UIFCW25
A UFS Collaboration Powered by EPIC

NOAA's AI Transformation

Speakers:
Rob Redmon, Director, NOAA Center for Artificial Intelligence

Jun Wang, MLWP project lead, NOAA/NWS/NCEP/EMC

Contributors:
Monica Youngman, Chief Scientist, National Weather Service/OSTI
Chair, NOAA Artificial Intelligence Executive Committee

Jacob Carley, Chief, Engineering and Implementation Branch, NOAA/NWS/NCEP/EMC

Isidora Jankov (OAR/GSL), Sergey Frolov (OAR/PSL), Corey Potvin (OAR/NSSL), Chris Slocum (NESDIS/STAR), Douglas Rao (NESDIS/NCEI, CISSESS), NCAI Team

September 9, 2025
3:30-4:00 MT

Outline

- NOAA AI Strategy Update
- NCAI Overview
- AI Activities relevant to UFS Community
- Operational Transition
- Discussion

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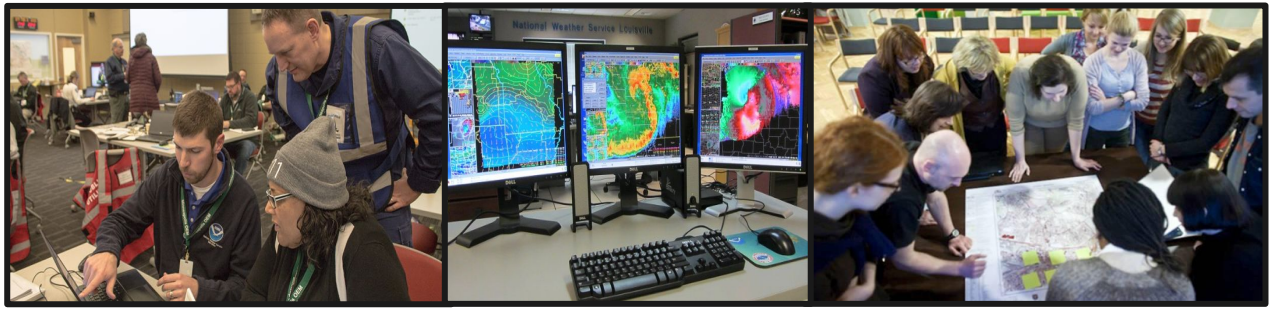
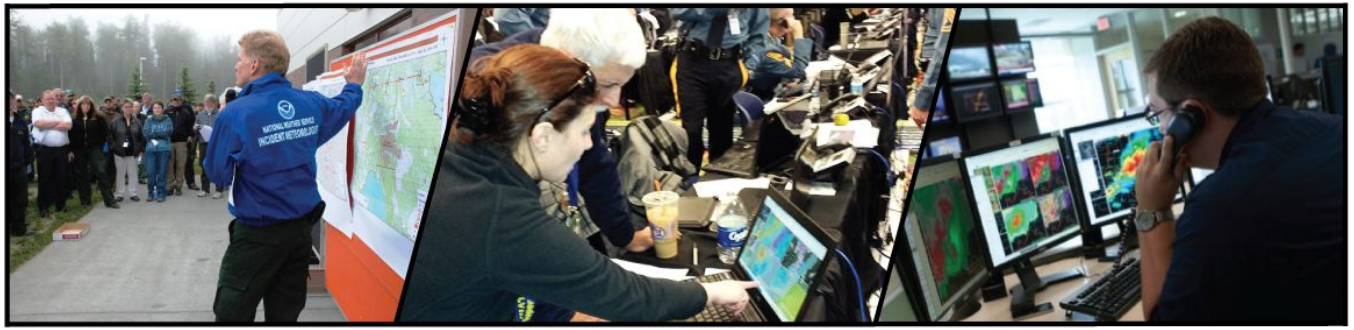
Why AI for NOAA Mission Delivery?

MISSION



PEOPLE



NOAA AI Strategy Rapid Refresh Goals

To ensure NOAA continues to serve the highest quality earth system prediction, resilience, and intelligence information, it is critical for NOAA to rapidly, effectively, and responsibly leverage AI.

