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IMP205

Open data for impact: Quantify and manage climate-related risks

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NOAA Open Data Dissemination
NOAA Office of the Chief Information Officer

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Housekeeping



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Open data for impact

Quantify and manage climate-related risks and opportunities

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Climate-related risks



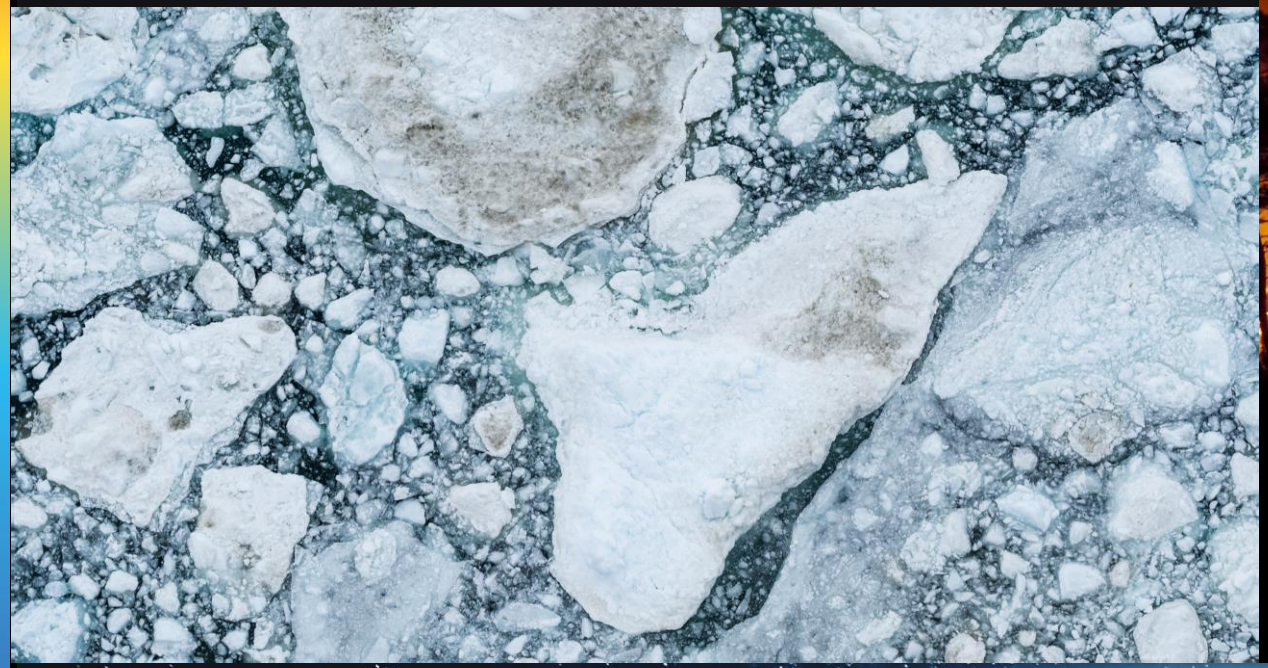
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Climate-related risks



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Climate-related risks



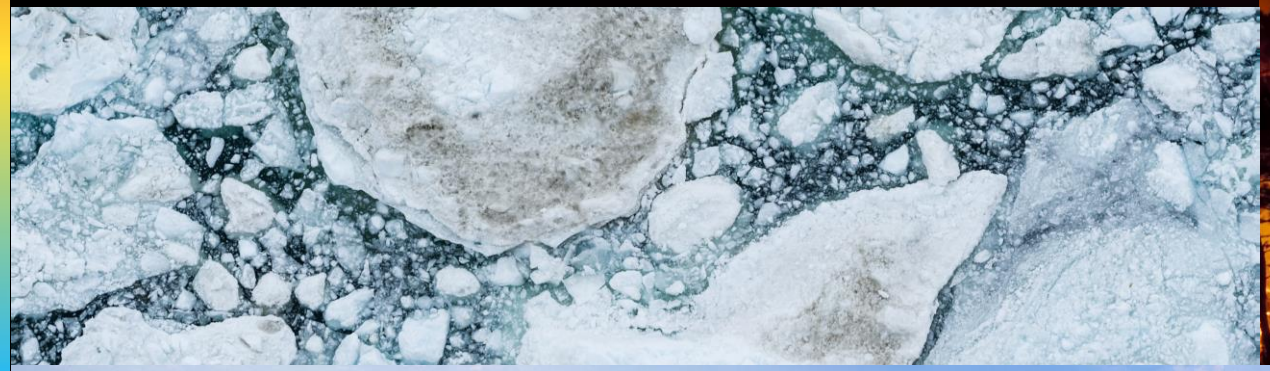




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Climate-related risks







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Gathering climate data



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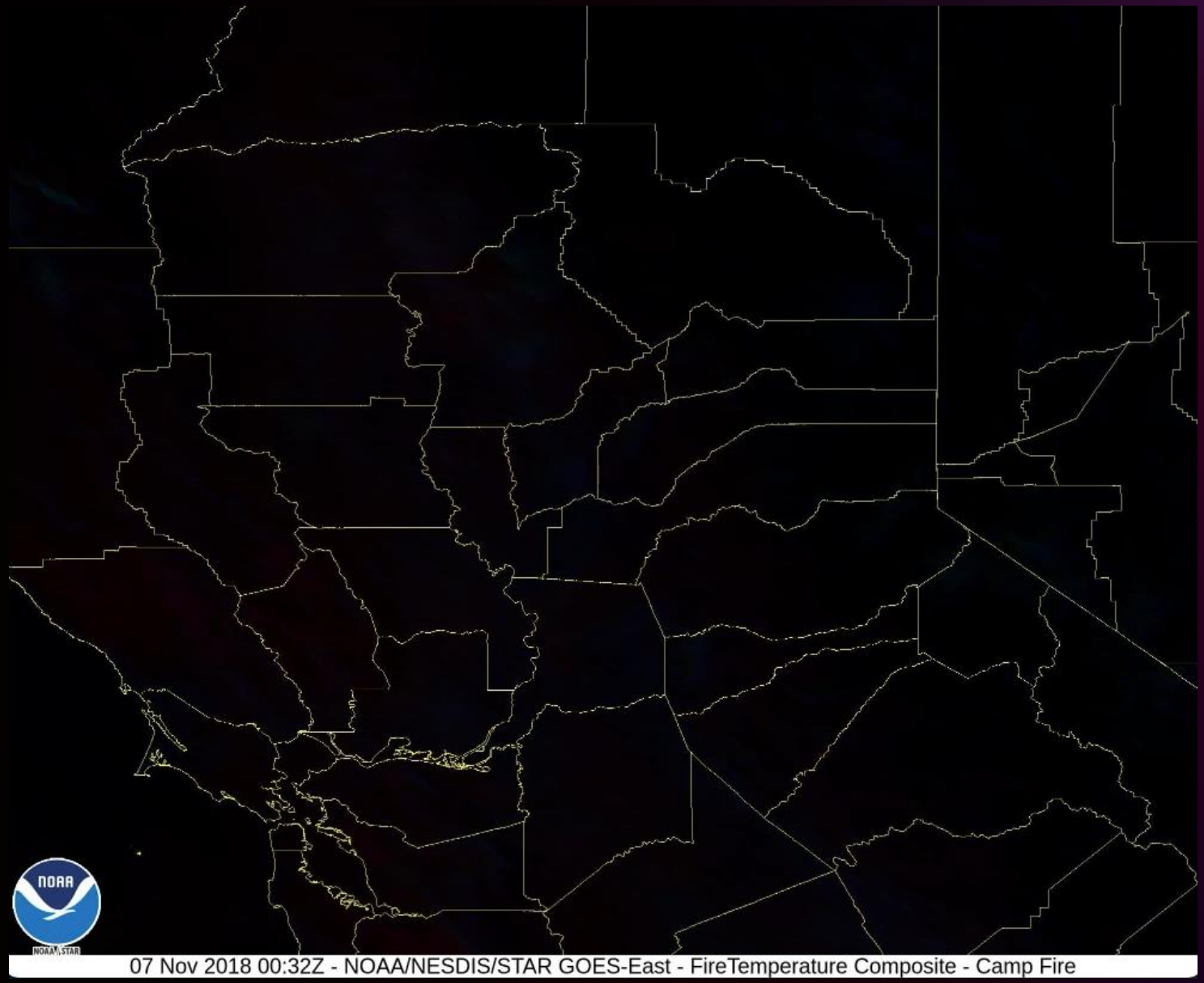
Measure risk using climate data

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Measure risk using climate data



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Open Data on AWS program

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Open Data on AWS program

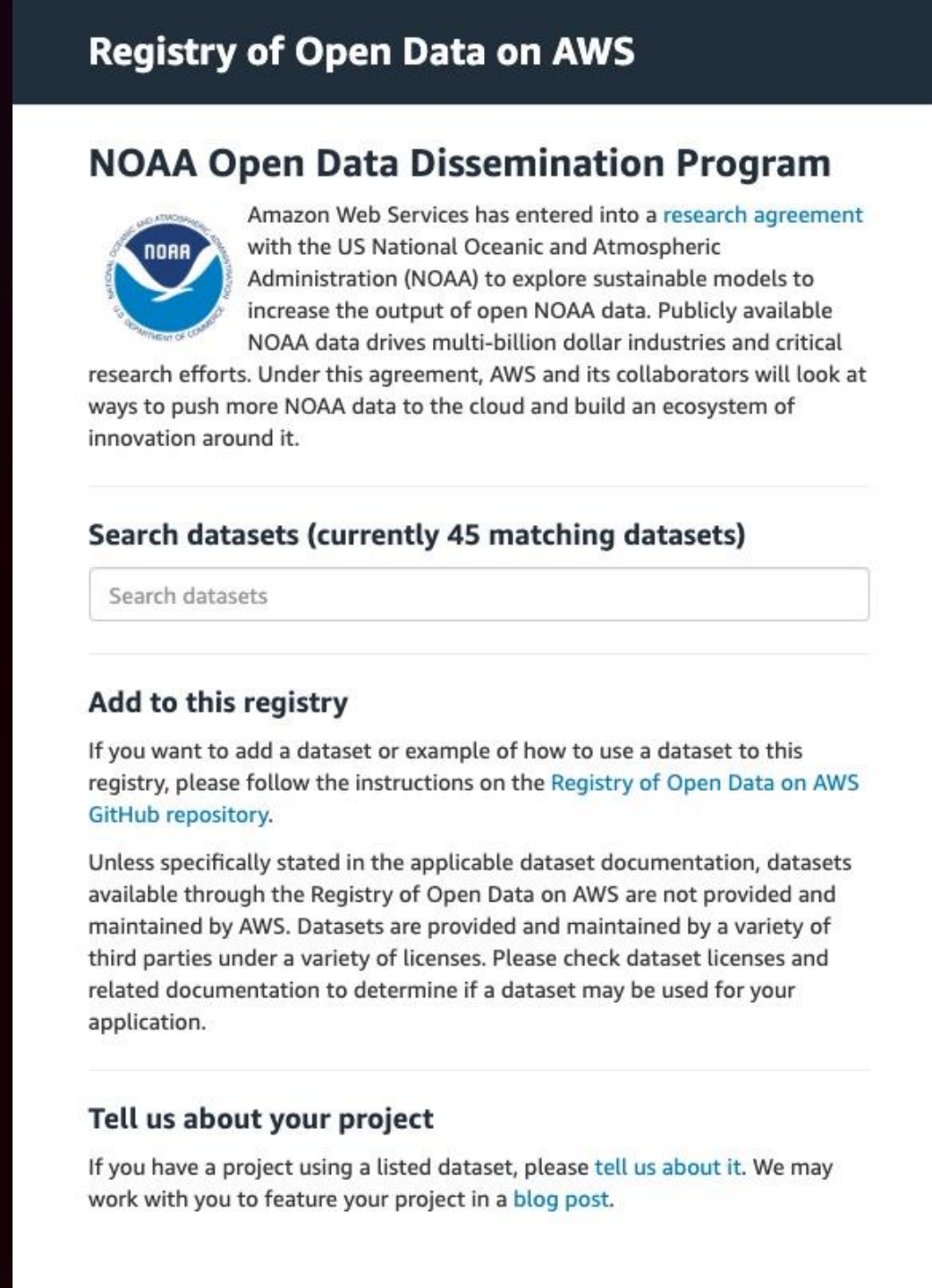
What if we made all these high-value datasets open to the public?

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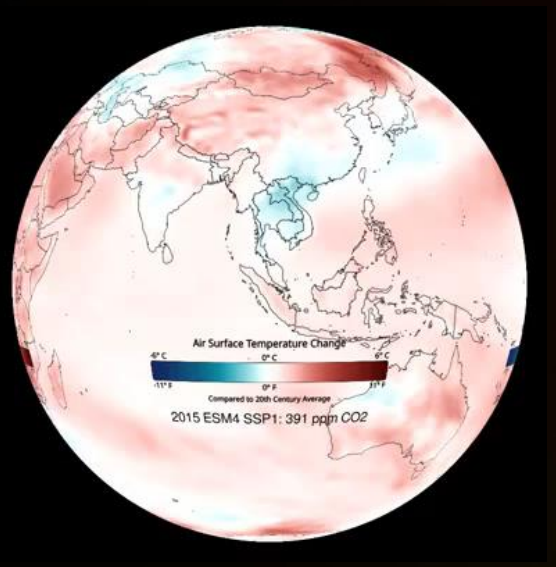
Now we have over 100 PBs of open data!



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NOAA NODD and OS-Climate

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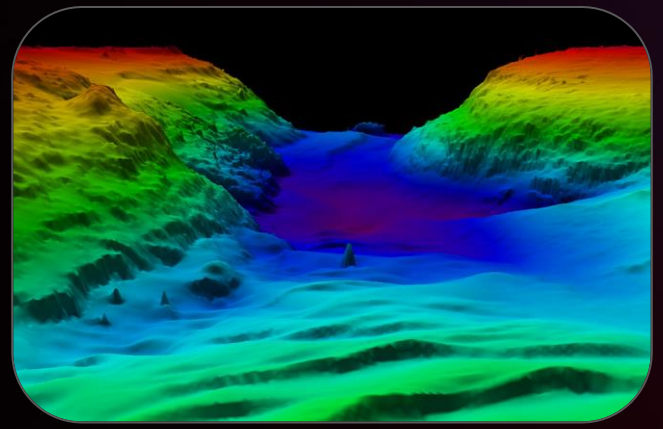


NOAA Open Data Dissemination (NODD)

Adrienne Simonson, Director
NOAA Open Data Dissemination
NOAA Office of the Chief Information Officer

Introduction

- National Oceanic and Atmospheric Administration (NOAA) is a mission-driven, federal agency under the Department of Commerce
- NOAA's products and services support economic vitality and affect more than 1/3 of America's gross domestic product
- NOAA Open Data Dissemination provides users with free and open access to NOAA's valuable environmental data



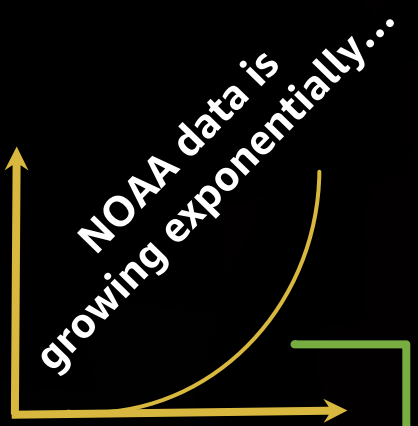




NOAA's priorities

- ✓ Build a Climate Ready Nation
- ✓ Make equity central to NOAA's mission
- ✓ Accelerate growth in an information-based blue economy

Why open data via the cloud







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Why open data via the cloud

NOAA data is growing exponentially…



TECHNOLOGY MODERNIZATION

Reduces stress on NOAA's on-premise dissemination systems

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NOAA
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
U.S. DEPARTMENT OF COMMERCE

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OPEN DATA

Open data requirements, federal data strategy, and the Evidence Act

ENABLE INNOVATION

Cloud-based access to NOAA data catalyzes innovation in environmental services

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NOAA
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
U.S. DEPARTMENT OF COMMERCE

