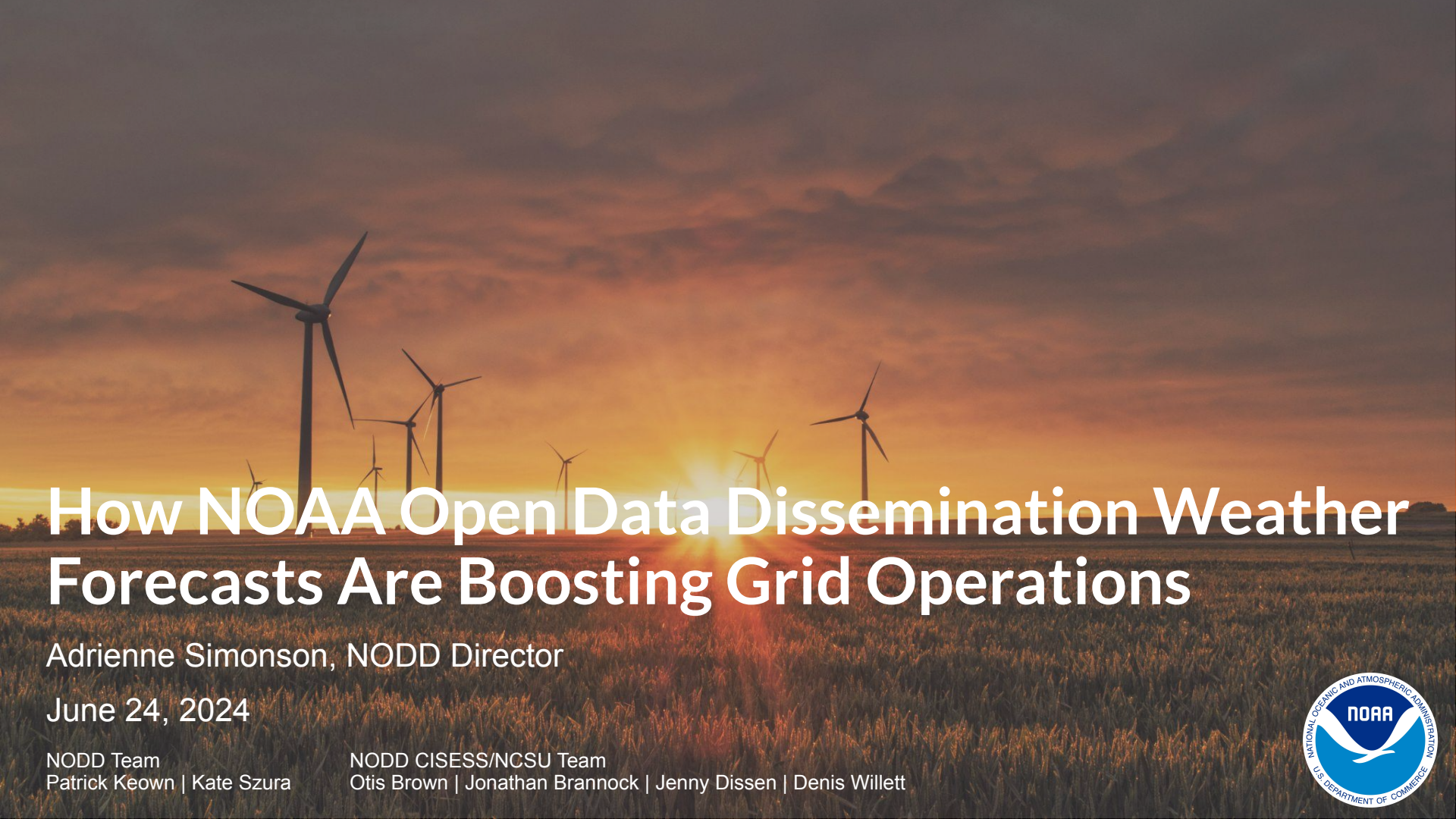


A photograph of several wind turbines in a field at sunset. The sun is low on the horizon, creating a warm orange and yellow glow. The sky is filled with soft, dark clouds. The foreground is a field of tall grass or crops.

