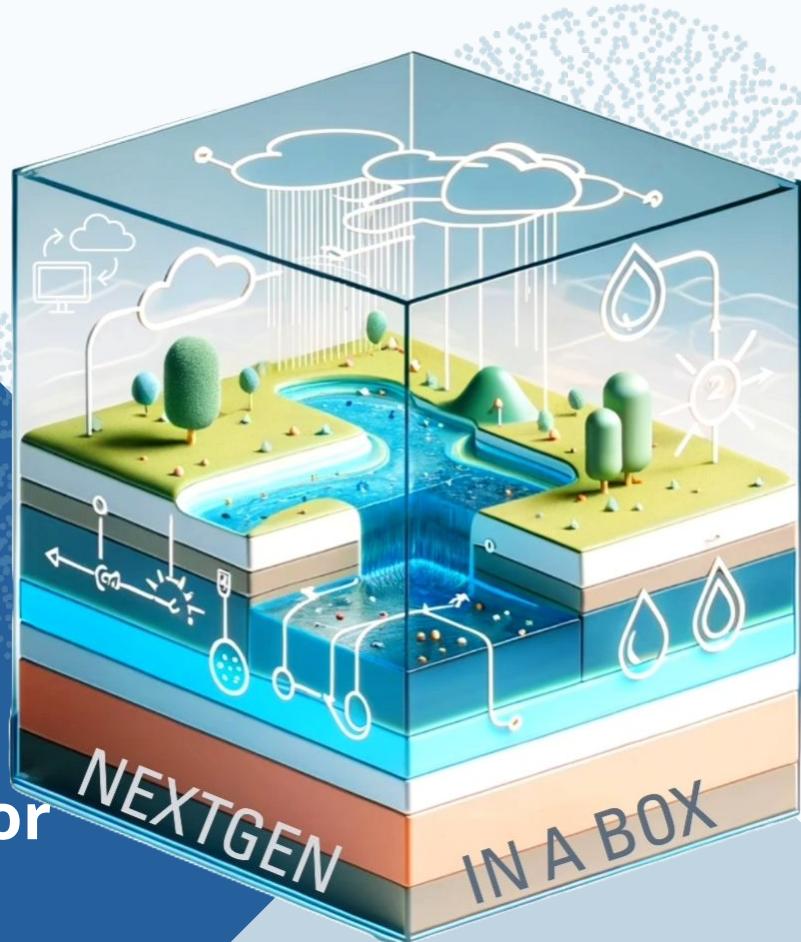




NHWC 2025: Navigating the NextGen Ecosystem and NextGen In A Box (NGIAB): Advancing Hydrologic Modeling through Community-Driven Development

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The University of Alabama

N. Frazier, Z. Wills, J. Laser
Lynker



Agenda

- NextGen Framework
- NGIAB EcoSystem
- Q&A

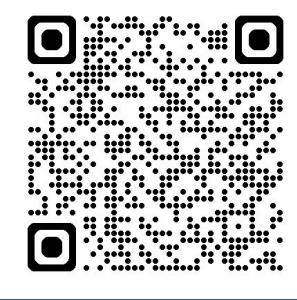
Next Generation Water Resources Modeling Framework (NextGen)

- 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.
- Multi-Language Support - C++, C, Fortran, Python
- Designed to provide multi-model hydrologic prediction advances for the National Water Model (NWM)

NextGen GitHub Repository:
[GitHub: NOAA-OWP/ngen](https://github.com/NOAA-OWP/ngen)

NextGen Wiki:
[GitHub: NOAA-OWP/ngen/wiki](https://github.com/NOAA-OWP/ngen/wiki)





National Water Model (NWM)

The screenshot shows the official NWM website at <https://water.noaa.gov/about/nwm>. The page features a header with the NOAA logo and navigation links for Home, Water Operations, More Water Information, Extreme Precipitation Estimates, and About. A prominent call-to-action button says "Click HERE for help with NWPS or our NEW Flood Mapping Services." Below the header, there's a section titled "The National Water Model" with a link to the NOAA publication. A detailed diagram illustrates the hydrologic cycle, showing processes like Condensation, Precipitation, Transpiration, Evaporation, and runoff paths from snowmelt and surface sources.

- NWM provides hydrologic predictions for over 2.7 million river reaches across the US.