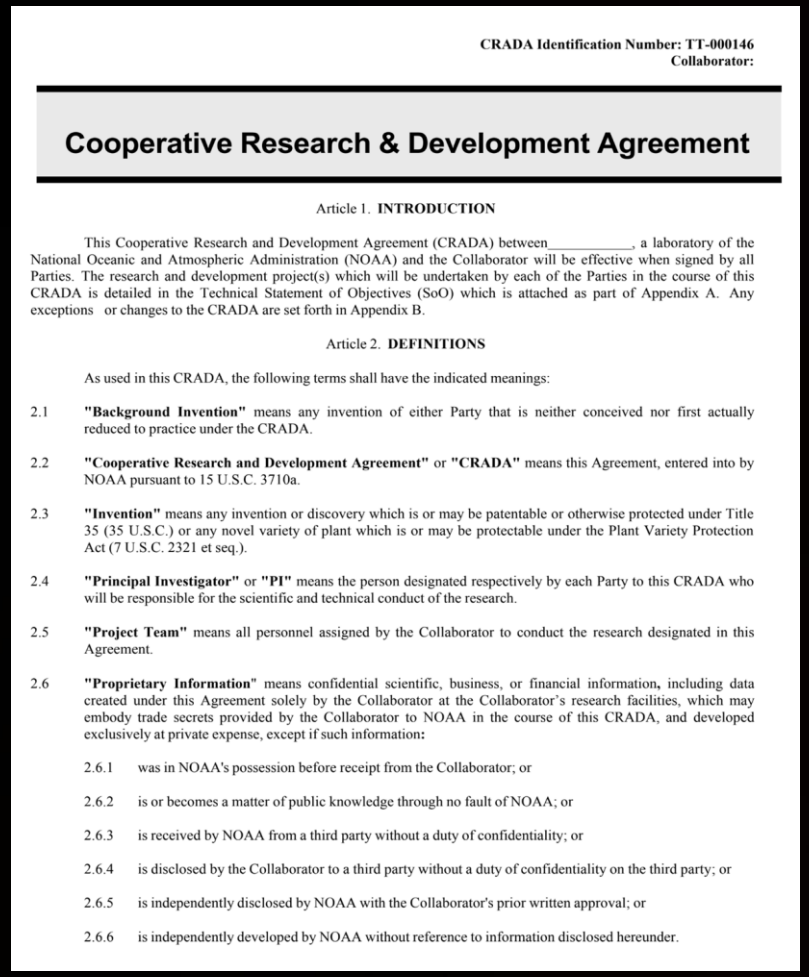
BDP → NODD timeline

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NOAA signs 3-year CRADA with AWS, Google, IBM, Microsoft, and OCC

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May 2018
CRADA extended

CRADA
Cooperative Research and Development Agreement



CRADA Identification Number: TT-000146
Collaborator:

Cooperative Research & Development Agreement

Article 1. **INTRODUCTION**

This Cooperative Research and Development Agreement (CRADA) between_____, a laboratory of the National Oceanic and Atmospheric Administration (NOAA) and the Collaborator will be effective when signed by all Parties. The research and development project(s) which will be undertaken by each of the Parties in the course of this CRADA is detailed in the Technical Statement of Objectives (SoO) which is attached as part of Appendix A. Any exceptions or changes to the CRADA are set forth in Appendix B.

Article 2. **DEFINITIONS**

As used in this CRADA, the following terms shall have the indicated meanings:

2.1 **"Background Invention"** means any invention of either Party that is neither conceived nor first actually reduced to practice under the CRADA.

2.2 **"Cooperative Research and Development Agreement"** or **"CRADA"** means this Agreement, entered into by NOAA pursuant to 15 U.S.C. 3710a.

2.3 **"Invention"** means any invention or discovery which is or may be patentable or otherwise protected under Title 35 (35 U.S.C.) or any novel variety of plant which is or may be protectable under the Plant Variety Protection Act (7 U.S.C. 2321 et seq.).

2.4 **"Principal Investigator"** or **"PI"** means the person designated respectively by each Party to this CRADA who will be responsible for the scientific and technical conduct of the research.

2.5 **"Project Team"** means all personnel assigned by the Collaborator to conduct the research designated in this Agreement.

2.6 **"Proprietary Information"** means confidential scientific, business, or financial information, including data created under this Agreement solely by the Collaborator at the Collaborator's research facilities, which may embody trade secrets provided by the Collaborator to NOAA in the course of this CRADA, and developed exclusively at private expense, except if such information:

2.6.1 was in NOAA's possession before receipt from the Collaborator; or

2.6.2 is or becomes a matter of public knowledge through no fault of NOAA; or

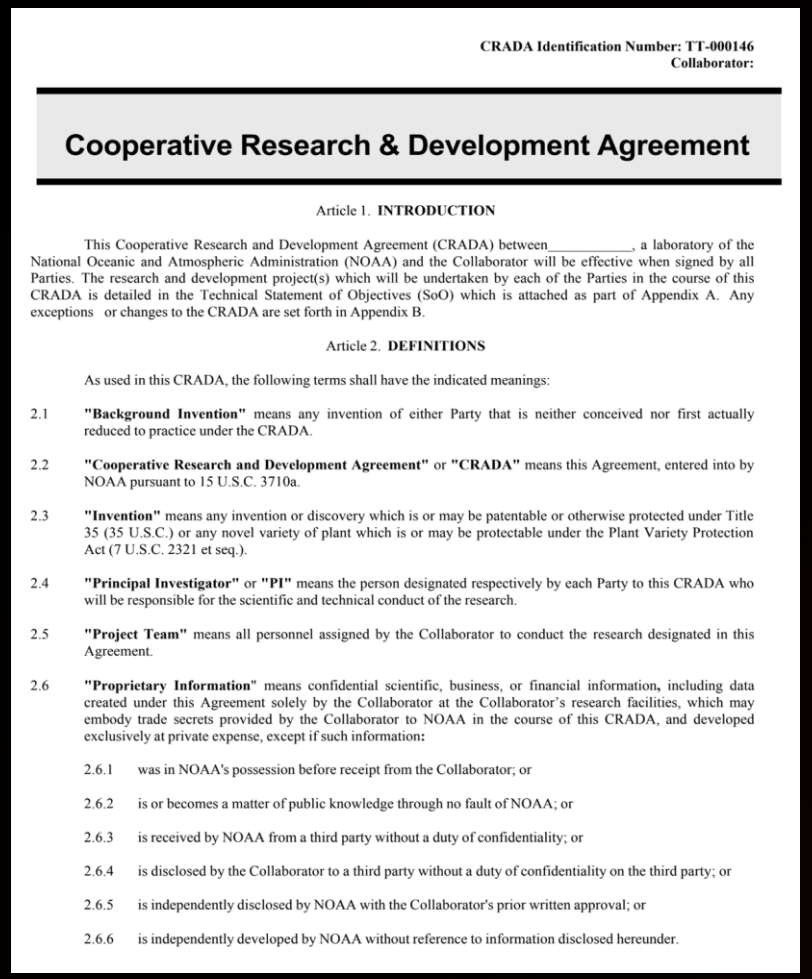
2.6.3 is received by NOAA from a third party without a duty of confidentiality; or

2.6.4 is disclosed by the Collaborator to a third party without a duty of confidentiality on the third party; or

2.6.5 is independently disclosed by NOAA with the Collaborator's prior written approval; or

2.6.6 is independently developed by NOAA without reference to information disclosed hereunder.

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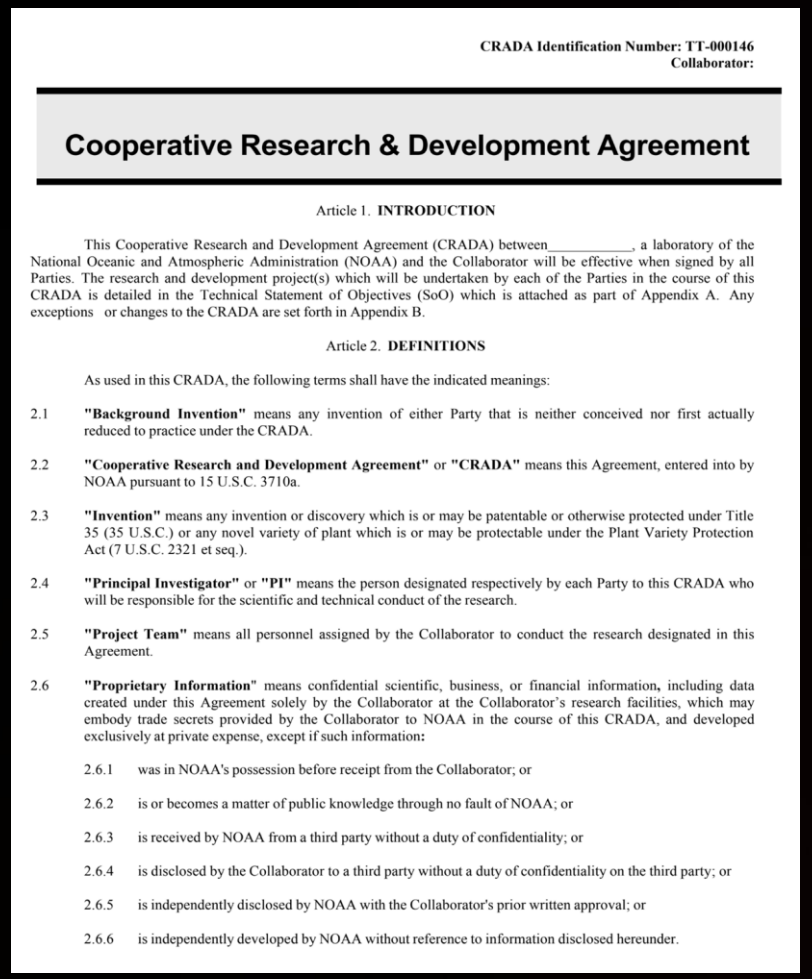
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- Formal process requesting information from industry

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- Formal process requesting information from industry
- Iterative approach to dissemination without disrupting NOAA operation
- Low-risk mechanism for creating and testing a smaller version of the full market ecosystem
- Lessons learned and real-time modifications of the dissemination process
- Goal: Make NOAA data publicly available at no net cost to NOAA or the public, including users of the data

Some key 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 the data

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- ❑ Key NOAA asset is expertise to understand and support the data
- ❑ The role of an intermediate "Data Broker" has emerged as a valuable function & possible Enterprise Service that could support NOAA in provision of data to the commercial cloud
- ❑ A defined commitment and level of service are needed by NOAA, the Collaborators, and Users



BDP → NODD architecture



Federal security boundary

Data transfer is one way

Data Broker

cisess
Cooperative Institute for Satellite Earth System Studies

NC STATE UNIVERSITY

Only trusted user inside security boundary

NOAA.GOV/NODD

Cloud partners

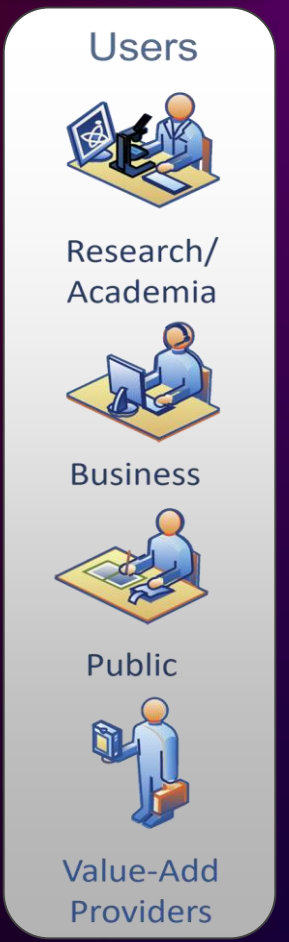
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AWS Registry of Open Data Program (RODA)

Microsoft Azure

Google Cloud

Users



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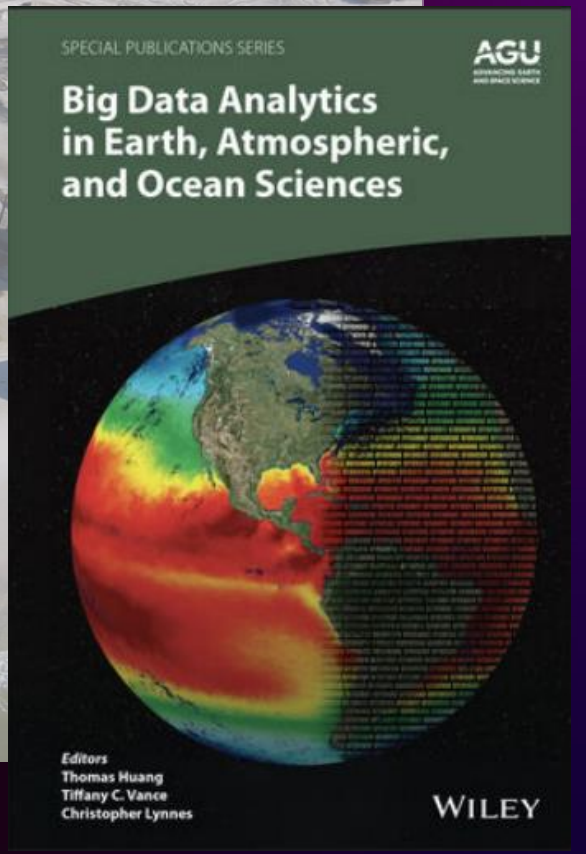
Challenges and opportunities



- Format conversions
- Cloud-based tools
- Data quality
- Data provenance
- Interoperability across disciplines
- Understanding user needs
- Understanding and communicating the value of the data and how to use it

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October 2019
BDP initial operational capability

NODD utilizes public-private partnerships

- **Revolutionizes** NOAA data dissemination by improving **public** access options



Avoids agency costs and risks associated with public access

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- ❑ **Provides a minimum of 5 PBs on each CSP** of NOAA's vast environmental data holdings
- ❑ **Via contract** we established with Cloud Service Providers (CSPs) for NOAA data in the cloud, with **no cost for public egress or data download**



Avoids agency costs and risks associated with public access

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NOAA

NODD utilizes public-private partnerships

- **Revolutionizes** NOAA data dissemination by improving **public** access options
- **Increases use and usability** of NOAA data for a growing **cloud** community
- **Democratizes NOAA data utilization** especially for small-to-medium-sized businesses by reducing and removing obstacles to the use of NOAA data

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Avoids agency costs and risks associated with public access

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NOAA

Congressional and NOAA leadership on NODD

- Approved by Congress in FY 22 to "improve public access to climate-change data and to transition NOAA data to the cloud."

- House FY23 Commerce, Justice, Science & Related Agencies Explanatory Statement includes $3.3M for NODD in support of Climate Ready Nation and NOAA's role in implementing EO 14008, "tackling the climate crisis at home and abroad."