# How NOAA Open Data Dissemination Weather Forecasts Are Boosting Grid Operations

Adrienne Simonson, NODD Director

June 24, 2024

NODD Team  
Patrick Keown | Kate Szura

NODD CISESS/NCSU Team  
Otis Brown | Jonathan Brannock | Jenny Dissen | Denis Willett





An aerial photograph of a suburban neighborhood. The image shows a mix of residential houses with red and grey roofs, green lawns, and trees. A road with a double yellow line runs diagonally across the upper left. To the left of the road are large, open agricultural fields. The overall scene is a typical suburban landscape.

# Agenda

## ❑ NOAA Open Data Dissemination (NODD):

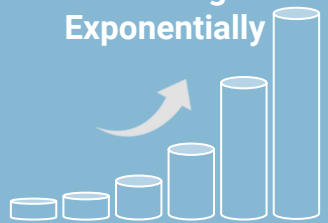
- ❑ Purpose & Mission
- ❑ Available Data
- ❑ Program Structure & Operational Support
- ❑ Engagement Opportunities

# NODD Disseminates NOAA Line Office Data

Data hosted through NODD is:

- Open and free data with value to the public
- Moves from NOAA Line Offices to public cloud buckets via the NODD Data Broker from which an exponential amount of users can access
- Has no use restrictions and does not require user registration
- Appropriate Metadata is required for each dataset

NOAA Data is  
Growing  
Exponentially



## TECHNOLOGY MODERNIZATION

Reduces stress on  
NOAA's on-premise  
dissemination  
systems

Improves services  
for users



## FULL & OPEN PUBLIC ACCESS

Supports Federal  
Data Strategy &  
Evidence Act Open  
Data Requirements

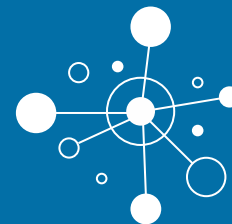
No egress costs



## ENABLES & ENGAGES USERS

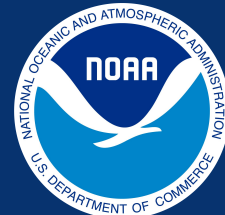
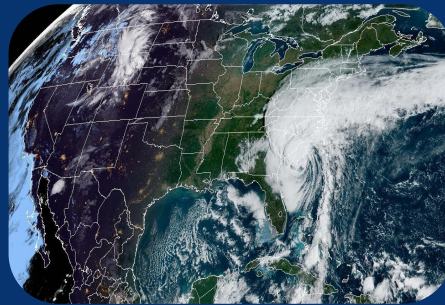
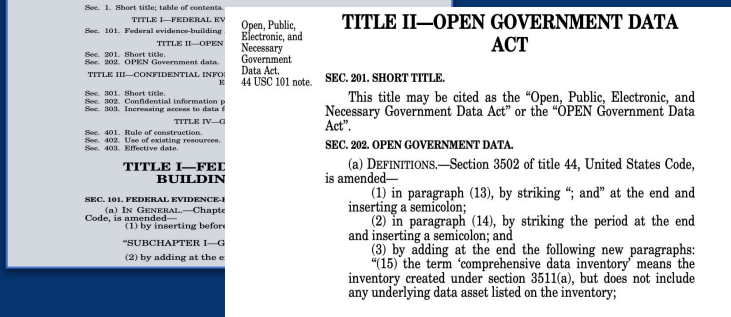
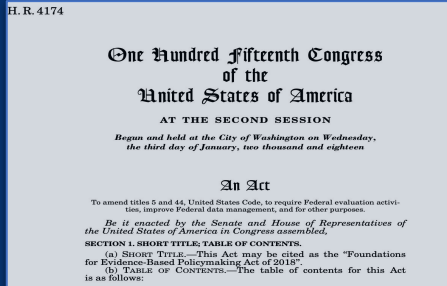
Catalyzes  
innovation in  
environmental  
services

