



**NCAR**  
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# NWP as a Service

**Providing Pre-Trained AI Weather Forecasting Services  
for Researchers**

**Daniel Howard**

[dhoward@ucar.edu](mailto:dhoward@ucar.edu) - HPC Consultant

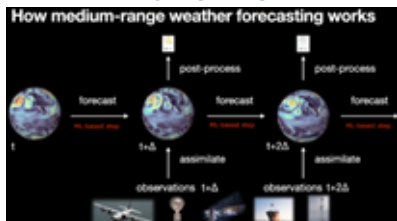
CISL (Computational & Information Systems Laboratory)

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# Enabling Access to AI Based NWP Workflows



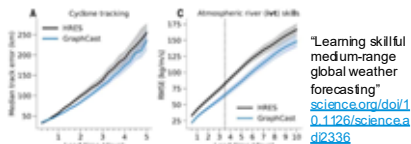
## AI4NWP Overview



Richard Turner "The Quiet AI Revolution in Weather Forecasting"

Generative AI methods have advanced significantly towards enabling numerical weather prediction (NWP).

Successful models including AIFS, GraphCast, Aurora, FourCastNet, and CDiff among others already show skillfulness and utility.



"Learning skillful medium-range global weather forecasting"  
[science.org/doi/10.1126/science.ad2336](https://science.org/doi/10.1126/science.ad2336)

## Community Tools

### [Earth2Studio \(NVIDIA\)](#)



Python package built to empower scientists with 6 core tools: Built-in Workflows, px, dx, datasources, IO, and statistical operators.

### [Anemoi \(ECMWF\)](#)



Framework for developing weather forecasting models, including training data prep, model training, & data registries.

### [CREDIT \(NSF NCAR\)](#)



Open software platform to train and deploy AI atmospheric prediction models, offering flexible configs and neural network architectures.

## Open Access Ecosystem

Most physics based weather forecasting is only accessible to those with access to compute resources of large scale.

This inherently reduces the ability for many people and organizations to engage, contribute, or benefit from NWP research and applications.



Efforts should focus on making data input/outputs FAIR, such as through NSF NCAR's [Geoscience Data Exchange](#) (GDEX), as well as provide training weights and AI notebook workflows.

This will increase usability and access of AI based weather/Earth science to enable innovation beyond science for industry and community

## Example Workflow Repositories

Recently, NSF NCAR led an internal ML Bootcamp upskilling user community on these tools. Intend to scale this publicly with university partners via [COMET](#).

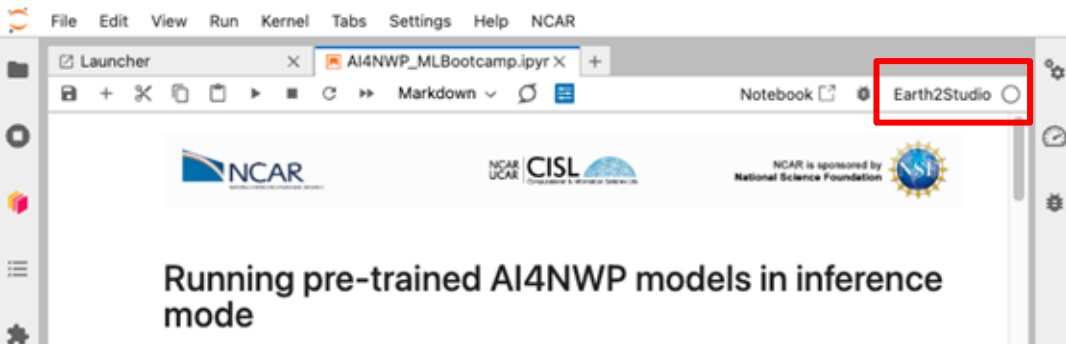
Existing catalogues that offer training resources are below. Per our own bootcamp feedback, **training resources that utilize interactive Jupyter notebooks that walks through the code are most valuable.**

[github.com/NCAR/AIML-Tutorial](https://github.com/NCAR/AIML-Tutorial)  
[nvidia.github.io/earth2studio/examples](https://nvidia.github.io/earth2studio/examples)