NODD is in the Operational Excellence and Mission Success section of the FY 2022–2026 NOAA Strategic Plan, released July 11



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BDP initial operational capability

2022
- FY22 Omnibus supports NODD
- NOAA Strategic Plan FY22–FY26



Today there are over 132+ NOAA datasets in the Registry of Open Data on AWS

- *Near real-time datasets*
- *Period of record*
- *Weather*
- *Atmospheric*
- *Climate*
- *Oceanic*
- *Fisheries*
- *Emergency response imagery*
- *Satellite*
- *Radar data*
- *Model data*
- *Forecast data*
- *Surface observations*

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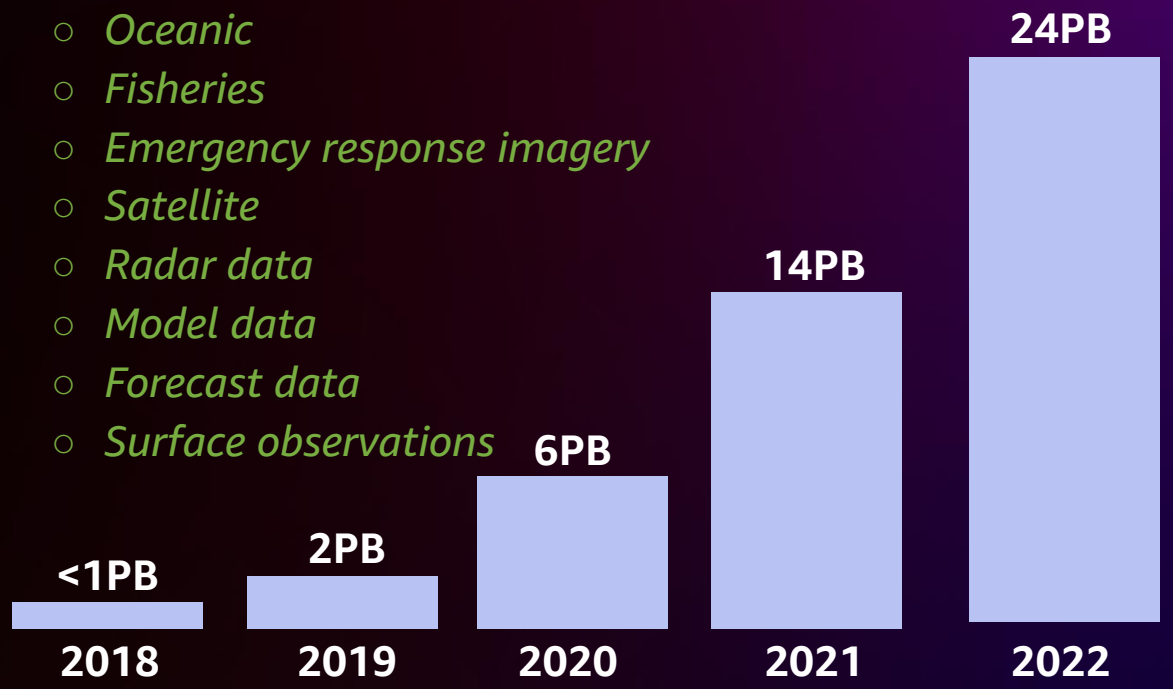
*https://registry.opendata.aws/collab/noaa

NOAA.GOV/NODD



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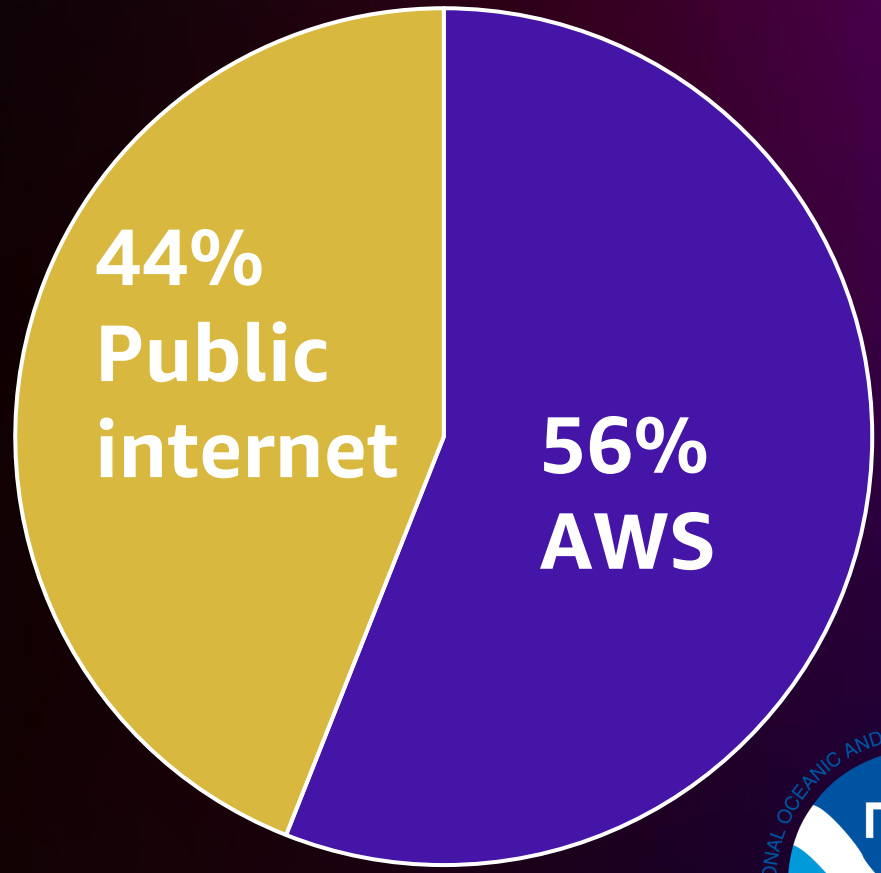
NOAA data on the Registry of Open Data on AWS

- We have **~12PB** of NOAA data **freely accessible to the public**
- AWS supports high volume of traffic for **interactions**
  - AWS has supported sustained **interactions** of 1.2–1.5 billion per day for 28 days straight for GOES data
- And **accessions**: We have seen 1.2PB of the data accessed in a single day
- Not possible with on-premise system



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Leveraging NOAA data to mitigate risk



NOAA's data is critical to all sectors of the U.S. economy, and is used in ways that improve lives, strengthen the nation's economy, and mitigate risk.

Leveraging NOAA data to mitigate risk







Leveraging NOAA data to mitigate risk













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Kate Duffy, Ph.D.

AT A GLANCE

Zeus AI is a startup, founded in 2022, that is using satellite imagery to provide real-time weather information to their customers. They received a NASA SBIR award to predict 3D atmospheric structure from geostationary satellites using ML and AI. Their product improves wind forecasting, which can be seen here in the background.

Background product image credit to Zeus AI

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NOAA Data via Open Data on AWS

GOES-R and HRRR

Zeus AI leverages GOES-R Level 1 multispectral satellite data, and HRRR data for their products accessed through NODD via Open Data on AWS.

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IMPACT PROVIDED

- Zeus AI is addressing current observing-system gaps by using AI to fuse geostationary satellite imagery with weather forecasts.
- This technology provides the accuracy of high-resolution models with a fraction of the computational cost, lower latency, and improved refresh rates.
- In August 2022, co-founder Kate Duffy shared that the NODD program “makes it possible for us at Zeus AI to work with the big data needed for AI modeling.”

Background product image credit to Zeus AI

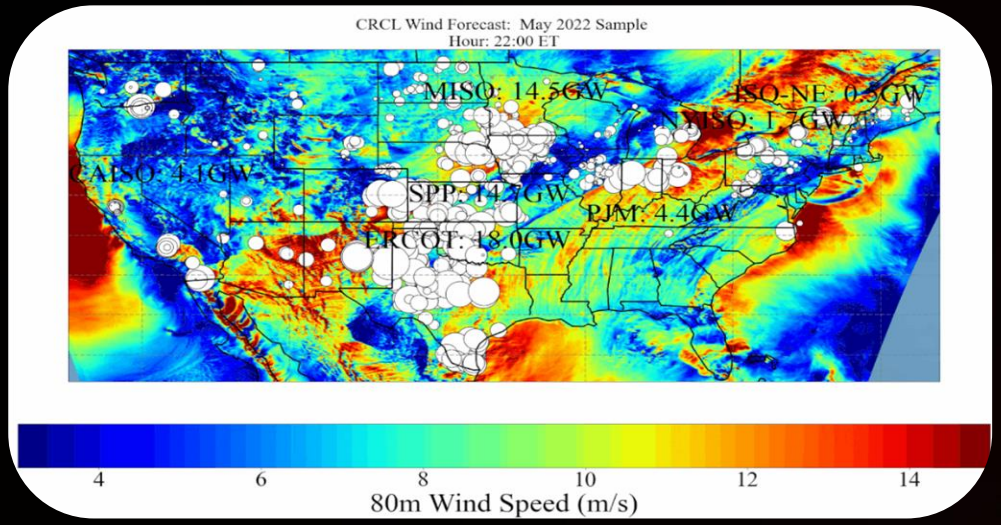




AT A GLANCE

CRCL Solutions is an AI-based company that provides energy forecasting solutions, co-founded by Daniel Vassallo (left) and Thomas Sherman (right). They provide wind and solar forecasts, down to the turbine and farm level, respectively, to those participating in wholesale markets. Their analytics help balance the supply and demand side of energy.

"Nodal, regional, and system-wide wind and solar power forecasts across the United States."



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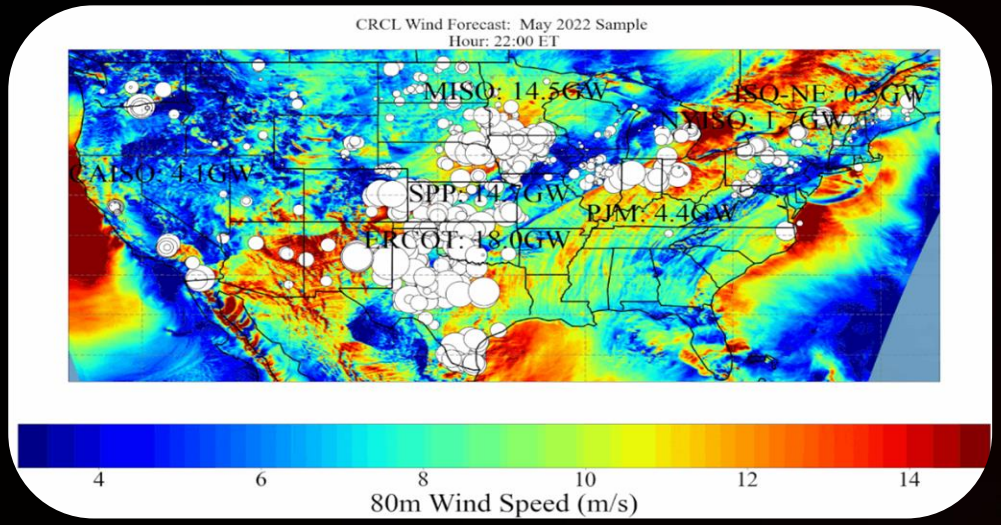


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NOAA DATA USED

HRRR

High Resolution Rapid Refresh

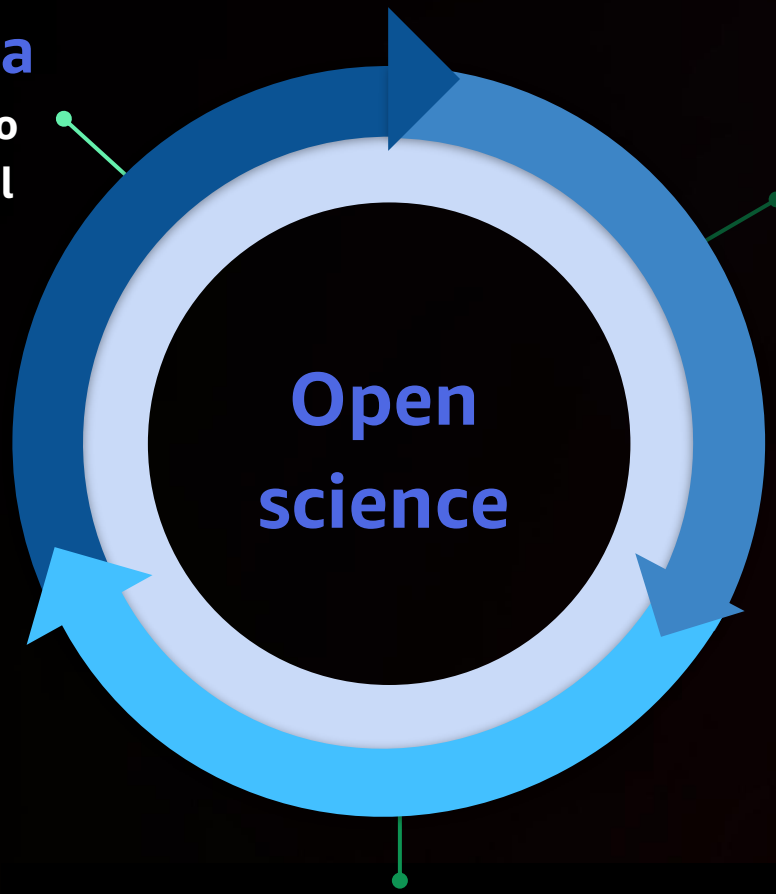
CRCL Solutions accesses historical HRRR via AWS

IMPACT PROVIDED

- CRCL uses HRRR model for both near real-time and historical data. CRCL pulls 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 CRCL's cloud environment. NOAA is CRCL's most important partner for providing information to the energy industry.
- CRCL co-founders were named 2022 Forbes 30 Under 30 Class.

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Today, NODD accelerates open science and interoperability



Open data

Open access to environmental data via BDP

Open reproducible analysis

Open scientific process and reusable analytics pipelines

Open products

Open access to research products, results, and new data for reproducibility

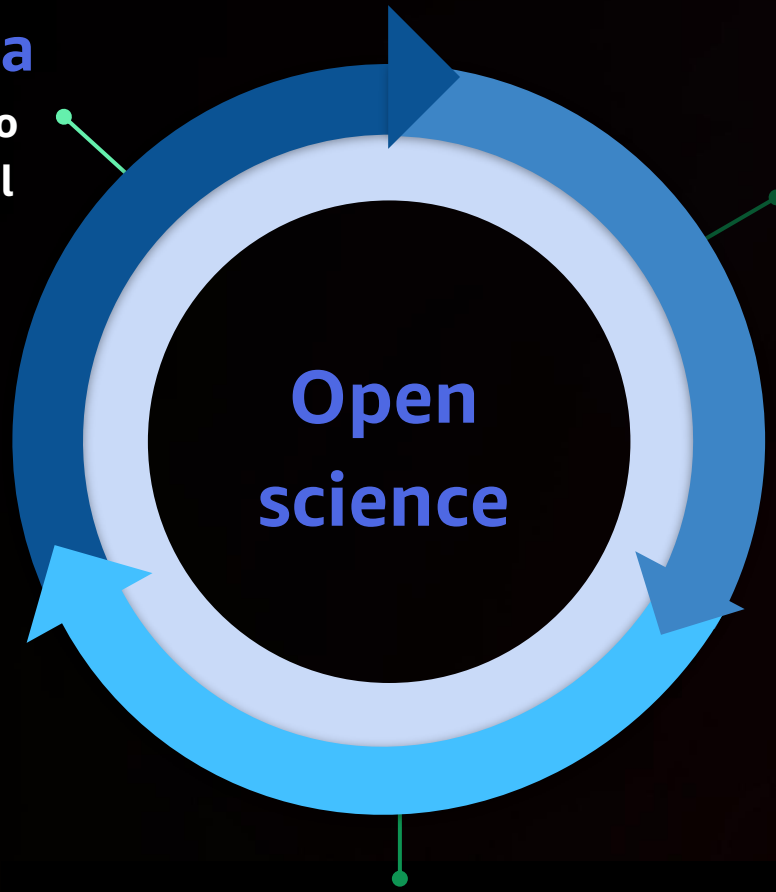
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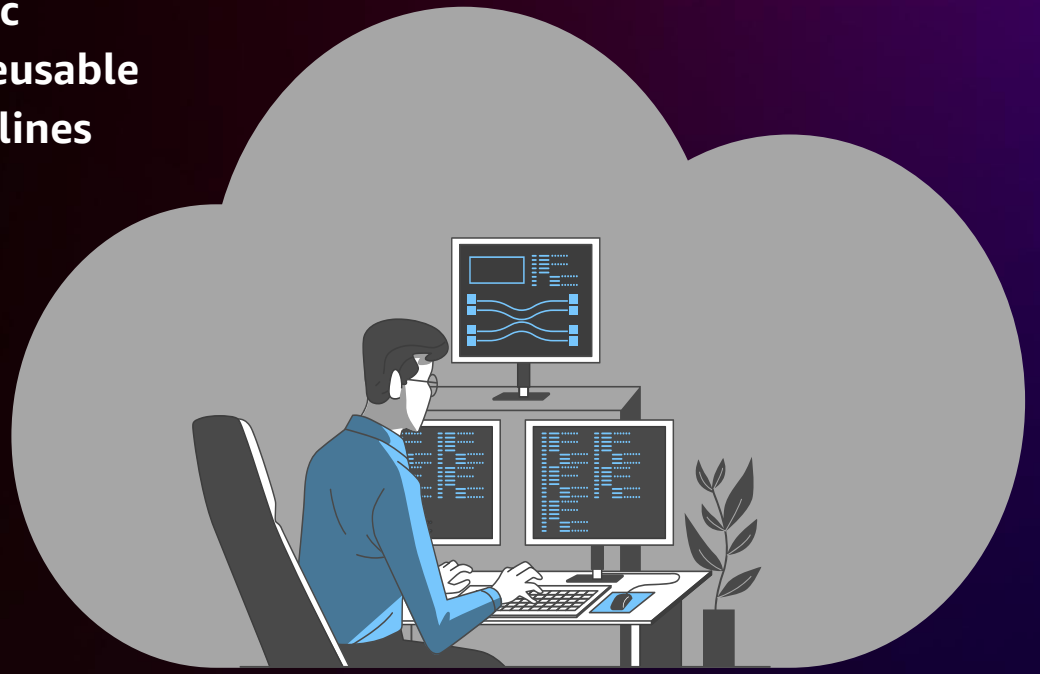
Open data