Enables  
interoperability





# NODD Supports “Foundations for Evidence-Based Policymaking Act”, Including Open Data Requirements



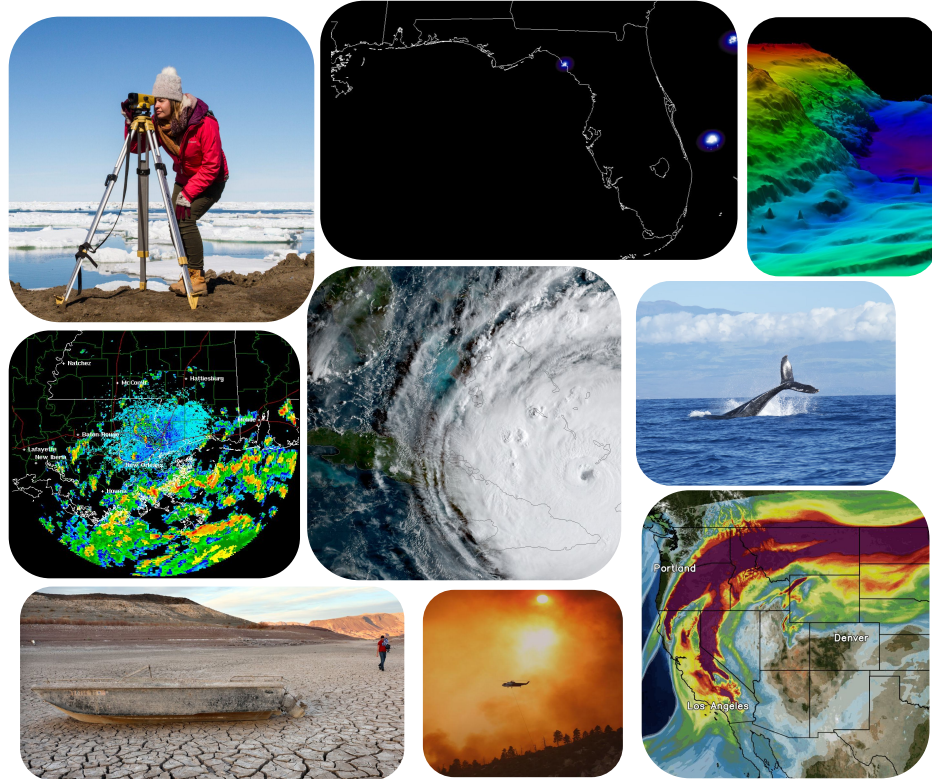
## & NOAA's Priorities

- ✓ Build a Climate Ready Nation
- ✓ Make Equity Central To NOAA's Mission
- ✓ Accelerate Growth In An Information Based Blue Economy





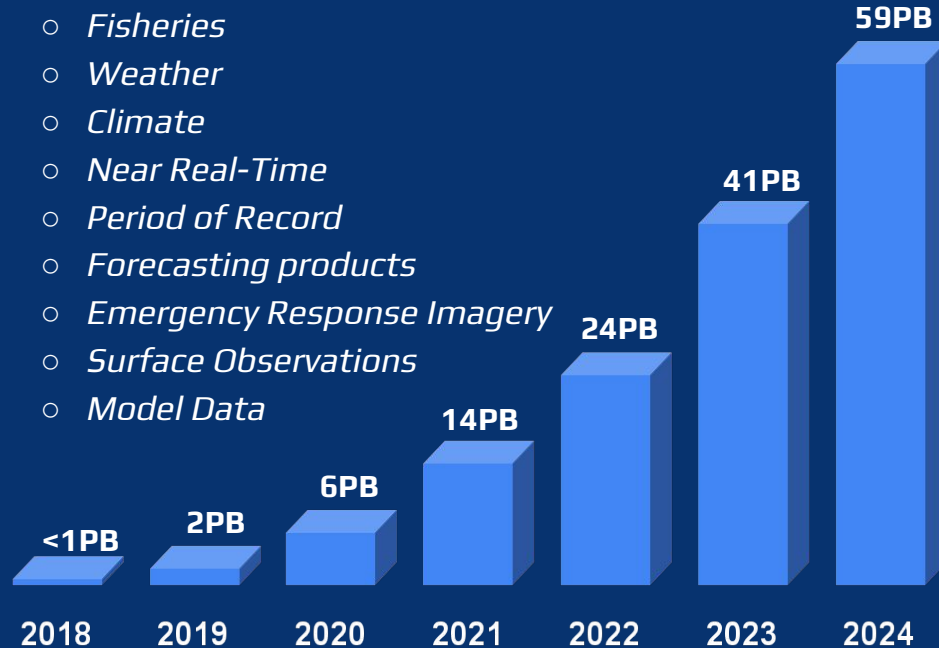
# NOAA Datasets Accessible via NODD



VISIT  
[NOAA.GOV/NODD](https://noaa.gov/nodd)  
TO EXPLORE THE FULL LIST



- Atmospheric
- Oceanic
- Fisheries
- Weather
- Climate
- Near Real-Time
- Period of Record
- Forecasting products
- Emergency Response Imagery
- Surface Observations
- Model Data



