



Climate Impact Traceability using NOAA Pathfinder Value Chains

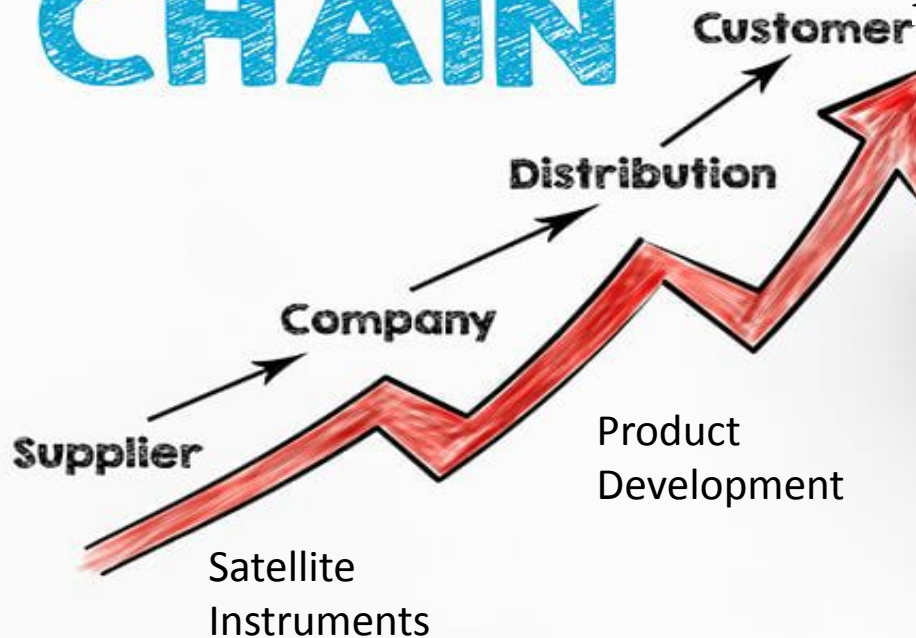
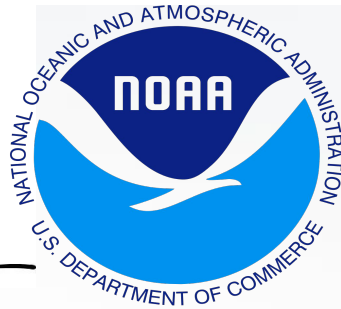
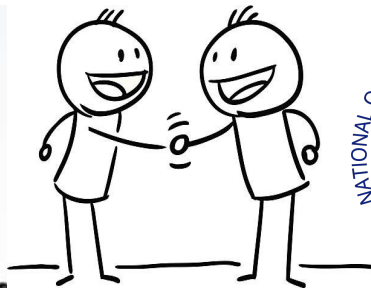
*Vanessa M. Escobar, Senior Scientist for User Engagement
NOAA Pathfinder Initiative Lead, NESDIS OSAAP*