<https://water.noaa.gov/about/nwm>

<https://edx.hydrolearn.org/courses/course-v1:BYU+NWM101+2021/about>



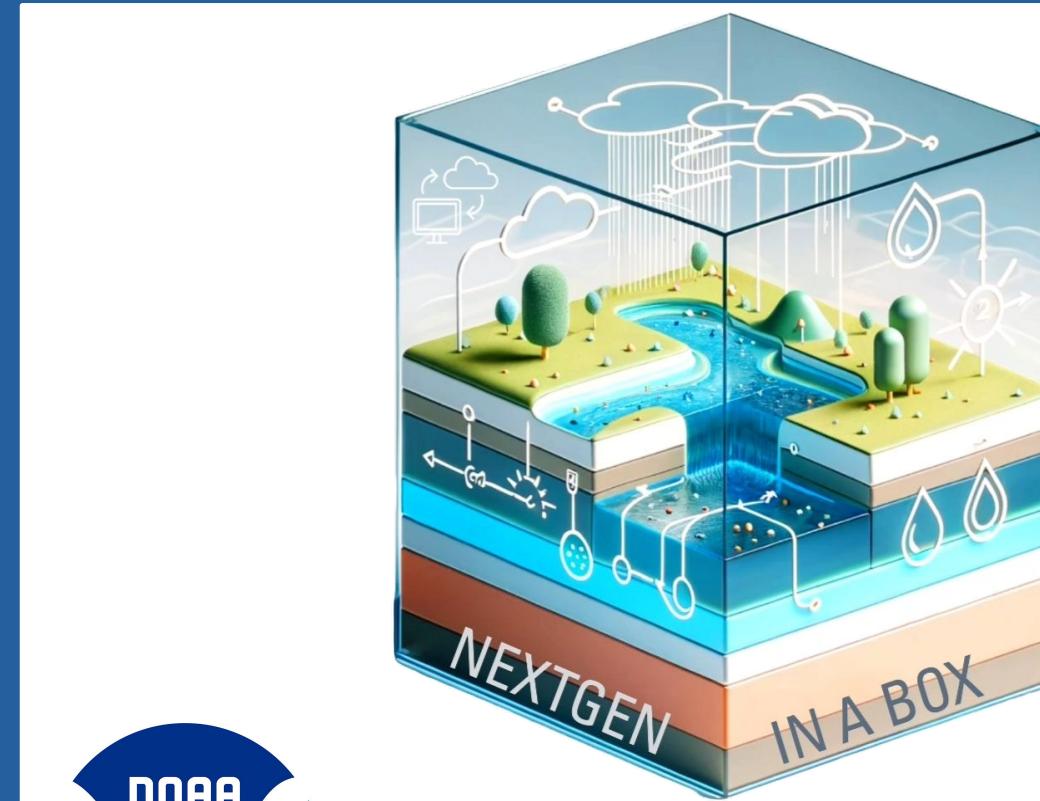
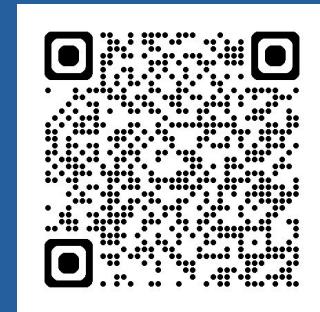
The screenshot shows a course page from hydroLearn at <https://portal.ciroh.org/courses>. The course is titled "Quantifying Runoff Generation". It includes a large blue geometric logo and a brief description of flash flooding in South Louisiana. Another section, "Introduction to the National Water Model", is shown with its own description and a thumbnail image of a map.

What is NextGen In A Box (NGIAB)?