# Highlighted Datasets for the Energy Sector

- **Numerical Weather Prediction (NWP)**
  - Climate Forecast System (CFS)
  - Global Forecast System (GFS)
  - Global Ensemble Forecast System (GEFS)
  - High-Resolution Rapid Refresh (HRRR)
  - Rapid Refresh (RAP)
- **Radar**
  - Next Generation Weather Radar (NEXRAD)
- **Satellite Data**
  - Geostationary Operational Environmental Satellites (GOES) - R Series
    - Solar Information
  - Joint Polar Satellite System (JPSS)
- **Weather/Climate Data**
  - Global Historical Climatological Network
  - nClimGrid
  - Climate Normals
  - Integrated Surface Database (ISD)
  - Storm Events Database

Do you have any data questions or requests?

Please reach out to the NODD team at [NODD@NOAA.GOV](mailto:NODD@NOAA.GOV) with any questions. The team can assist or connect you with a NOAA subject matter expert or cloud subject matter expert.

***Data is made available via our three cloud service providers (CSPs):***

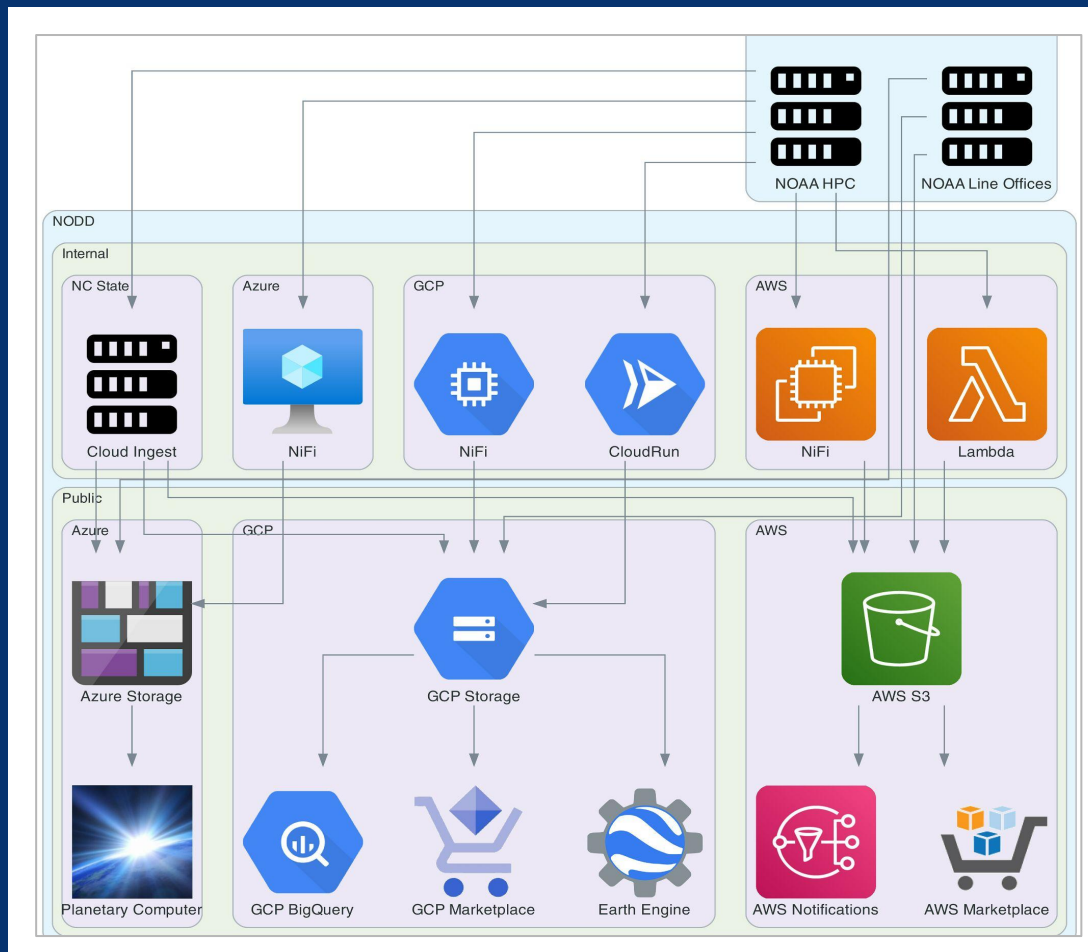




# NODD Architecture

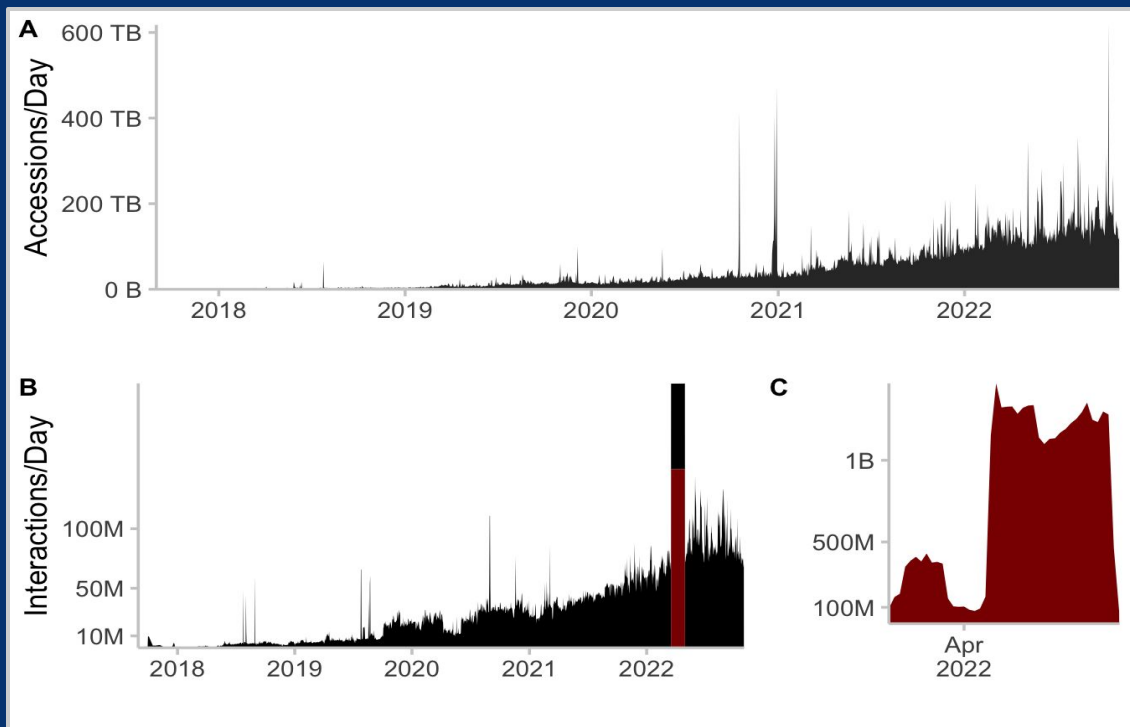
Data updates are available via SNS, Pub/Sub, and Azure Event Notifications. Please refer to the cloud service provider (CSP) landing page to see if a dataset of interest has an event driven notification set up.

