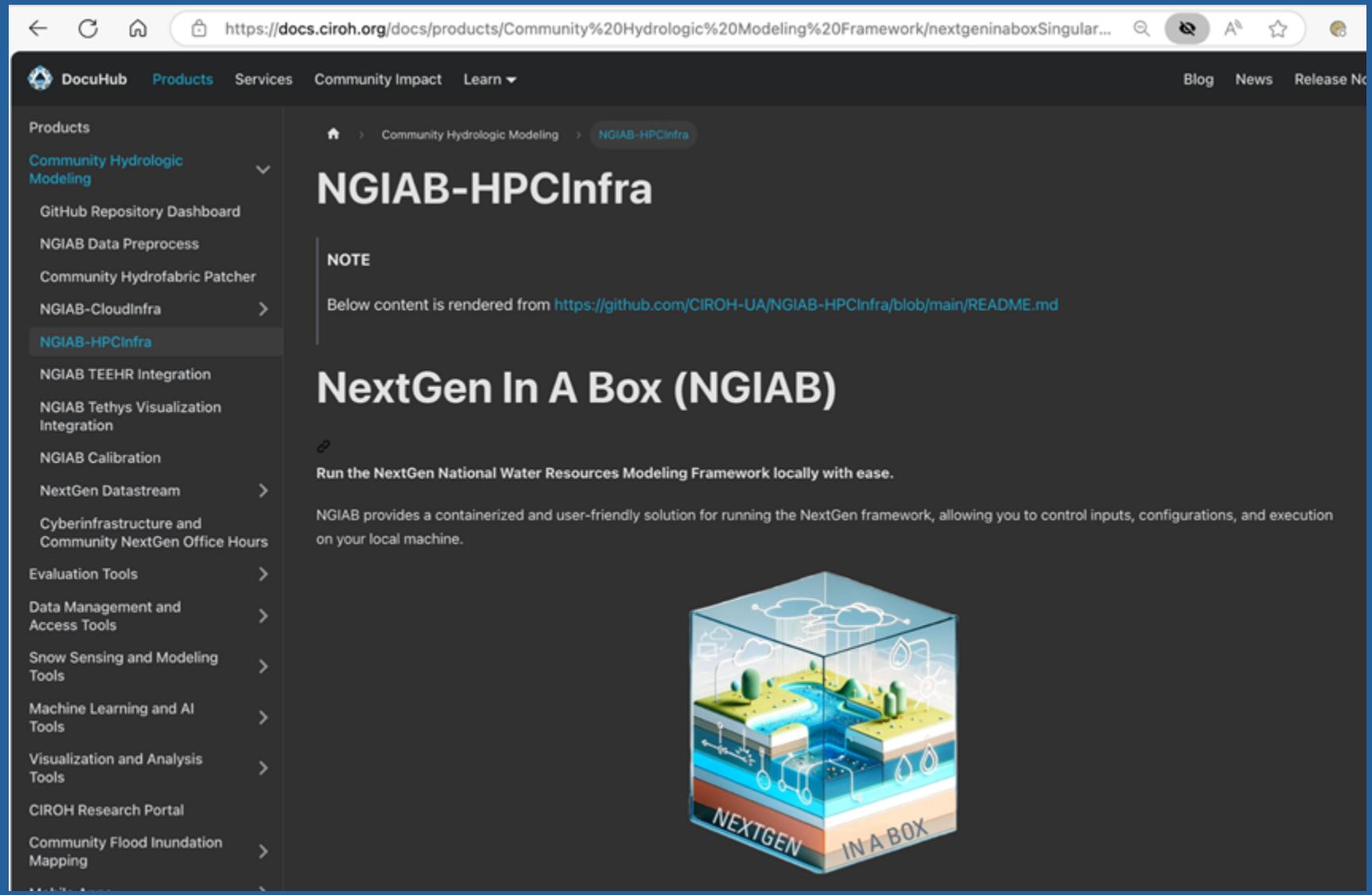
Running NextGen In A Box (NGIAB) on HPC!

Using Singularity Image



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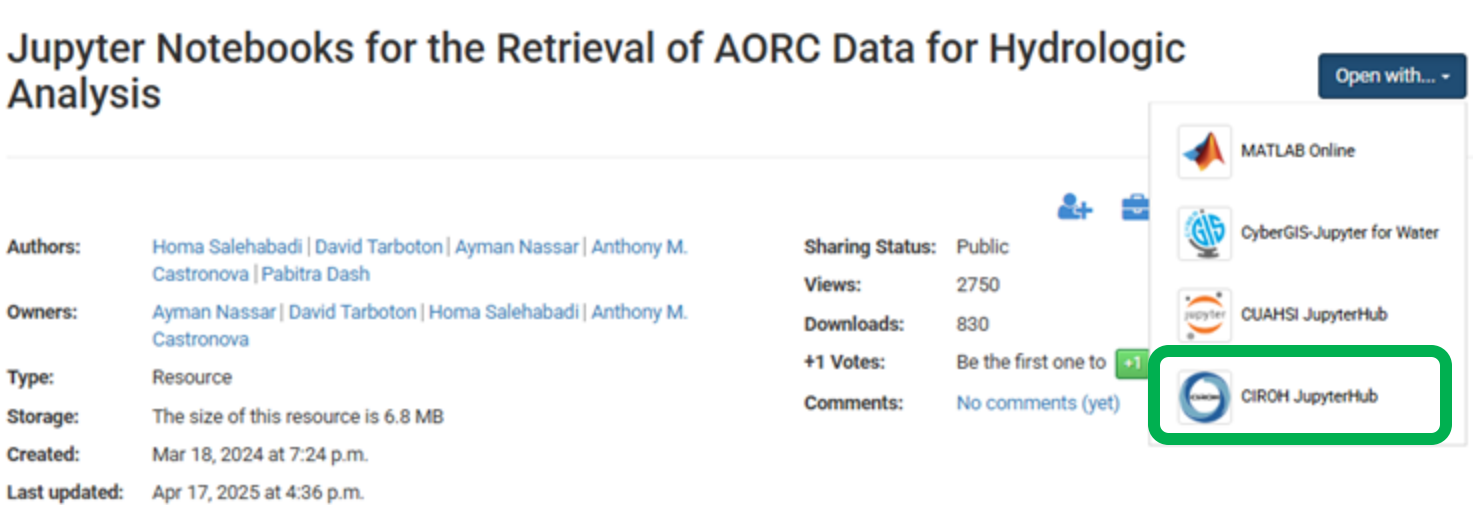
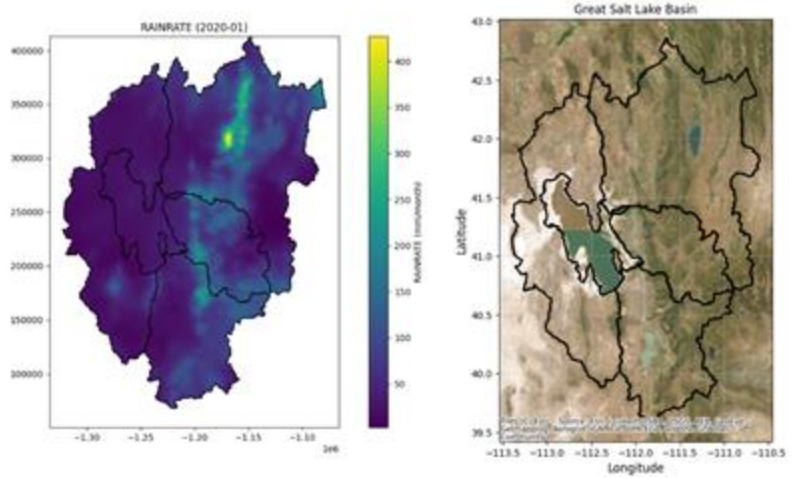
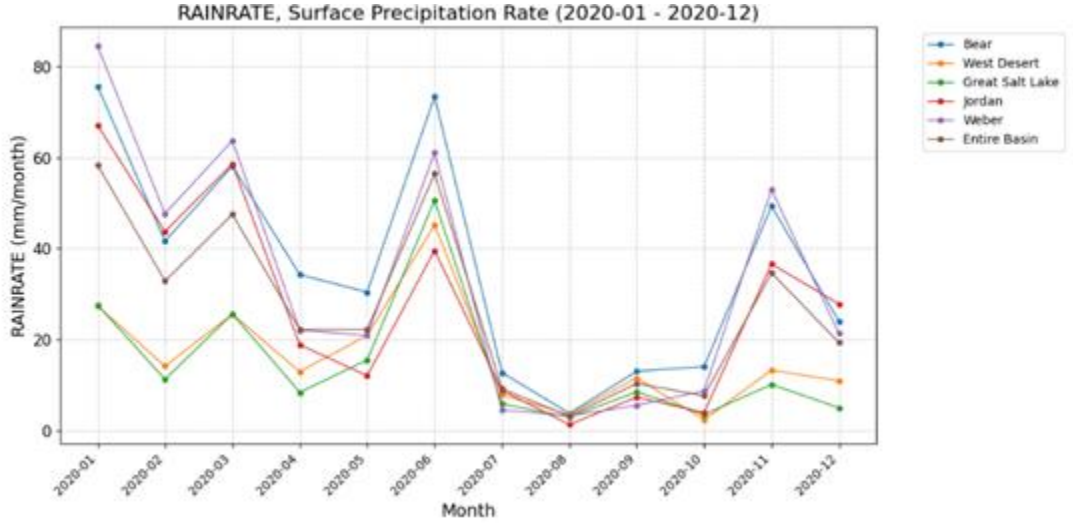
Enhancing and simplifying access to NOAA Analysis of Record for Calibration (AORC) dataset on CIROH JupyterHub

Salehabadi, H., D. Tarboton, A. Nassar, A. M. Castronova, P. Dash (2025). Jupyter Notebooks for the Retrieval of AORC Data for Hydrologic Analysis, HydroShare, http://www.hydroshare.org/resource/72ea9726187e43d7b50a624f2acf591f



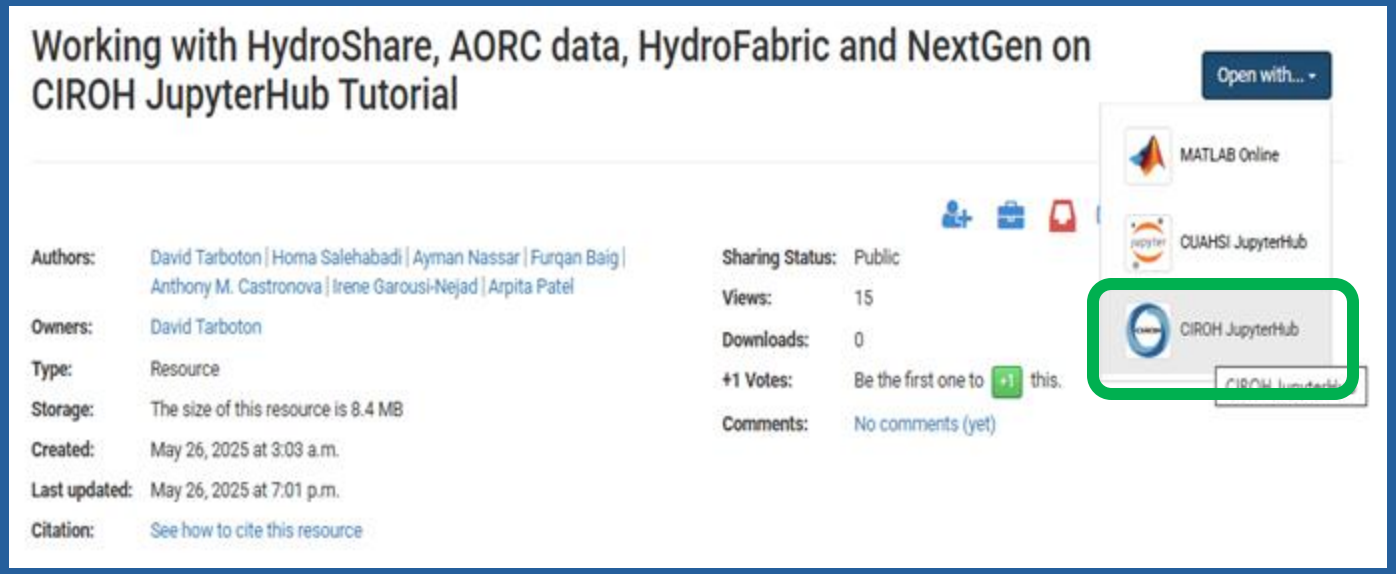


1. Retrieve and aggregate data from the latitude-longitude gridded dataset for a specific point using geographic coordinates.
2. Retrieve and aggregate data from the latitude-longitude gridded dataset for an area defined by a polygon shapefile.
3. Retrieve and aggregate data from the NWM projected dataset for a specific point.
4. Retrieve and aggregate data from the NWM projected dataset for an area defined by a polygon shapefile.



NGIAB data preprocess and NextGen on CIROH JupyterHub

Tutorial in HydroShare search for cirohdevcon25



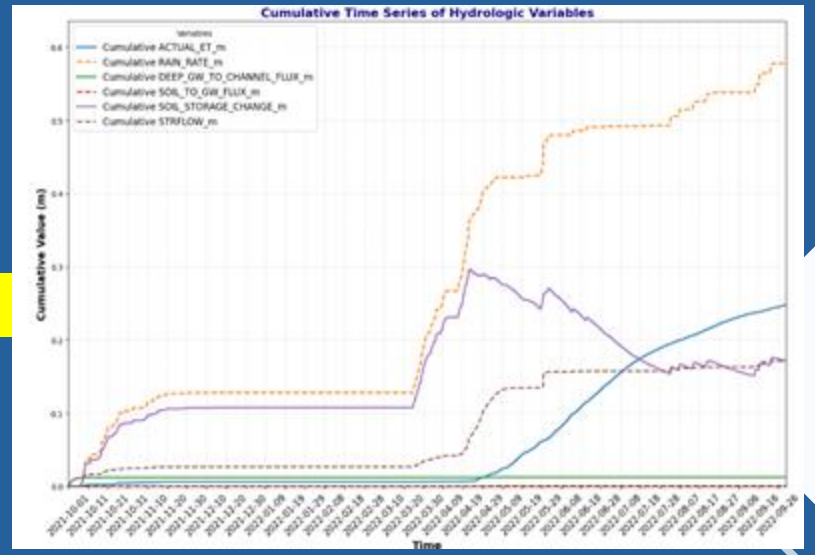
source /ngen/.venv/bin/activate — Virtual environment

python -m ngiab_data_cli -i "gage-10109001" -s
python -m ngiab_data_cli -i "cat-2861446" –s — Hydrofabric

python -m ngiab_data_cli -i "cat-2861446" -f --start "2021-10-01" --end "2022-09-30" — Forcing

python -m ngiab_data_cli -i "cat-2861446" -r --start "2021-10-01" --end "2022-09-30" — Configuration

/dmod/bin/ngen-serial config/cat-2861446_subset.gpkg all config/cat-2861446_subset.gpkg all config/realization.json — Run



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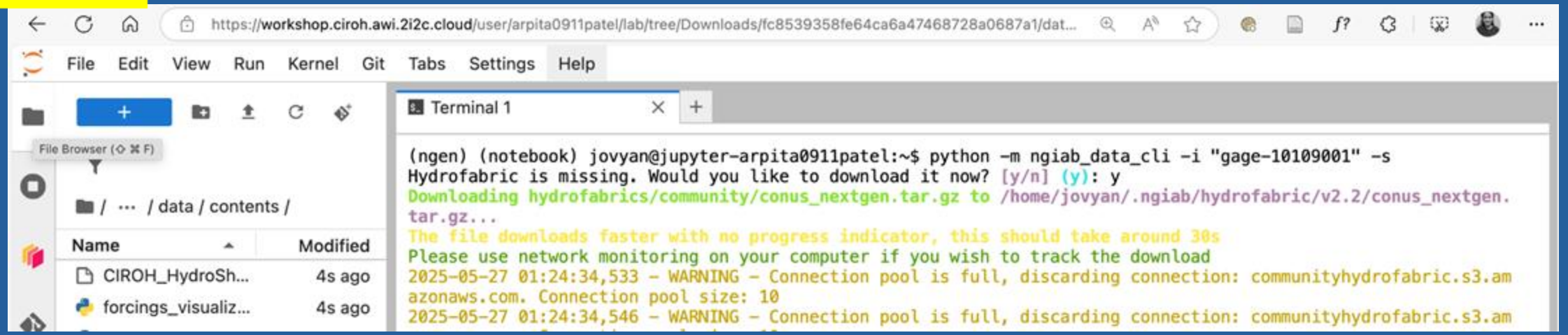
NGIAB data preprocess and NextGen on CIROH JupyterHub

Hydrofabric




```
Decompressing Hydrofabric...
⁖ Decompressing 0:00:20
  Decompressing 0:01:16
Output directory is not set. Would you like to use the default? ~/ngiab_preprocess_output/ [y/n] (y): 2025-05-
27 01:26:04,765 - INFO - Getting catid for 10109001, in /home/jovyan/.ngiab/hydrofabric/v2.2/conus_nextgen.gpk
g
2025-05-27 01:26:05,092 - INFO - Found cat-2861391 from gage-10109001
2025-05-27 01:26:05,094 - INFO - Processing cat-2861391 in /home/jovyan/ngiab_preprocess_output/gage-10109001
2025-05-27 01:26:05,096 - INFO - Building network graph
2025-05-27 01:27:23,265 - INFO - Upstream catchments: 88
2025-05-27 01:27:23,265 - INFO - Subsetting hydrofabric
cat-2861391
2025-05-27 01:27:23,599 - INFO - Subsetting tables: ['divides', 'divide-attributes', 'flowpath-attributes', 'f
lowpath-attributes-ml', 'flowpaths', 'hydrolocations', 'nexus', 'pois', 'lakes', 'network']
2025-05-27 01:27:34,098 - INFO - Subset complete for 213 features (catchments + nexuses)
2025-05-27 01:27:34,099 - INFO - Subsetting complete.
2025-05-27 01:27:34,099 - INFO - All operations completed successfully.
2025-05-27 01:27:34,099 - INFO - Output folder: file:////home/jovyan/ngiab_preprocess_output/gage-10109001
(ngen) (notebook) jovyan@jupyter-arpita0911patel:~$
```