AI for NOAA's Mission Delivery

Data for AI

Information Technology for AI

Workforce Proficiency in AI

Robust and Trustworthy AI

NOAA Center for AI (NCAI)

NOAA AI Executive Committee (NAIEC)

NOAA AI Working Groups (NAIWGs)

LO AI Projects

Administrative Tools like Gemini

AI-Ready Data *(ML Training Library)*

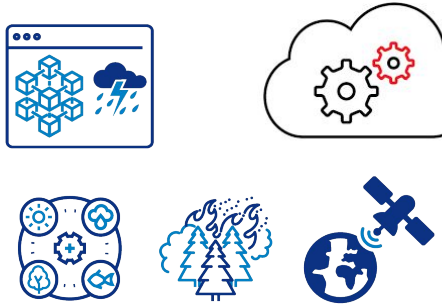
Workforce Training *(Learning Journeys)*

Partnerships *(CRADAs, MOUs)*

NOAA Center for AI – High Impact Activities

Training
AI Workflows

Cloud Sandboxes
Engagement



Workshops
7th AI Workshop *Generative AI for Earth and Space Modeling and Information Services,*
Sep 16-17
noaa.gov/ai/events

NCAI Program Office & Tech Hub

Robust and Trustworthy AI Innovation
Why, What, How

Training

AI Data Standards

Partnerships Engagement

Communities of Practice

Connecting Inside NOAA:
Web: sites.google.com/a/noaa.gov/ncai/
Chat with the NCAI Community

Publicly:
noaa.gov/ai (e.g. Workshops),
ncai.team@noaa.gov

AI-Ready Standards

New Data Governance Activity:
AI Data WG

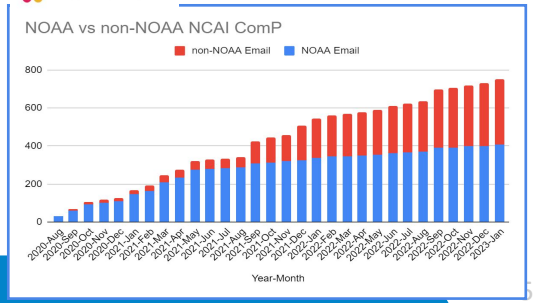
AI Ready Data (examples):

- Ocean: World Ocean DB, Sea Surface Temperature, Sea Ice
- Coasts: Offshore Winds
- Land: Temperature T2m

