

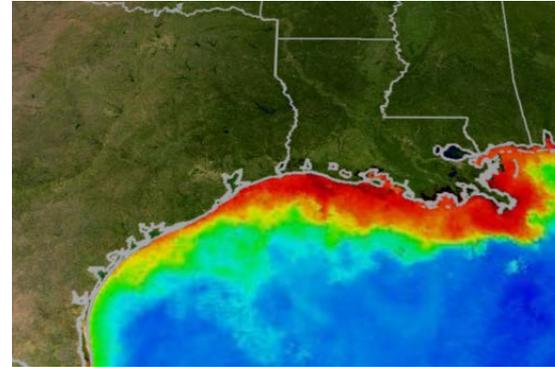
# NOAA Big Data Project

# Highly Diverse Large Data Sets

Surface Observations



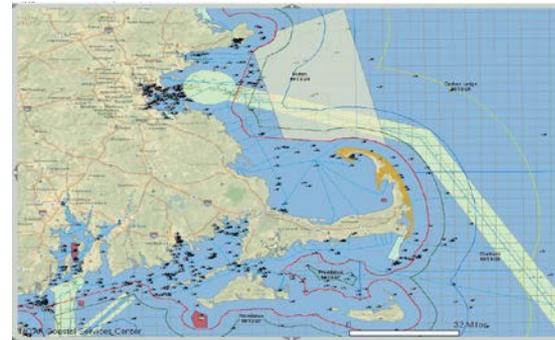
Satellite Imagery



Fisheries Data



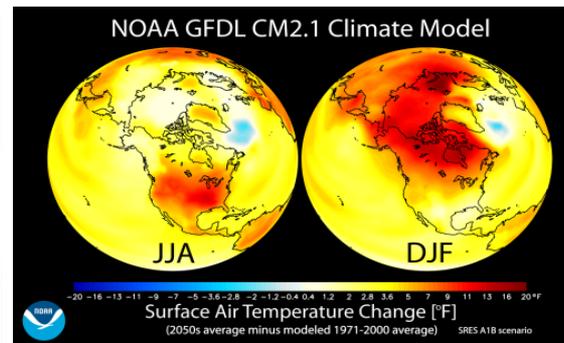
Coastal Mapping



Severe Weather Warnings



Weather and Climate Models



# NOAA BDP

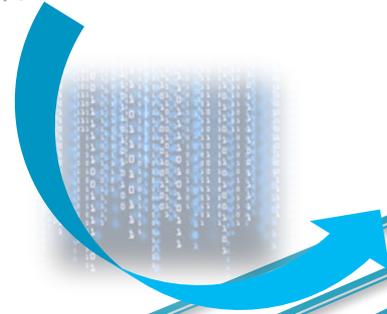
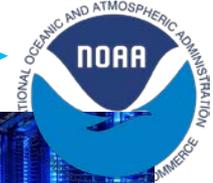
## Basic Premise:

1. Due to a variety of accessibility issues, some of NOAA's environmental data is underutilized.
  2. There is untapped economic value in that data.
  3. That value can be leveraged to improve accessibility and pay for staging of that data on the public cloud, where people and organizations of all kinds can innovate as part of a market ecosystem.
- 

# Traditional Govt. Acquisition Approach

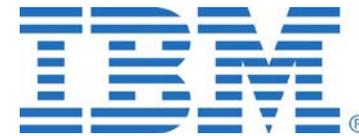


U.S. CAPITOL WASHINGTON, D.C.



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# BDP Approach



# The Bargain

- ▶ NOAA provides its data. (some cost recovery allowed)
  - ▶ Any/All NOAA data is on the table
  - ▶ Collaborators choose which data sets to intake and how to use that data (working closely with NOAA if necessary)
  - ▶ Collaborators stage and disseminate the data according to their own business models
- 

# BDP Approach



Value Added Service



# BDP Approach



# CRADA: Cooperative Research and Development Agreement

## 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 both 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 amendments 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:

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

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

"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.).

"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.