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NGIAB data preprocess and NextGen on CIROH JupyterHub

Forcing

```
(ngen) (notebook) jovyan@jupyter-arpita0911patel:~$  python -m ngiab_data_cli -i "cat-2861446" -f --start "202
1-10-01" --end "2022-09-30"
2025-05-27 02:19:55,259 - INFO - Processing cat-2861446 in /home/jovyan/ngiab_preprocess_output/cat-2861446
2025-05-27 02:19:56,161 - INFO - Upstream catchments: 2
2025-05-27 02:19:56,161 - INFO - Generating forcings from 2021-10-01 00:00:00 to 2022-09-30 00:00:00...



2025-05-27 02:20:33,587 - INFO - No cache found
2025-05-27 02:20:33,606 - INFO - Selected time range and clipped to bounds
2025-05-27 02:20:33,606 - INFO - Downloading and caching forcing data, this may take a while
[##########                              ] | 27% Completed | 22.8s
forcing path cat-2861446 /home/jovyan/ngiab_preprocess_output/cat-2861446/forcings
2025-05-27 02:21:49,999 - INFO - Computing zonal stats in parallel for all timesteps
Forcings processed in 3.569252 seconds ━━━━━━ 100% 8/8 •  Elapsed Time: 0:00:…  Remaining Time: 0:00:…
2025-05-27 02:21:54,149 - INFO - Forcing generation complete! Zonal stats computed in 4.150324 seconds
2025-05-27 02:21:54,265 - INFO - Saving to disk
2025-05-27 02:21:54,455 - INFO - Forcings generation complete.
2025-05-27 02:21:55,456 - INFO - All operations completed successfully.
2025-05-27 02:21:55,456 - INFO - Output folder: file:////home/jovyan/ngiab_preprocess_output/cat-2861446
```

Configuration

```
(ngen) (notebook) jovyan@jupyter-arpita0911patel:~$ python -m ngiab_data_cli -i "cat-2861446" -r --start "2021
-10-01" --end "2022-09-30"
2025-05-27 02:22:17,098 - INFO - Processing cat-2861446 in /home/jovyan/ngiab_preprocess_output/cat-2861446
2025-05-27 02:22:17,992 - INFO - Upstream catchments: 2
2025-05-27 02:22:17,992 - INFO - Creating realization from 2021-10-01 00:00:00 to 2022-09-30 00:00:00...
2025-05-27 02:22:26,722 - INFO - Realization creation complete.
2025-05-27 02:22:26,723 - INFO - All operations completed successfully.
2025-05-27 02:22:26,723 - INFO - Output folder: file:////home/jovyan/ngiab_preprocess_output/cat-2861446
(ngen) (notebook) jovyan@jupyter-arpita0911patel:~$ cd /home/jovyan/ngiab_preprocess_output/cat-2861446
```

NextGen Run on CIROH JupyterHub

Run

```
.json
(ngen) (notebook) jovyan@jupyter-arpita0911patel:~/ngiab_preprocess_output/cat-2861446$ /dmod/bin/ngen-serial
config/cat-2861446_subset.gpkg all config/cat-2861446_subset.gpkg all config/realization.json
NGen Framework 0.3.0
Building Nexus collection
Reading 2 features from layer nexus using ID column `id`
Building Catchment collection
Reading 2 features from layer divides using ID column `divide_id`
Initializing formulations
[   {
          name :    bmi_c++,
          params :         {
               allow_exceed_end_time :            true,
               fixed_time_step :          false,
               init_config :       /dev/null,
               library_file : /dmod/shared_libs/libslothmodel.so,
               main_output_variable :               z,
               model_params :             {
                    sloth_ice_fraction_schaake(1,double,m,node) :                  0,
                    sloth_ice_fraction_xinanjiang(1,double,1,node) :                  0,
                    sloth_soil_moisture_profile(1,double,1,node) :                  0,
               },
```

```
ulation
2025-05-27 02:29:54,989 - root - INFO - [compute.py:907 - compute_nhd_routing_v02]: PARALLEL TIME 4.4919953346
25244 seconds.
2025-05-27 02:29:54,991 - root - INFO - [output.py:180 - nwm_output_generator]: Handling output ...
2025-05-27 02:29:55,506 - root - INFO - [__main__.py:340 - main_v04]: ************ TIMING SUMMARY ************
2025-05-27 02:29:55,506 - root - INFO - [__main__.py:341 - main_v04]: ----------------------------------------
2025-05-27 02:29:55,506 - root - INFO - [__main__.py:342 - main_v04]: Network graph construction: 2.11 secs, 2
9.24 %
2025-05-27 02:29:55,506 - root - INFO - [__main__.py:349 - main_v04]: Forcing array construction: 0.09 secs, 1
.22 %
2025-05-27 02:29:55,506 - root - INFO - [__main__.py:356 - main_v04]: Routing computations: 4.49 secs, 62.36 %
2025-05-27 02:29:55,506 - root - INFO - [__main__.py:363 - main_v04]: Output writing: 0.51 secs, 7.15 %
2025-05-27 02:29:55,506 - root - INFO - [__main__.py:370 - main_v04]: ----------------------------------------
2025-05-27 02:29:55,506 - root - INFO - [__main__.py:371 - main_v04]: Total execution time: 7.199999999999999
secs
Finished routing
NGen top-level timings:
        NGen::init: 2.13784
        NGen::simulation: 3.3627
        NGen::routing: 7.21504
(ngen) (notebook) jovyan@jupyter-arpita0911patel:~/ngiab_preprocess_output/cat-2861446$
(ngen) (notebook) jovyan@jupyter-arpita0911patel:~/ngiab_preprocess_output/cat-2861446$
```

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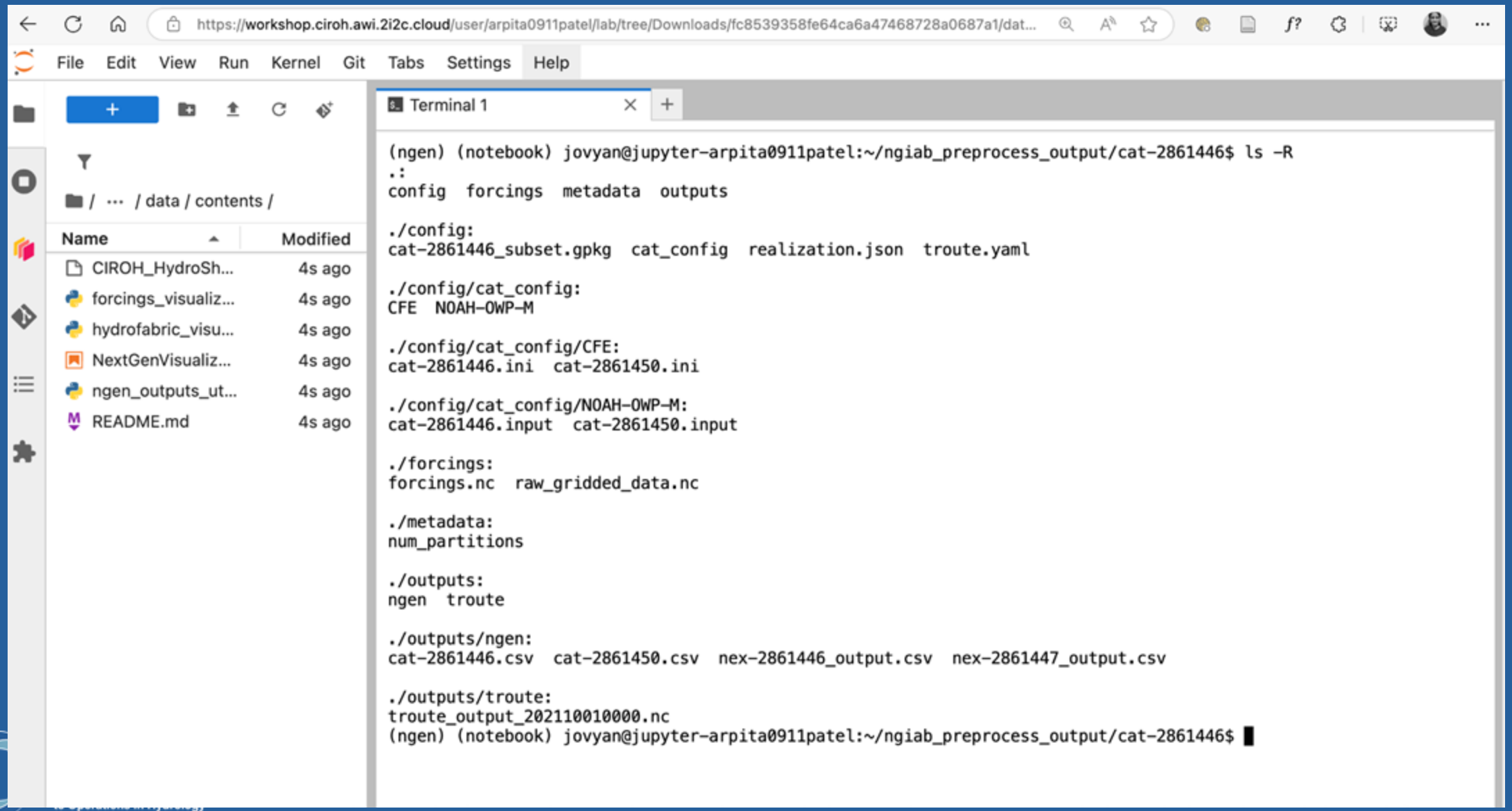
NextGen o/p folder structure



NGIAB Case Study HandsOn Demo

Provo River Basin Case Study!

Please visit

https://docs.ciroh.org/training-NGIAB-101/devcon25js.html

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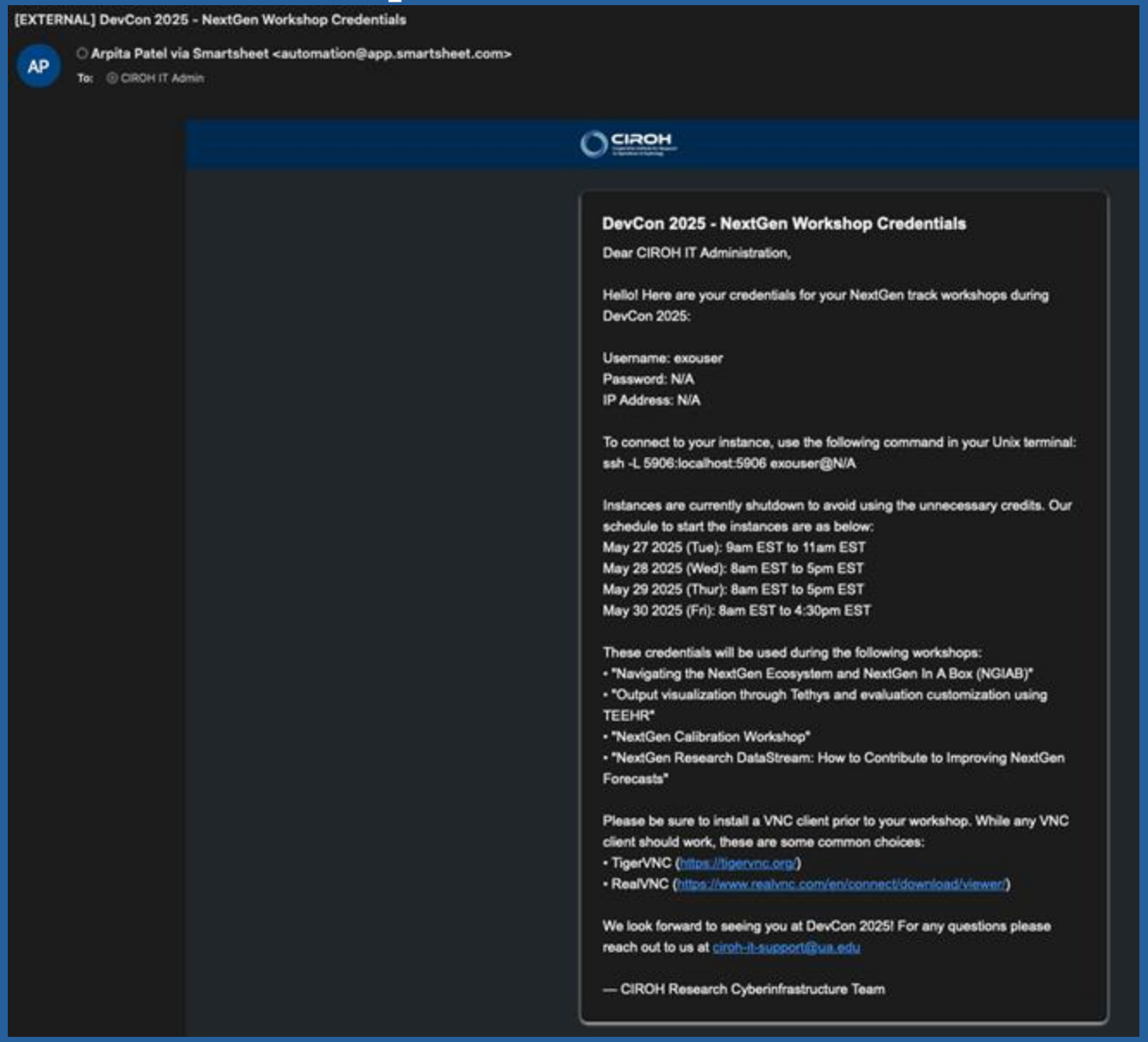
Workshop credentials email



[EXTERNAL] DevCon 2025 - NextGen Workshop Credentials

AP

Arpita Patel via Smartsheet <automation@app.smartsheet.com>

To: CIROH IT Admin

CIROH

DevCon 2025 - NextGen Workshop Credentials

Dear CIROH IT Administration,

Hello! Here are your credentials for your NextGen track workshops during DevCon 2025:

Username: exouser
Password: N/A
IP Address: N/A

To connect to your instance, use the following command in your Unix terminal:
ssh -L 5906:localhost:5906 exouser@N/A

Instances are currently shutdown to avoid using the unnecessary credits. Our schedule to start the instances are as below:
May 27 2025 (Tue): 9am EST to 11am EST
May 28 2025 (Wed): 8am EST to 5pm EST
May 29 2025 (Thur): 8am EST to 5pm EST
May 30 2025 (Fri): 8am EST to 4:30pm EST

These credentials will be used during the following workshops:
• "Navigating the NextGen Ecosystem and NextGen In A Box (NGIAB)"
• "Output visualization through Tethys and evaluation customization using TEEHR"
• "NextGen Calibration Workshop"
• "NextGen Research DataStream: How to Contribute to Improving NextGen Forecasts"

Please be sure to install a VNC client prior to your workshop. While any VNC client should work, these are some common choices:
• TigerVNC (https://tigervnc.org/)
• RealVNC (https://www.realvnc.com/en/connect/download/viewer/)

We look forward to seeing you at DevCon 2025! For any questions please reach out to us at ciroh-it-support@ua.edu

— CIROH Research Cyberinfrastructure Team

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Task 1

https://docs.ciroh.org/training-NGIAB-101/devcon25js.html

When logging in for the first time, you may be asked whether you'd like to trust the host. Type 'yes' to do so.

After that, simply type in your password to gain access to your instance's terminal.

Task 1: Running NGIAB With Prepared Data

1. Run the following command to preprocess data:

BASH

```
uvx --from ngiab_data_preprocess cli -i gage-10154200 -sfr --st
```

Copy

2. Run the following commands to clone the NGIAB-CloudInfra repo and run guide script:

BASH

```
mkdir NGIAB_demo
cd NGIAB_demo
git clone https://github.com/CIROH-UA/NGIAB-CloudInfra.git
cd NGIAB-CloudInfra
./guide.sh
```

Copy

3. When prompted, enter the following input data directory path:

```
/home/exouser/ngiab_preprocess_output/gage-10154200
```

4. Follow the prompts. Choose between serial or parallel mode. Serial will run NextGen on one process, whereas parallel will run NextGen on multiple processes at once.

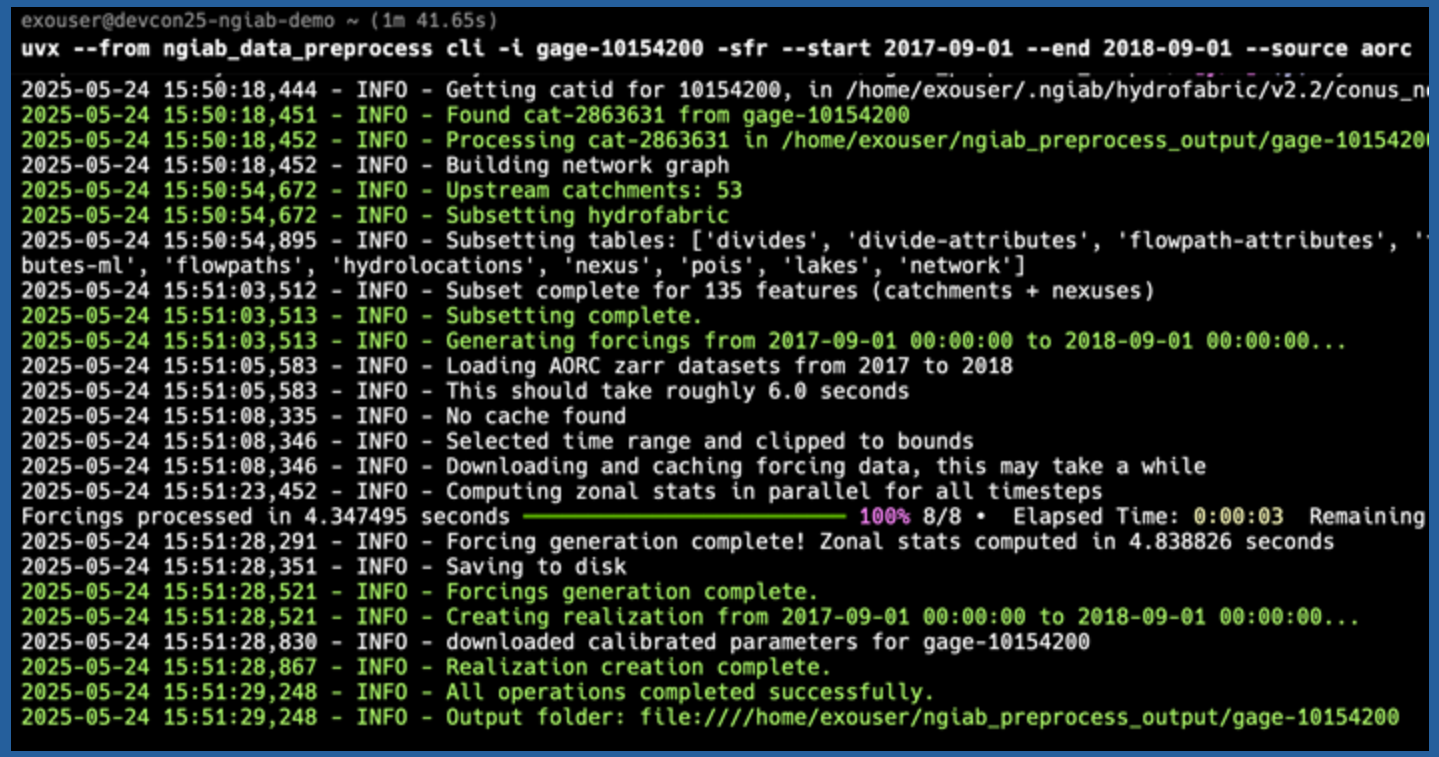
5. When prompted to redirect command output to **`/dev/null`**, select yes. This keeps your output logs clean.