“Festooning” to build Value Chains

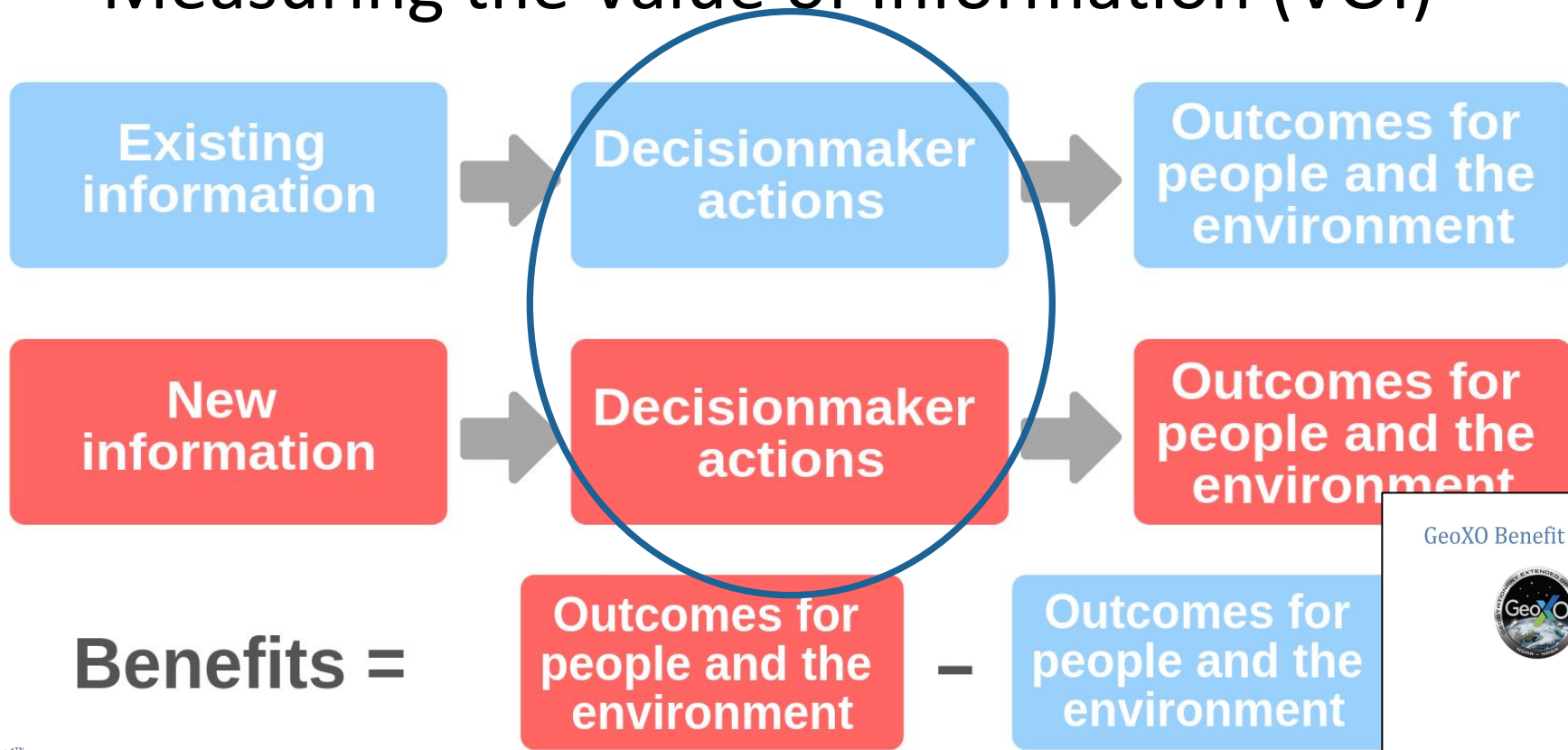


- ❖ Series of consecutive steps that follow a product from its initial design to its arrival at a customer's door
 - ❖ The full lifecycle of a product or process, including material sourcing, production, consumption and disposal/recycling processes
-
- ✓ Identify user needs that require attention
 - ✓ Validate what is actually being used
 - ✓ Provide visibility to areas that repair
 - ✓ Confirm areas we should continue to support
 - ✓ Guide future development
 - ✓ Requires everyone work together!

VALUE CHAIN



Measuring the Value of Information (VOI)



Benefits =

**Outcomes for
people and the
environment**

-

**Outcomes for
people and the
environment**

Courtesy: Y. Kuwayama, Reso

GeoXO Benefit Analysis



Jeffery Adkins, Integrated Systems Solutions, Inc.
Contractor for the NOAA Chief Economist

August 2022



NOAA Pathfinder Initiative

SCIENCE WORKING IN SOCIETY

A community of practice that demonstrates **impact through the traceability** of the use of NOAA information. Pathfinders **quantify existing value** and **project future benefits** of developing systems.



Building a Value Chains with Pathfinders

- ✓ Community of decision-makers
- ✓ Series of pointed decisions and actions
- ✓ Demonstration of value/impact
- ✓ Observation/learning and best practice
- ✓ Exchange of risks, costs and benefits with each step





A Pathfinder's Journey
New Jersey Flooding

Pathfinders' Flood Value Chain Perspective

Environmental Data Available

- Water level stations
- Buoy data
- GEO (GOES)
- LEO (JPSS)
- VIIRS (future)
- ABI (future)

Pathfinder's Models, Products, Services in action

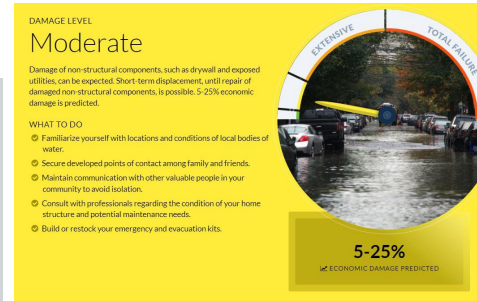
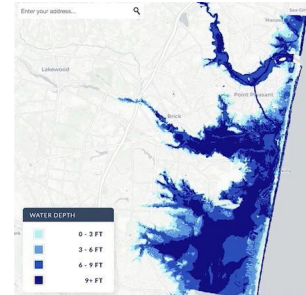
- NOAA tides and current dataset - Water Level data, atmospheric data (Wind Speed, Temperature, Pressure)
- Coastal Elevation Model - Topobathymetric DEM
- USGS DEM
- NOAA Storms Events Database
- NOAA Precipitation Frequency Data Server
- National Water Model
- NWS real-time and historical precipitation, radar, and forecasts
- Digital Coast Data Access Viewer
- Physical Oceanographic Real-Time System
- NOS Tides and Currents
- National Geodetic Survey
- Coastal Inundation Dashboard
- Storm Surge Warning System - real-time storm surge forecasts
- Sea Level Rise and Coastal Flooding Impacts Viewer
- CPC precipitation and temperature forecast
- Hydrometeorological Automated Data System
- Advanced Hydrologic Prediction Service
- Flood Inundation Mapping and Alert Network
- Water Watch