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 R20



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

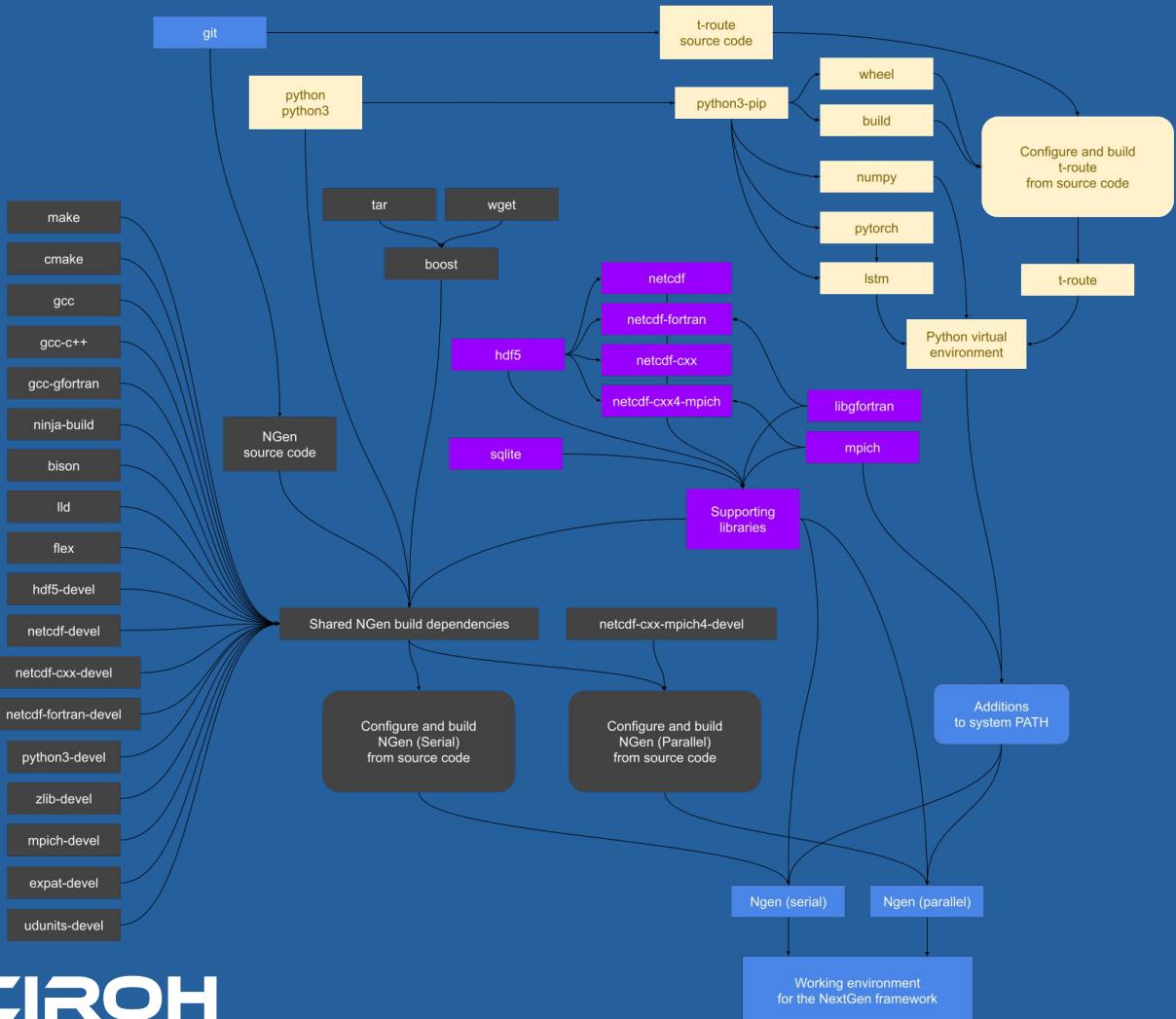
- Reduces **learning curve** for NextGen framework
- Compare **model performance**
- Facilitates accessibility and **accelerates modeling**

Collaborative
Modeling
Tool

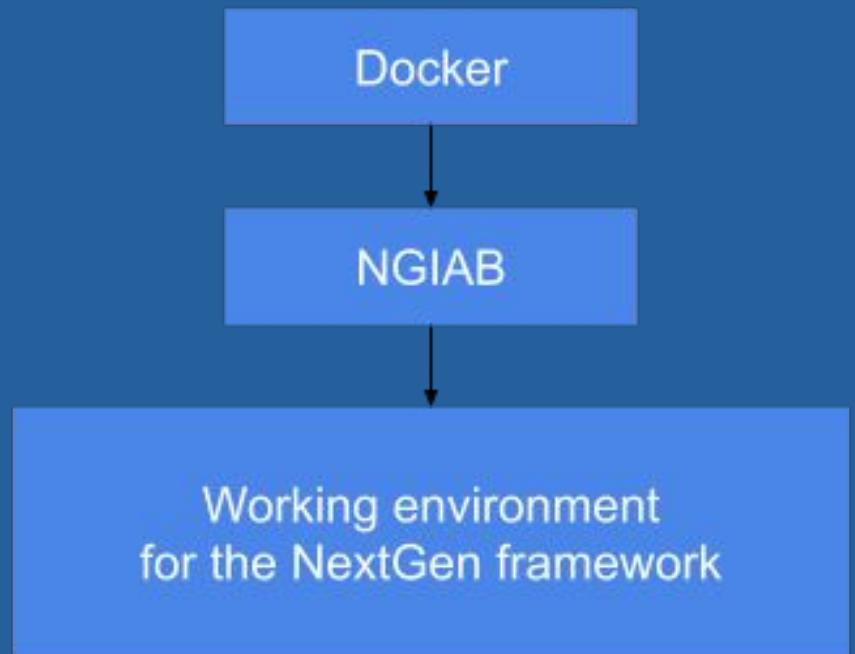
- **Easy to use**
- **Reproducible** research outcomes
- Increases **collaboration** among researchers