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

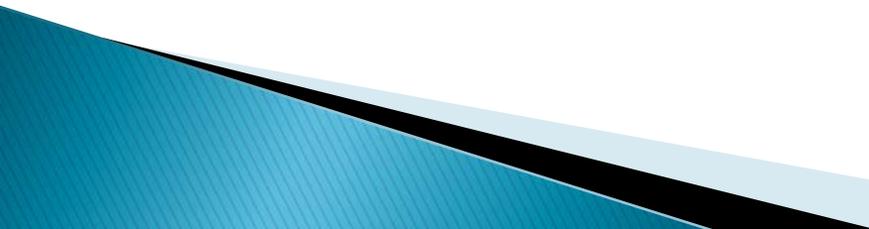
"Proprietary Information" means confidential scientific, business, or financial information, including data created under this Agreement solely by the Collaborator at the Collaborator's research facilities, which may embody trade secrets provided by the Collaborator to NOAA in the course of this CRADA, 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

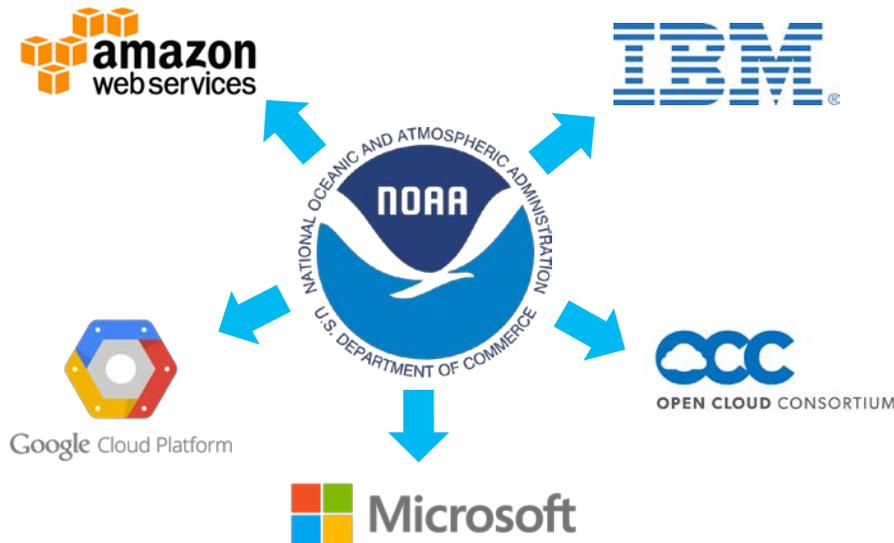
Core Principle #1  
Non-exclusive  
access to NOAA  
Data

Core Principle #2  
Equal access to  
NOAA data on  
equal terms

# BDP Collaborators: What do they get out of this?

- ▶ The ability to develop commercial data applications, not only for data that is already readily available, but also for those data sets that currently have accessibility issues.
  - ▶ The invitation to enter into collaborative research that will inform NOAA leadership as it develops data policy.
  - ▶ A level of NOAA focus and customer service that would not otherwise be possible.
- 