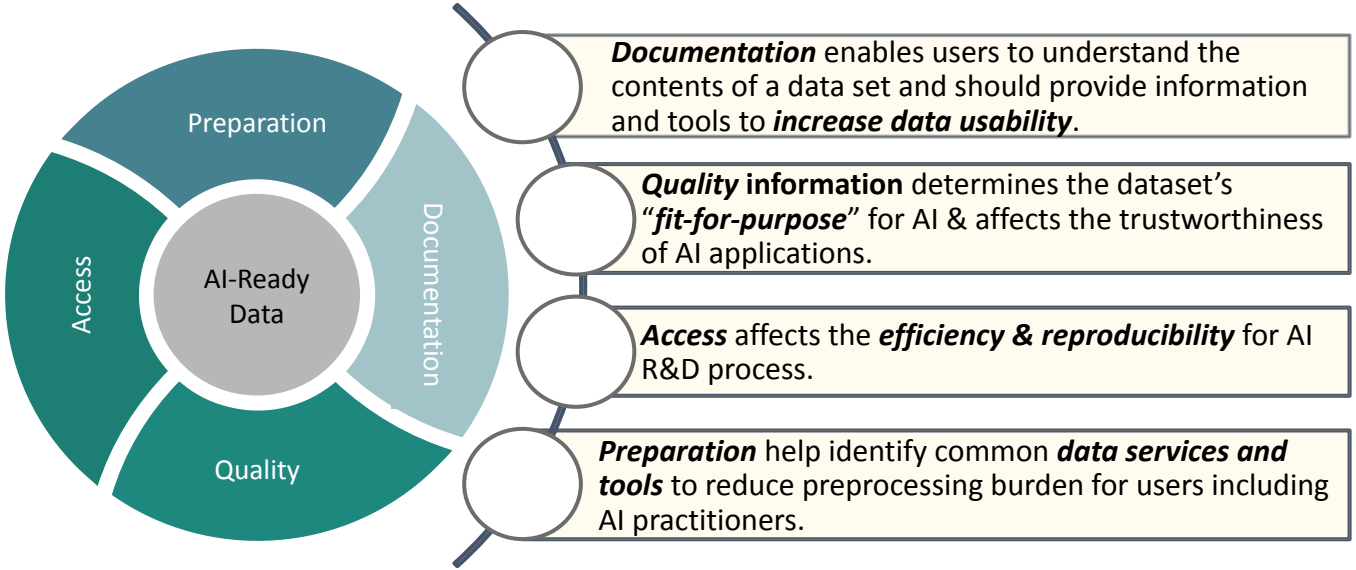
Generative AI for Admin & Info

Gemini

slack Pilot



AI-Ready Data in Earth and Space Sciences



Community Resources:

- ESIP Data Readiness
  See GitHub link below.
- NOAA AI Data WG under the Data Governance Committee, contact Douglas Rao, Tyler Christensen, Rob Redmon.

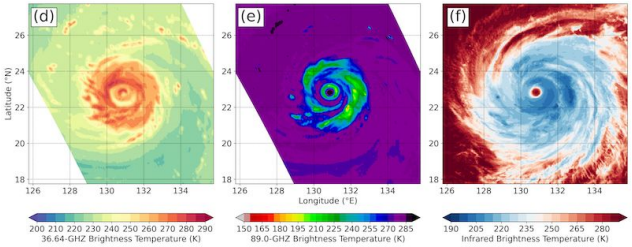
Earth Science Information Partners (ESIP) Data Readiness Cluster (https://github.com/ESIPFed/data-readiness) is a forum for community members from agencies (NOAA, NASA, USGS, DOE, USAF, Met Office, etc), private sectors, and academia to:

- Understand users' data needs for AI/ML Research and Development with Earth system science data
- Develop community standards, leading practices & tools for AI-ready data

AI-Ready Data – Accelerating AI4NWP

(a) TC PRIMED TC⁹

Tropical Cyclone PRecipitation, Infrared, Microwave, and Environmental Dataset



(b) Offshore Wind Profiles

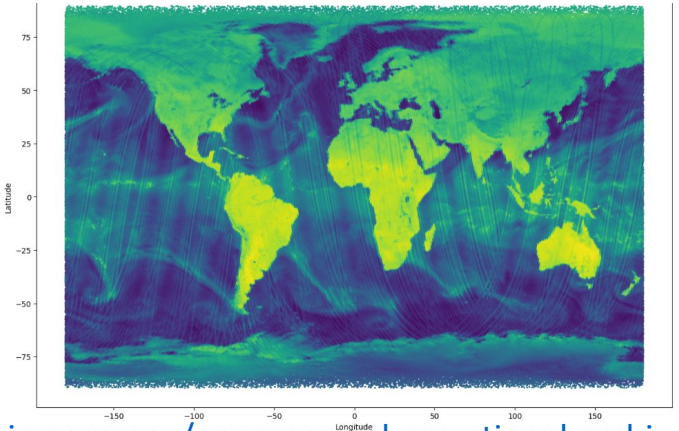
Offshore vertical wind profiles provide valuable coastal knowledge, e.g. for offshore industry siting and coastal weather modeling.

NCAI AI-ready Data and Learning Journeys
noaa.gov/ai/resources/learning-journey-library

(c) NNJA-AI NOAA-NASA Joint Archive

```
from nnja import DataCatalog
catalog = DataCatalog(skip_manifest=True)
amsu_ds = catalog['amsua-1bamua-NC021023'].load_manifest().sel(
    time='2021-01-01 00Z',
    variables=['LAT', 'LON', 'TMBR_00001']
)
df = amsu_ds.load_dataset(backend='pandas')
plot_df(df, 'TMBR_00001')
```