Third-Party Sources

- FEMA flood maps
- Infrastructure apping
- Census data
- Real estate parcels
- National risk index
- Bridge, dam, and canal locations

Users/Decision Makers

- Individual homeowners
- Business owners
- Community leaders and town managers
- Emergency managers



Informing the Pathway to Retire, Sustain, Develop, Improve

Single Users

User Requests

- Users work with NOAA to submit a formal request
- Formal Triage, Adjudication, Review Process

Formal product surveys

- NOAA reaches out to product users with targeted request for specific impact/needs that feed data analytics designed to inform decisions for Retire, Improve, Develop, Sustain
- Cost/Benefit Trades across diverse set of products

User/Developer feedback

- Discovery/incorporation during agile sprints where user is “Product Owner” and actively involved in development of product
- Execution optimization

Groups of Users

Sensor/Satellite User Conferences

- Facilitated exchanges feed large-scale efforts

Innovation Working Groups

- Identification of needed aspirational capabilities and improvements, and innovations to allow for more efficient product portfolios

Products and Services Workshops

- Evaluation of baseline, expected, aspirational performance levels and identification of needed improvements

Services Working Groups

- Evaluation of information delivery and usefulness and identification of needed improvements

Outreach Conferences/Conferences of opportunity

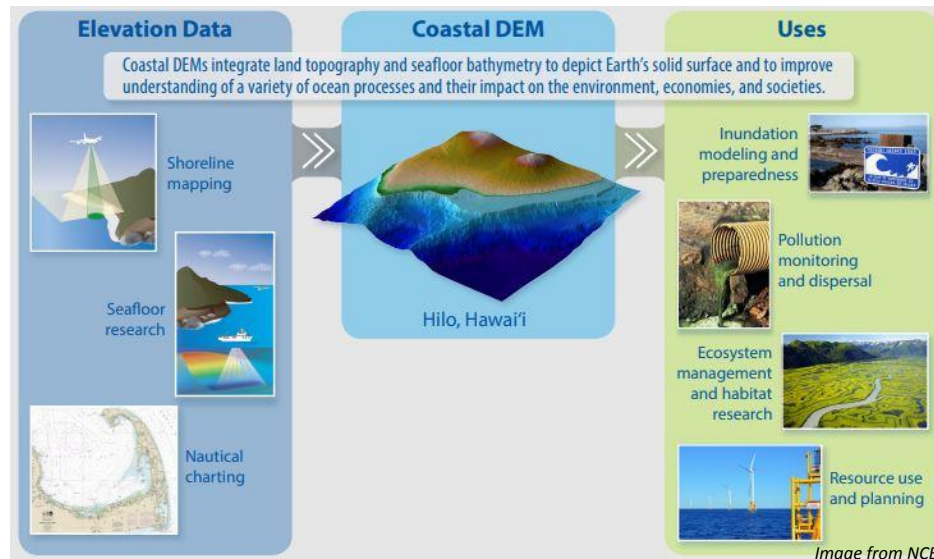
- Large-scale indicators of needed capabilities, improvements, innovations, deliverability and usefulness