# Building Data Ecosystems: What does NOAA get out of this?

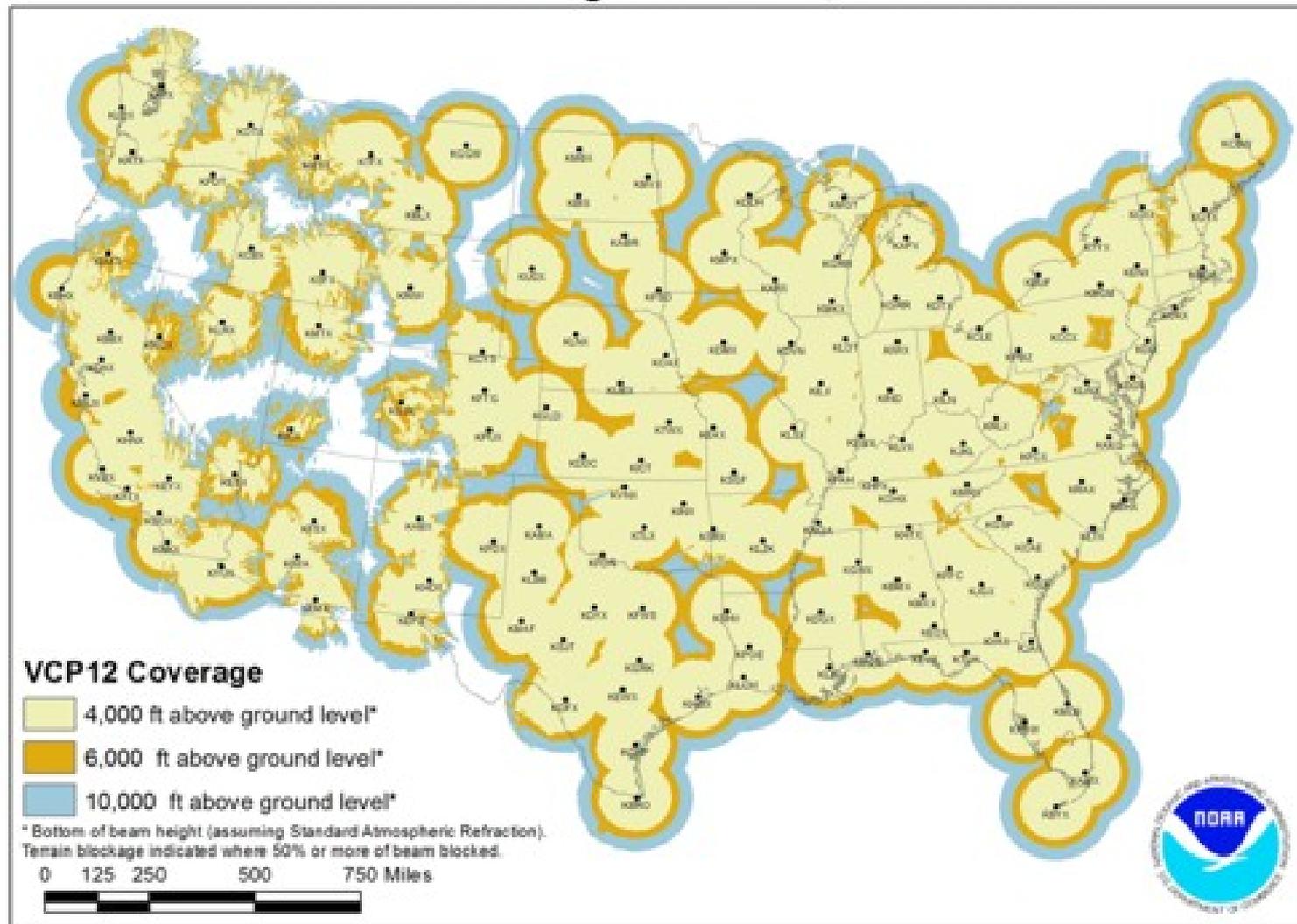


## NOAA's benefits of funneling data users through our BDP collaborators:

- Reduce government infrastructure cost
- Harness market forces to build an objective mechanism to prioritize our dissemination and accessibility efforts
- Create an incentive structure where true public-private partnerships can thrive and grow environmental data usage!

# Proof of concept: NEXRAD Level II

## NEXRAD Coverage Below 10,000 Feet AGL



# Proof of concept: NEXRAD Level II

- ▶ 160 high-resolution Doppler radar sites across the country
  - ▶ Each site detects and disseminates data in 5 minute intervals
  - ▶ For the first time ever, the public now has access to the entire NEXRAD archive from 1991 – present.
  - ▶ 270 terabytes and 180 million files of historical data.
  - ▶ Amazon Web Services is the first to make this dataset available. Microsoft is expected to follow suit.
  - ▶ Amazon is also provided a real-time NEXRAD feed from one of our Top-Tier providers
- 

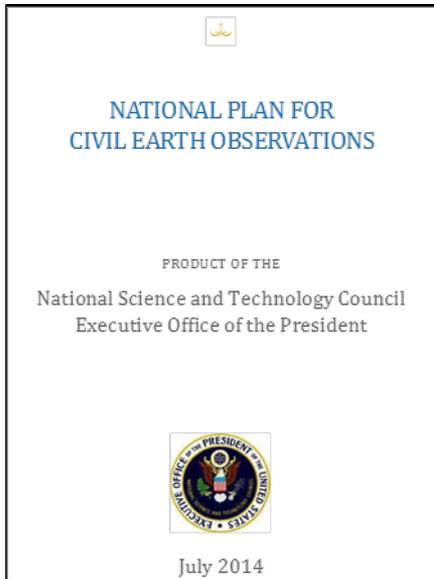
# Proof of concept: NEXRAD Level II

## Annex I: 2012 EOA Results

This annex provides results for the 145 high-impact observation systems identified from the 362 observation systems assessed by the 13 SBA teams of approximately 300 Federal subject-matter experts. These 145 observation systems are listed in two tiers in the tables below. Impact is indicated with respect to each of the 13 societal themes (12 SBAs and reference measurements), as described in Section 2.2.