AMSU Brightness Temperature



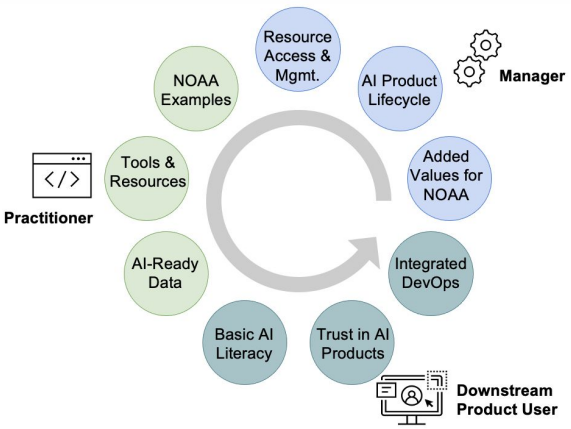
epic.noaa.gov/noaa-nasa-observational-archive-reanalysis-ai-friendly-format/

Workforce Training – Responsible AI

Understanding NOAA training needs and gaps

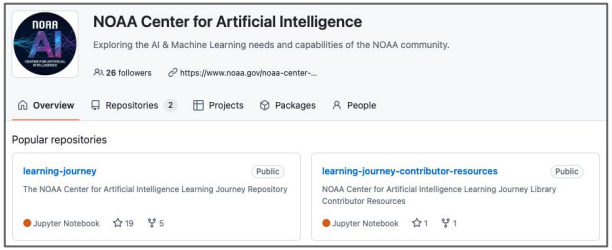
Facilitating resource development & curation

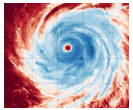
Enabling workforce & building competency



Pilot gap assessment for NOAA AI training needs:

https://www.noaa.gov/ai/resources





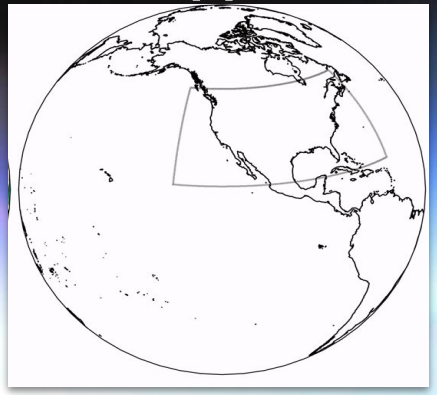
Published learning journeys:
Rip currents, tropical cyclones, offshore wind, geomagnetic navigation, ocean acoustics
https://github.com/noaa-ncai

Hosting training events / tutorials on AI topics relevant to NOAA missions

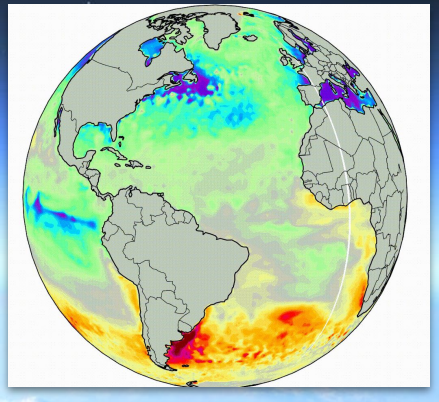
e.g. Thursday September 11
"Training #4: NOAA AI Learning Journeys Tutorial"

AI Activities of Interest

Nested Applications



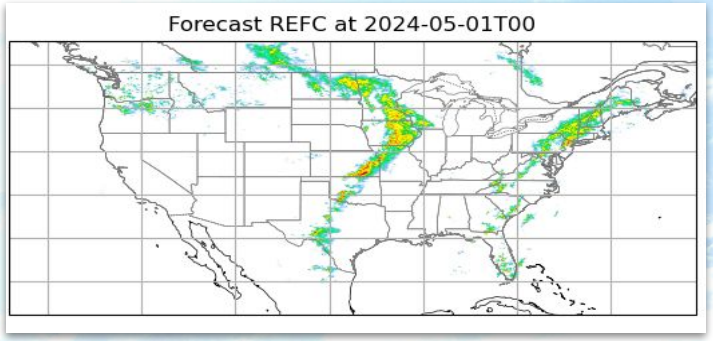
Global Coupled Ensembles



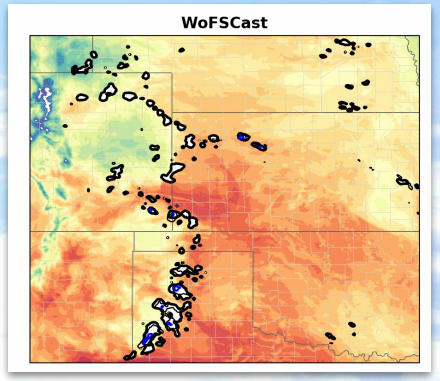
EAGLE Vision

Made possible via collaboration between EPIC, OAR labs, NWS

High Resolution Regional



Storm-scale



See talk by Sergey Frolov tomorrow during the Emerging Technologies AI/ML session starting at 3:30pm MT.