6. After the run is completed, run the TEEHR evaluation when prompted. Choose Option 1 (use

NGIAB Data Preprocess

```
exouser@devcon25-ngiab-demo ~
uvx --from ngiab_data_preprocess cli -i gage-10154200 -sfr --start 2017-09-01 --end 2018-09-01 --source aorc
Installed 77 packages in 473ms
Output directory is not set. Would you like to use the default? ~/ngiab_preprocess_output/ [y/n] (y):
```

When prompted type “y” Use the default output folder given.



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NGIAB Data Preprocess

Output Folder Structure from Data Preprocess

```
exouser@devcon25-ngiab-demo ~/ngiab_preprocess_output/gage-10154200 (0.057s)
ls -R /home/exouser/ngiab_preprocess_output/gage-10154200

/home/exouser/ngiab_preprocess_output/gage-10154200:
config  forcings  metadata  outputs

/home/exouser/ngiab_preprocess_output/gage-10154200/config:
cat_config  downloaded_params.json  gage-10154200_subset.gpkg  realization.json  troute.yaml

/home/exouser/ngiab_preprocess_output/gage-10154200/config/cat_config:
CFE  NOAH-OWP-M

/home/exouser/ngiab_preprocess_output/gage-10154200/config/cat_config/CFE:
cat-2863621.ini  cat-2863627.ini  cat-2863809.ini  cat-2863815.ini  cat-2863821.ini  cat-2863827.ini  cat-2863833.ini  cat-2863839.ini  cat-2863845.ini
cat-2863622.ini  cat-2863628.ini  cat-2863810.ini  cat-2863816.ini  cat-2863822.ini  cat-2863828.ini  cat-2863834.ini  cat-2863840.ini  cat-2863846.ini
cat-2863623.ini  cat-2863629.ini  cat-2863811.ini  cat-2863817.ini  cat-2863823.ini  cat-2863829.ini  cat-2863835.ini  cat-2863841.ini  cat-2863847.ini
cat-2863624.ini  cat-2863630.ini  cat-2863812.ini  cat-2863818.ini  cat-2863824.ini  cat-2863830.ini  cat-2863836.ini  cat-2863842.ini  cat-2863848.ini
cat-2863625.ini  cat-2863631.ini  cat-2863813.ini  cat-2863819.ini  cat-2863825.ini  cat-2863831.ini  cat-2863837.ini  cat-2863843.ini  cat-2863849.ini
cat-2863626.ini  cat-2863808.ini  cat-2863814.ini  cat-2863820.ini  cat-2863826.ini  cat-2863832.ini  cat-2863838.ini  cat-2863844.ini

/home/exouser/ngiab_preprocess_output/gage-10154200/config/cat_config/NOAH-OWP-M:
cat-2863621.input  cat-2863627.input  cat-2863809.input  cat-2863815.input  cat-2863821.input  cat-2863827.input  cat-2863833.input  cat-2863839.input  cat-2863845.
cat-2863622.input  cat-2863628.input  cat-2863810.input  cat-2863816.input  cat-2863822.input  cat-2863828.input  cat-2863834.input  cat-2863840.input  cat-2863846.
cat-2863623.input  cat-2863629.input  cat-2863811.input  cat-2863817.input  cat-2863823.input  cat-2863829.input  cat-2863835.input  cat-2863841.input  cat-2863847.
cat-2863624.input  cat-2863630.input  cat-2863812.input  cat-2863818.input  cat-2863824.input  cat-2863830.input  cat-2863836.input  cat-2863842.input  cat-2863848.
cat-2863625.input  cat-2863631.input  cat-2863813.input  cat-2863819.input  cat-2863825.input  cat-2863831.input  cat-2863837.input  cat-2863843.input  cat-2863849.
cat-2863626.input  cat-2863808.input  cat-2863814.input  cat-2863820.input  cat-2863826.input  cat-2863832.input  cat-2863838.input  cat-2863844.input

/home/exouser/ngiab_preprocess_output/gage-10154200/forcings:
forcings.nc  raw_gridded_data.nc

/home/exouser/ngiab_preprocess_output/gage-10154200/metadata:
num_partitions

/home/exouser/ngiab_preprocess_output/gage-10154200/outputs:
ngen  troute

/home/exouser/ngiab_preprocess_output/gage-10154200/outputs/ngen:

/home/exouser/ngiab_preprocess_output/gage-10154200/outputs/troute:
```

NGIAB Run

```
exouser@devcon25-ngiab-demo ~
mkdir NGIAB_demo
cd NGIAB_demo
git clone https://github.com/CIROH-UA/NGIAB-CloudInfra.git
cd NGIAB-CloudInfra
./guide.sh
```

```
CIROH: NextGen In A Box (NGIAB)
Advanced Hydrologic Modeling Tool
```

```
→ Visit our website: https://ngiab.ciroh.org
i Developed by CIROH & Lynker
```

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NGIAB Execution

```
                    MODEL INPUT REQUIREMENTS

This application requires the following directory structure for proper operation:

  → forcings/ - Contains hydrofabric input data for model simulations
          └─ Meteorological and terrain data for hydrologic calculations

  → config/ - Contains all configuration settings for the model
          └─ Model parameters, simulation period, and execution settings

  → outputs/ - Target directory for simulation results
          └─ Flow estimates, water levels, and diagnostic information

ℹ Please specify a directory containing these components below.

  Last used data directory: /home/exouser/ngiab_preprocess_output/gage-10154200
  → Use the same path? [Y/n]:
```

Copy path from previous datapreprocess o/p and paste here!
Type "Y" if path is displayed

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NGIAB Execution

```
VALIDATING INPUT DIRECTORY

Checking directory structure at: /home/exouser/ngiab_preprocess_output/gage-10154200

✓ Analyzing directory structure - Complete!
  → Checking for forcings directory... ✓ Found with 2 files
  → Checking for config directory... ✓ Found with 110 files
  → Checking for outputs directory... ✓ Found but empty (0 files)
  → Checking for restarts directory... ⚠ Optional directory not found. Continuing...

SUCCESS: Directory structure validated successfully!

FILE MANAGEMENT


→ Checking Outputs directory for existing files...
  ✓ Outputs is clean and ready for new simulations!

→ Checking Restarts directory for existing files...
  ✓ Restarts is clean and ready for new simulations!
```

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NGIAB Execution

```
HYDROFABRIC ANALYSIS

✓ Scanning for model files - Complete!
→ Searching for hydrofabric files...
  ✓ Found 1 files:
      /home/exouser/ngiab_preprocess_output/gage-10154200/config/gage-10154200_subset.gpkg
→ Searching for realization files...
  ✓ Found 1 files:
      /home/exouser/ngiab_preprocess_output/gage-10154200/config/realization.json

SYSTEM CONFIGURATION

→ Hardware Detection:
  i Operating System: Linux
  i Architecture: x86_64

→ Checking for Docker:
  ✓ Docker detected (version: 26.1.3)

MODEL EXECUTION OPTIONS

→ Please select an option to proceed:

1) Run NextGen using existing local docker image  3) Exit
2) Update to latest docker image and run
#?
```

Select Option 1 (use existing Docker image)

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NGIAB Execution

```
Selected files:
Catchment: ./config/gage-10154200_subset.gpkg
Nexus: ./config/gage-10154200_subset.gpkg
Realization: config/realization.json

Generated 8 partitions
Your NGEN run command is mpirun -n 8 /dmod/bin/ngen-parallel ./config/gage-10154200_subset.gpkg all ./config/gage-10154200_
subset.gpkg all config/realization.json /ngen/ngen/data/partitions_8.json
If your model didn't run, or encountered an error, try checking the Forcings paths in the Realizations file you selected.
Do you want to redirect command output to /dev/null? (y/N, default: n):
```

When prompted to redirect command output to /dev/null, select no to see details about the run

```
Updating layer: surface layer
Running timestep 3000
Updating layer: surface layer
Running timestep 3000
Updating layer: surface layer
Running timestep 3100
Updating layer: surface layer
Running timestep 4300
Updating layer: surface layer
Running timestep 3100
Updating layer: surface layer
Running timestep 3600
Updating layer: surface layer
Running timestep 3100
Updating layer: surface layer
Running timestep 1000
Updating layer: surface layer
Running timestep 4400
Updating layer: surface layer
Running timestep 3100
Updating layer: surface layer
Running timestep 3100
Updating layer: surface layer
Running timestep 3200
Updating layer: surface layer
Running timestep 3700
```

```
Finished 8761 timesteps.
creating supernetwork connections set
2025-05-24 16:24:52,318 - root - INFO - [AbstractNetwork.py:525 - create_independent_networks]: organizing connections into
 reaches ...
2025-05-24 16:24:52,319 - root - INFO - [AbstractNetwork.py:682 - initial_warmstate_preprocess]: setting channel initial st
ates ...
2025-05-24 16:24:52,329 - root - INFO - [AbstractNetwork.py:128 - assemble_forcings]: Creating a DataFrame of lateral inflo
w forcings ...
supernetwork connections set complete
... in 0.9965684413909912 seconds.
2025-05-24 16:24:53,210 - root - INFO - [DataAssimilation.py:77 - __init__]: NudgingDA class is Started.
2025-05-24 16:24:53,212 - root - INFO - [DataAssimilation.py:286 - __init__]: PersistenceDA class is started.
2025-05-24 16:24:53,213 - root - INFO - [DataAssimilation.py:840 - __init__]: RFCDA class is started.
2025-05-24 16:24:53,214 - root - INFO - [DataAssimilation.py:719 - __init__]: great_lake class is started.
2025-05-24 16:24:53,215 - root - INFO - [__main__.py:1178 - nwm_route]: executing routing computation ...
2025-05-24 16:24:53,217 - root - INFO - [compute.py:659 - compute_nhd_routing_v02]: JIT Preprocessing time 0.00056314468383
78906 seconds.
2025-05-24 16:24:53,217 - root - INFO - [compute.py:660 - compute_nhd_routing_v02]: starting Parallel JIT calculation
2025-05-24 16:24:56,195 - root - INFO - [compute.py:907 - compute_nhd_routing_v02]: PARALLEL TIME 2.9787158966064453 second
s.
2025-05-24 16:24:56,199 - root - INFO - [output.py:180 - nwm_output_generator]: Handling output ...
```

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NGIAB Execution

```
2025-05-24 16:24:56,713 - root - INFO - [__main__.py:340 - main_v04]: ************ TIMING SUMMARY ************
2025-05-24 16:24:56,713 - root - INFO - [__main__.py:341 - main_v04]: ----------------------------------------
2025-05-24 16:24:56,713 - root - INFO - [__main__.py:342 - main_v04]: Network graph construction: 1.0 secs, 18.51 %
2025-05-24 16:24:56,713 - root - INFO - [__main__.py:349 - main_v04]: Forcing array construction: 0.9 secs, 16.61 %
2025-05-24 16:24:56,713 - root - INFO - [__main__.py:356 - main_v04]: Routing computations: 2.98 secs, 55.29 %
2025-05-24 16:24:56,713 - root - INFO - [__main__.py:363 - main_v04]: Output writing: 0.51 secs, 9.53 %
2025-05-24 16:24:56,713 - root - INFO - [__main__.py:370 - main_v04]: ----------------------------------------
2025-05-24 16:24:56,713 - root - INFO - [__main__.py:371 - main_v04]: Total execution time: 5.39 secs
Finished routing
NGen top-level timings:
        NGen::init: 4.31709
        NGen::simulation: 14.8263
        NGen::routing: 5.41092

real    0m25.071s
user    1m34.448s
sys     0m33.774s
Finished executing command successfully.
Would you like to continue?
Select an option (type a number):
1) Interactive-Shell
2) Exit
#?
```

NextGen run is complete!

Select Option 2 (exit)

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NextGen Output

```
exouser@devcon25-ngiab-demo ~/ngiab_preprocess_output/gage-10154200/outputs (0.058s)
ls -R

.:
ngen  troute

./ngen:
cat-2863621.csv  cat-2863811.csv  cat-2863825.csv  cat-2863839.csv         nex-2863624_output.csv  nex-2863826_output.csv
cat-2863622.csv  cat-2863812.csv  cat-2863826.csv  cat-2863840.csv         nex-2863625_output.csv  nex-2863828_output.csv
cat-2863623.csv  cat-2863813.csv  cat-2863827.csv  cat-2863841.csv         nex-2863626_output.csv  nex-2863829_output.csv
cat-2863624.csv  cat-2863814.csv  cat-2863828.csv  cat-2863842.csv         nex-2863627_output.csv  nex-2863830_output.csv
cat-2863625.csv  cat-2863815.csv  cat-2863829.csv  cat-2863843.csv         nex-2863628_output.csv  nex-2863831_output.csv
cat-2863626.csv  cat-2863816.csv  cat-2863830.csv  cat-2863844.csv         nex-2863629_output.csv  nex-2863832_output.csv
cat-2863627.csv  cat-2863817.csv  cat-2863831.csv  cat-2863845.csv         nex-2863630_output.csv  nex-2863836_output.csv
cat-2863628.csv  cat-2863818.csv  cat-2863832.csv  cat-2863846.csv         nex-2863631_output.csv  nex-2863837_output.csv
cat-2863629.csv  cat-2863819.csv  cat-2863833.csv  cat-2863847.csv         nex-2863632_output.csv  nex-2863838_output.csv
cat-2863630.csv  cat-2863820.csv  cat-2863834.csv  cat-2863848.csv         nex-2863809_output.csv  nex-2863842_output.csv
cat-2863631.csv  cat-2863821.csv  cat-2863835.csv  cat-2863849.csv         nex-2863810_output.csv  nex-2863843_output.csv
cat-2863808.csv  cat-2863822.csv  cat-2863836.csv  nex-2863621_output.csv  nex-2863821_output.csv  nex-2863844_output.csv
cat-2863809.csv  cat-2863823.csv  cat-2863837.csv  nex-2863622_output.csv  nex-2863822_output.csv  nex-2863847_output.csv
cat-2863810.csv  cat-2863824.csv  cat-2863838.csv  nex-2863623_output.csv  nex-2863823_output.csv

./troute:
troute_output_201709010000.nc
```

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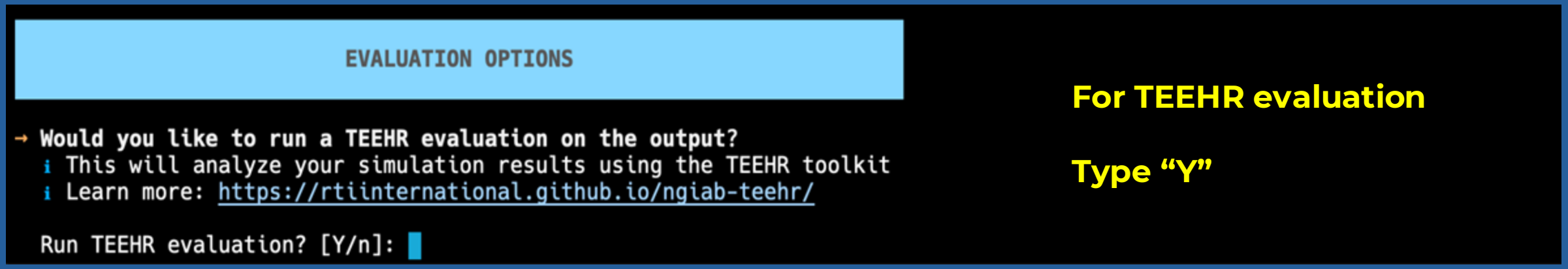
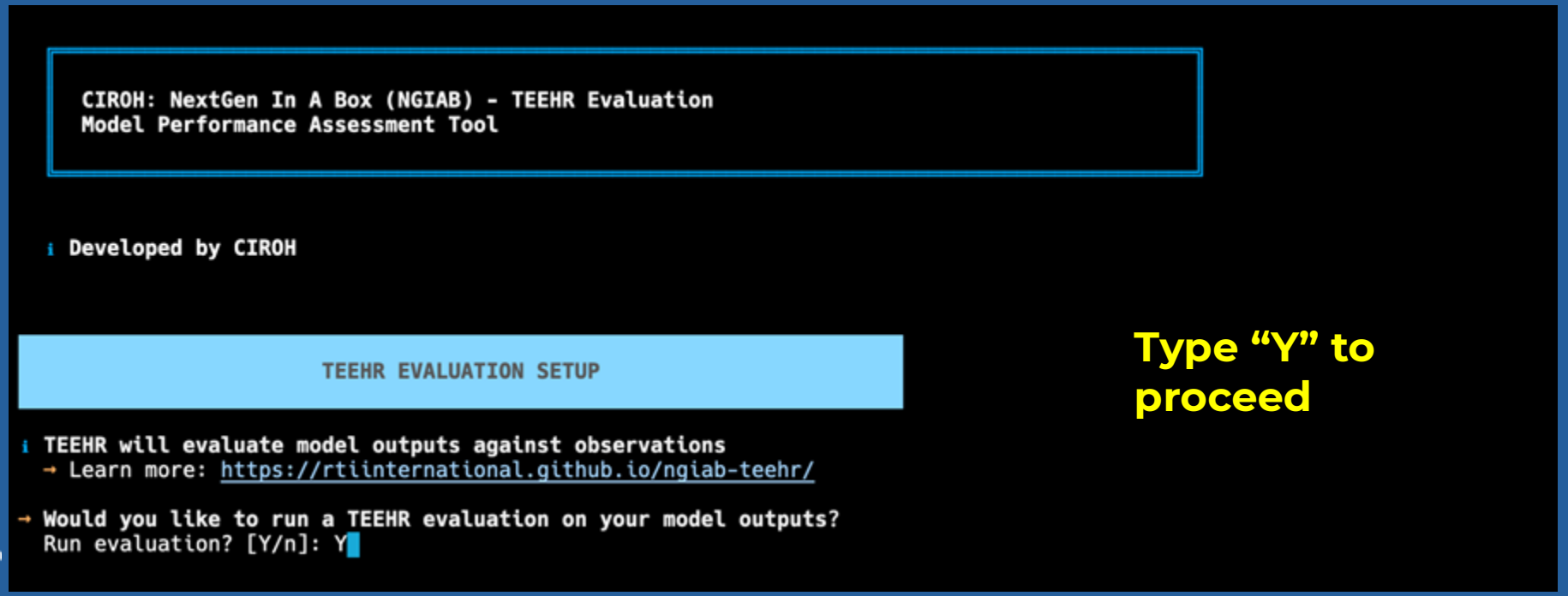
TEEHR Evaluation