Table 1: Tier 1 High-Impact Observation Systems (Ranked Order)

Observation System (Ranked Order)	Agency	Ag&Frst	BioDiv	Climate	Disasters	Ecosys	Energy	HumanHlth	Ocn&Cstl	Space Wx	Trans	WaterRes	Wx	Ref/Meas
1. Global Positioning System (GPS) satellites	DOD/USAF													
2. Next Generation Weather Radar (NEXRAD)	DOC/NOAA								*					
3. Landsat satellite	DOI/USGS, NASA										*			
4. Geostationary Operational Environmental Satellite System (GOES-NOP)	DOC/NOAA			*		*								
5. National Agriculture Imagery Program (NAIP)	USDA/FSA													
6. Airborne LIDAR	DOC/NOAA, DOD/USACE, DOI/USGS, NSF													
7. Forest Inventory and Analysis (FIA)	USDA/USFS							*						



# NEXRAD on Amazon S3



NEXRAD Lvl 2



Application for better Pricing farm/crop insurance

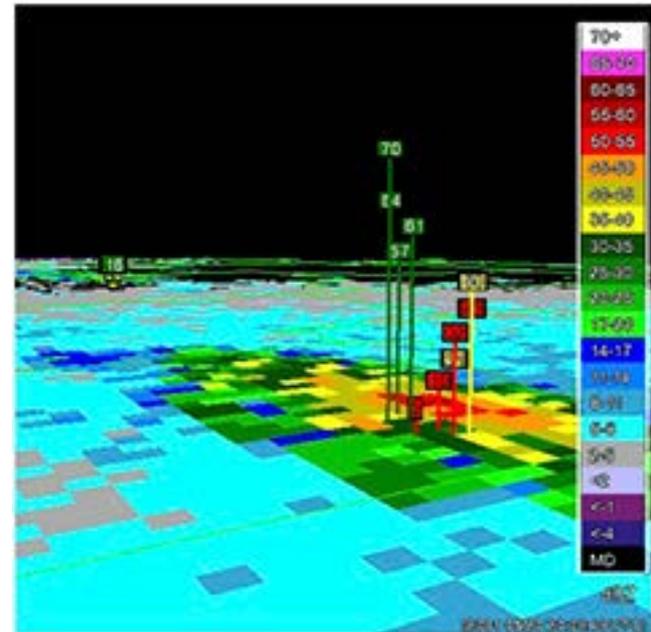
Insurance issuers



# Other Data Sets – MRMS

Multi-Radar/Multi-Sensor System =  
Multiple radars + surface and upper  
air observations + lightning detection  
systems  
+ satellite and forecast models.

- Resolution of 1-km x 2-min  
update cycle with 3D reflectivity  
mosaic at 31 levels
- Ingest includes commercial,  
Canadian radars and U.S. Terminal  
Doppler Weather Radars (TDWR)
- MRMS products assist for hail,  
wind, tornado, quantitative  
precipitation estimation forecasts,  
convection, icing, and turbulence  
diagnosis.