Summary: WoFSCast: Warn-on-Forecast System (WoFS) Emulator

GraphCast-based; 3-km spacing on 900-km domain; 6-h forecasts at 10-min intervals (Flora and Potvin 2025)

WoFSCast ensemble (18 members) performed very well in 2025 HWT Spring Forecasting Experiment

Ongoing R&D:

Probabilistic loss (CRPS) produces sharper, better-calibrated forecasts

Adding variables (e.g., CAPE, SRH, UH)

Planning MPAS training dataset (3 & 1 km)

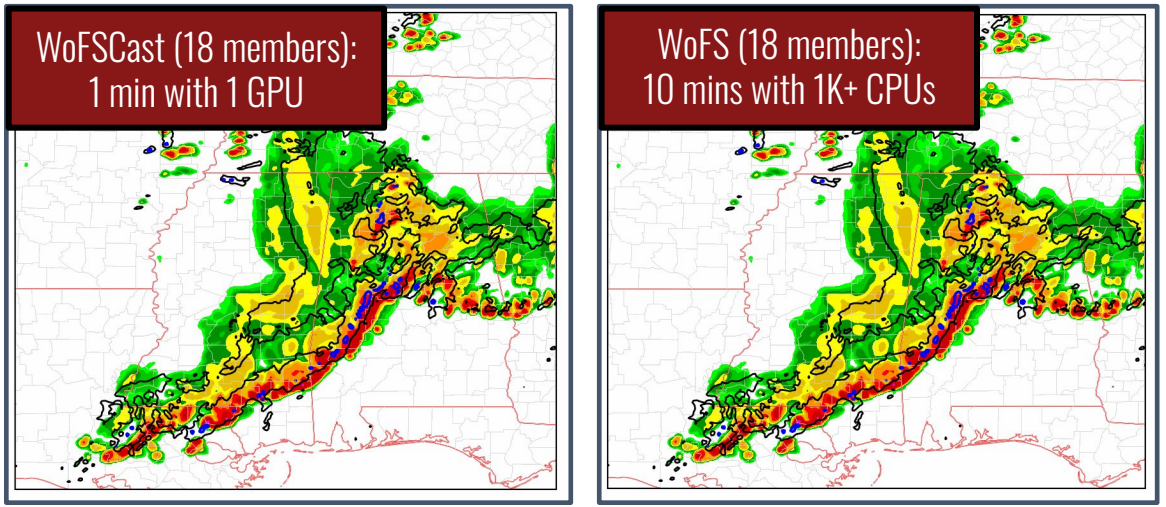
Longer-term:

1-km MPAS-based WoFSCast

AI-augmented DA

Implement in EAGLE

Credit: Corey Potvin



See full presentation by Corey Potvin tomorrow during the Emerging Technologies AI/ML session starting at 3:30pm MT.

Summary: HRRRCast - High Resolution Rapid Refresh Emulator - Limited Area Part of EAGLE

V1.0 (Current, Near-Real Time at EMC)

- ResNet-based architecture
- 12 vertical levels
- Focus on Composite Reflectivity (proxy for precipitation)
- Visualization with DESI
- Running in real-time at EMC

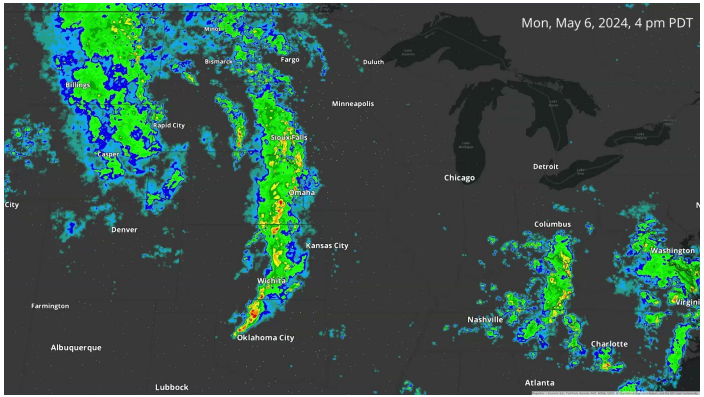
V2.0 (Coming Soon)

- Improved architecture
- 20 vertical levels (+8)
- 11 additional 2D variables, including precipitation
- Ensemble forecasts capability

HRRRCast real-time Forecasts

HRRRCast manuscript

Scan me!