[github.com/NOAA-EPIC/ai-notebooks](https://github.com/NOAA-EPIC/ai-notebooks)

[ai2es.org/short-courses-and-tutorials/](https://ai2es.org/short-courses-and-tutorials/)

# Providing Pre-installed AI4NWP Environments



```
import earth2studio.run as run

nsteps = 8
io = run.diagnostic(
    ["2021-06-01"], nsteps, prognostic_model, diagnostic_model, data, io
)

print(io.root.tree())

# Prognostic Model - Load the default model package which downloads the check point from NGC
2025-11-06 11:37:03.632 | SUCCESS | earth2studio.run:diagnostic:220 - Fetched data from GFS
2025-11-06 11:37:03.649 | INFO | earth2studio.run:diagnostic:252 - Inference starting!

Running inference: 0% | 0/9 [00:00:07, 71t/s]
Running inference: 11% | 1/9 [00:00:00:03, 2.511t/s]
Running inference: 22% | 2/9 [00:00:00:02, 2.651t/s]
Running inference: 33% | 3/9 [00:01:00:02, 2.701t/s]
Running inference: 44% | 4/9 [00:01:00:01, 2.731t/s]
Running inference: 56% | 5/9 [00:01:00:01, 2.761t/s]
Running inference: 67% | 6/9 [00:02:00:01, 2.791t/s]
Running inference: 78% | 7/9 [00:02:00:00, 2.791t/s]
Running inference: 89% | 8/9 [00:02:00:00, 2.821t/s]
Running inference: 100% | 9/9 [00:03:00:00, 2.781t/s]

2025-11-06 11:37:06.889 | SUCCESS | earth2studio.run:diagnostic:266 - Inference complete
```



This example workflow is provided via NSF NCAR's JHub interface for ease of access and exploration of AI4NWP applications.

## Earth2Studio Prognostic Models

| Model                 | Resolution | Architecture           | Time Step | Coverage      |
|-----------------------|------------|------------------------|-----------|---------------|
| GraphCast Small       | 1.0°       | Graph Neural Network   | 6h        | Global        |
| GraphCast Operational | 0.25°      | Graph Neural Network   | 6h        | Global        |
| Pangu 3hr             | 0.25°      | Transformer            | 3h        | Global        |
| Pangu 6hr             | 0.25°      | Transformer            | 6h        | Global        |
| Pangu 24hr            | 0.25°      | Transformer            | 24h       | Global        |
| Aurora                | 0.25°      | Transformer            | 6h        | Global        |
| FuXi                  | 0.25°      | Transformer            | 6h        | Global        |
| AIFS                  | 0.25°      | Transformer            | 6h        | Global        |
| StormCast             | 3km        | Diffusion + Regression | 1h        | Regional (US) |
| SFNO                  | 0.25°      | Neural Operator        | 6h        | Global        |
| DLESyM                | 0.25°      | Convolutional          | 6h        | Global        |

## Earth2Studio Data Sources

| Data Source   | Type              | Resolution | Coverage      | Data Format |
|---------------|-------------------|------------|---------------|-------------|
| GFS           | Operational       | 0.25°      | Global        | GRIB2       |
| GFS_FX        | Forecast          | 0.25°      | Global        | GRIB2       |
| HRRR          | Operational       | 3km        | Regional (US) | GRIB2       |
| HRRR_FX       | Forecast          | 3km        | Regional (US) | GRIB2       |
| ARCO ERA5     | Reanalysis        | 0.25°      | Global        | Zarr        |
| CDS           | Reanalysis        | 0.25°      | Global        | NetCDF      |
| IFS           | Operational       | 0.25°      | Global        | GRIB2       |
| NCAR_ERA5     | Reanalysis        | 0.25°      | Global        | NetCDF      |
| WeatherBench2 | Reanalysis        | 0.25°      | Global        | Zarr        |
| GEFS_FX       | Ensemble Forecast | 0.25°      | Global        | GRIB2       |
| IMERG         | Precipitation     | 0.1°       | Global        | NetCDF      |
| CBottle3D     | AI Generated      | 100km      | Global        | HEALPix     |