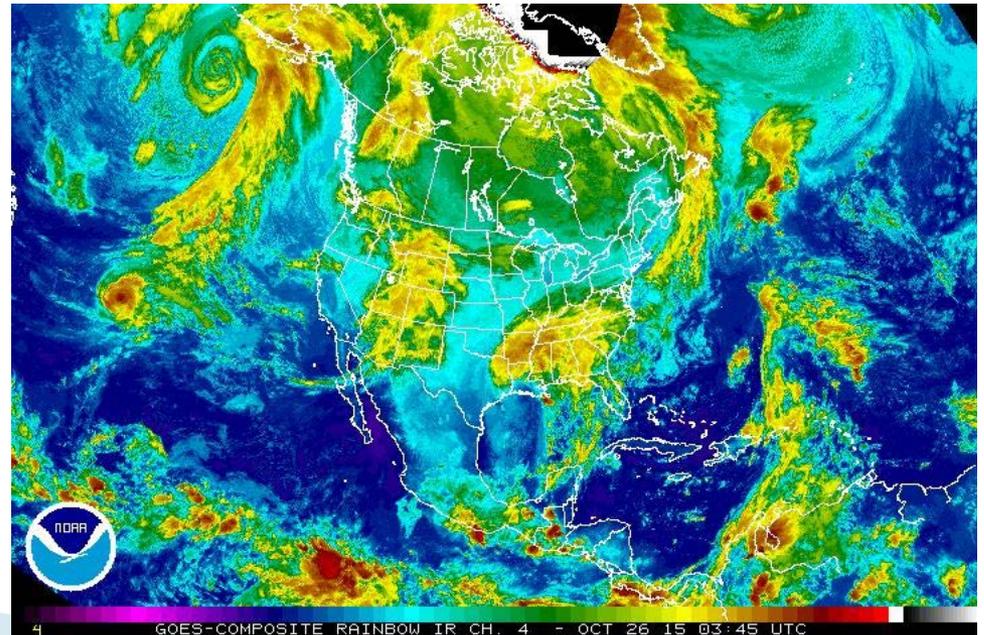
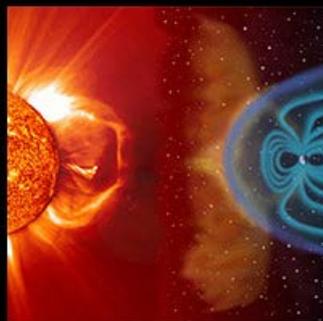
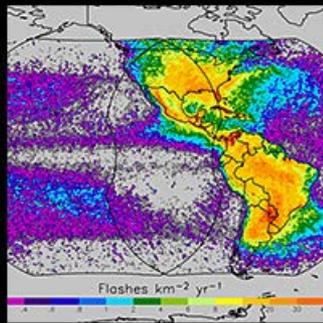
- Federal Aviation  
Administration (FAA) uses  
MRMS to advance  
techniques in quality  
control, icing detection,  
and turbulence

# Next up – GOES?



## Geostationary Operational Environmental Satellites (GOES)

- 2 operational and 1 reserve satellite provide geosynchronous orbital observations over the Western Hemisphere
- GOES R scheduled to launch in 2016



