



NextGen In a Box (NGIAB): A Platform-Agnostic Solution for NextGen

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NextGen In a Box (NGIAB): A Platform-Agnostic Solution for NextGen

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1 TL;DR

This training will lead you through building a simple NextGen realization and running it with NextGen-in-a-Box. To complete the training, you will need Docker, Visual Studio Code, and the source files from two repositories on the CIROH-UA Github organization: NGIAB_data_preprocessor, and NGIAB_CloudInfra.

2 Short Description

The Next Generation Water Resources Modeling Framework (NextGen), a prominent advancement in hydrology and water resources management, holds significant implications for contemporary practices within the field. A notable instantiation of NextGen, known as NextGen In a Box (NGIAB), is a current containerized solution embodying state-of-the-art methodologies and technologies pertinent to NextGen.

This workshop provides participants with a comprehensive understanding of NextGen and its constituent components. Moreover, it aims to impart to participants a nuanced understanding of NextGen In a Box (NGIAB) within the broader context of the Next Generation Water Resources Modeling Framework. By delving into theoretical concepts and practical applications, participants have the knowledge and skills to leverage NGIAB in water resources modeling and management endeavors effectively.

3 Learning Outcomes

By engaging in the workshop, attendees will gain insight into NextGen, which involves examining NGIAB and highlighting the following important elements:

1. **Conceptualization of NGIAB:** A thorough examination of NGIAB's fundamental attributes and functionalities elucidates its purpose and utility within the context of NextGen.
2. **Development of NGIAB:** Insights into the developmental processes underpinning NGIAB's creation provide participants with a nuanced understanding of the framework's origins and evolution.
3. **Platform-Agnostic Nature of NGIAB:** An exploration of NGIAB's adaptability across diverse platforms underscores its versatility and compatibility with varying technological environments.

4. **Deployment of NGIAB via Docker:** Detailed guidance on the deployment and execution of NGIAB utilizing Docker containerization technology equips participants with practical skills and knowledge, supplemented by illustrative examples and sample test data.

4 Prerequisites

In order to participate in this workshop, each attendee must fulfill the following criteria:

4.1 Prior Knowledge

The possession of the following knowledge can facilitate a more rapid and comprehensive understanding of NGIAB for the participant.

- **Hydrofabric** (optional): A workshop providing a basic idea of forcing data (temp, humidity, solar flux, etc.)
- **ForcingProcessor** (optional): A workshop that aims to give knowledge of a ForcingProcessor tool that converts NWM forcing data to NextGen forcing data using Python language.
- **Basic Model Interface (BMI)** (optional): A set of standard control and query functions that, when added to a model code, make that model both easier to learn and easier to couple with other software elements.

4.2 Software & Data

The knowledge of the following software is required:

- **Git:** A distributed version control system designed to track source code changes during software development.
- **GitHub:** An AI-powered developer platform that allows developers to create, store, manage, and share their code.
- **Visual Studio Code:** Colloquially known as VS Code, is a source-code editor crafted by Microsoft for deployment across Windows, Linux, and macOS platforms. Its repertoire encompasses an array of functionalities, including but not limited to debugging facilitation, syntax highlighting, adept code completion, code snippet integration, code refactoring capabilities, and seamless integration with Git repositories.
- **Dev Containers:** The Visual Studio Code Dev Containers extension enables the utilization of a container as a comprehensive development environment. This extension permits the opening of any folder within a container or a folder mounted into a container, thereby harnessing the complete feature set of Visual Studio Code.

The installation of the following software is required on a personal computer or a High-Performance Computing (HPC) system:

- **Git:** Participants can install Git on their personal computer by following instructions on the website.
- **Visual Studio Code:** Participants can install VS Code on their personal computer by following the instructions on the website.
- **Dev Containers:** Participants can install Dev Containers on their personal computers by following the instructions on the website.

You can also follow the tutorial on website.

- **Docker:** Participants can install Docker on their personal computer by following instructions on the website.

All the participants are required to acquire the following repositories on the system:

- **NGIAB-CloudInfra**: Every participants will have to clone the NGIAB-CloudInfra repository (Link).
- **NGIAB_data_preprocess**: Every participants will have to clone the NGIAB_data_preprocess (Link)

[RECOMMENDED STEP]

Since the data and images are approximately 3GB each, we recommend that all participants download the following images and data in advance to mitigate delays during the workshop.

- **CONUS and Model Attributes**: Please follow the subsequent steps to download the CONUS data from the S3 bucket.

Step 1: Clone the NGIAB_data_preprocess (Link) repository.

```
git clone https://github.com/AlabamaWaterInstitute/NGIAB_data_preprocess.git
```

Step 2: Change current directory to data_sources

```
cd NGIAB_data_preprocess/data_sources
```

Step 3: Download the CONUS dataset

```
wget https://lynker-spatial.s3.amazonaws.com/v20.1/conus.gpkg
```

Step 4: Download the Model Attributes

```
wget https://lynker-spatial.s3.amazonaws.com/v20.1/model_attributes.parquet
```

- **Image**: Please follow the subsequent steps to download the NextGen docker image.

```
docker pull joshcu/ngiab_workshop_demo:latest
```

5 Workshop Material

Prior to workshop day, our team will provide the following workshop material as a resource to the participants:

- Documentation and tutorials will be available through CIROH documentation website
- Workshop slides will be available on the GitHub