*Figure: NODD architecture displaying data movement from NOAA on-prem systems to each of the three cloud service providers.*





# NODD Data Accessibility



- NODD supports high volume of traffic for interactions
- NODD has supported sustained interactions by count of 1.2 -1.5 billion per day for 28 days straight for GOES data
- And interactions by volume – we have seen 1.2PB of the data accessed in a single day

**Not possible with on-premise system**



# Benefits to Users of Cloud Scalability via NODD

## Metrics Track Increased Use on Cloud Platforms



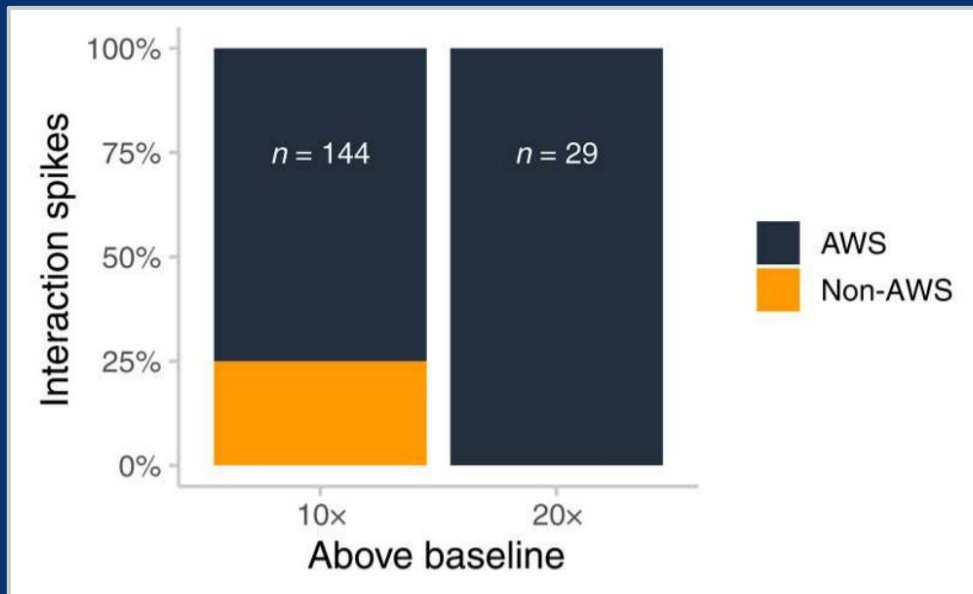
SCIENCE ADVANCES | RESEARCH RESOURCE

### PLANETARY SCIENCE

#### NOAA Open Data Dissemination: Petabyte-scale Earth system data in the cloud

Denis S. Willett<sup>1\*</sup>, Jonathan Brannock<sup>1†</sup>, Jenny Dissen<sup>1</sup>, Patrick Keown<sup>2</sup>, Katelyn Szura<sup>2</sup>, Otis B. Brown<sup>1</sup>, Adrienne Simonson<sup>2</sup>

NOAA Open Data Dissemination (NODD) makes NOAA environmental data publicly and freely available on Amazon Web Services (AWS), Microsoft Azure (Azure), and Google Cloud Platform (GCP). These data can be accessed by anyone with an internet connection and span key datasets across the Earth system including satellite imagery, radar, weather models and observations, ocean databases, and climate data records. Since its inception, NODD has grown to provide public access to more than 24 PB of NOAA data and can support billions of requests and petabytes of access daily. Stakeholders routinely access more than 5 PB of NODD data every month. NODD continues to grow to support open petabyte-scale Earth system data science in the cloud by on-boarding additional NOAA data and exploring performant data formats. Here, we document how this program works with a focus on provenance, key datasets, and use. We also highlight how to access these data with the goal of accelerating use of NOAA resources in the cloud.



AWS usage metrics reveal sustained access of more than 5 PB per month and more than 1 billion interactions per week, with occasional sustained interactions of 1.5 billion per day. This suggests users are availing themselves of CSP platform tools rather than egressing the data, especially for large analyses not typically possible via traditional infrastructure.