For TEEHR evaluation

Type “Y”



Type “Y” to proceed

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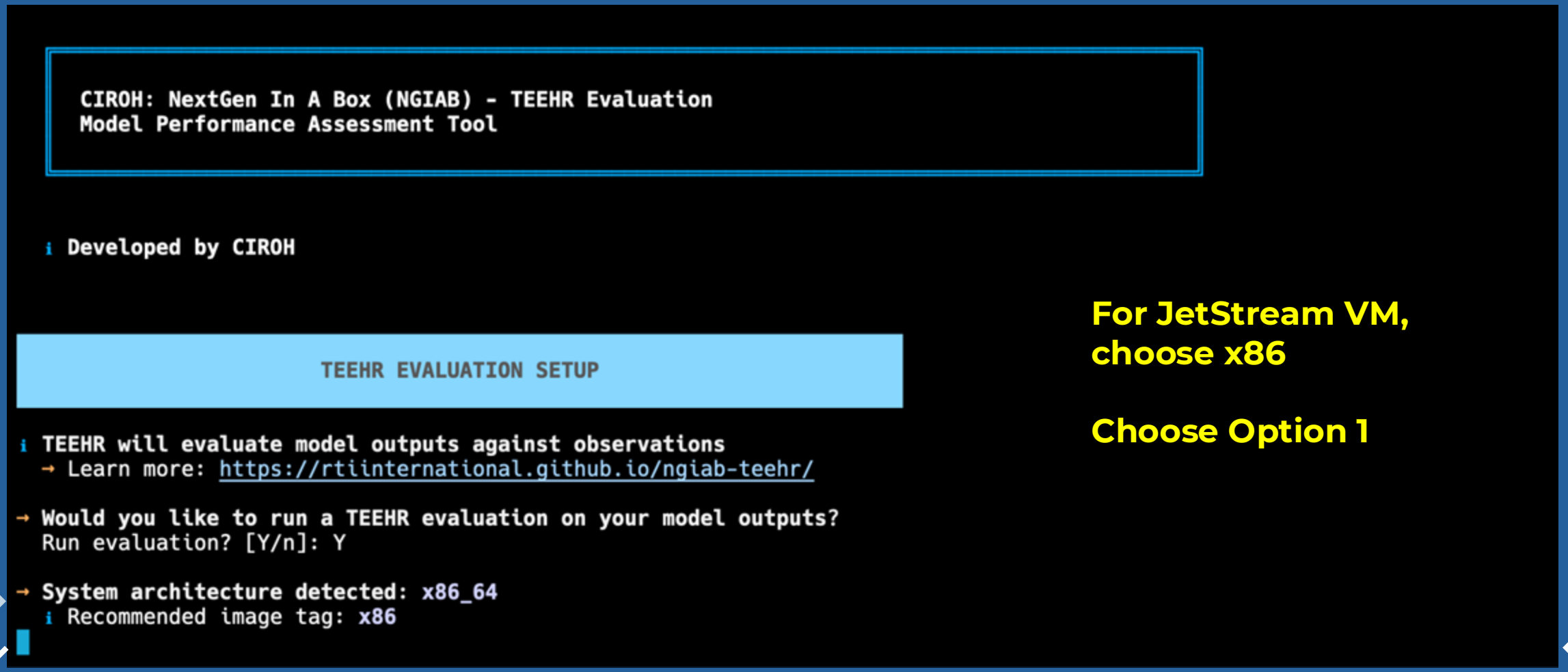
TEEHR Evaluation



For JetStream VM, choose x86

Choose Option 1

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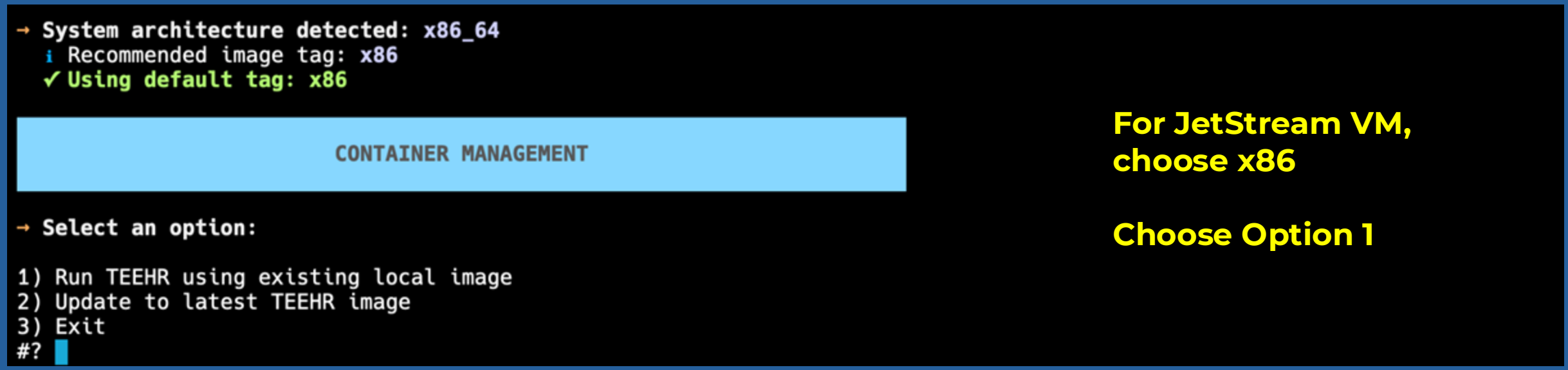
TEEHR Evaluation



For JetStream VM, choose x86

Choose Option 1

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TEEHR Evaluation

```
  ✓ Using existing local TEEHR image

                    RUNNING TEEHR EVALUATION

ℹ Evaluating model outputs in: /home/exouser/ngiab_preprocess_output/gage-10154200
  → This analysis may take several minutes depending on your dataset size
✓ Initializing TEEHR evaluation - Complete!

→ Cleaning up resources...
  ✓ Cleanup completed
/usr/local/lib/python3.11/site-packages/pyspark/bin/load-spark-env.sh: line 68: ps: command not found
Setting default log level to "WARN".
To adjust logging level use sc.setLogLevel(newLevel). For SparkR, use setLogLevel(newLevel).
25/05/24 16:33:27 WARN NativeCodeLoader: Unable to load native-hadoop library for your platform... using builtin-java clas
es where applicable
```

```
INFO:teehr.visualization.dataframe_accessor:Generating timeseries plot.
INFO:teehr.visualization.dataframe_accessor:Processing combination: ('ngen', 'ngen-2863631', NaT)
INFO:teehr.visualization.dataframe_accessor:
                        reference_time == NaT, ignoring reference_time for
                        combo: ('ngen', 'ngen-2863631', NaT)

INFO:teehr.visualization.dataframe_accessor:Plotting data for combination: ('ngen', 'ngen-2863631', NaT)
INFO:teehr.visualization.dataframe_accessor:Processing combination: ('nwm30_retrospective', 'nwm30-10373692', NaT)
INFO:teehr.visualization.dataframe_accessor:
                        reference_time == NaT, ignoring reference_time for
                        combo: ('nwm30_retrospective', 'nwm30-10373692', NaT)

INFO:teehr.visualization.dataframe_accessor:Plotting data for combination: ('nwm30_retrospective', 'nwm30-10373692', NaT)
INFO:teehr.visualization.dataframe_accessor:Saving timeseries plot at data/teehr

                    EVALUATION COMPLETE

TEEHR evaluation completed successfully!
```

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TEEHR Evaluation

```
EVALUATION COMPLETE

TEEHR evaluation completed successfully!

ℹ Results have been saved to your outputs directory:
  → /home/exouser/ngiab_preprocess_output/gage-10154200/outputs/teehr/

ℹ You can visualize these results using the Tethys platform
  → Run ./viewOnTethys.sh /home/exouser/ngiab_preprocess_output/gage-10154200 to start visualization

Thank you for using NGIAB!
ℹ For support, please email: ciroh-it-support@ua.edu


→ Cleaning up resources...
  ✓ Cleanup completed

→ Cleaning up resources...
  ✓ Cleanup completed
```

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TEEHR Evaluation

```
exouser@devcon25-ngiab-demo ~/ngiab_preprocess_output/gage-10154200 (0.053s)
ls teehr/

__init__.py  dataset      ngen_usgs_crosswalk.parquet  readme.md  teehr.log
cache        metrics.csv  nwm_usgs_crosswalk.parquet   scripts    timeseries_plot_streamflow_hourly_inst.html
```

```
exouser@devcon25-ngiab-demo ~/ngiab_preprocess_output/gage-10154200 (0.053s)
ls -R teehr/

teehr/:
__init__.py  dataset      ngen_usgs_crosswalk.parquet  readme.md  teehr.log
cache        metrics.csv  nwm_usgs_crosswalk.parquet   scripts    timeseries_plot_streamflow_hourly_inst.html

teehr/cache:
fetching  loading  locations.parquet  ngen_output.parquet  readme.md

teehr/cache/fetching:
nwm  usgs

teehr/cache/fetching/nwm:
nwm30_retrospective

teehr/cache/fetching/nwm/nwm30_retrospective:
streamflow_hourly_inst

teehr/cache/fetching/nwm/nwm30_retrospective/streamflow_hourly_inst:
20170901_20180901.parquet

teehr/cache/fetching/usgs:
usgs_observations

teehr/cache/fetching/usgs/usgs_observations:
streamflow_hourly_inst

teehr/cache/fetching/usgs/usgs_observations/streamflow_hourly_inst:
2017-09-01_2018-09-01.parquet
```

```
teehr/cache/loading:
location_crosswalks  locations  secondary_timeseries

teehr/cache/loading/location_crosswalks:
ngen_usgs_crosswalk.parquet  nwm_usgs_crosswalk.parquet

teehr/cache/loading/locations:
locations.parquet

teehr/cache/loading/secondary_timeseries:
ngen_output.parquet

teehr/dataset:
attributes      joined_timeseries    location_crosswalks  primary_timeseries    units
configurations  location_attributes  locations            secondary_timeseries  variables

teehr/dataset/attributes:
_readme.md  attributes.csv

teehr/dataset/configurations:
_readme.md  configurations.csv

teehr/dataset/joined_timeseries:
 _readme.md  'configuration_name=ngen'  'configuration_name=nwm30_retrospective'

'teehr/dataset/joined_timeseries/configuration_name=ngen':
'variable_name=streamflow_hourly_inst'

'teehr/dataset/joined_timeseries/configuration_name=ngen/variable_name=streamflow_hourly_inst':
part-00000-c4736269-4023-449e-967d-902a68650f65.c000.snappy.parquet
```

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NGIAB Visualizer

```
VISUALIZATION OPTIONS

→ Would you like to visualize results using Tethys?
  ℹ This will provide an interactive web interface to explore your model results
  Visualize results? [Y/n]:
```

Type “Y”

```
==================================================
|  CIROH: NextGen In A Box (NGIAB) - Tethys      |
|  Interactive Model Output Visualization        |
==================================================

ℹ Developed by CIROH

PREPARING VISUALIZATION ENVIRONMENT

  ✓ Copied → /home/exouser/ngiab_visualizer/gage-10154200
Checking for /home/exouser/ngiab_visualizer/ngiab_visualizer.json...
  ✓ Model run “gage-10154200” registered (f9f9b308-eebe-4fd1-9f4d-501f6fcba474)
ℹ Directory /home/exouser/.datastream_ngiab doesn't exist — creating it...
  ℹ No existing Datastream cache found - a fresh download will be used.

LAUNCHING TETHYS VISUALIZATION

Specify the Tethys image tag to use:
  → Tag (e.g. v0.2.1, default: latest):
```

Choose the default latest image but hitting enter

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NGIAB Visualizer

```
Specify the Tethys image tag to use:
  → Tag (e.g. v0.2.1, default: latest):
  i Found local image awiciroh/tethys-ngiab:latest
  → Use local copy (L) or Pull latest from registry (P)? [L/P]:
```

Type “L” to choose local copy

```
  ✓ Using local image
Select a port to run Tethys on. [Default: 80]
  → Port:
```

Hit enter so select default port 80, if in use then select 81

```
  → Using default port 80 for Tethys.
    ✓ Port 80 selected
  → Launching Tethys container...
    i Tethys container is already running. Stopping it first...
    ⚠ Forcibly removing container...
  i Setting up Docker network for Tethys...
    ✓ Network tethys-network created successfully.
    i Starting Tethys container...
    i Running docker command...
8c90ff9a54a6e294630b0f1b72915cc028cadc7e5af5cba303cf5c80580cb074
    ✓ Tethys container started successfully.
  i  Waiting for container: tethys-ngen-portal to become healthy. This can take a couple of minutes...
```

This might take a minute or so!

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NGIAB Tethys Visualizer

```
  i Starting Tethys container...
  i Running docker command...
8c90ff9a54a6e294630b0f1b72915cc028cadc7e5af5cba303cf5c80580cb074
  ✓ Tethys container started successfully.
i  Waiting for container: tethys-ngen-portal to become healthy. This can take a couple of minutes...

 ✓ Container tethys-ngen-portal is now healthy!

                    VISUALIZATION READY

 Your model outputs are now available for visualization!

i Access the visualization at: http://localhost:80/apps/ngiab
i Login credentials:
  → Username: admin
  → Password: pass

i Source code: https://github.com/CIROH-UA/ngiab-client

 Tethys is now running
i Access the visualization at: http://localhost:80/apps/ngiab
i Press Ctrl+C to stop Tethys when you're done.
```

Tethys Visualizer is now running!
Open VNC Client to browse this URL

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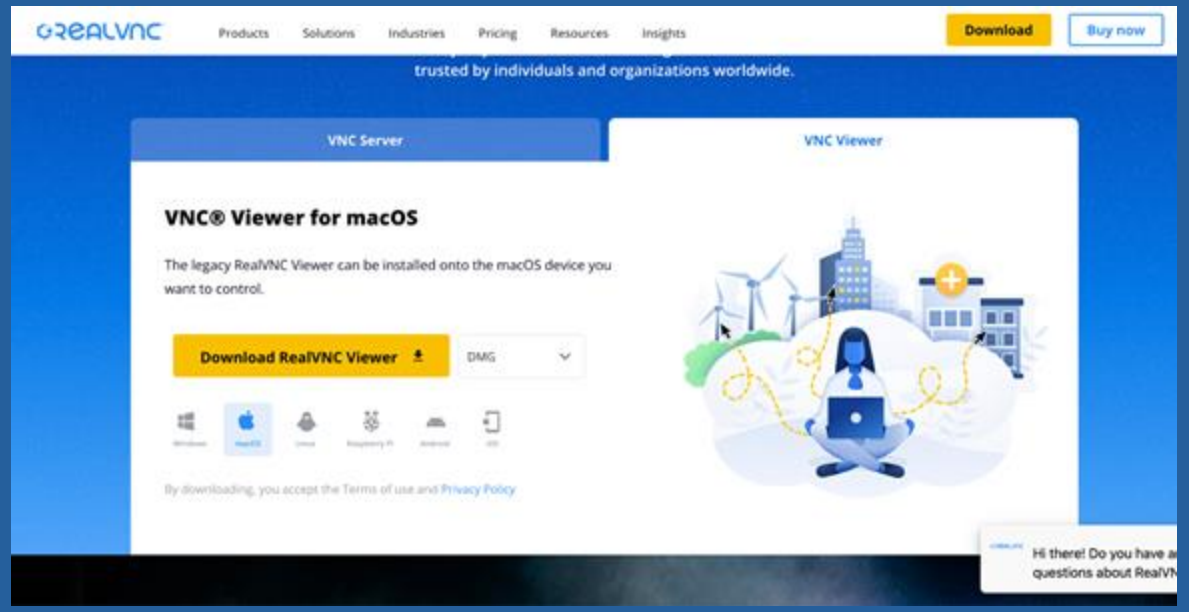
VNC Client Setup

While any VNC client should work, these are common choices:

- **TigerVNC (https://tigervnc.org/)**
- **RealVNC (https://www.realvnc.com/en/connect/download/viewer/)**