Why to use NGIAB?

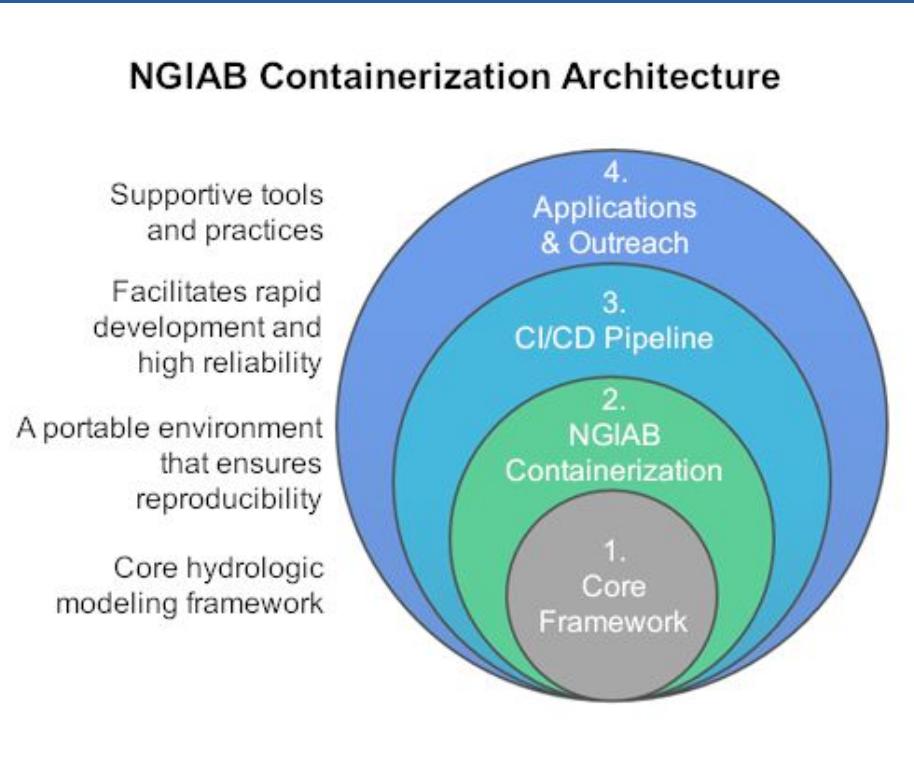
NextGen build tracing



NGIAB



NGIAB Tech Spec



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

Open-Source Technologies

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

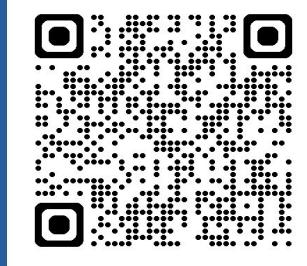


COMMUNITY IMPACT

Join the growing community of researchers using NextGen In A Box



NGIAB base repositories



<https://github.com/CIROH-UA/ngen>
fork of
<https://github.com/NOAA-OWP/ngen>

This GitHub repository page for ngen shows the following details:

- Code tab:** Active.
- Issues:** 0.
- Pull requests:** 1.
- Discussions:** 0.
- Actions:** 0.
- Projects:** 0.
- Wiki:** 0.
- Security:** 0.
- Insights:** 0.
- Settings:** 0.