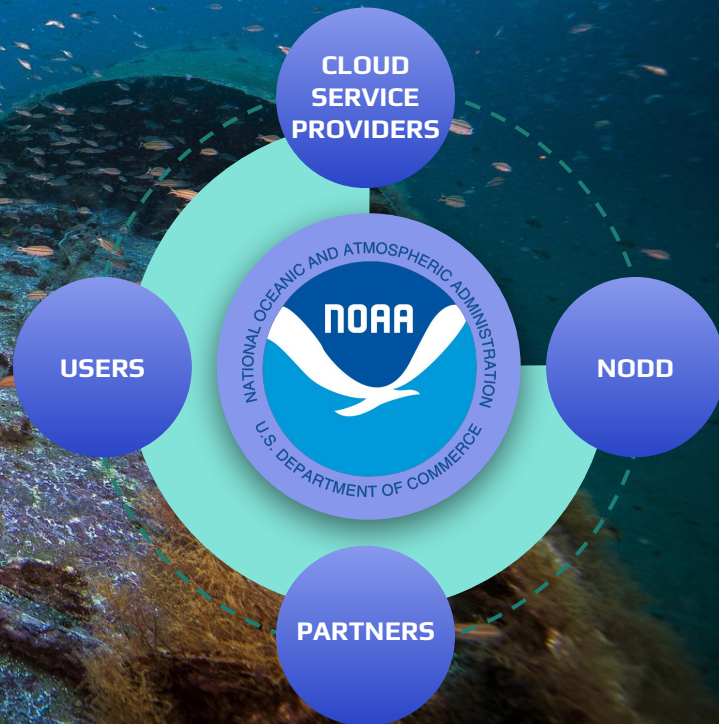
# NODD As An Ecosystem

*“Data have value when they are used in decision making. If not, then the economic value of such data is effectively zero.”*

## Lessons Learned:

- Access on cloud platforms has resulted in increased usage of NOAA's data.
- Integration of NOAA data into industry tools is most effective.
- Key NOAA asset is **expertise** to understand and support use of NOAA's data.
- Users appreciate the option to receive **service delivery** notifications.
- User engagement provides valuable **customer experience** insight.

Questions? Email us at [NODD@NOAA.GOV](mailto:NODD@NOAA.GOV)





# Who is Using NODD?

NOAA  
Line  
Offices

Data & User  
Communities

Cloud &  
Other  
Partners

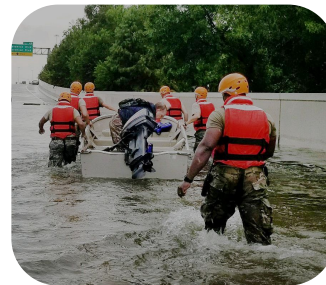
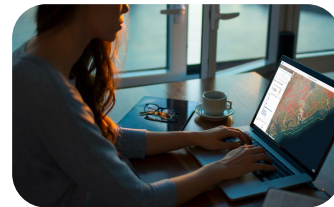
NODD works with NOAA Line Offices, our cloud service providers and other partners, and data and user communities to create an ecosystem where users can access valuable NOAA data to create analyses that drive decision-making worldwide.

## What Value Comes from Data Sharing?

### *Economic & Societal*

Cloud access allows for both faster and larger-scale analyses not typically possible via traditional infrastructure. The ability to analyze data faster and in tandem with other datasets helps drive analysis, new insights and innovation, and decision-making at scales not previously possible.

## Sectors Using NODD





# NODD Office Hours

Connecting Data Users to NOAA Scientists  
& Cloud Subject Matter Experts

Visit [NOAA.GOV/NODD](https://noaa.gov/nodd) for resources

## Eight Office Hours To Date

Reaching over 750 registrants

- High-Resolution Rapid Refresh (HRRR)
- S-100/S-111 Forecast Guidance of Surface Water Currents
- Global Ensemble Forecast System (GEFS)
- National Water Model (NWM)
- Geostationary Operational Environmental Satellites (GOES-R) Cryosphere Products
- Emergency Response Imagery (ERI)
- Joint Polar Satellite System (JPSS) via Google & AWS



June 13, 2024 | 12:00 - 1:15pm EDT | [Register HERE](https://noaa.gov/nodd)

**NOAA LOW EARTH ORBIT (LEO)  
JPSS SATELLITE DATA  
NODD OFFICE HOURS**

Hosted by NOAA National Environmental Satellite, Data, and Information Service (NESDIS), NOAA Open Data Dissemination (NODD), and NODD's cloud partner Amazon Web Services (AWS). Please join to learn more about NOAA's LEO Joint Polar Satellite System (JPSS) data (SNPP, NOAA 20 & 21), connect with NOAA and cloud subject matter experts, and share your use case.