Open access to environmental data via BDP



Open reproducible analysis

Open scientific process and reusable analytics pipelines



Open products

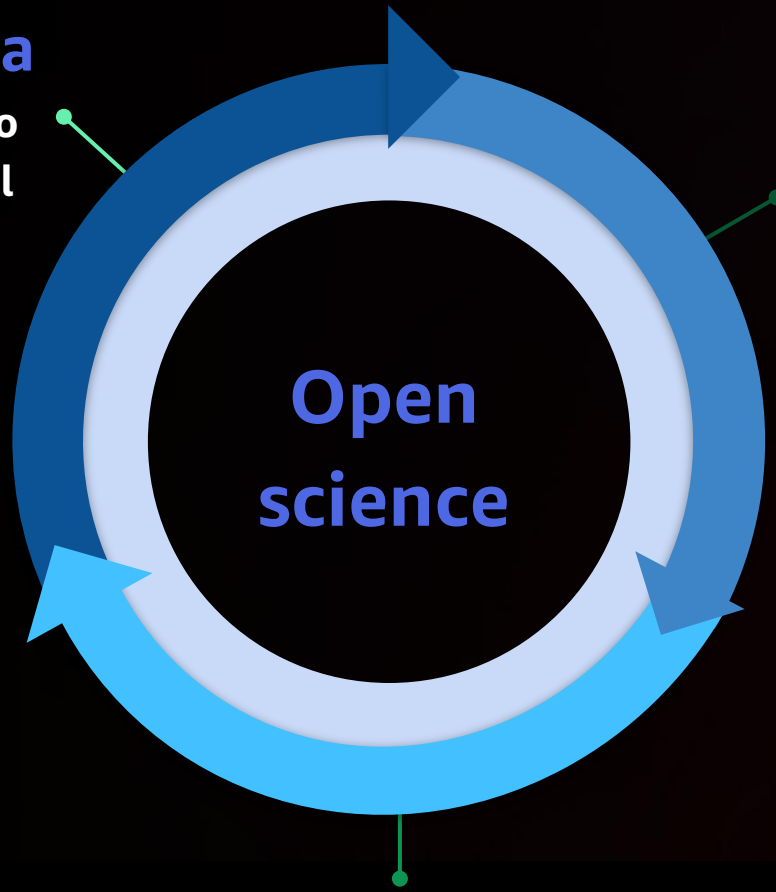
Open access to research products, results, and new data for reproducibility

aws

Today, NODD accelerates open science and interoperability

Open data

Open access to environmental data via BDP



Open reproducible analysis

Open scientific process and reusable analytics pipelines



Open products

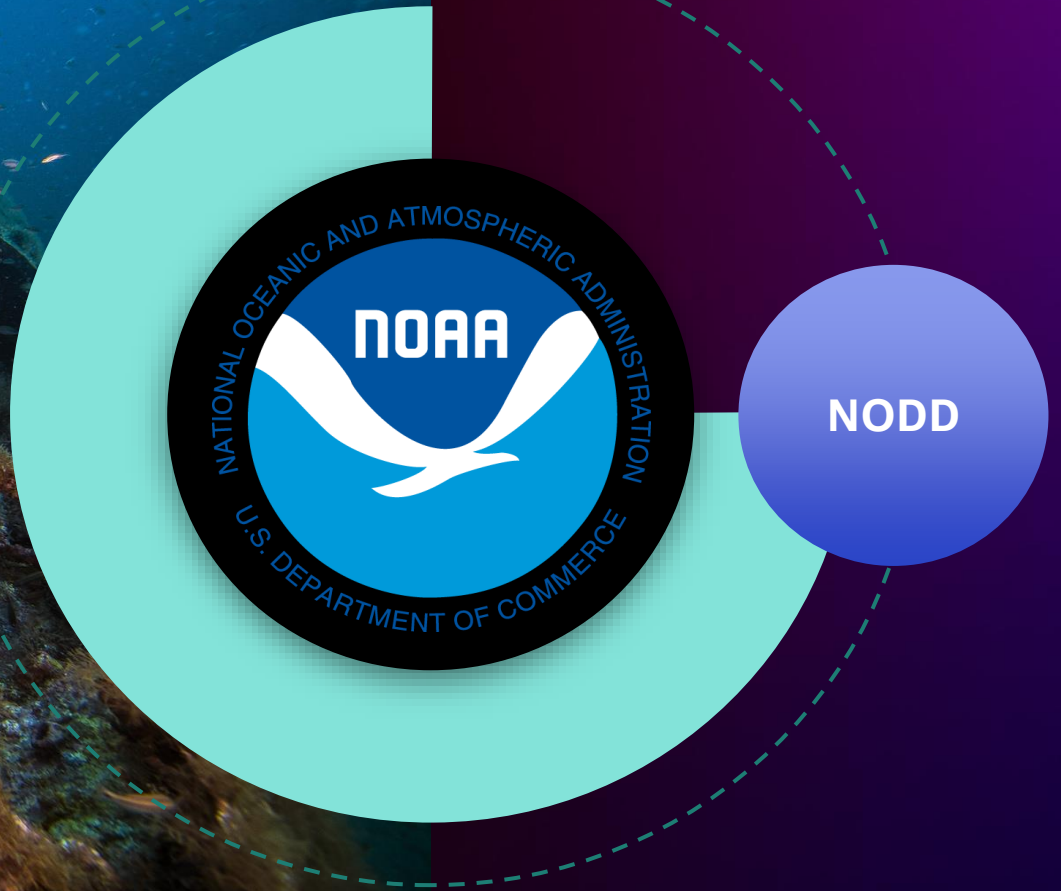
Open access to research products, results, and new data for reproducibility



aws

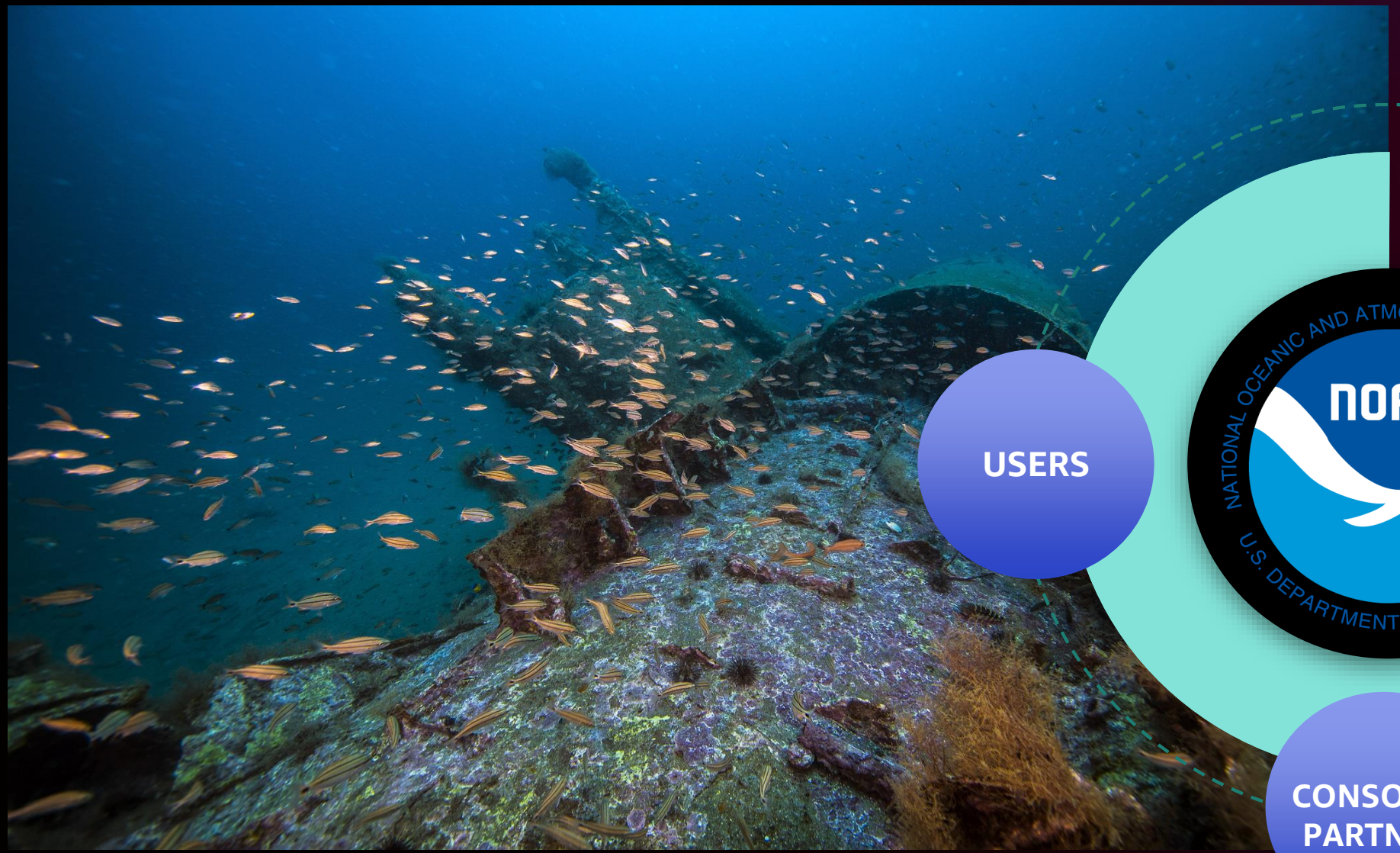
NODD as an ecosystem

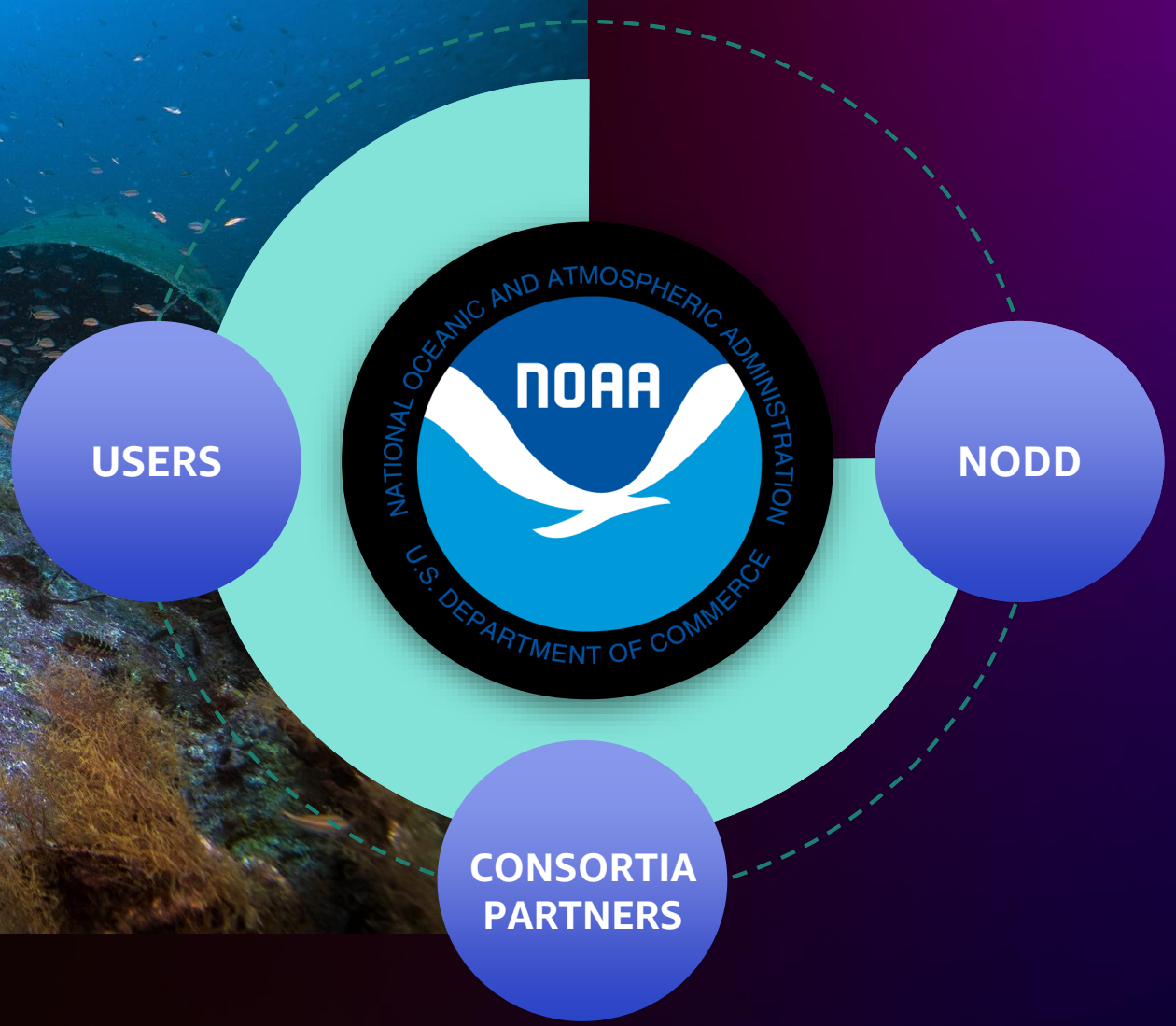




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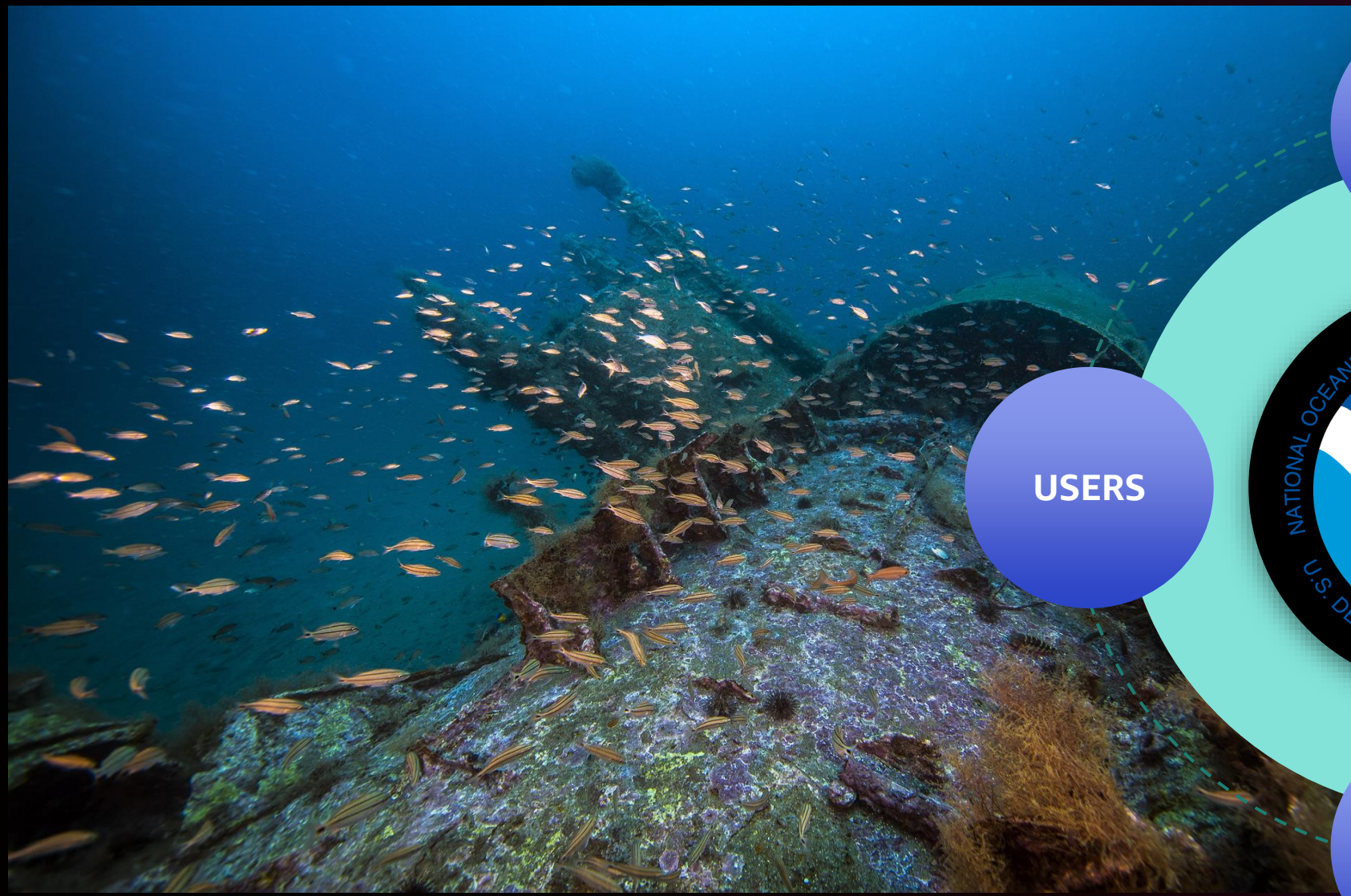
NODD as an ecosystem