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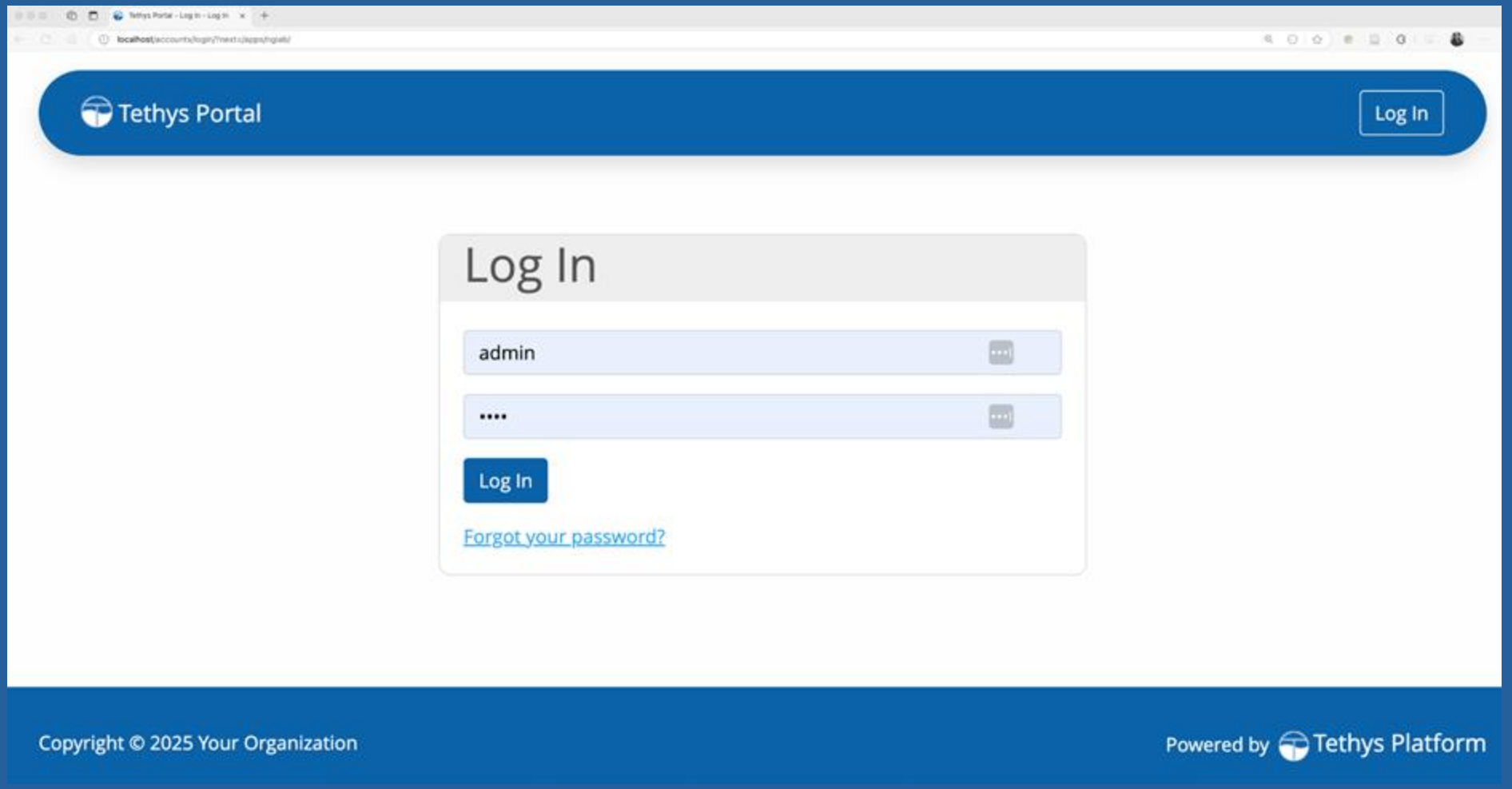
NGIAB Tethys Visualizer



Enter id/pwd: admin/pass

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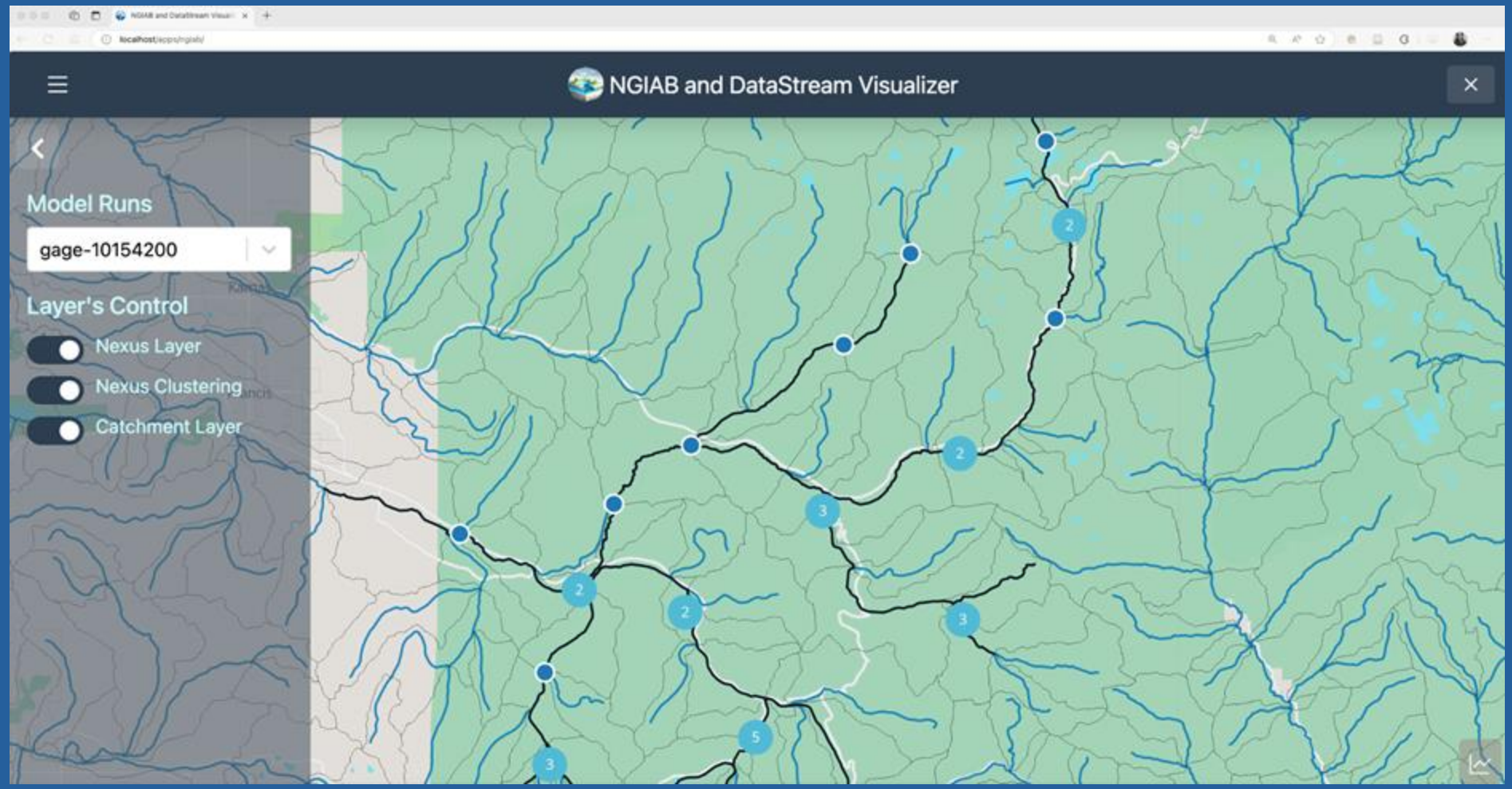
NGIAB Tethys Visualizer



Select gage-10154200 from the dropdown

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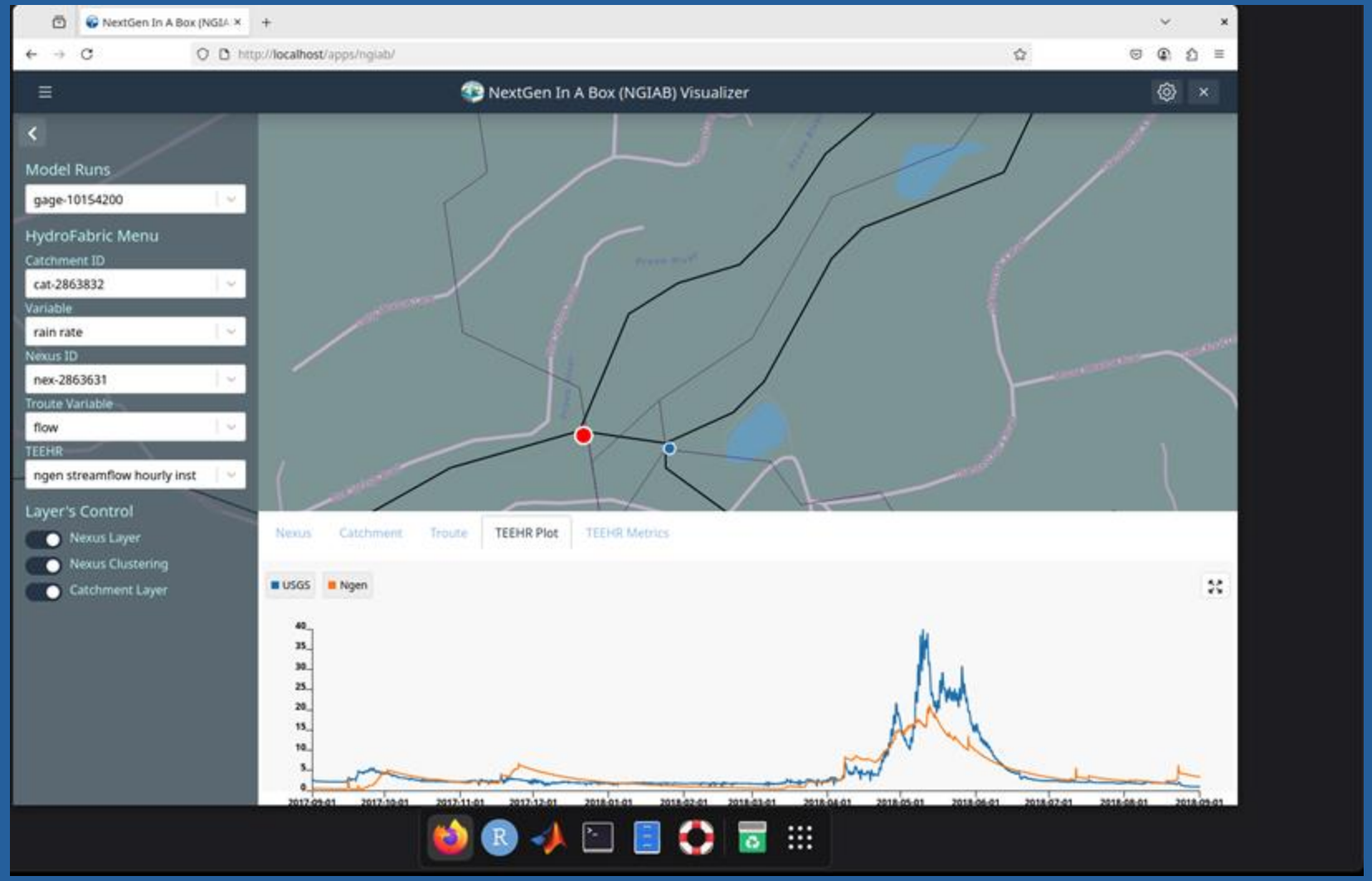
NGIAB Visualizer



Select catchment ID: cat-2863832

Variable: rain rate

Nexus ID: nex-2863631

Troute Variable: flow

TEEHR: ngen streamflow hourly inst

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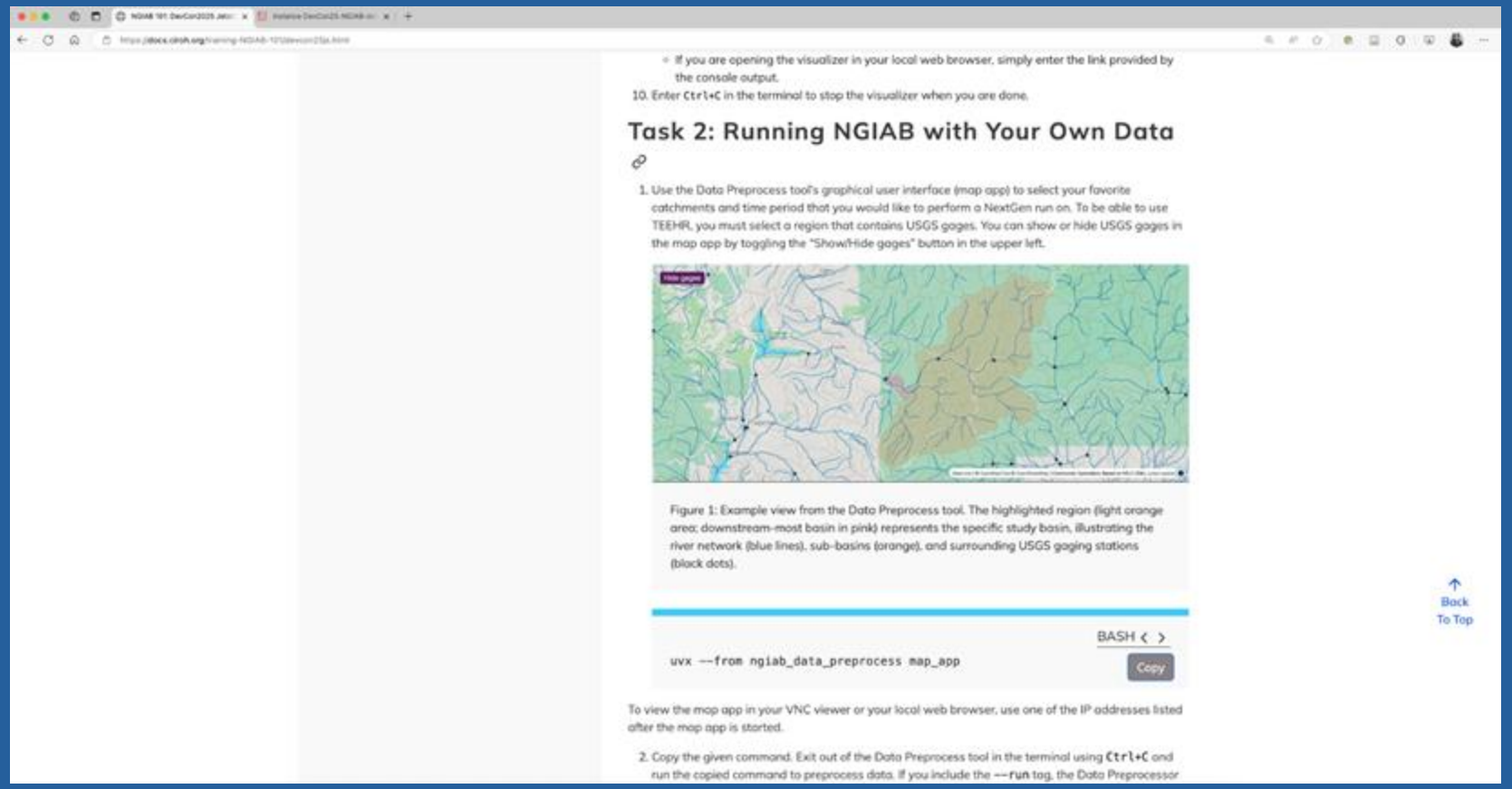
Task 2



- If you are opening the visualizer in your local web browser, simply enter the link provided by the console output.

10. Enter `Ctrl+C` in the terminal to stop the visualizer when you are done.

Task 2: Running NGIAB with Your Own Data

1. Use the Data Preprocess tool's graphical user interface (map app) to select your favorite catchments and time period that you would like to perform a NextGen run on. To be able to use TEEHR, you must select a region that contains USGS gages. You can show or hide USGS gages in the map app by toggling the "Show/Hide gages" button in the upper left.

Figure 1: Example view from the Data Preprocess tool. The highlighted region (light orange area; downstream-most basin in pink) represents the specific study basin, illustrating the river network (blue lines), sub-basins (orange), and surrounding USGS gaging stations (black dots).

Back To Top

BASH

```
uvx --from ngiab_data_preprocess map_app
```

Copy

To view the map app in your VNC viewer or your local web browser, use one of the IP addresses listed after the map app is started.

2. Copy the given command. Exit out of the Data Preprocess tool in the terminal using `Ctrl+C` and run the copied command to preprocess data. If you include the `--run` tag, the Data Preprocessor

For Task 2:

Ctrl+C - to stop the existing visualizer

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Data Preprocess Tool Map

```
~/NGIAB_demo/NGIAB-CloudInfra git:(main)
uvx --from ngiab_data_preprocess map_app

 * Serving Flask app 'map_app'
 * Debug mode: off
werkzeug    : INFO     WARNING: This is a development server. Do not use it in a production deployment. Use a production W
SGI server instead.
 * Running on all addresses (0.0.0.0)
 * Running on http://127.0.0.1:65112
 * Running on http://192.168.1.61:65112
werkzeug    : INFO     Press CTRL+C to quit
```

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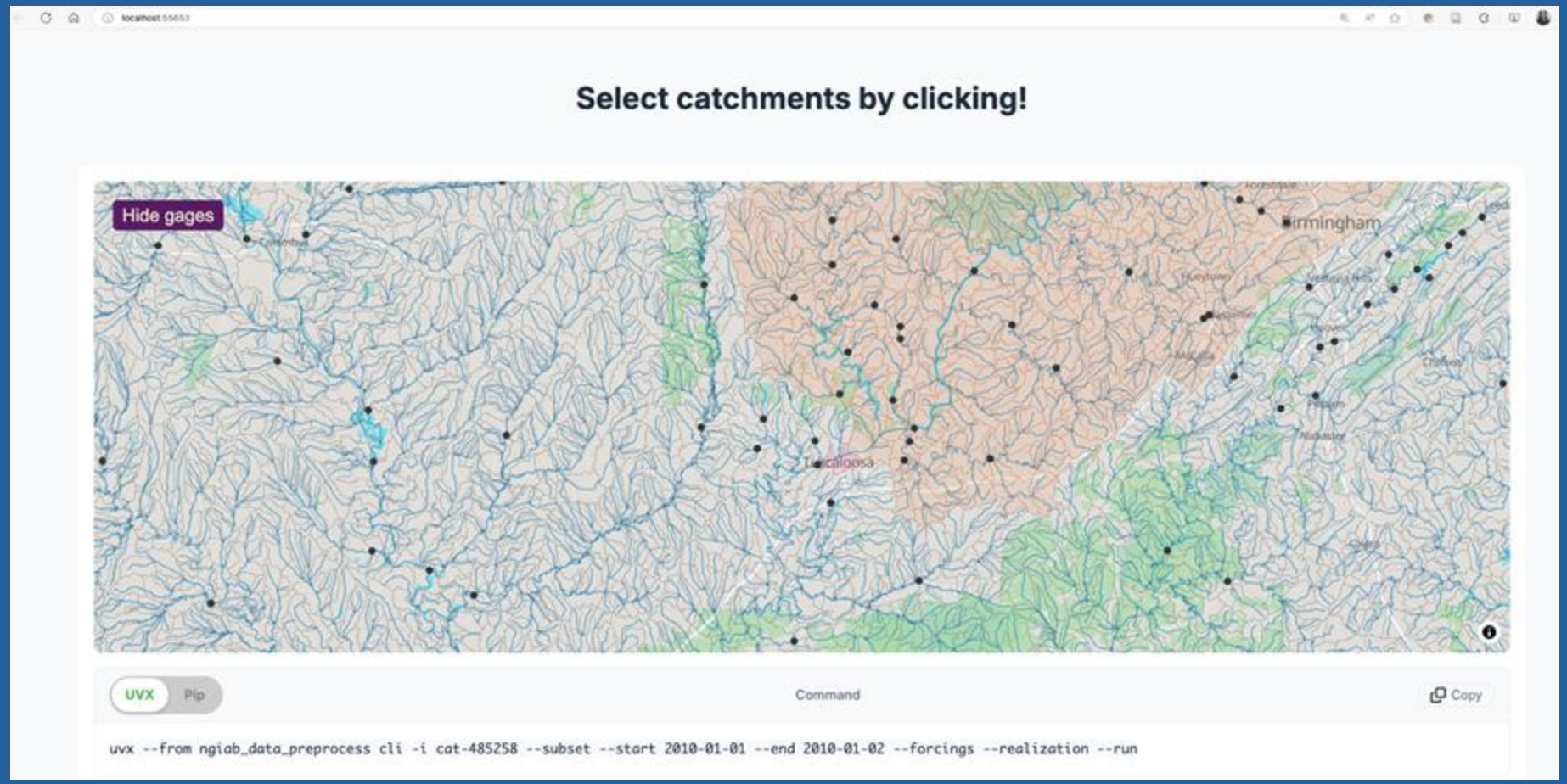
NGIAB Data Preprocess GUI (map app)



Go to select basin near Tuscaloosa, AL to perform a NextGen run on.