Repository Information:

- Owner:** CIROH-UA
- Name:** ngen
- Visibility:** Public
- Forked from:** NOAA-OWP/ngen
- Branches:** 6
- Tags:** 2
- Last commit:** ed2a903 · 3 weeks ago
- Commits:** 3,072

Commit History:

- JoshCu Merge pull request #11 from hellkite500/patch-1 · ed2a903 · 3 weeks ago · 3,072 Commits
 - .github Fix placement of constraints.txt in Action. 7 months ago
 - cmake feat(cmake): include git commit id in configuration ... 9 months ago
 - data Move merged CONUS realization configs to data/ba... 8 months ago
 - doc add option to disable netcdf forcing cache 3 months ago
 - docker Delete disused dockerfile last year
 - docs Added a placeholder for docs so that the directory ... 5 years ago
 - extern update noaa-owp-modular to latest 4 months ago
 - include fix: reduce formulation manager memory consumpti... last month
 - src add option to disable netcdf forcing cache 3 months ago

<https://github.com/CIROH-UA/t-route>
fork of
<https://github.com/NOAA-OWP/t-route>

<https://github.com/CIROH-UA/t-route>
fork of
<https://github.com/NOAA-OWP/t-route>

This GitHub repository page for t-route shows the following details:

- Code tab:** Active.
- Issues:** 1.
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- Discussions:** 0.
- Actions:** 0.
- Projects:** 0.
- Wiki:** 0.
- Security:** 1.
- Insights:** 0.
- Settings:** 0.

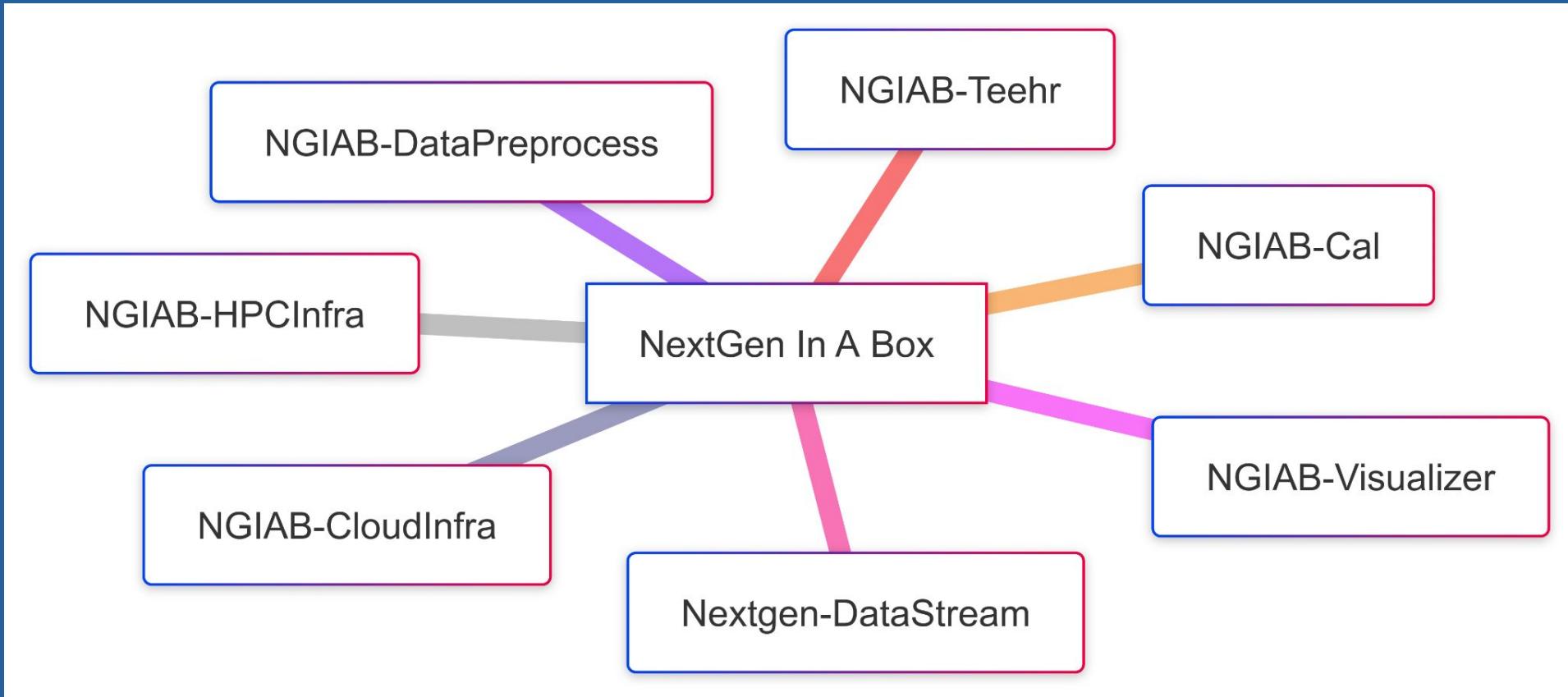
Repository Information:

- Owner:** CIROH-UA
- Name:** t-route
- Visibility:** Public
- Forked from:** NOAA-OWP/t-route
- Branches:** 4
- Tags:** 1
- Last commit:** 0189720 · 4 months ago
- Commits:** 1,066

Commit History:

- JoshCu optimize output_writing ~3x speedup · 0189720 · 4 months ago · 1,066 Commits
 - .github remove fiona dep, require non-dev geopandas 8 months ago
 - doc Add config notes (NOAA-OWP#810) 8 months ago
 - docker feature - adds dockerfile, helper script, build action 2 years ago
 - src optimize output_writing ~3x speedup 4 months ago
 - test Great Lakes Data Assimilation (NOAA-OWP#808) 10 months ago
 - .gitattributes Initial commit 5 years ago
 - .gitignore add some file extensions to be ignored by git last year
 - LICENSE Initial commit 5 years ago

NGIAB Ecosystem



NGIAB Product Portfolio website

NextGen In A Box

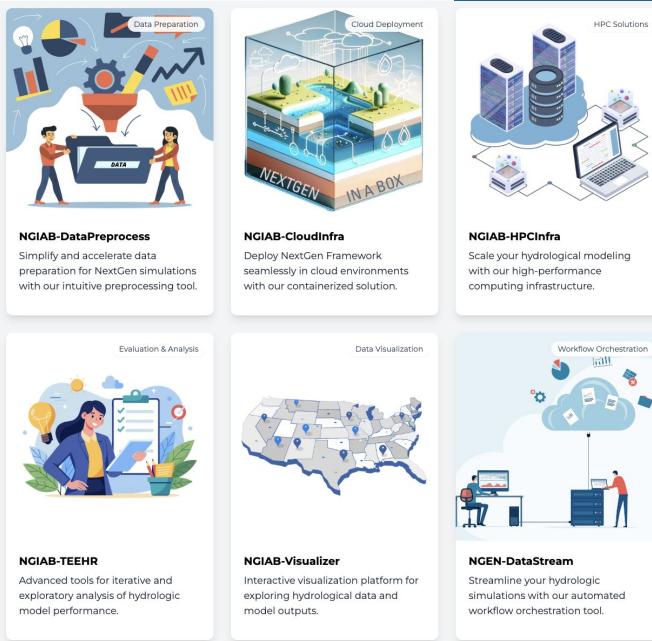
Revolutionizing Water Modeling

NGIAB

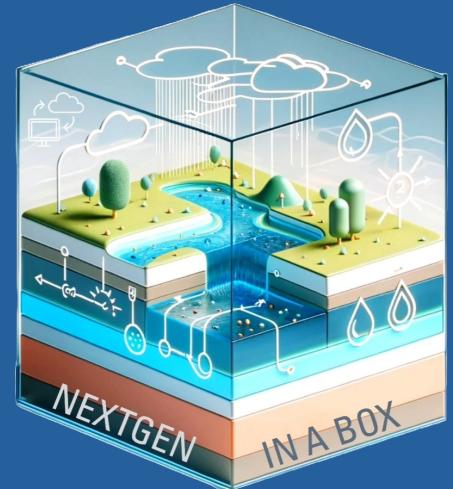
Transforming complex hydrological modeling into accessible solutions

30-Minute Setup

Open Source



ngiab.ciroh.org



The screenshot shows the homepage of the ngiab.ciroh.org website. The header features the CIROH logo and the text 'NEXTGEN IN A BOX'. Below the header, the tagline 'Transforming Hydrology Modeling using open-source technologies' is displayed. At the bottom, there are two buttons: 'OUR TOOLS' and 'GETTING STARTED'.

NGIAB resources demo

- NGIAB portfolio website: ngiab.ciroh.org
- NGIAB 101 training module : <https://docs.ciroh.org/training-NGIAB-101/>
- DocuHub: <https://docs.ciroh.org/docs/products/ngiab/>

NGIAB trainings at CIROH DevCon!