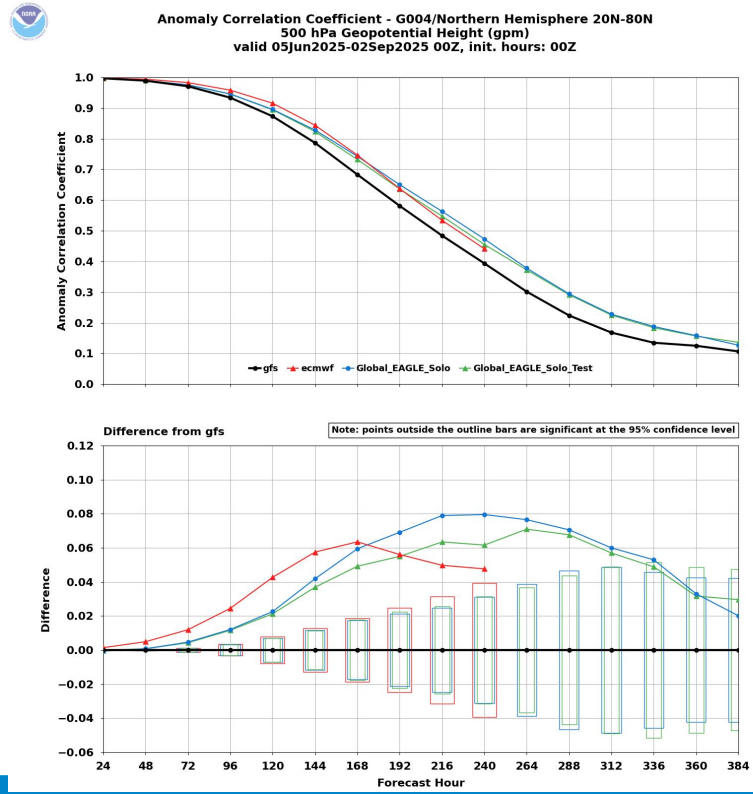


See poster presentation by Isidora Jankov – “HRRRCast: a data-driven emulator for regional weather forecasting at convection allowing scales”

Summary: Data-driven MLWP Development for Global Forecasts

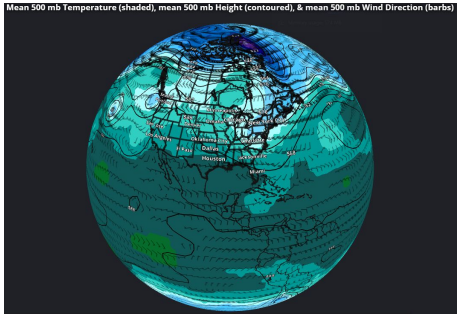
- EAGLE global deterministic (solo) and ensemble v1:
  - Fine-tuning GraphCast using NCEP in-house data and other data sets.
  - Implementation of the EAGLE global solo and ensemble later this calendar year.
- Ongoing development:
  - transitioning to UFS2ARCO/Anemoi framework
  - Updated loss function
  - Increase vertical resolution
  - Generate more forecast products

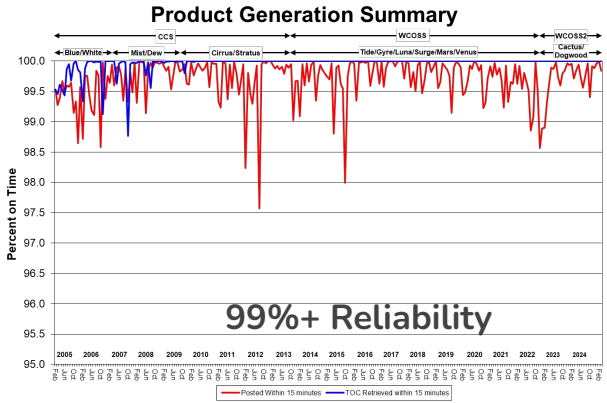
See the full presentation by Jun Wang in Wednesday's Emerging Technologies session.