Click on Show gages button to see the gages!

The highlighted region (light orange area); downstream-most basin in pink) represents the specific study basin illustrating the river network (blue lines) sub-basins (orange)
surrounding USGS gaging stations (black dots)

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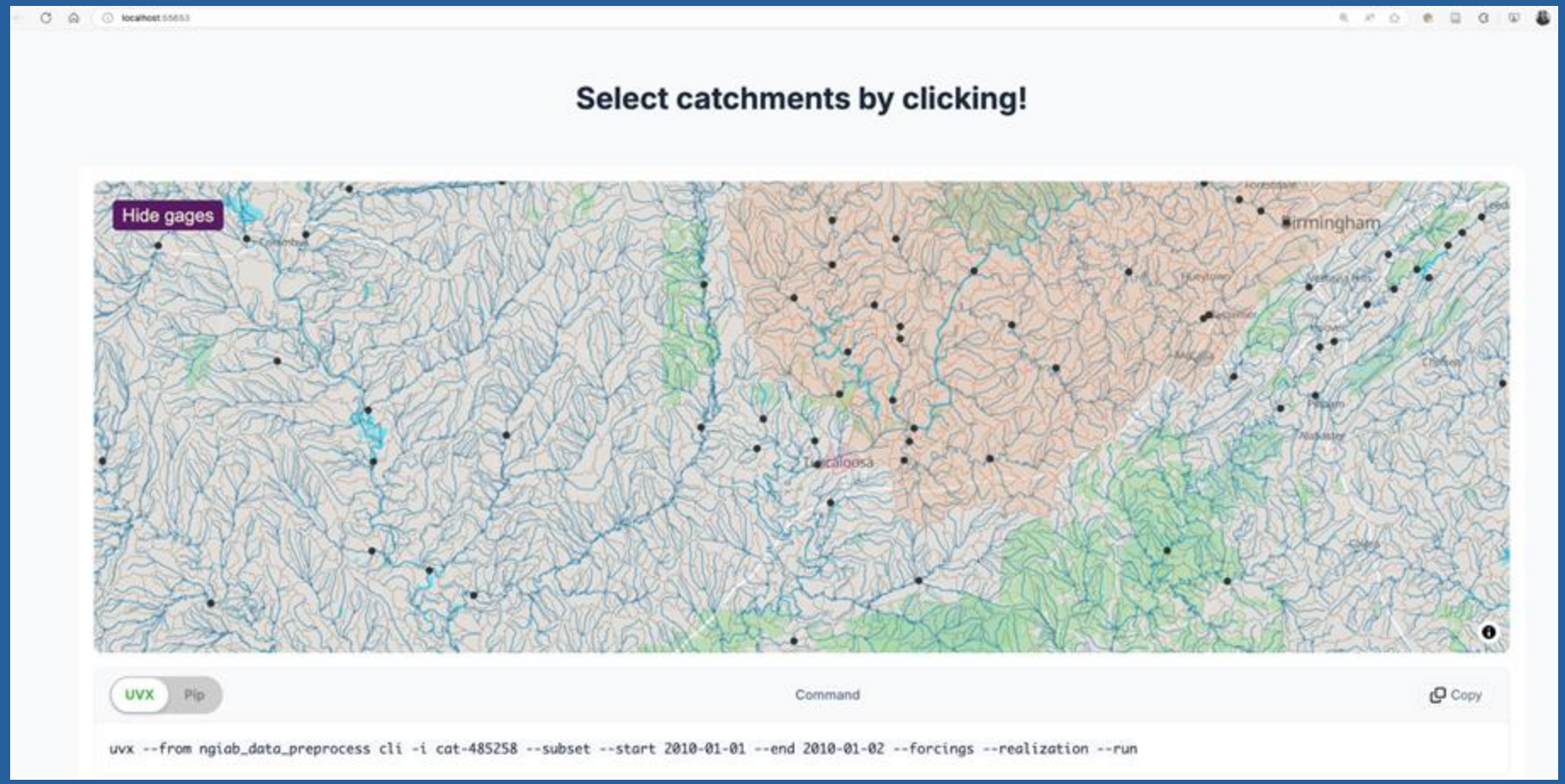
NGIAB Data Preprocess GUI (map app)



If you include --run tag, the Data Preprocess will automatically execute NextGen using NGIAB

Copy the command

and using Ctrl+C run on terminal

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NGIAB Data Preprocess using uvx and --

```
~/NGIAB_demo/NGIAB-CloudInfra git:(main)±1
uvx --from ngiab_data_preprocess cli -i cat-485258 --subset --start 2010-01-01 --end 2010-01-02 --forcings --realization --run
2025-05-24 13:01:17,372 - INFO - Running all missing steps required to run ngiab.
2025-05-24 13:01:17,373 - INFO - Processing cat-485258 in /Users/apatel54/ngiab_preprocess_output/cat-485258
2025-05-24 13:01:17,759 - INFO - Upstream catchments: 1625
2025-05-24 13:01:17,759 - INFO - Subsetting hydrofabric
2025-05-24 13:01:17,877 - INFO - Subsetting tables: ['divides', 'divide-attributes', 'flowpath-attributes', 'flowpath-attributes-ml', 'flowpaths', 'hydrolocations', 'nexus', 'pois', 'lakes', 'network']
2025-05-24 13:01:20,567 - INFO - Subset complete for 4038 features (catchments + nexuses)
2025-05-24 13:01:20,568 - INFO - Subsetting complete.
2025-05-24 13:01:20,568 - INFO - Generating forcings from 2010-01-01 00:00:00 to 2010-01-02 00:00:00...
```

```
2025-05-24 18:02:17,783 - root - INFO - [output.py:180 - nwm_output_generator]: Handling output ...
2025-05-24 18:02:17,796 - root - INFO - [__main__.py:340 - main_v04]: ************ TIMING SUMMARY ************
2025-05-24 18:02:17,796 - root - INFO - [__main__.py:341 - main_v04]: ----------------------------------------
2025-05-24 18:02:17,796 - root - INFO - [__main__.py:342 - main_v04]: Network graph construction: 0.39 secs, 18.89 %
2025-05-24 18:02:17,796 - root - INFO - [__main__.py:349 - main_v04]: Forcing array construction: 1.18 secs, 56.3 %
2025-05-24 18:02:17,796 - root - INFO - [__main__.py:356 - main_v04]: Routing computations: 0.5 secs, 24.08 %
2025-05-24 18:02:17,796 - root - INFO - [__main__.py:363 - main_v04]: Output writing: 0.01 secs, 0.62 %
2025-05-24 18:02:17,796 - root - INFO - [__main__.py:370 - main_v04]: ----------------------------------------
2025-05-24 18:02:17,797 - root - INFO - [__main__.py:371 - main_v04]: Total execution time: 2.0799999999999996 secs
Finished routing
NGen top-level timings:
        NGen::init: 7.13841
        NGen::simulation: 1.17989
        NGen::routing: 2.10485
Run completed successfully, exiting, have a nice day!
2025-05-24 13:02:18,319 - INFO - Next Gen run complete.
2025-05-24 13:02:18,320 - INFO - All operations completed successfully.
2025-05-24 13:02:18,320 - INFO - Output folder: file:////Users/apatel54/ngiab_preprocess_output/cat-485258
```

One command to RUN NextGen using NGIAB!!!

If you use --run tag, you will need to run the runTeehr.sh and viewonTethys.sh scripts separately.

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NGIAB Data Preprocess using uvx

```
2025-05-24 18:02:17,783 - root - INFO - [output.py:180 - nwm_output_generator]: Handling output ...
2025-05-24 18:02:17,796 - root - INFO - [__main__.py:340 - main_v04]: ************ TIMING SUMMARY ************
2025-05-24 18:02:17,796 - root - INFO - [__main__.py:341 - main_v04]: ----------------------------------------
2025-05-24 18:02:17,796 - root - INFO - [__main__.py:342 - main_v04]: Network graph construction: 0.39 secs, 18.89 %
2025-05-24 18:02:17,796 - root - INFO - [__main__.py:349 - main_v04]: Forcing array construction: 1.18 secs, 56.3 %
2025-05-24 18:02:17,796 - root - INFO - [__main__.py:356 - main_v04]: Routing computations: 0.5 secs, 24.08 %
2025-05-24 18:02:17,796 - root - INFO - [__main__.py:363 - main_v04]: Output writing: 0.01 secs, 0.62 %
2025-05-24 18:02:17,796 - root - INFO - [__main__.py:370 - main_v04]: ----------------------------------------
2025-05-24 18:02:17,797 - root - INFO - [__main__.py:371 - main_v04]: Total execution time: 2.0799999999999996 secs
Finished routing
NGen top-level timings:
        NGen::init: 7.13841
        NGen::simulation: 1.17989
        NGen::routing: 2.10485
Run completed successfully, exiting, have a nice day!
2025-05-24 13:02:18,319 - INFO - Next Gen run complete.
2025-05-24 13:02:18,320 - INFO - All operations completed successfully.
2025-05-24 13:02:18,320 - INFO - Output folder: file:////Users/apatel54/ngiab_preprocess_output/cat-485258
```

Copy the output folder for the next run

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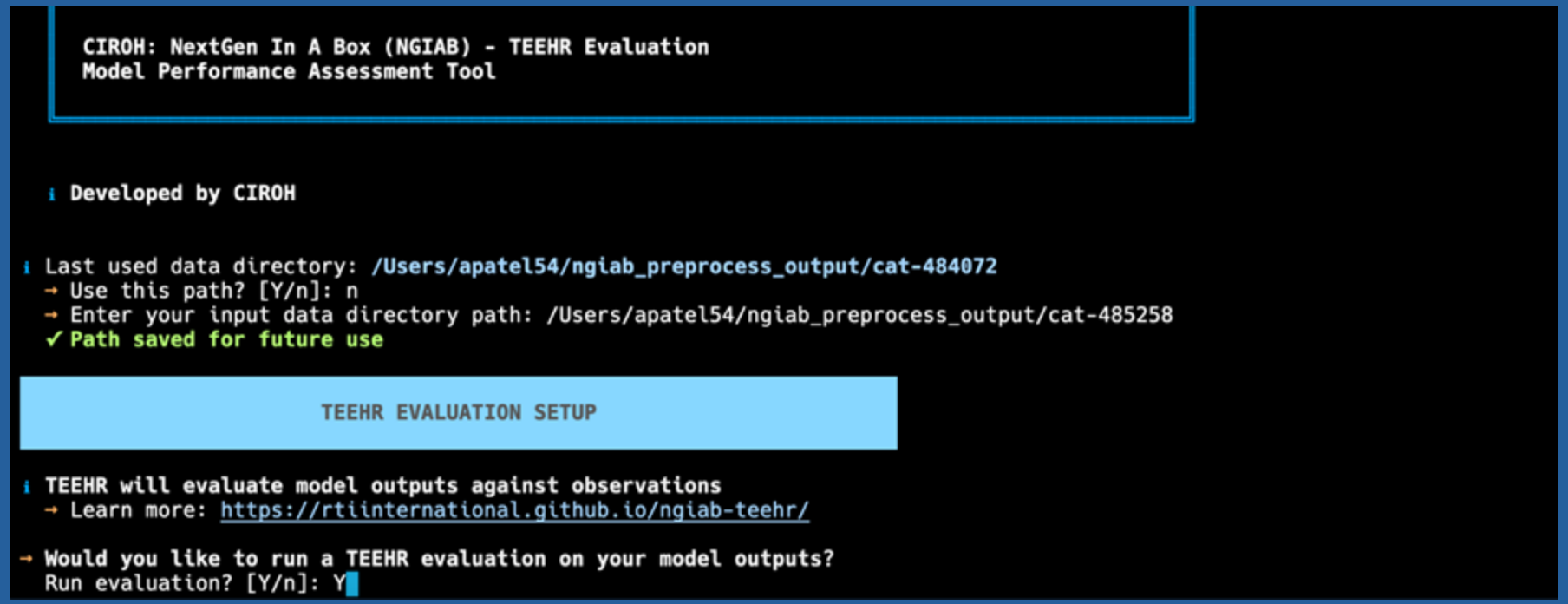
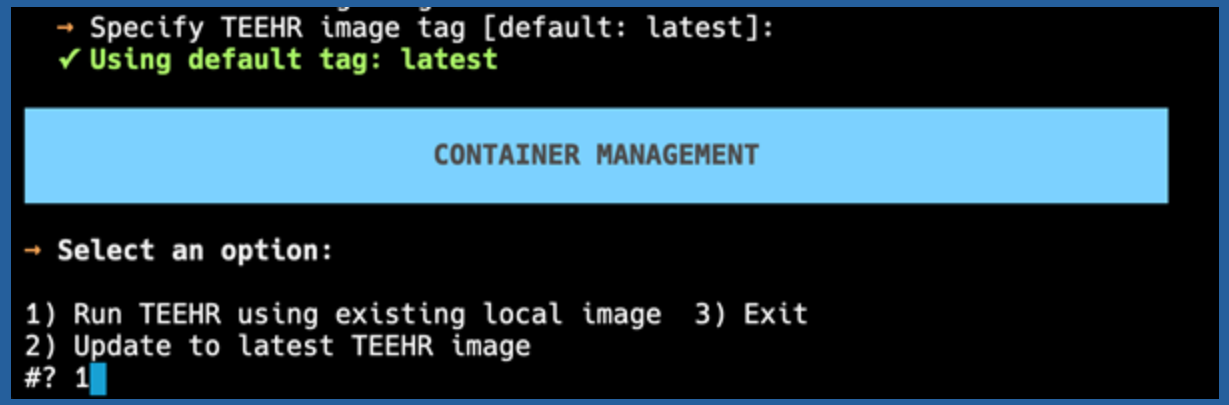
NGIAB TEEHR evaluation using runTeehr.sh



Run ./runTeehr.sh

Enter "n" and enter the correct path to use from previous run
Enter Y to run evaluation



Enter 1 to run evaluation

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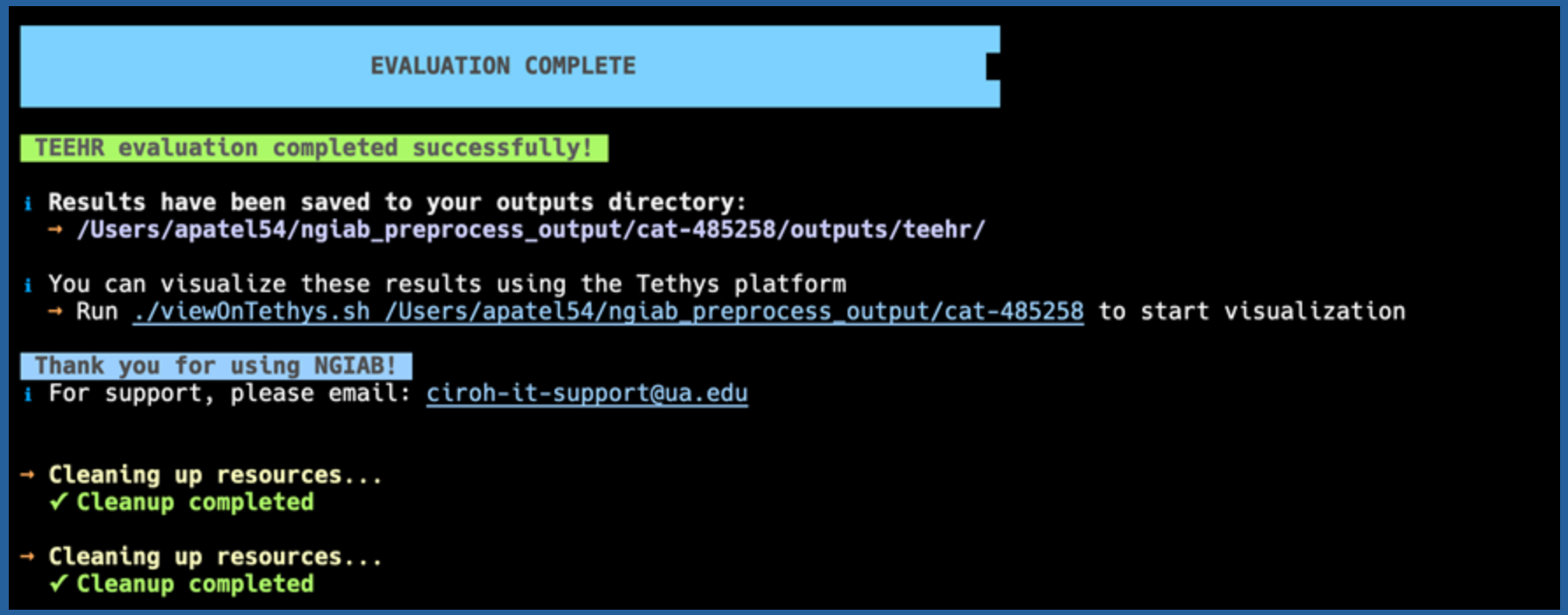
NGIAB TEEHR evaluation using runTeehr.sh