How NGIAB helping research?

The screenshot shows a web browser displaying a blog post from the CIROH DocuHub. The title of the post is "δHBV2.0: How NGIAB and Wukong HPC Streamlined Advanced Hydrologic Modeling". The post is dated May 16, 2025, and has a 2-minute read time. It features five authors: Yalan Song, Research Assistant Professor; Arpita Patel, DevOps Manager and Enterprise Architect; Leo Lonzarich, Graduate Researcher; and James Halgren, Assistant Director of Science. The post includes two figures: (a) a line graph comparing model efficiency (NSE) and cumulative distribution functions for various models, showing δHBV2.0 as better than others; and (b) maps of North America showing streamflow and exceedance probability.

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.

Recognition of NGIAB

The screenshot shows a news article from the UA News Center. The title is "NextGen In A Box Makes Water Modeling More Accessible". The date is May 28, 2025, and it was written by Jessica Nelson. The article discusses the NextGen In A Box software, developed by CIROH and Lynker, which makes hydrological modeling more accessible. It includes a large image of a water surface with concentric ripples.

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UA NEWS CENTER
Home > NextGen In A Box Makes Water Modeling More Accessible

NextGen In A Box Makes Water Modeling More Accessible

May 28, 2025 • Written by Jessica Nelson • 2 min read

X f in Email

TUSCALOOSA, Ala. — Until now, cutting-edge hydrological modeling has been locked behind technical barriers. [NextGen In A Box](#) is a transformative open source solution now available through the [Cooperative Institute for Research to Operations in Hydrology](#), headquartered at The University of Alabama. NGIAB developed by CIROH and Lynker packages a complete software setup for using the U.S. fourth generation [National Water Model](#), bringing sophisticated water modeling to everyone from local communities to top-tier researchers.

The screenshot shows the Alabama Water Institute page on the University of Alabama website. The main headline is "NextGen In A Box (NGIAB): Revolutionizing Hydrological Modeling with a 30-Minute Setup". The article was written by Kayla Roberson and published on February 14, 2025. It discusses the software's accessibility and its impact on hydrological modeling.

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Alabama Water Institute

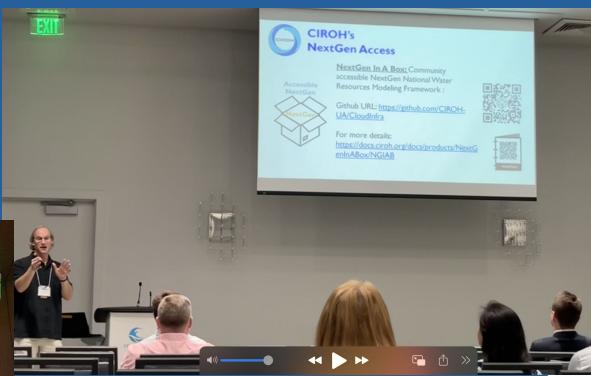
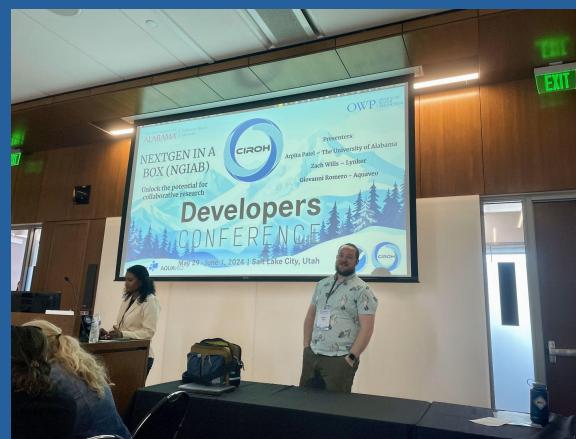
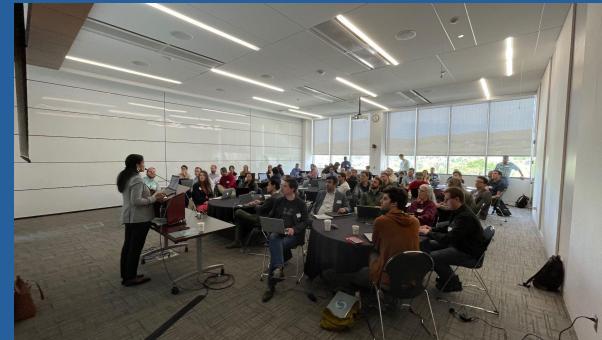
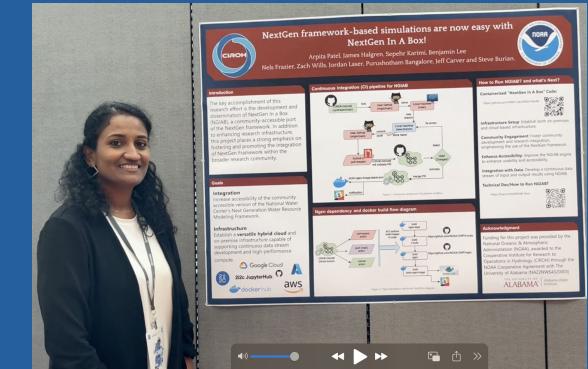
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NextGen In A Box (NGIAB): Revolutionizing Hydrological Modeling with a 30-Minute Setup