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NODD as an ecosystem



CLOUD SERVICE PROVIDERS

USERS

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NOAA
U.S. DEPARTMENT OF COMMERCE

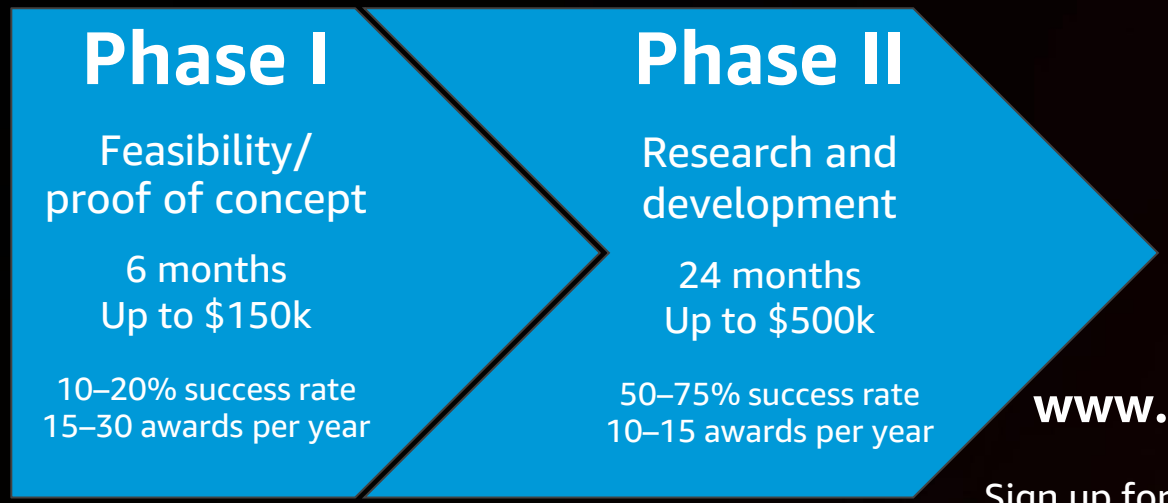
NODD

CONSORTIA PARTNERS

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Small Business Innovation Research: SBIR at NOAA

- Grant funding for small businesses to conduct R&D towards innovative products or services with strong commercial potential
- Annual competition, applications submitted via Grants.gov
- Broad topics that cover most of the NOAA mission (climate, weather, oceans, coasts)
    - Proposals using NOAA data are highly desirable



www.techpartnerships.noaa.gov/SBIR

Sign up for email list to be notified of new opportunities

Contact: noaa.sbir@noaa.gov

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AMERICA'S SEED FUND

SBIR

POWERED BY

NOAA

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

U.S. DEPARTMENT OF COMMERCE



Better together

What NOAA data do you want to see in the cloud?

Email us:
NODD@NOAA.GOV



AWS re:Invent

OS-CLIMATE

OS-C

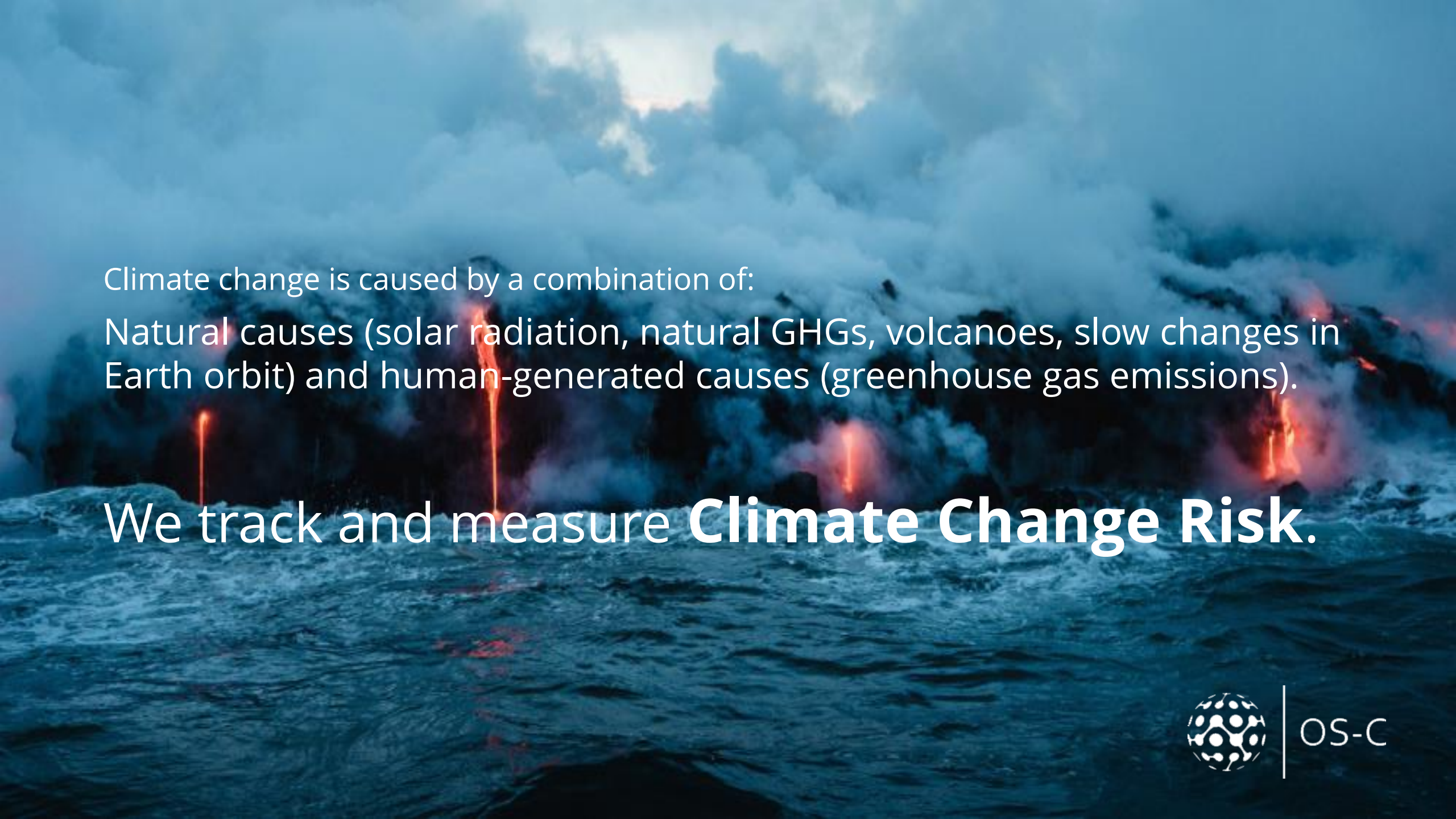
Brendan Reilly
Senior Advisor OS-Climate
President Climate Risk Research Foundation
breilly@os-climate.org



A Lynx Foundation Initiative

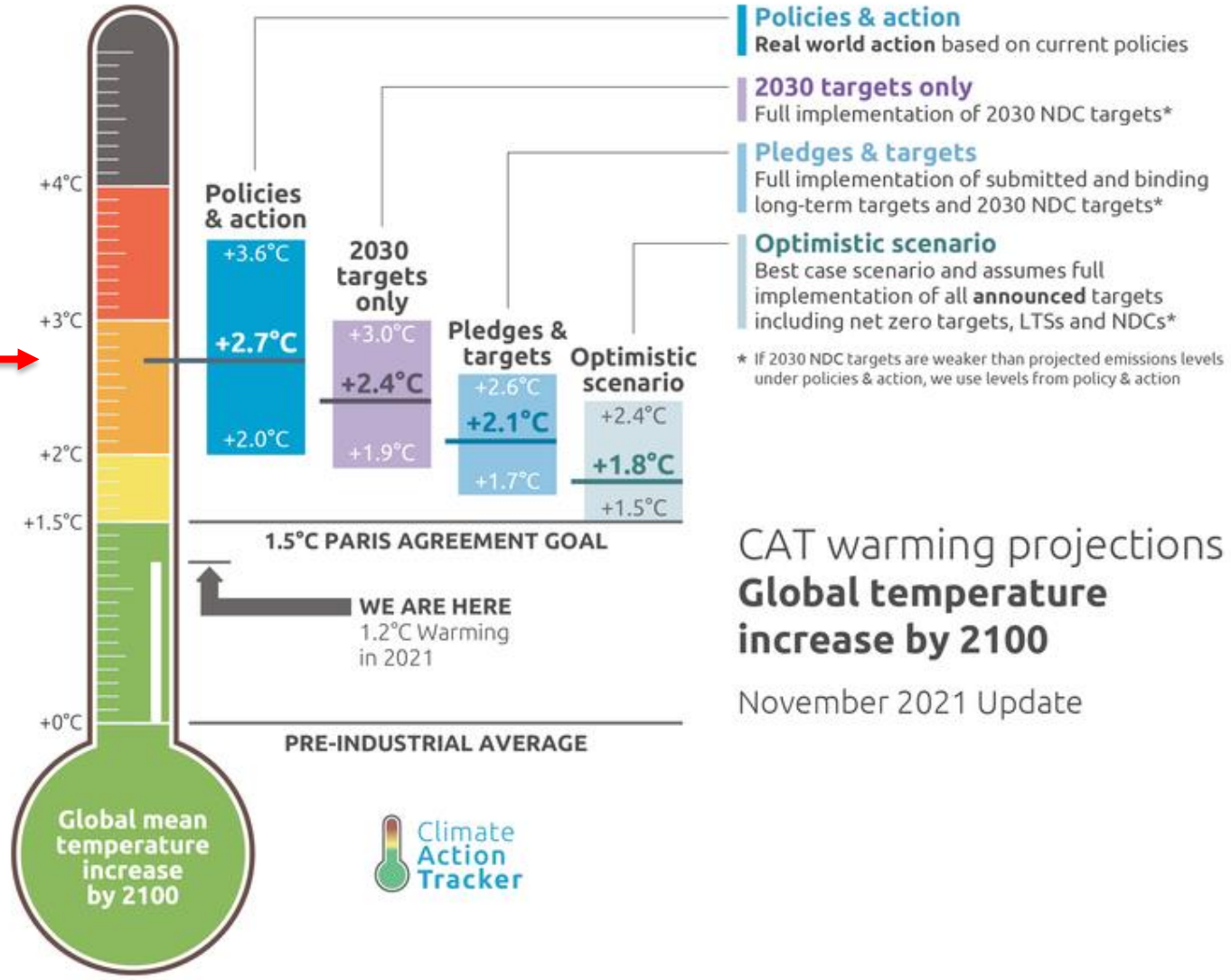
OS-Climate is an open-source collaboration community building a transparently governed public utility that provides free access to the climate risk data and software tools needed to help identify the potential impact and magnitude of climate-related risks and to develop a better understanding of possible mitigation strategies

OS-C


Climate change is caused by a combination of:
Natural causes (solar radiation, natural GHGs, volcanoes, slow changes in Earth orbit) and human-generated causes (greenhouse gas emissions).
We track and measure **Climate Change Risk**.
OS-C

1.5°C Paris Agreement Goal

Current policies



OS-C



Climate Change Risk:

POLICY RISK
ECONOMIC RISK
CARBON RISK
PHYSICAL CLIMATE RISK
SOCIAL RISK

OS-C



Climate Change Risk:

POLICY RISK – Zero-carbon grid by 2035, CA bans sale of ICE cars in 2035…

ECONOMIC RISK – Energy cost, food cost, GDP…

CARBON RISK – Carbon levels, carbon tax/price…

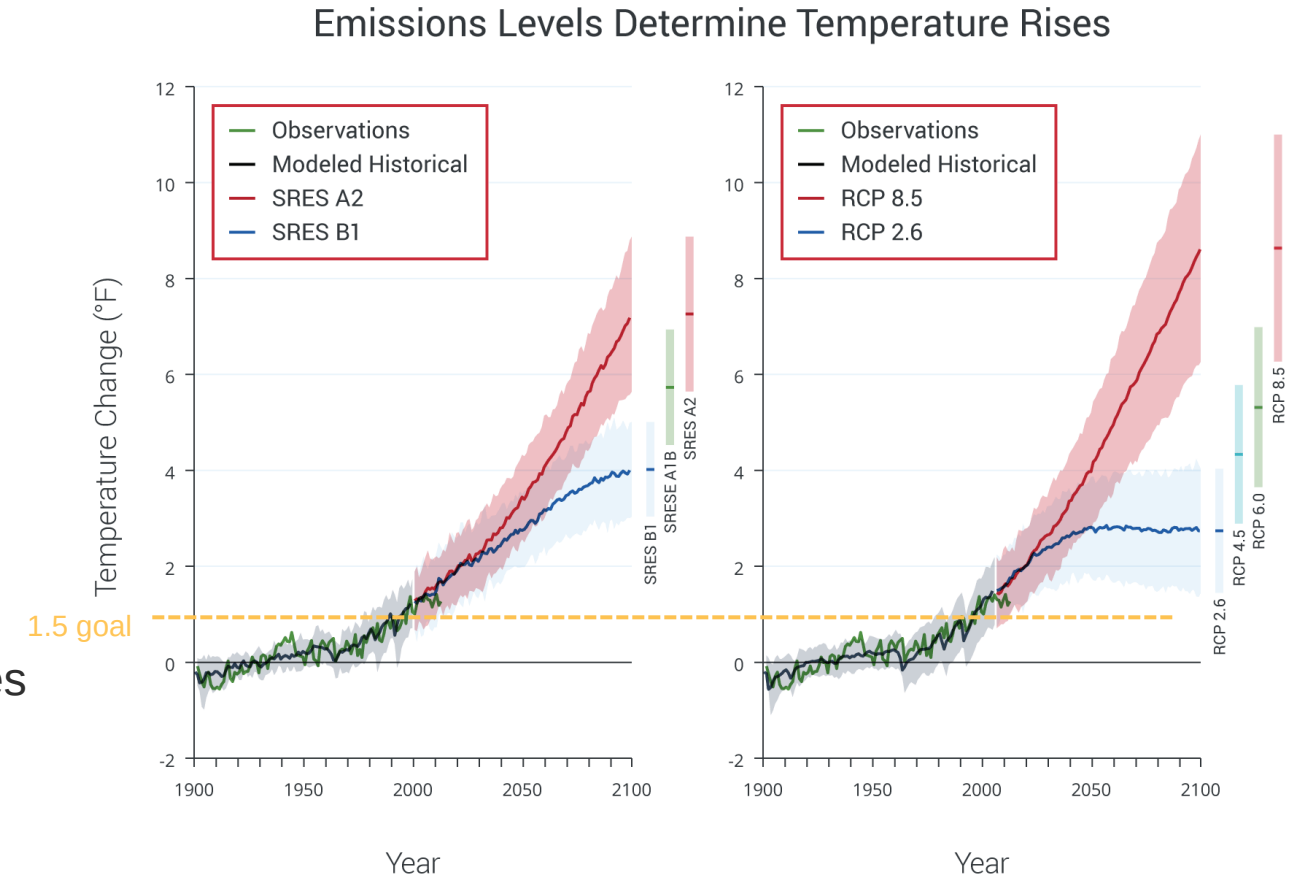
PHYSICAL CLIMATE RISK – Sea level rising, heat stress, flooding…

SOCIAL RISK – Health, access to food and water, damage to habitats…

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Calculating Climate-Related Risk

- **Physical Risk**
  - Global climate models
  - Chronic and acute risks
    - Aligned to RCP/GMT range
    - 1850 to 2100
- **Transition Risk**
  - Integrated assessment models
    - IPCC, NGFS, IEA, BOE, more
      - 1,000+ socioeconomic variables
      - Aligned to RCP/GMT range
    - 1850 to 2100



Why?