**Adrienne Simonson**  
NOAA Open Data Dissemination (NODD)

**Satya Kalluri**  
NOAA LEO Joint Polar Satellite System (JPSS)

**Lihang Zhou**  
NOAA LEO Joint Polar Satellite System (JPSS)

**Chris Stoner**  
AWS Open Environmental Data Lead

**Mya Sears**  
NC Institute for Climate Studies (NCICS)

NOAA Ocean Color Product | Image Captured by JPSS Visible Infrared Imaging Radiometer Suite (VIIRS) Sensor

## Key Office Hours Findings

- Eight Office Hours hosted to date in collaboration with each of the **three cloud service providers** and with **NOAA Line and Program offices**
- Users heard about product updates, cloud access options, and participated in hands-on Jupyter notebook trainings
- Users had the opportunity to ask experts technical product questions, and expressed interest in cloud-optimized formats and learning about technical support options. Please visit our website at [NOAA.GOV/NODD](https://noaa.gov/nodd) to view notes that include Q&As from each session

## AT A GLANCE

Enverus, who recently acquired CRCL Solutions, is an energy-focused SaaS platform that provides data, analytics, and insights for the oil, gas, and renewable energy sectors to help companies optimize their operations and strategic decision-making. They recently acquired CRCL Solutions, a company that developed AI-based energy forecasting solutions, specifically wind and solar forecasts, down to the turbine and farm level, to those participating in wholesale markets. These analytics help balance the supply and demand side of energy.

### **NOAA DATA USED:** *HRRR (High Resolution Rapid Refresh)*

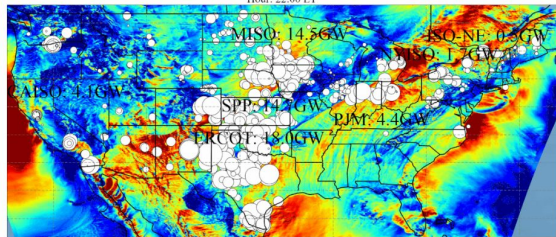
Enverus' AI forecasting model accesses historical HRRR via AWS

## IMPACT PROVIDED

The AI method uses the HRRR model for both near real-time and historical data. They pull the near real-time data through NOAA's NOMADS environment and accesses historical HRRR via AWS as part of NODD.

All data and conversions are completed within their own cloud environment. NOAA HRRR data is an important input for providing wind and solar forecast information to the energy industry.

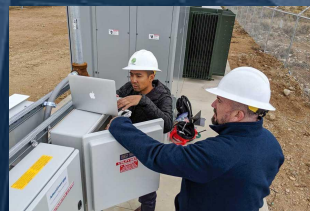
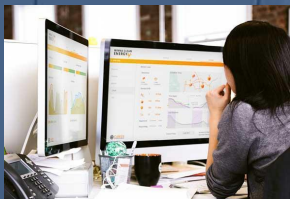
CRCL Wind Forecast: May 2022 Sample  
Hour: 22:00 ET



80m Wind Speed (m/s)



# CAMUS



## AT A GLANCE

Camus Energy is a SaaS company that provides grid management software to distribution utilities.

CAMUS delivers distributed energy resource (DER) orchestration in support of zero-carbon grid operations.

## NOAA DATA USED

**HRRR**  
*High Resolution Rapid Refresh*  
Via Google Cloud

Camus uses HRRR data in machine learning models that forecast load & generation for the distribution system from minutes to 48 hours in the future.

## IMPACT PROVIDED

Forecasts enable more efficient operations allowing distribution utilities to improve

- Safety
- Reliability
- Cost of service
- Renewable energy integration



# Let's Connect.



[nodd@noaa.gov](mailto:nodd@noaa.gov)



[noaa.gov/nodd](https://noaa.gov/nodd)

*Adrienne Simonson, NOAA OCIO, Director*  
*Patrick Keown, NOAA OCIO, Program Manager*  
*Katelyn Szura, NOAA OCIO, Communications Lead*  
*Otis Brown, Director, CISESS / NC State University*  
*Jonathan Brannock, Cloud Software Engineer, CISESS / NC State University*  
*Jenny Dissen, Engagement & Partnerships, CISESS / NC State University*  
*Denis Willett, Cloud Software Engineer, CISESS / NC State University*