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NGIAB Tethys Visualizer using viewonTethys.sh

```
~/NGIAB_demo/NGIAB-CloudInfra git:(main)±1
./viewOnTethys.sh


==============================================
|  CIROH: NextGen In A Box (NGIAB) - Tethys     |
|  Interactive Model Output Visualization       |
==============================================

i Developed by CIROH

i Last used data directory: /Users/apatel54/ngiab_preprocess_output/cat-485258
  → Use this path? [Y/n]: Y
```

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NGIAB Tethys Visualizer using viewonTethys.sh

```
i Last used data directory: /Users/apatel54/ngiab_preprocess_output/cat-485258
  → Use this path? [Y/n]: Y
  ✓ Using previously configured path
  ✓ Path saved for future use.

                PREPARING VISUALIZATION ENVIRONMENT

  ⚠ /Users/apatel54/ngiab_visualizer is not empty.
  → Keep (K) or Fresh start (F)? [K/F]: K
```

Enter K

```
  ⚠ /Users/apatel54/ngiab_visualizer is not empty.
  → Keep (K) or Fresh start (F)? [K/F]: K
  ✓ Copied → /Users/apatel54/ngiab_visualizer/cat-485258
Checking for /Users/apatel54/ngiab_visualizer/ngiab_visualizer.json...
  ✓ Model run “ registered (3AB164B5-83DB-4E70-8E7D-A0A8227E348D)
  i Existing Datastream cache detected: /Users/apatel54/.datastream_ngiab
  Keeping it avoids re-downloading archives, but a large cache
  can slow the first container start-up depending on your system.

  → Keep cache (K) or Fresh start (F)? [K/F]: K
```

Enter K

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NGIAB Tethys Visualizer using viewonTethys.sh

```
LAUNCHING TETHYS VISUALIZATION

Specify the Tethys image tag to use:
  → Tag (e.g. v0.2.1, default: latest):
  i Found local image awiciroh/tethys-ngiab:latest
  → Use local copy (L) or Pull latest from registry (P)? [L/P]: L
```

Enter L

```
  ✓ Using local image
Select a port to run Tethys on. [Default: 80]
  → Port:
→ Using default port 80 for Tethys.
  ✓ Port 80 selected
→ Launching Tethys container...
  i Tethys container is already running. Stopping it first...
  ⚠ Forcibly removing container...
i Setting up Docker network for Tethys...
  ✓ Network tethys-network created successfully.
  i Starting Tethys container...
  i Running docker command...
c8441d4fc31ae8866ecc51ce462fd068c00ac3bf9a805b55fd68d6e5dad80769
  ✓ Tethys container started successfully.
i  Waiting for container: tethys-ngen-portal to become healthy. This can take a couple of minutes...
```

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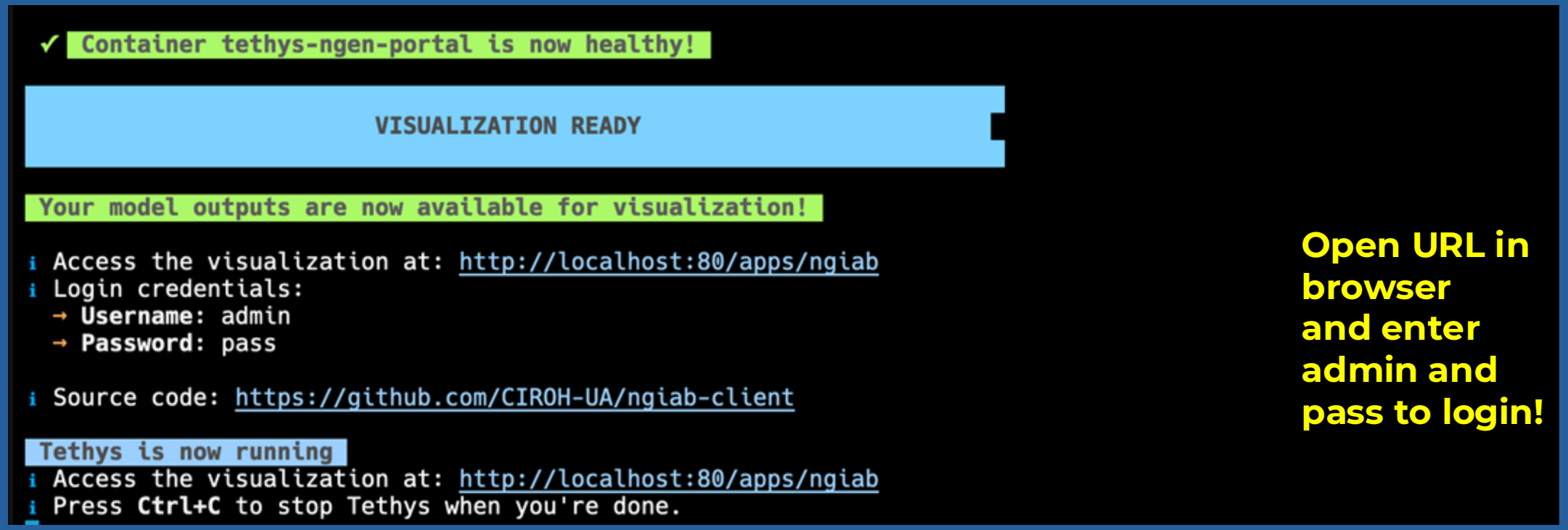
NGIAB Tethys Visualizer using viewonTethys.sh



Open URL in browser and enter admin and pass to login!

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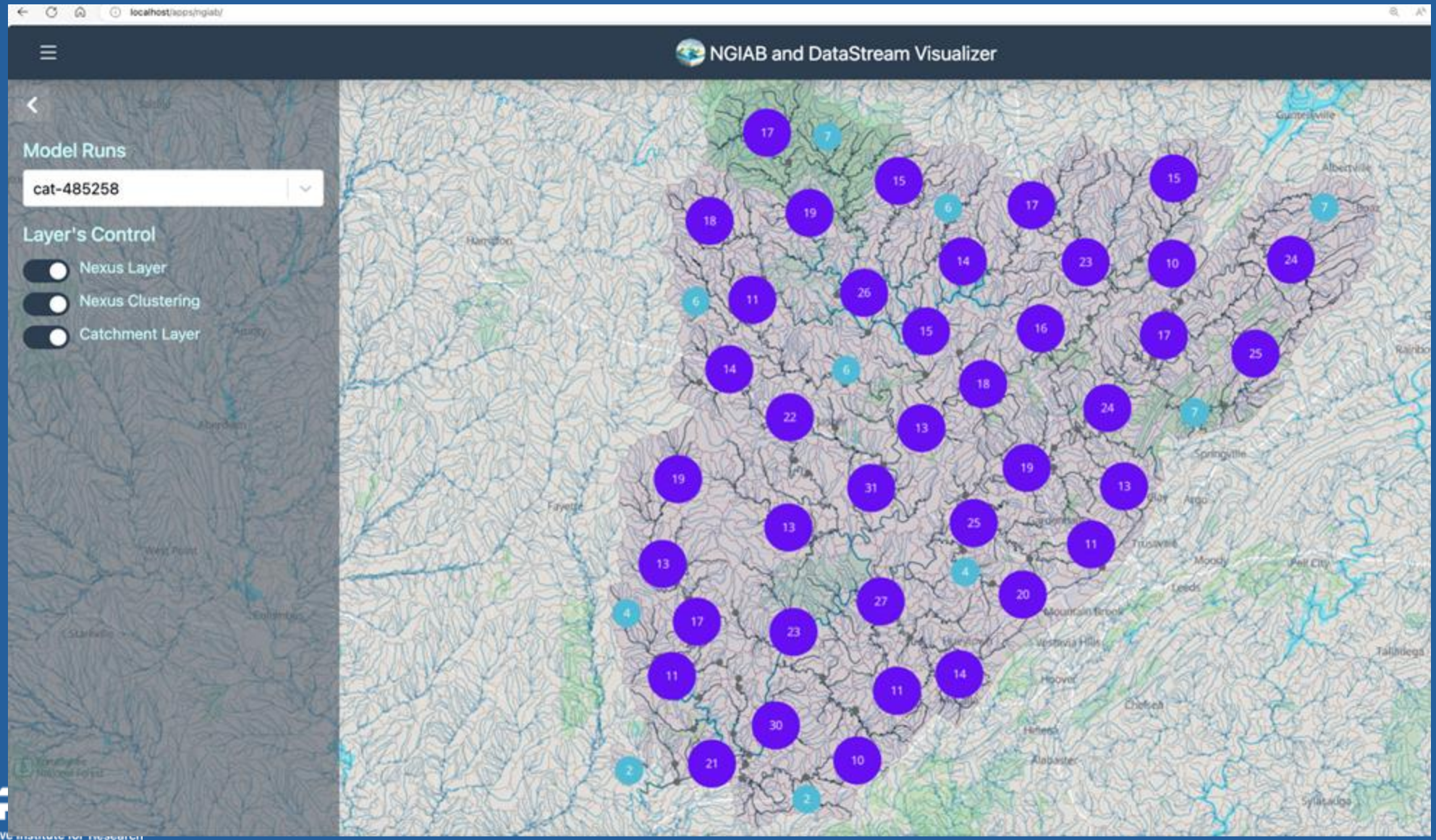
NGIAB Tethys Visualizer using viewonTethys.sh



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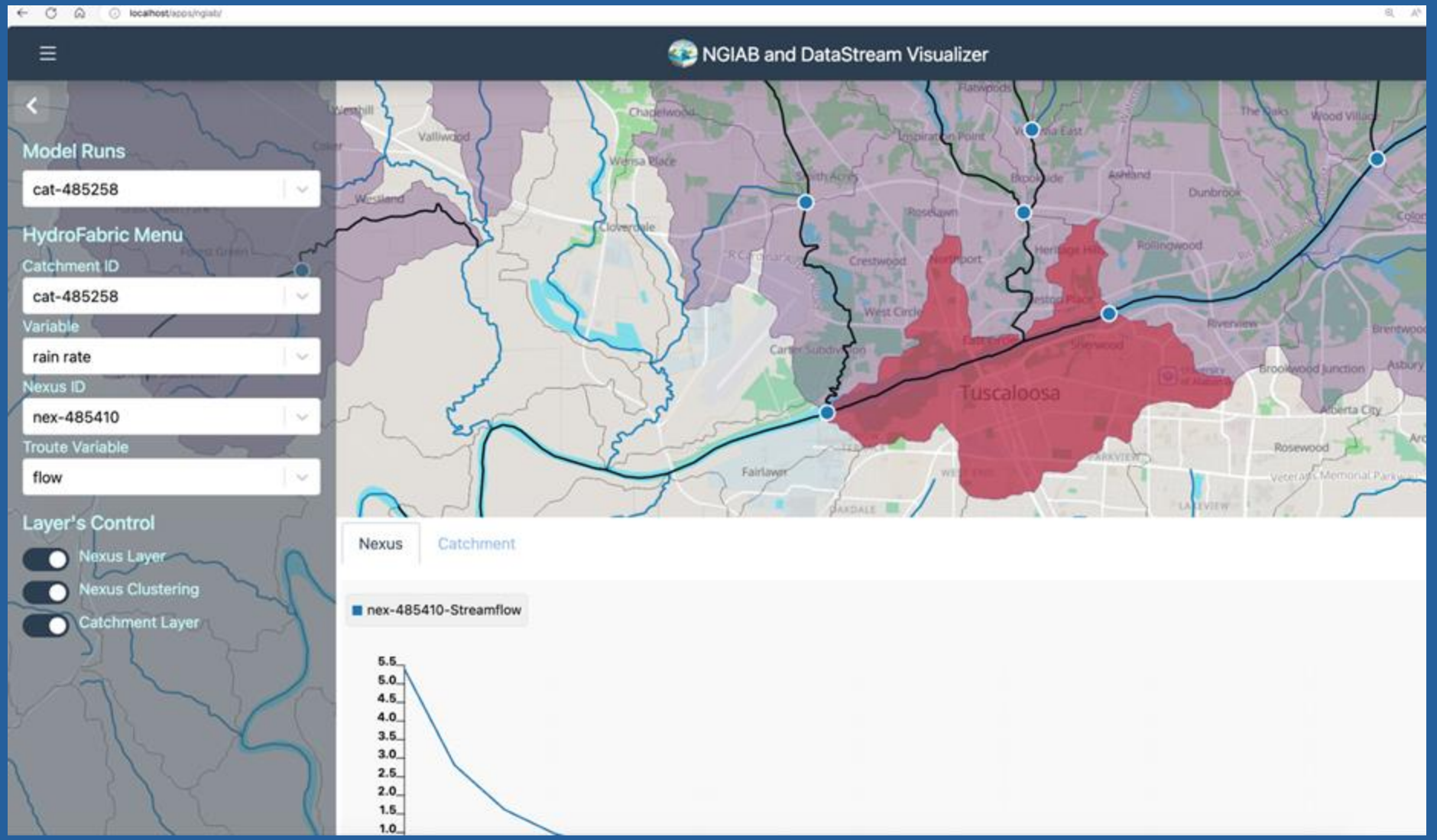
NGIAB Tethys Visualizer using viewonTethys.sh



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Another example: cat-484069

Run cmd: uvx --from ngiab_data_preprocess cli -i cat-484069 --subset --start 2010-01-01 --end 2010-01-02 --forcings --realization --run

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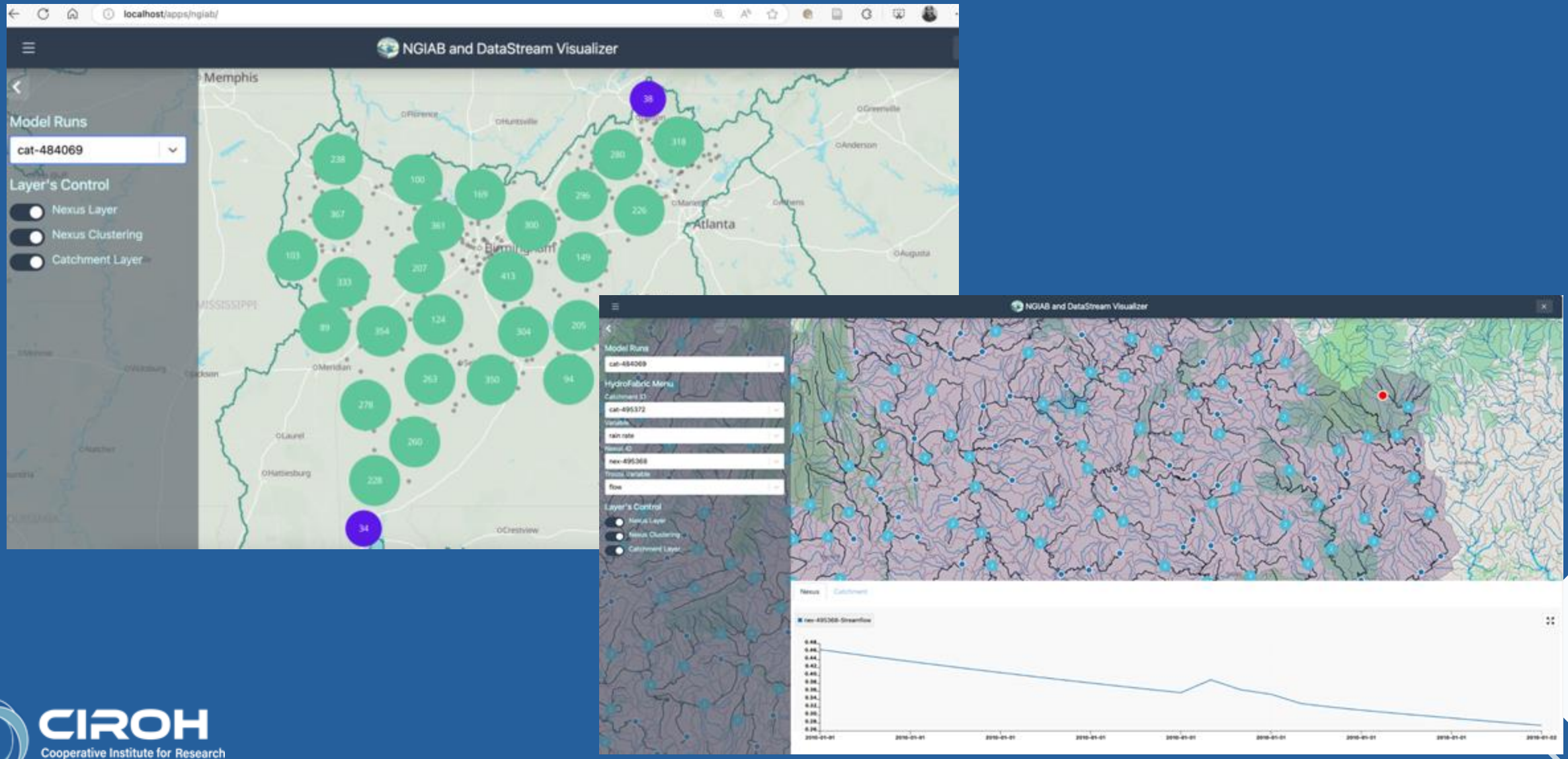
NGIAB Tethys Visualizer - cat-484069