Transitioning AI Models to Operations

- **Data** - Ensure data quality and efficient management
- **Performance** - Monitor model performance for accuracy
- **Reliable and Secure** - Guarantee system scalability and reliability
- **Forecaster Interpretation** - Provide comprehensive operational training
- **Resources** - Ensuring there are the computational and personnel resources to ensure 24/7 operations





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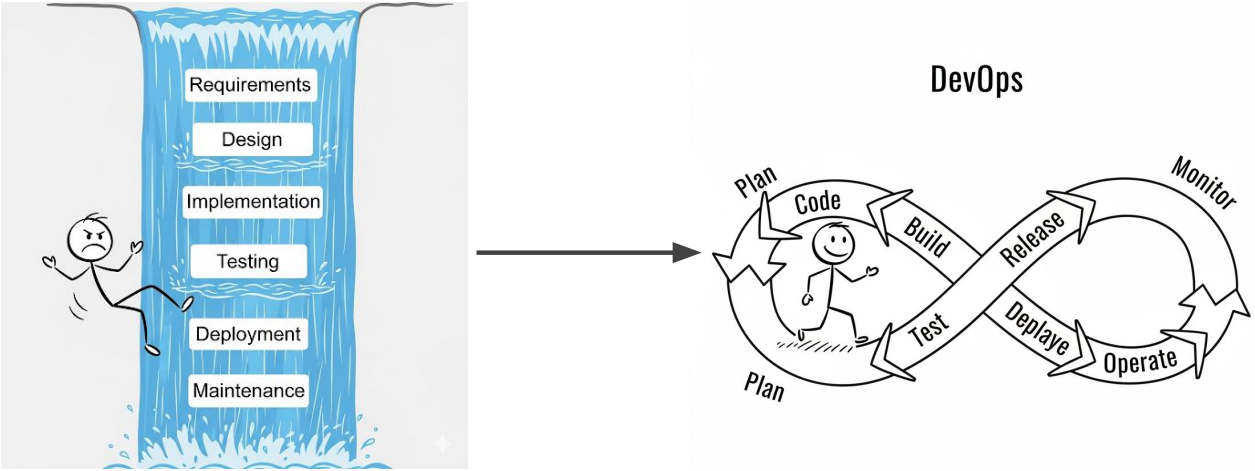
Transitioning EAGLE to Operations - A new Paradigm

Opportunity to move from legacy waterfall R2O methods and begin adopting a more flexible paradigm



- ➔ Decouple the scientific innovation timeline from the release timeline.
- ➔ Bring Development and Operations closer together.
- ➔ Reduced implementation risks and deliver science quickly.
- ➔ Approach is being trialed *now* for EAGLE's first implementation.

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NOAA AI – noaa.gov/ai

Questions and Community Discussion

Summary for UIFCW of our growing partnerships–not an exhaustive list.

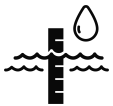
BACKUP

NOAA AI Strategy Rapid Refresh Goals [Draft]

To ensure NOAA continues to serve the highest quality earth system prediction, resilience, and intelligence information, it is critical for NOAA to rapidly, effectively, and responsibly leverage AI.

AI for NOAA's Mission Delivery

Use AI to enhance NOAA mission delivery - from weather forecasting to fisheries management, to ocean modeling and space weather prediction.



Data Optimization

Ensure that Earth and space data and information are AI-ready and publicly available as appropriate per regulations, facilitating collaboration with the private sector, academia, and other government agencies.

Adaptable IT Framework

Establish an ecosystem of flexible, scalable, on-demand computing, storage, and software environments that seamlessly integrates AI development and operations, supporting the full range of administrative, business, and scientific workflows.

Workforce Proficiency

Advance AI within NOAA and promote U.S. global AI competitiveness through an AI-proficient workforce.

Trustworthy and Ethical

Secure NOAA's global authority in Earth and space systems through development and use of reliable, robust, and trustworthy AI.