- Identify possible impact on asset values
- Understand impacts on society
  (global, regional, local – by age, race, income…)
- Develop mitigation strategies



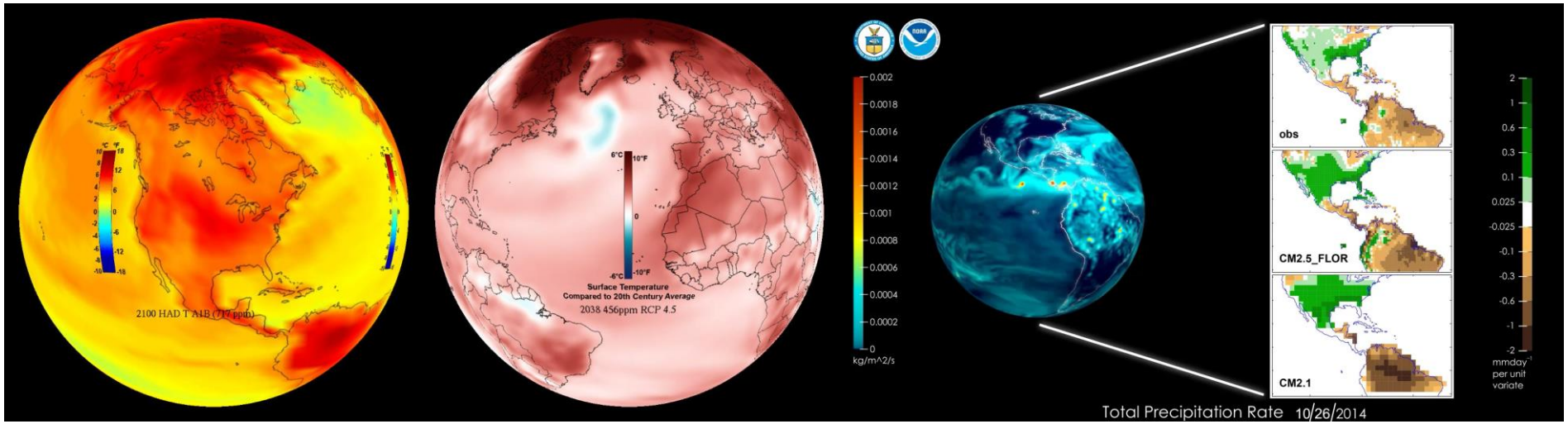
How?

- Global collaboration
- Massive amounts of data from trusted sources
  (Including NOAA) aligned spatially and temporally
- Stochastic approach used to estimate how probable outcomes are within a forecast
  (Monte Carlo simulation of climate scenarios)

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Physical Risk: NOAA – Global Climate Models

NOAA uses massive volumes of climate and Earth system model outputs that that align with the Intergovernmental Panel on Climate Change (IPCC) and coordinated through the Coupled Model Intercomparison Project (CMIP6) simulations



1850 — 2100

NOAA Climate Change Web Portal
https://psl.noaa.gov/ipcc

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How Climate Risk is Calculated – Physical Risk

Coupled Model Intercomparison Project (CMIP6) simulations

Climate Models	Global Research Institutions/Agencies	Representative Concentration Pathways	Mapped to Every Climate Risk Region on the Planet

ACCESS-CM2
ACCESS-ESM1-5
AWI-CM-1-1-MR*
AWI-ESM-1-1-LR
BCC-CSM2-MR
BCC-ESM1
CAMS-CSM1-0*
CanESM5
CAS-ESM2-0
CESM2
CESM2-FV2
CESM2-WACCM
CESM2-WACCM-FV2*
CMCC-CM2-HR4
CMCC-CM2-SR5
FGOALS-g3
FIO-ESM-2-0
GISS-E2-1-G
GISS-E2-1-H
IITM-ESM*
MCM-UA-1-0
MIROC6
MPI-ESM-1-2-HAM
MPI-ESM1-2-HR
MPI-ESM1-2-LR
MRI-ESM2-0
NESM3*
NorCPM1*
NorESM2-LM
NorESM2-MM
SAM0-UNICON
TaiESM1

Alfred Wegener Institute, Helmholtz Center for Polar and Marine Research, Germany
Atmosphere and Ocean Research Institute, University of Tokyo, Japan
Beijing Climate Center, China Meteorological Administration, China
Canadian Center for Climate Modeling and Analysis, Canada
Center for Climate Change Research, Indian Institute of Tropical Meteorology Pune, India
Center for Climate System Research (The University of Tokyo)
Centre National de Recherches Meteorologiques
Chinese Academy of Meteorological Sciences, China Meteorological Administration, China
Commonwealth Scientific and Industrial Research Organization, Australia
Fondazione Centro Euro-Mediterraneo sui Cambiamenti Climatici, Italy
Goddard Institute for Space Studies, NASA, USA
Hadley Centre for Climate Prediction and Research / Met Office
Institut Pierre Simon Laplace
Institute for Numerical Mathematics, Russia
Institute of Atmospheric Physics, Chinese Academy of Sciences, China
LASG / Institute of Atmospheric Physics
Max Planck Institute for Meteorology, Germany
Nanjing University of Information Science and Technology, China
NASA / Goddard Institute for Space Studies
National Center for Atmospheric Research, Climate and Global Dynamics Laboratory, USA
NOAA, Geophysical Fluid Dynamics Laboratory
Norwegian Climate Center, Norway

RCP Alignment	GMT Minimum	GMT Maximum
Historical	1.15	1.28
RCP1.9	0.9	1.5
RCP2.6	0.9	2.3
RCP3.4	2	2.4
RCP4.5	1.7	3.2
RCP6.0	2	3.7
RCP7.0	3	6.2
RCP8.5	3.8	7.4
RCP3.4 OS	2	2.4
RCP-LowNTCF	3.2	5.4
Global	0.9	7.4



A Representative Concentration Pathway is a greenhouse gas concentration trajectory adopted by the IPCC

OS-C

How Climate Risk is Calculated – Transition Risk

Integrated assessment models

Representative Concentration Pathways	Integrated Assessment Models	Transition Scenarios	Socioeconomic Variables

RCP Alignment	GMT Minimum	GMT Maximum
Historical	1.15	1.28
RCP1.9	0.9	1.5
RCP2.6	0.9	2.3
RCP3.4	2	2.4
RCP4.5	1.7	3.2
RCP6.0	2	3.7
RCP7.0	3	6.2
RCP8.5	3.8	7.4
RCP3.4 OS	2	2.4
RCP-LowNTCF	3.2	5.4
Global	0.9	7.4

- IPCC -SSP1 Sustainability
- NiGEM NGFS
- REME GEMINI-E3
- GWS GINFORS
- ABARE GTEM
- MIT IGSM
- IPCC -SSP2
- CIRED IMACLIM
- NEAA IMAGE
- EPRI MERGE
- NGFS2 Orderly
- NGFS3 Disorderly
- BOE-CBES-EA
- IPCC-SSP4 Inequality
- NGFS Divergent Net-Zero

Middle of the Road RCP1.9	SSP2-19
Middle of the Road RCP2.6	SSP2-26
Middle of the Road RCP3.4	SSP2-34
Middle of the Road RCP4.5	SSP2-45
Middle of the Road RCP6.0	SSP2-60
Middle of the Road RCP7.0	SSP2-Baseline

- GDP
- Agricultural demand (energy)
- Electricity (Investment, Price)
- Gas (Investment, Price)
- Oil (Investment, Price)
- Solar (Investment, Price)
- Wind (Investment, Price)
- Nuclear (Investment, Price)
- Agriculture Price non-energy crops
- Agriculture Price Livestock
- Agriculture Production Livestock
- Agriculture Production Non-energy crops
- Agriculture Demand (food crops, livestock)
- Consumption
- Emissions (AFOLU, Energy, Other)
- Population
- Price (Corn, Soybean, Wheat)
- Price Residential Energy
- Food Demand (crops, livestock)
- Land Cover (Built-up Area, Croplands, Forest, pasture, Other)
- Water withdrawal
- Yield (Cereal, Oilcrops, Sugarcrops)

1000+ Variables

A Representative Concentration Pathway is a greenhouse gas concentration trajectory adopted by the IPCC

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How Climate Risk Is Calculated

Climate Risk Region

Physical Risks

Chronic Climate Risk
Sea level rise
Ocean acidification
Glacier melt & instability
Ice sheet melt & instability
Permafrost melt
Soil degradation
Carbon emissions
Mean Temperature
Precipitation pattern changes
Ecotone migration
Biodiversity Loss
Deforestation

Acute Climate Risk
Drought
Wildfire
Heat wave
Cold snap
Extreme precipitation
Extreme wind
Cyclone/Hurricanes/Typhoons
Storm surge
Flood
Extra Tropical Cyclone
Hail
Lightning
Marine heatwave
Tornadoes
Slope instability
Glacial Lake Outburst
Sand/Dust Storms
Earthquake



Transition Risks

Socioeconomic Variables
GDP
Agricultural demand (energy)
Electricity (Investment, Price)
Gas (Investment, Price)
Oil (Investment, Price)
Solar Power (Investment, Price)
Wind Power (Investment, Price)
Nuclear Power (Investment, Price)
Agriculture Price non-energy crops
Agriculture Price Livestock
Agriculture Production Livestock
Agriculture Production Non-energy crops
Agriculture Demand (food crops, livestock)
Consumption
Emissions (AFOLU, Energy, Other)
Population
Price (Corn, Soybean, Wheat)
Price Residential Energy
Food Demand (crops, livestock)
Land Cover (Built-up Area, Croplands, Forest, pasture, Other)
Water withdrawal
Yield (Cereal, Oilcrops, Sugarcrops)

1000+ Variables

A Representative Concentration Pathway is a greenhouse gas concentration trajectory adopted by the IPCC

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Mapping Risk Spatially and Temporally to Every Climate Risk Region

- Timescale: 1850 to 2100
- Resolution
  - 5^2 meters flooding
  - 50^2 meters heat, drought
- 32M+ climate risk regions
- 9 pathways + historic
- 20+ physical risks
- 30+ transition scenarios
  - IPCC, NGFS, IEA…
  - 1000+ socioeconomic variables

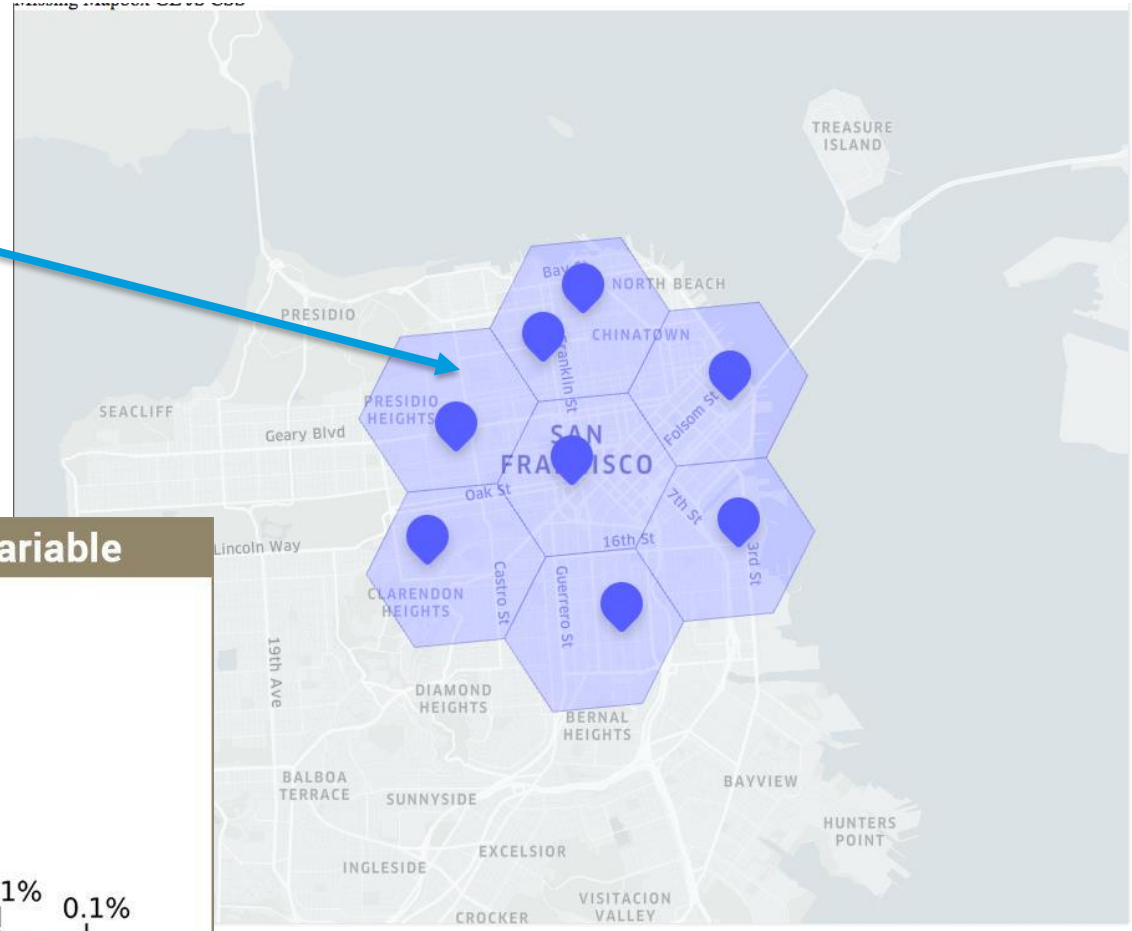


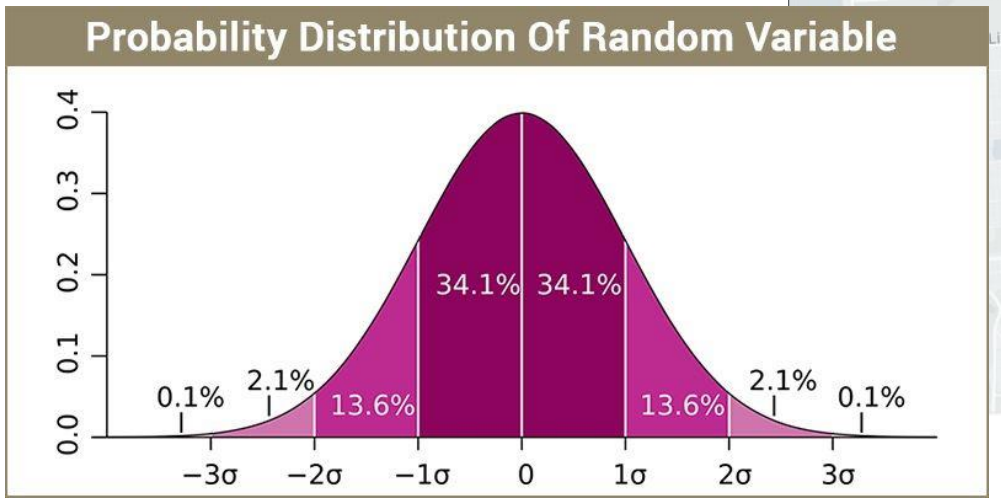
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Understanding the causal affects of **Climate Change** and how to calculate **Risk**
OS-C

Understanding Risk

- Not every risk affects every region
- 3M+ scenarios of possible futures (risks and opportunities) as a result of climate change for every climate risk region
- What is the probability of each?