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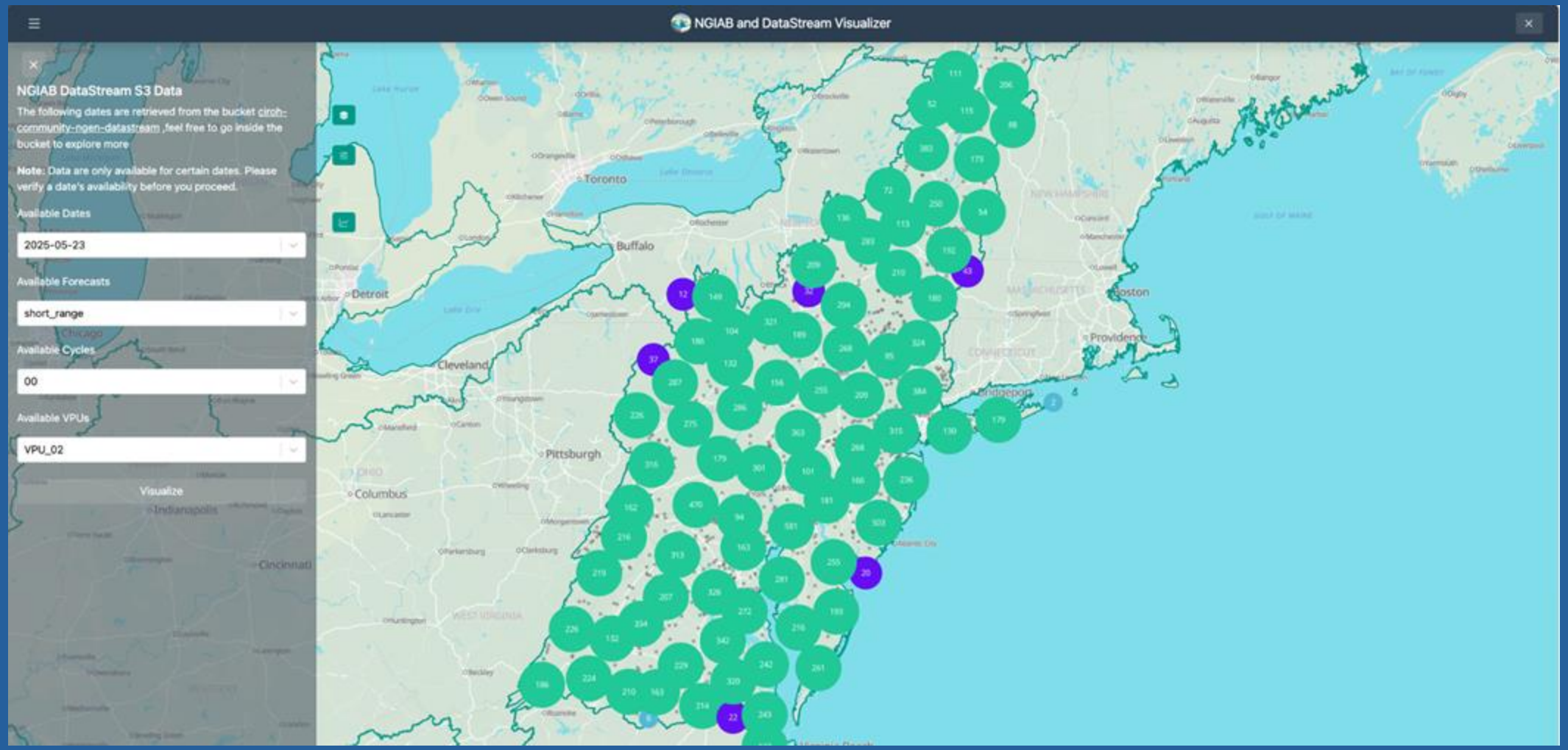
DataStream Visualizer



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CIROH Community Office Hours

Community Hydrologic Modeling › Cyberinfrastructure and Community NextGen Office Hours

CIROH Cyberinfrastructure & Community NextGen Monthly Office Hours

Join us for our monthly sessions focused on CIROH's research computing resources and the Community NextGen project.

These office hours provide an excellent opportunity to engage with experts, ask questions, and stay updated on the latest developments.

How to Join

Email us at ciroh-it-admin@ua.edu to receive the Teams Meeting link and calendar invitation.

What We Cover

- **CIROH Research Cyberinfrastructure**: Cloud computing resources, on-premise computing, and external computing access
- **Community NextGen**: Advanced hydrologic modeling tools

Resources

- CIROH Cyberinfrastructure Documentation
- Community NextGen Framework Documentation

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Calibration News!

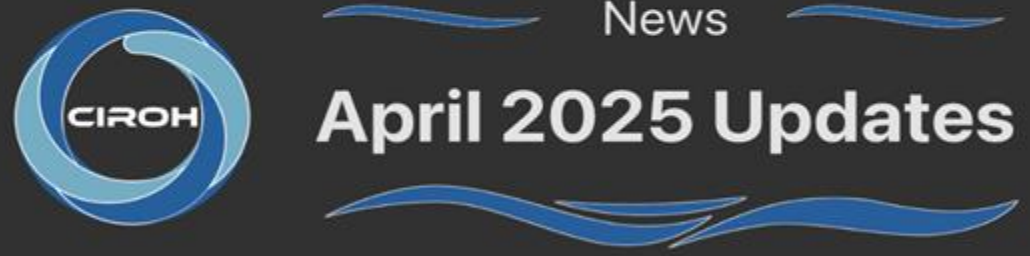
DocuHub Products Services Community Impact Learn Blog News Release Notes Portal

Community NextGen Updates

Stay connected with the latest developments in NextGen water modeling! This news hub brings you updates, breakthroughs, and opportunities from across our com of practice.

Discover how researchers and practitioners are applying NextGen frameworks to solve pressing water challenges, learn about upcoming training events, and explore new resources to enhance your modeling workflow. Our community-driven approach ensures you'll always be informed about the innovations that matter most.

Click to collapse



feature **New NGIAB-Calibration Feature**🎉

⚙️ Major update to NextGen In A Box! It now supports extended calibration for CFE and NOAA OWP modules. The new calibration framework provides more flexible param tuning and improved model performance.

🤖 Uses ngen-cal branch: https://github.com/CIROH-UA/ngen-cal/tree/ngiab_cal

📖 For detailed instructions on how to use the new calibration capabilities, please check out: https://github.com/CIROH-UA/ngen-cal/tree/ngiab_cal#how-to-use-this

CIROH Research Cyberinfrastructure supporting Community NextGen

Google Cloud & AWS Sponsored $5000 for DevCon2025

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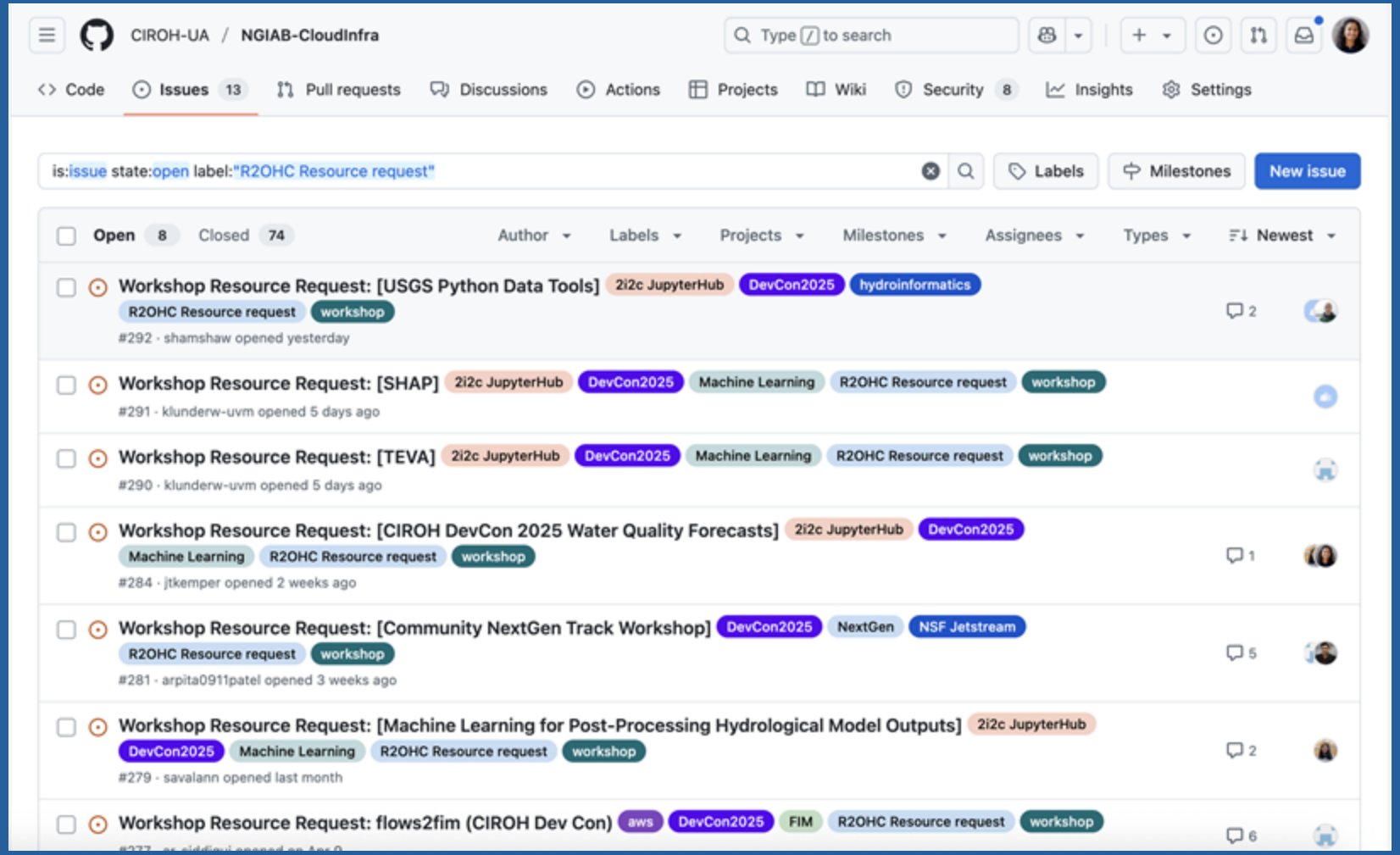
Community Cyberinfrastructure supporting Community NextGen

More than 74 Infrastructure request supported!



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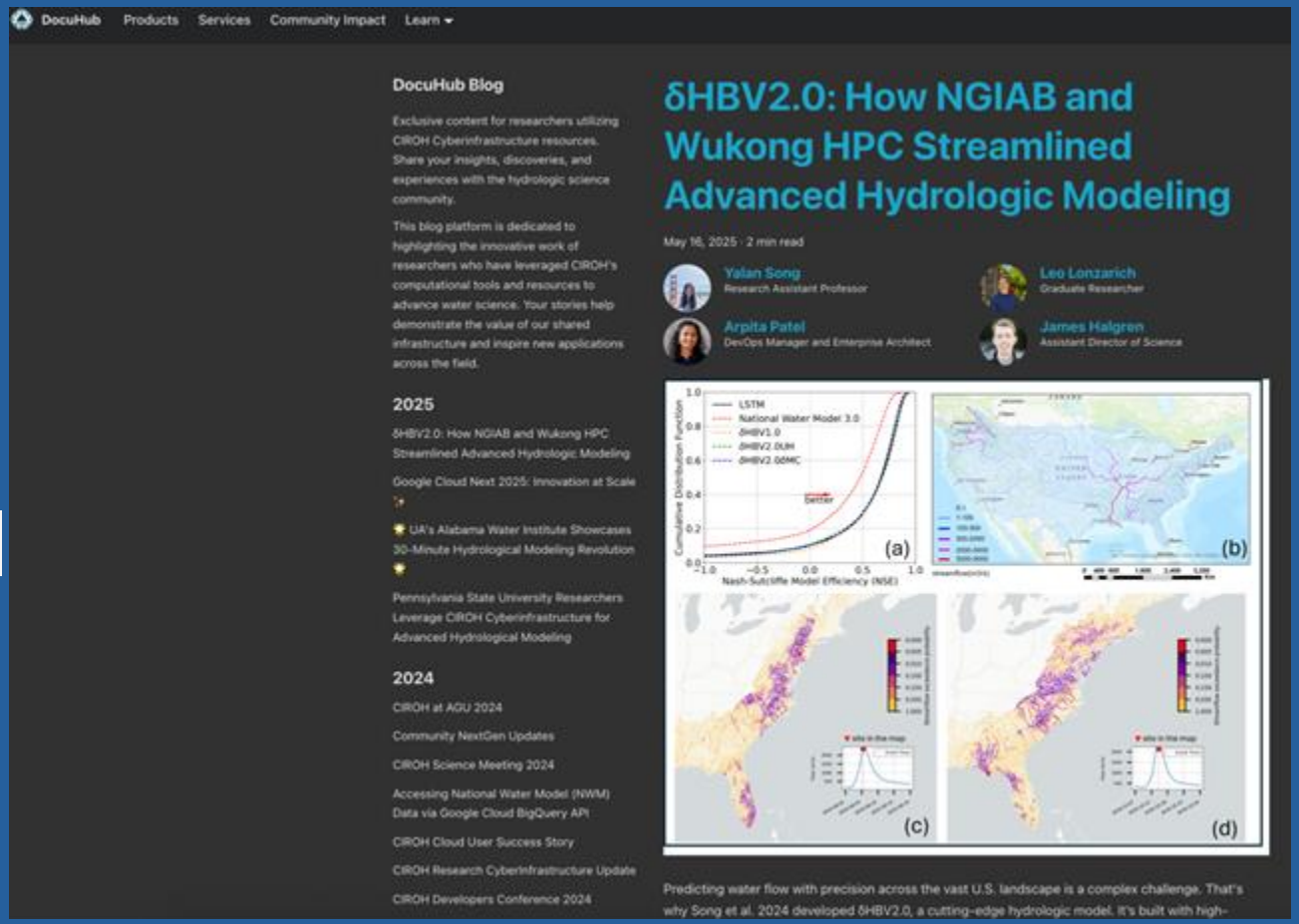
First paper using NGIAB!!!

δHBV2.0 + NGIAB

Differentiable Modeling in Operations

Leo Lonzarich

Tadd Bindas, Farshid Rahmani, Yalan Song, Haoyu Ji, Jiangtao Liu, Doaa Aboelyazeed, Jonathan Frame, *Chaopeng Shen (Advisor)*



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Community NextGen Repos

Source code at:

- https://github.com/CIROH-UA/NGIAB-CloudInfra
- https://github.com/CIROH-UA/ngen
- https://github.com/CIROH-UA/t-route
- https://github.com/CIROH-UA/lstm
- https://github.com/CIROH-UA/NGIAB-HPCInfra
- https://github.com/CIROH-UA/NGIAB_data_preprocess
- https://github.com/CIROH-UA/ngen-datastream
- https://github.com/CIROH-UA/ngiab-teehr
- https://github.com/CIROH-UA/ngiab-client
- https://github.com/CIROH-UA/ngiab-cal

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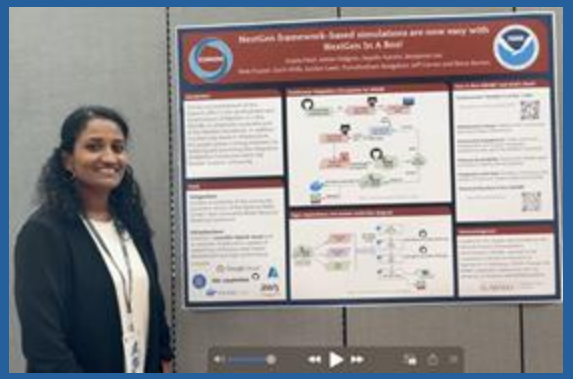

Q&A

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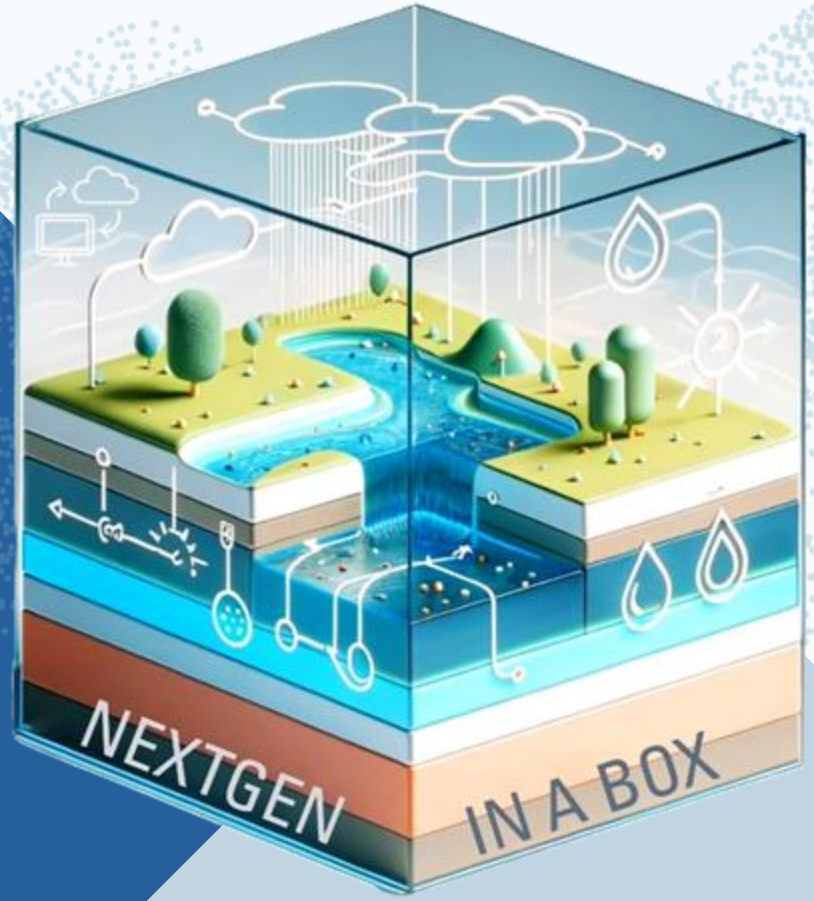
Thank You!



Acknowledgement

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