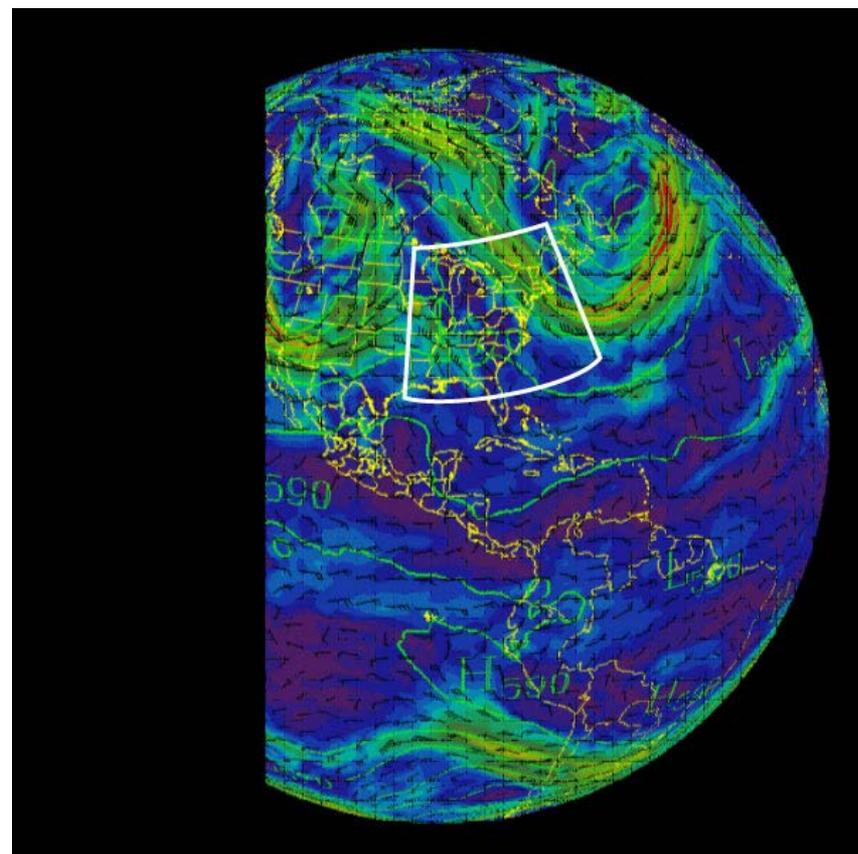
# Numerical Weather Prediction Models

## Operational Models

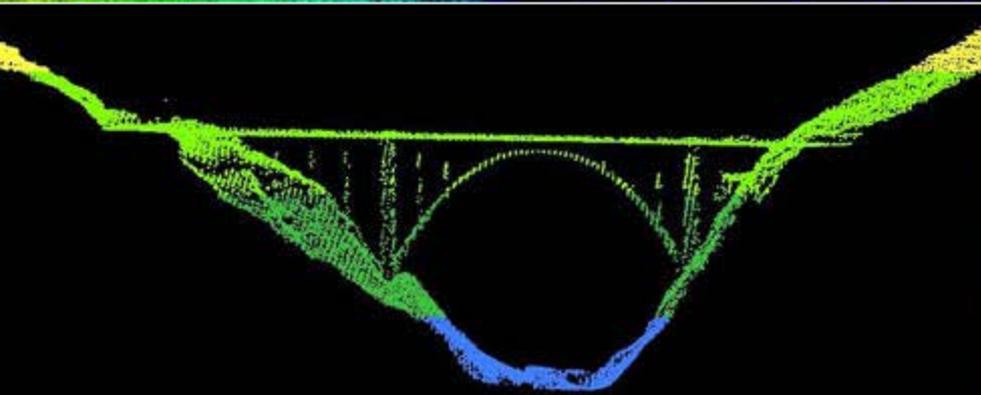
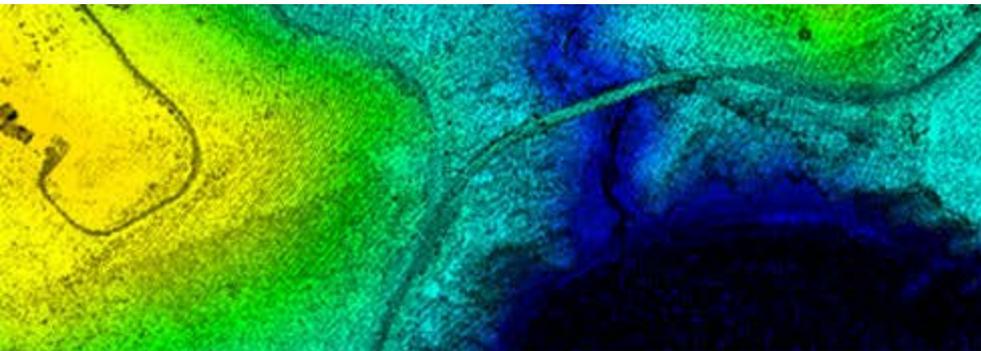
- Global Forecast System (GFS)
- Global Ensemble Forecast System (GEFS)
- North American Mesoscale (NAM)

## Experimental Models

- High Resolution Rapid Refresh Model (HRRR)
- Non-Hydrostatic Icosahedral Model (NIM)
- Low-Following Finite Volume Icosahedral Model (FIM)



# LIDAR



# Challenges



How do you test use cases for NOAA data without an established market ecosystem?

How do you develop a market ecosystem for environmental data without proven use cases for untapped NOAA data?