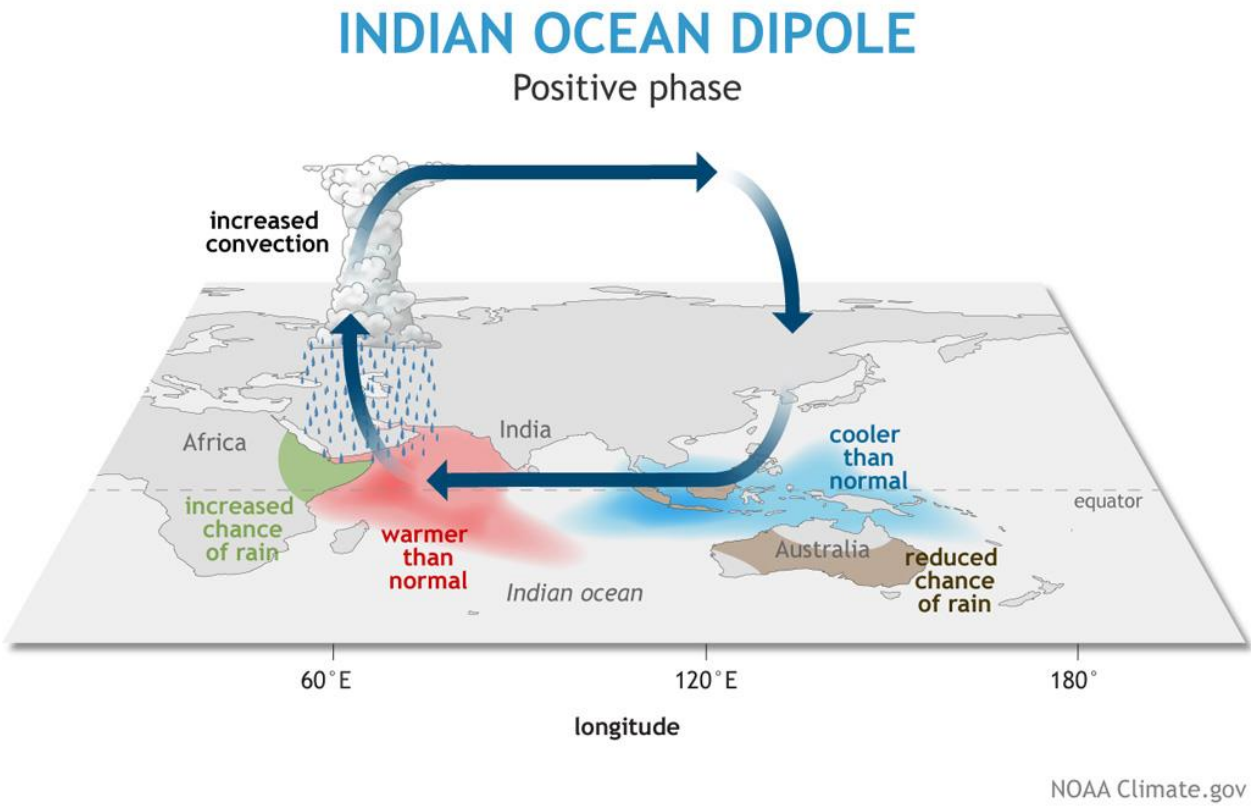


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Understanding the Causal Affects of Climate

If we understand what drives our climate, we can model out the possible future affects of changes

- Increased CO2 in atmosphere increases magnitude of climate modulators
  (Example: Indian Ocean Dipole)
- Result:
  - Cooler temperatures and reduced rain/drought in Australia
  - Warmer temperatures and more rain in Southeast Africa



OS-C

Causal Affect of Climate on Society

- In 2019–2020 more than 10M hectares of land burned in Australia
- 1B+ animals dies
- Australian GDP declined by 1.9%
- Increase in global lumber commodity price
- 3M+ displaced from flooding in Africa





AccuWeather

Australia's wildfires will lead to GDP falloff in the billions, AccuWeather predicts

OS-C

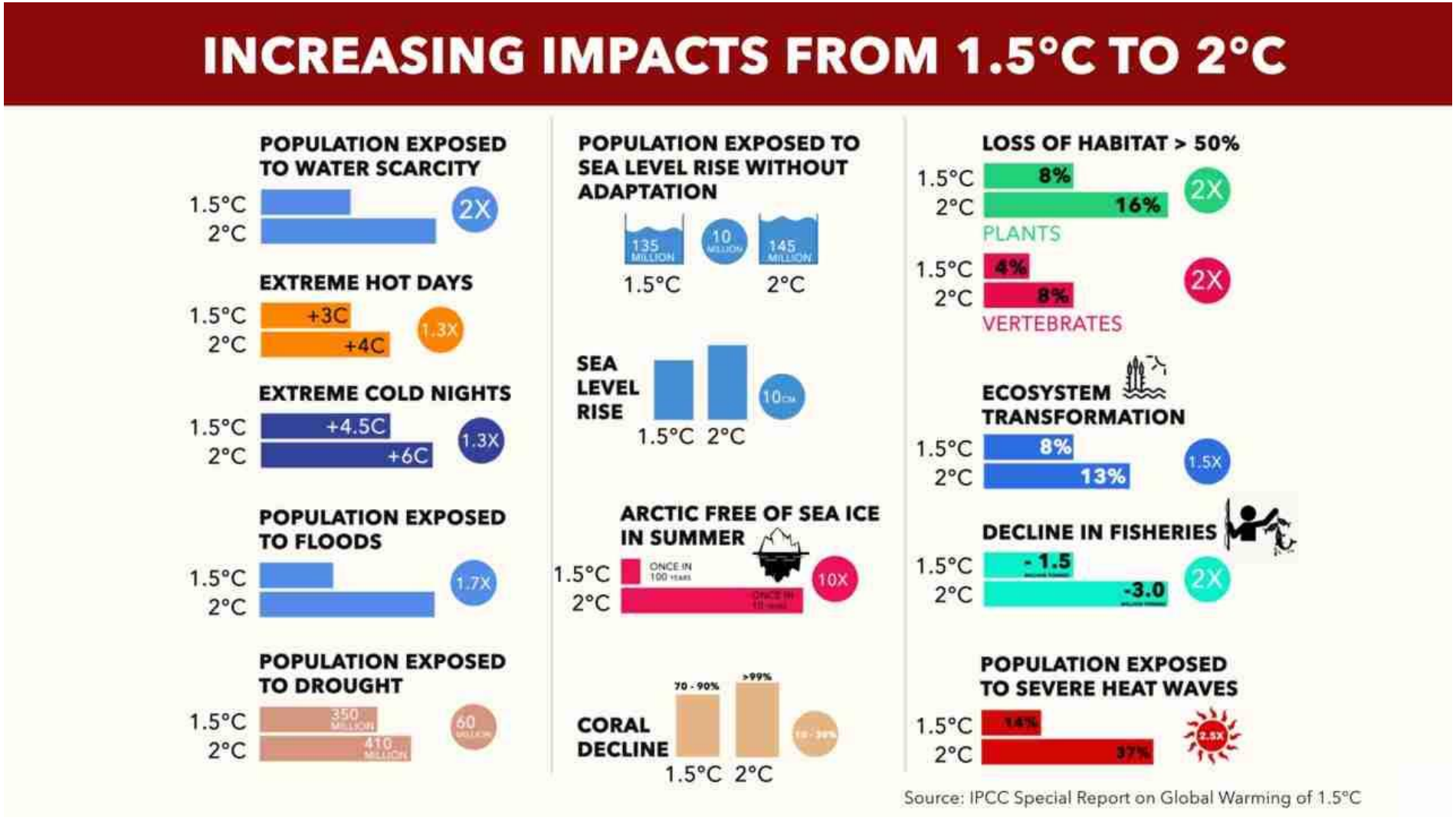
Causal Affect of Climate on Society

- In 2022 more than 7M hectares of 22M flooded in Pakistan
- 33M people displaced
- Reduce GDP by 3.84%
- $21B gross output loss
- 30% of agriculture production damaged



OS-C

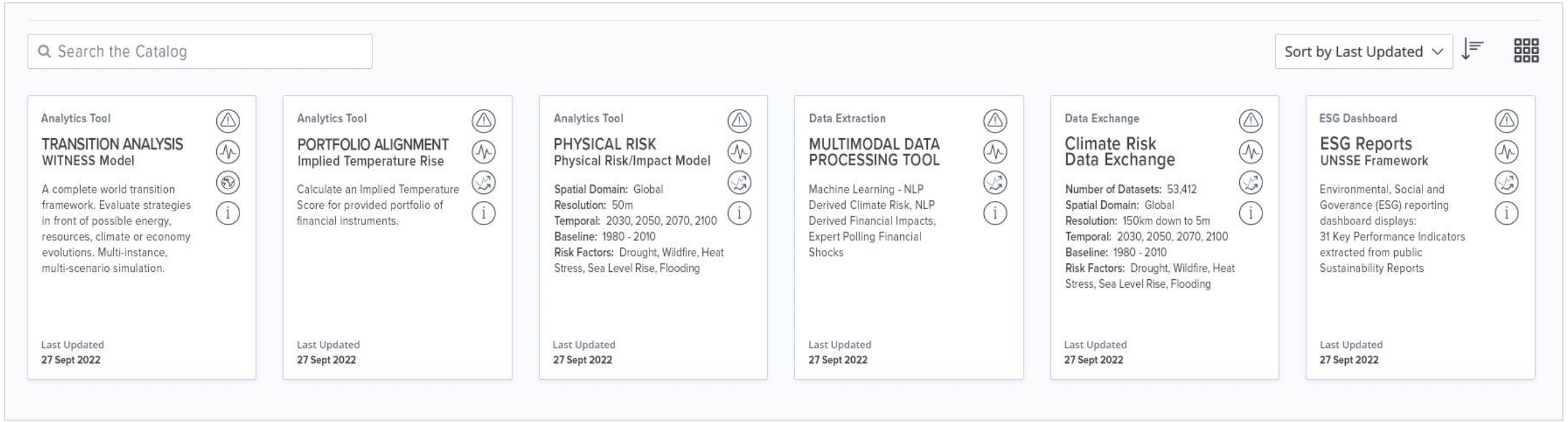
The Difference 0.5C Makes



Source: IPCC Special Report on Global Warming of 1.5°C

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OS-Climate: Current Initiatives



OS-Climate Members/Partners:

Federated Hermes International
LSEG
BNY MELLON
Microsoft
Allianz
Goldman Sachs
AIRBUS
Red Hat
S&P Global
ORTEC FINANCE
JUPITER
OpenEarth
THE NET-ZERO ASSET OWNER ALLIANCE
CLIMATE POLICY INITIATIVE
riskthinking.AI
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OS-Climate: Physical Risk & Resilience Tool

- Designed to help asset owners, asset managers, as well as policy and decision makers identify the potential impact and magnitude of climate-related risks and to develop a better understanding of possible mitigation strategies

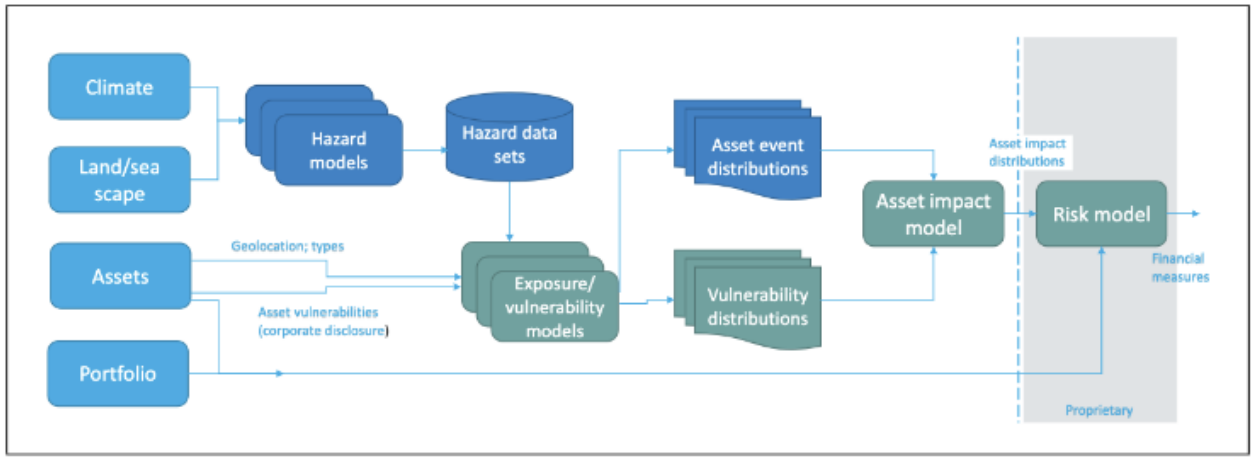
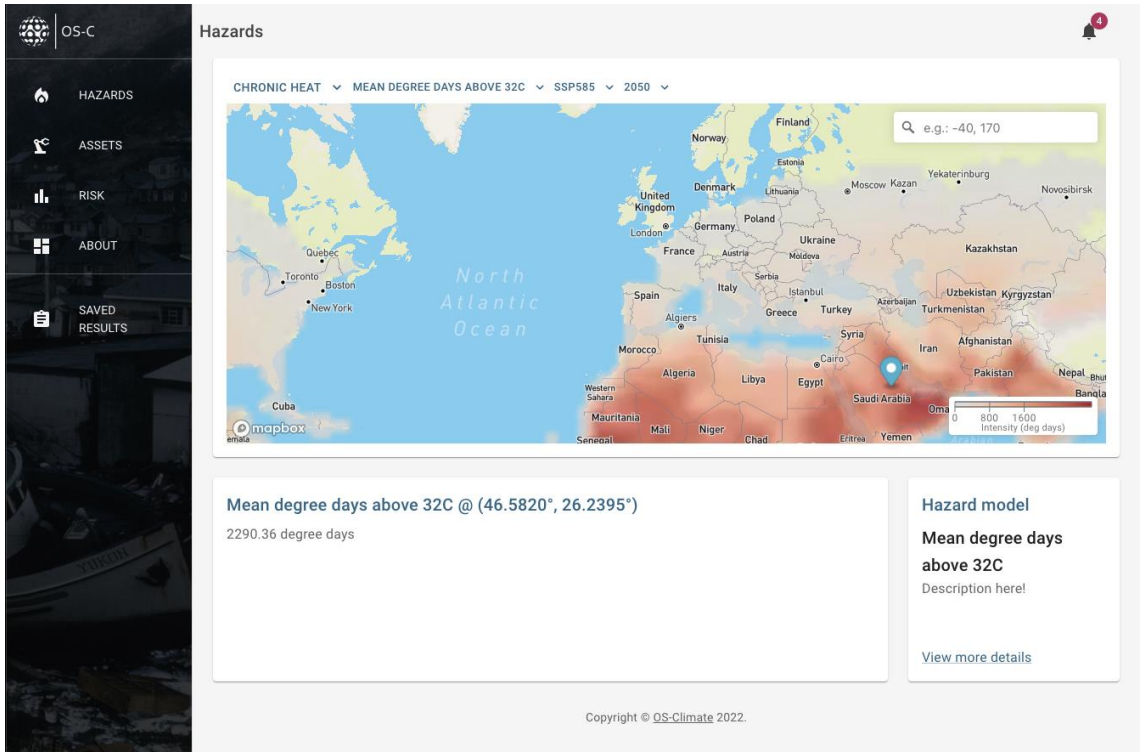


Figure 1: Physical risk model components.