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-







CIROH
Cooperative Institute for Research
to Operations in Hydrology

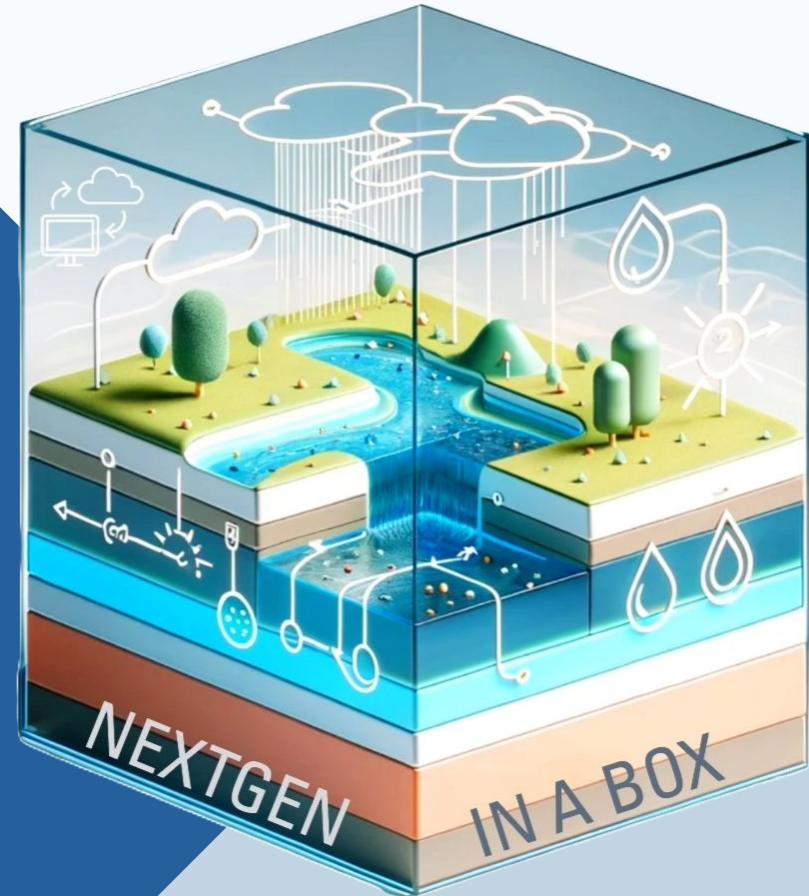
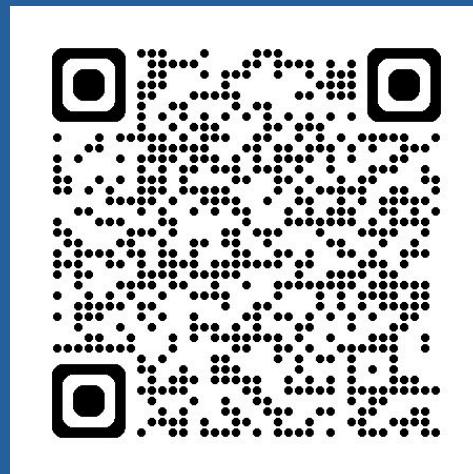
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ALABAMA[®]

Alabama Water
Institute

Thank You!

Arpita Patel
apatel54@ua.edu

Connect on LinkedIn:



Acknowledgement

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