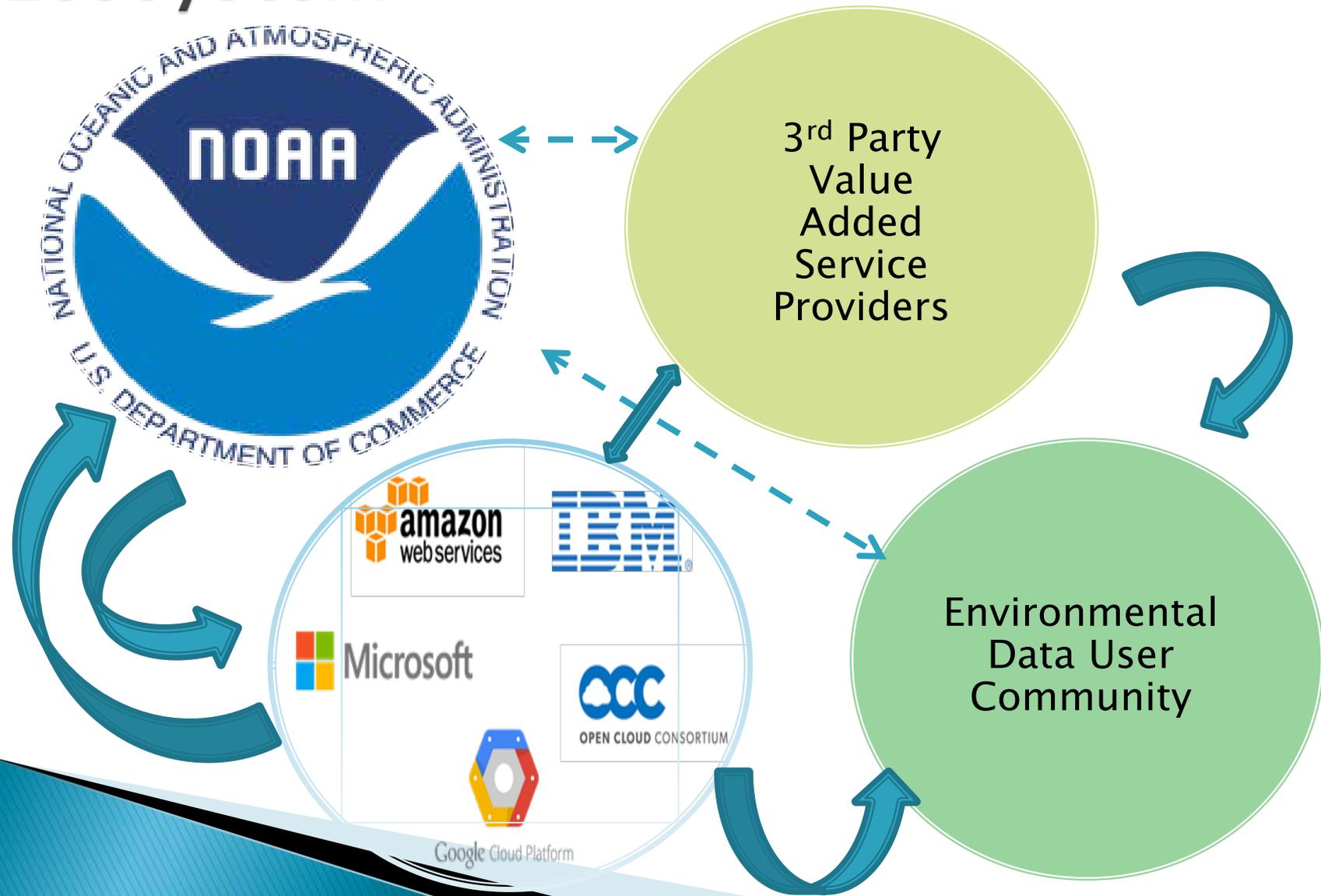
# Challenge: Different Levels of Market Maturity

Dry Side: Established industry based on atmospheric data makes the job relatively easier

Wet Side: Industry for oceans and water data is far more inchoate. We're starting from the beginning

The logo for AccuWeather, featuring a white sun icon on an orange background with the text "AccuWeather" in white.The logo for The Weather Company, featuring a blue water drop icon above the text "The Weather Company" in blue.The logo for Esri, featuring a globe icon to the left of the text "esri" in black.The logo for The Climate Corporation, featuring a stylized leaf and water drop icon to the left of the text "THE CLIMATE CORPORATION" in black.The logo for Maersk, featuring a white star on a blue square background above the text "MAERSK" in black.The logo for Unilever, featuring a blue ornate crest above the text "Unilever" in blue.The logo for Munich RE, featuring the text "Munich RE" in blue next to a blue icon of horizontal lines.The logo for The Coca-Cola Company, featuring the text "The Coca-Cola Company" in its signature red script.

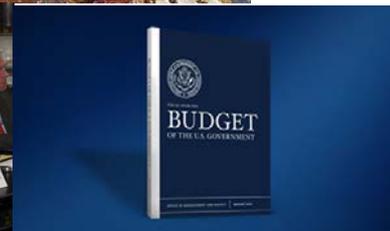
# Challenge: Fostering a Market Ecosystem



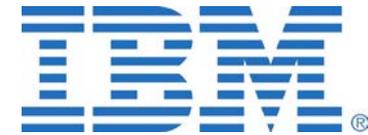
# Challenge: Sustaining Momentum



-VS-



# Challenge: Managing equitable yet efficient relationships among NOAA and its collaborators



Google Cloud Platform



OPEN CLOUD CONSORTIUM



# Challenge:

- ▶ How do we define and measure success?