https://os-climate.org/physical-risk-tool

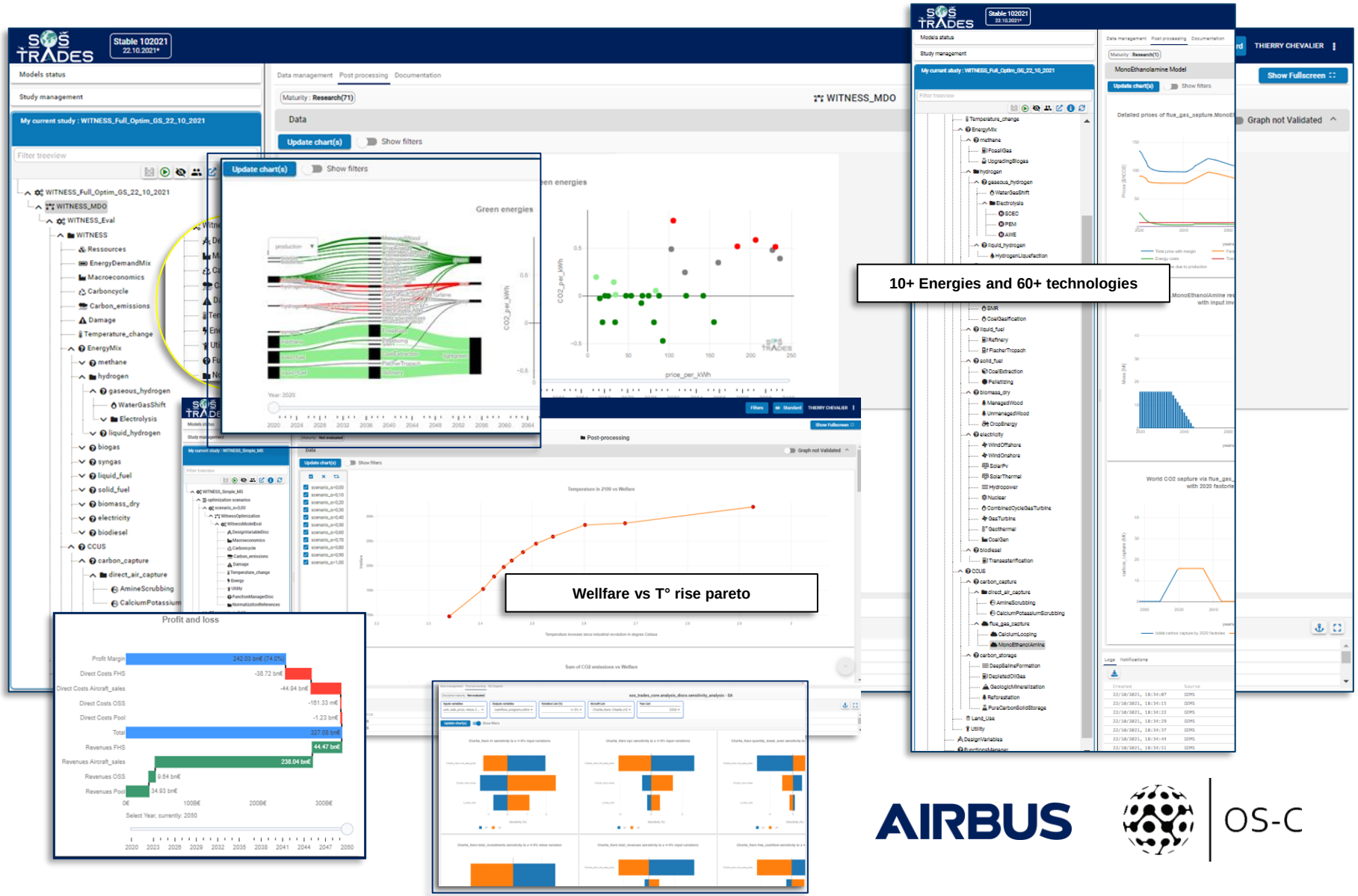
BNP PARIBAS

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OS-C Transition Risk Solution WITNESS

Through the WITNESS collaborative design space, OS-C will enable transition analysis stakeholders (institutional investors, academics, regulators) to collaboratively develop shared assumptions and scenarios, facilitating convergence of transition analysis methodologies

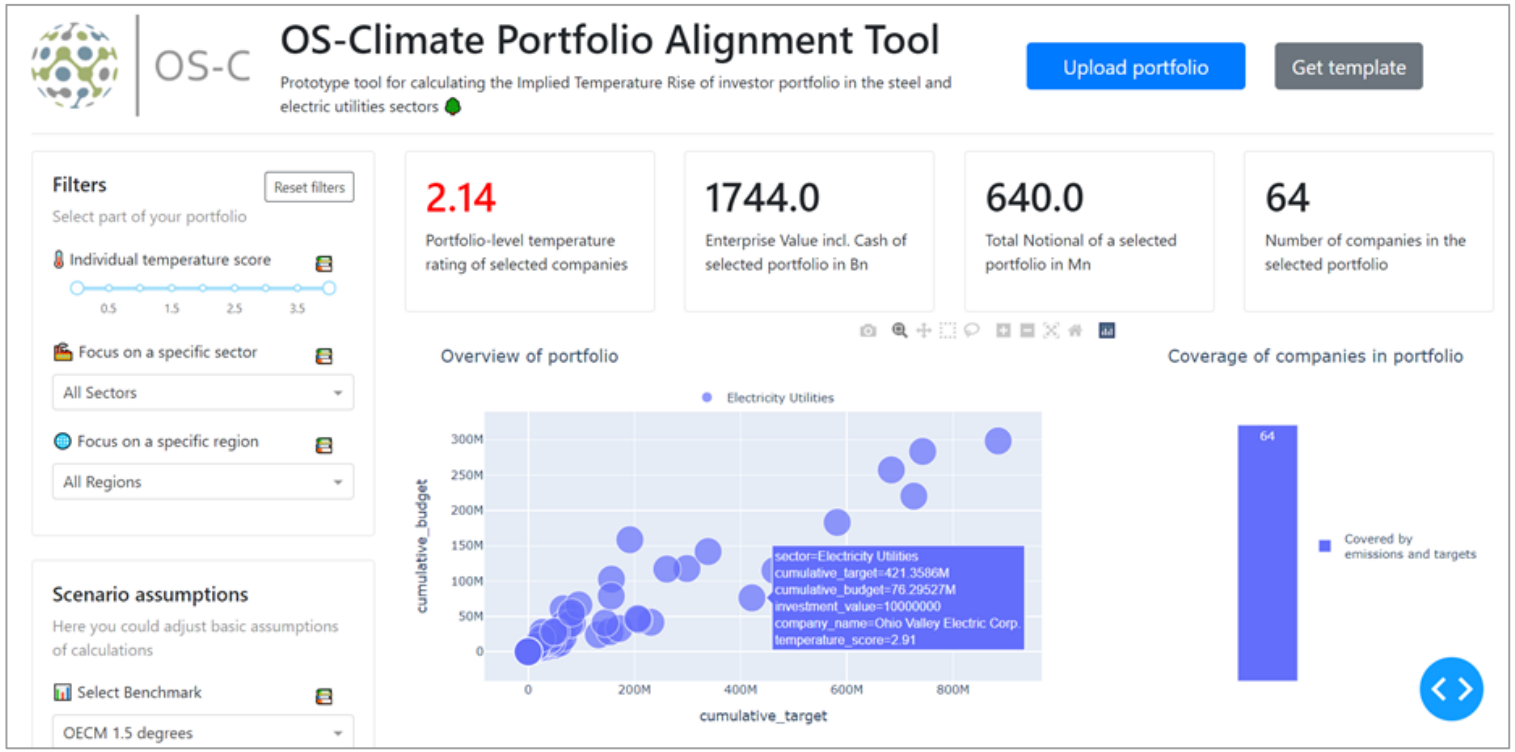
- Transition scenarios taking into account economy, energy, climate, resources
- Automated inclusion and integration of new models in the framework
- Cooperative/multi-user set-up/ analysis of simulations
- Multi-scenario with possible embedded multi-disciplinary analysis and/or multi-disciplinary optimization options



AIRBUS | OS-C

OS-C Portfolio Alignment: ITR Tool (Implied Temperature Rise)

- Climate-aligned investing
- Debt is more expensive or not available to high-carbon industries and companies
- Global investment shift away from carbon-intensive businesses



https://github.com/os-climate/ITR

Allianz

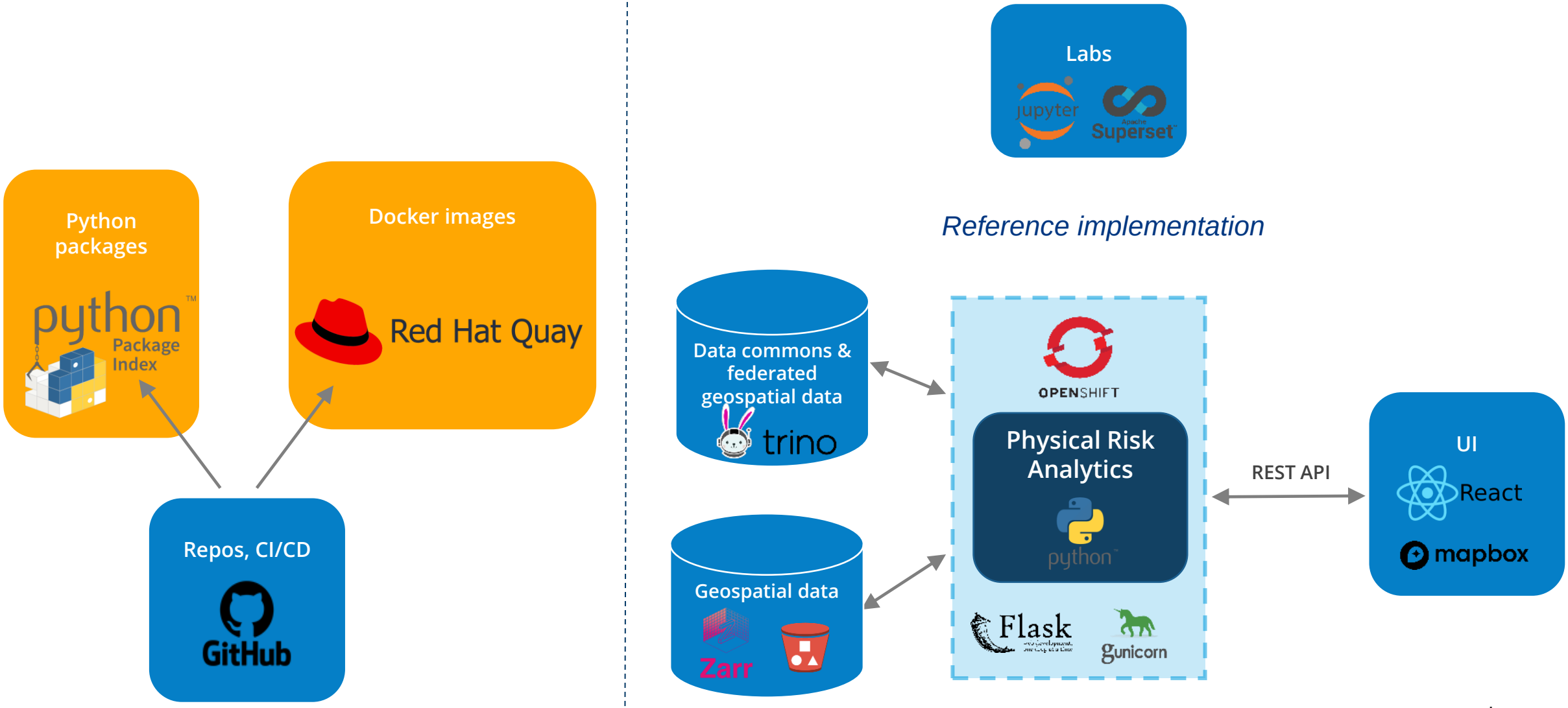
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Additional Projects

- Data Extraction/AI Tool Project
  https://vimeo.com/652668377
- Corporate Hierarchy Entity Matching Tool
  https://osclimateorg.sharepoint.com/:v:/g/EWLsGwMLaflEsDZgQYm3-fEBftkOuXRAFT7GQM5MXyYMPg?e=qCB09H
- PCAF Sovereign Calculations Tool
  https://osclimateorg.sharepoint.com/:b:/g/EdRTUaCr5qtOsZWQ0fNqs4cBmBrWHKoxcr2xTNS4S54YDg?e=A3pHXc

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Technology Stack



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TECH FOR IMPACT

UNDERSTANDING RISK AND DEVELOPING MITIGATION STRATEGIES



We Need Your Help

How to Get Involved

email: breilly@os-climate.org

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Takeaways

aws

Launcher

Nexr

An introducti

Adapted from AMS Short C

Amazon Simple Storage Se

It is designed to deliver 99

Boto3 is a Python package

```
[ ]: # install cartopy in t
     #     source activate
     #     conda install py

     # install cartopy in t
     #     conda install ca
     # restart the kernel
```

```
[ ]: # %pip install jupyter
```

```
[ ]: import boto3
     from boto.s3.connectio
     from datetime import t
     import os
     import pyart
     from matplotlib import
     import tempfile
     import numpy as np

     %matplotlib inline
```

Launcher

Nexrad_Demo.ipynb

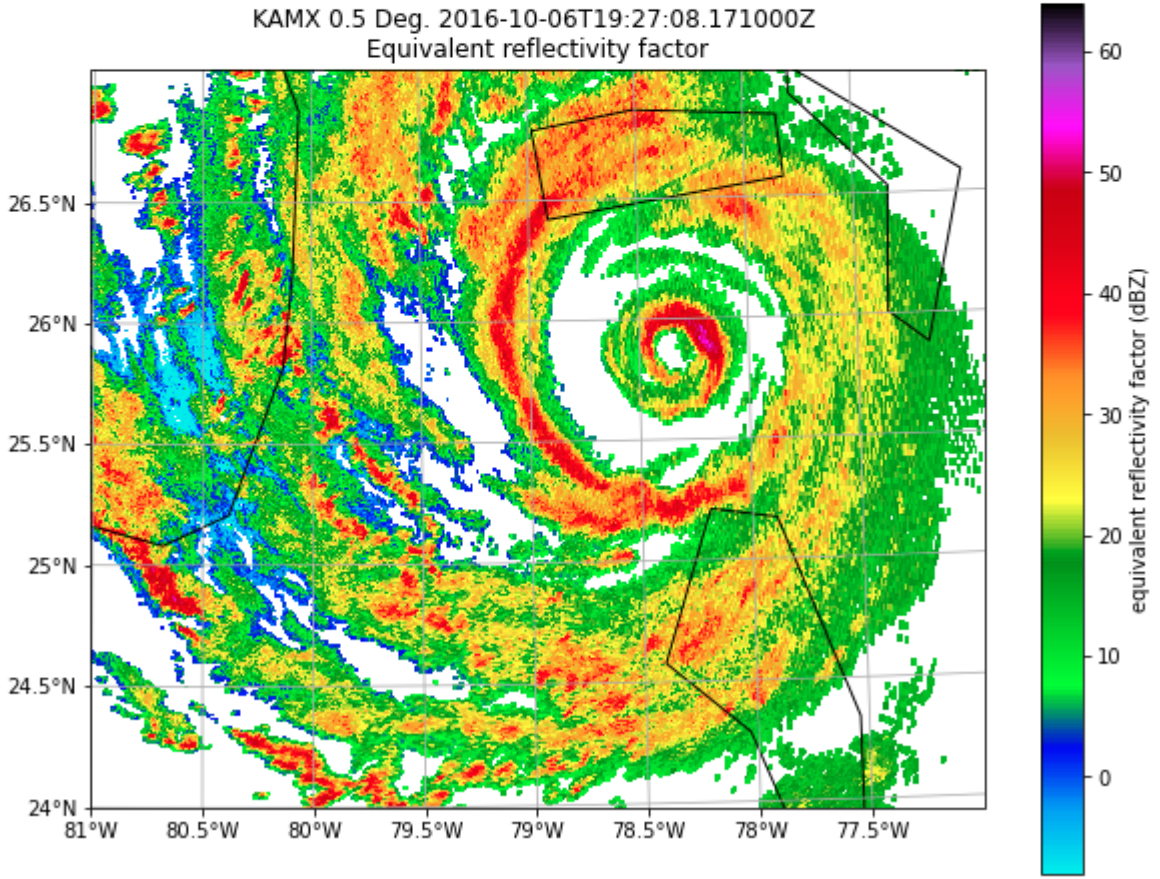
Code

git

aws_nexrad_smsl:Python

```
lat = np.arange(min_lat, max_lat, .5)
lon = np.arange(min_lon, max_lon, .5)

display = pyart.graph.RadarMapDisplay(my_radar)
fig = plt.figure(figsize = [10,8])
display.plot_ppi_map('reflectivity', sweep = 0, resolution = '110m',
                     vmin = -8, vmax = 64, mask_outside = False,
                     cmap = pyart.graph.cm.NWSRef,
                     min_lat = min_lat, min_lon = min_lon,
                     max_lat = max_lat, max_lon = max_lon,
                     lat_lines = lat, lon_lines = lon)
```



now at Google.

data from anywhere on the web.

Links and QR codes

NODD data in Open Data on AWS

“Big Data Analytics” Published by Wiley

NOAA SBIR program

OS-Climate github repo

NEXRAD Amazon SageMaker Studio Lab

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Thank you!

Chris Stoner
cstner@amazon.com

Adrienne Simonson
nodd@noaa.gov

Brendan Reilly
breilly@os-climate.org



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