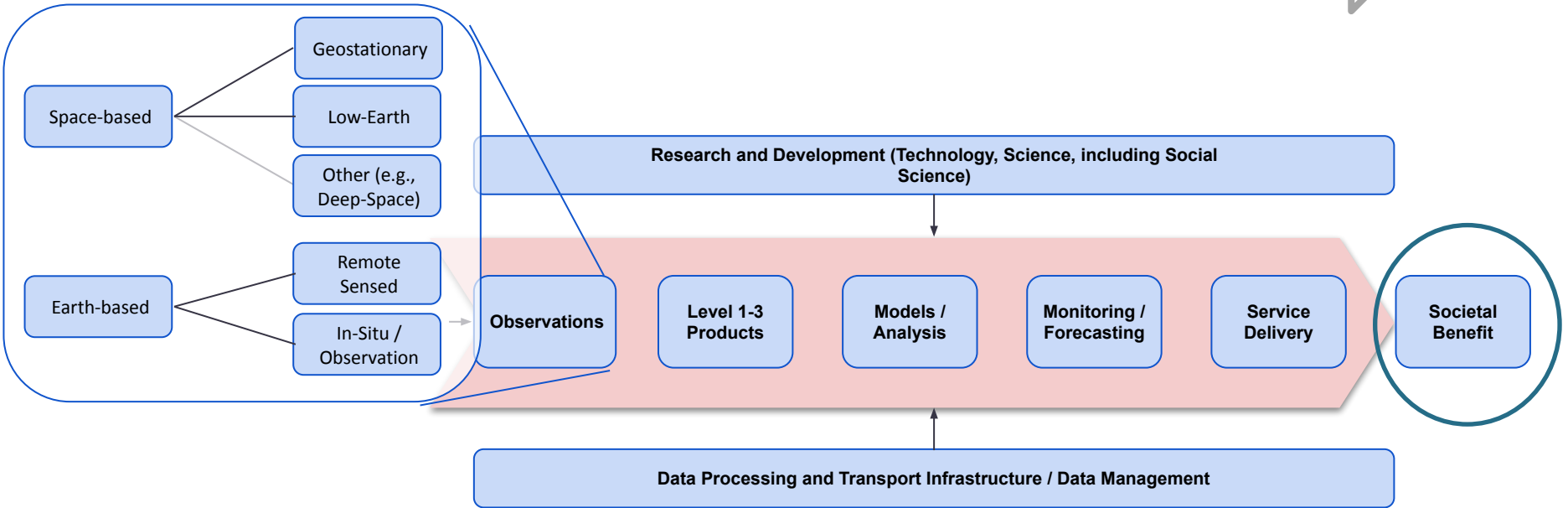
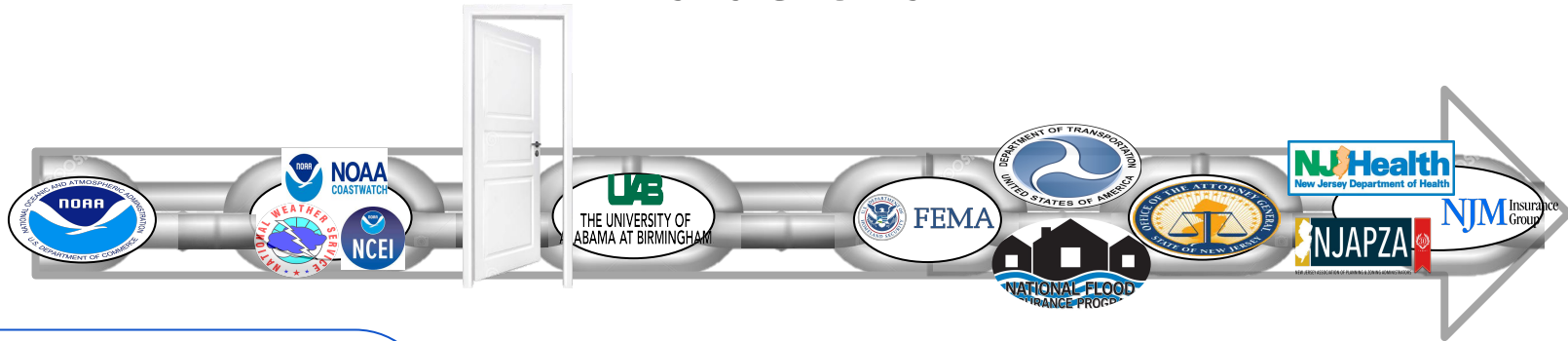
Critical NOAA Products link to NCEI

Pathfinder Models, Products, Services

- NOAA tides and current dataset - Water Level data, atmospheric data (Wind Speed, Temperature, Pressure)
- Coastal Elevation Model - Topobathymetric DEM
- USGS DEM
- NOAA Storms Events Database
- NOAA Precipitation Frequency Data Server
- National Water Model
- NWS real-time and historical precipitation, radar, and forecasts
- Digital Coast Data Access Viewer
- Physical Oceanographic Real-Time System
- NOS Tides and Currents
- National Geodetic Survey
- Coastal Inundation Dashboard
- Storm Surge Warning System - real-time storm surge forecasts
- Sea Level Rise and Coastal Flooding Impacts Viewer
- CPC precipitation and temperature forecast
- Hydrometeorological Automated Data System
- Advanced Hydrologic Prediction Service
- Flood Inundation Mapping and Alert Network
- Water Watch



Value Chain



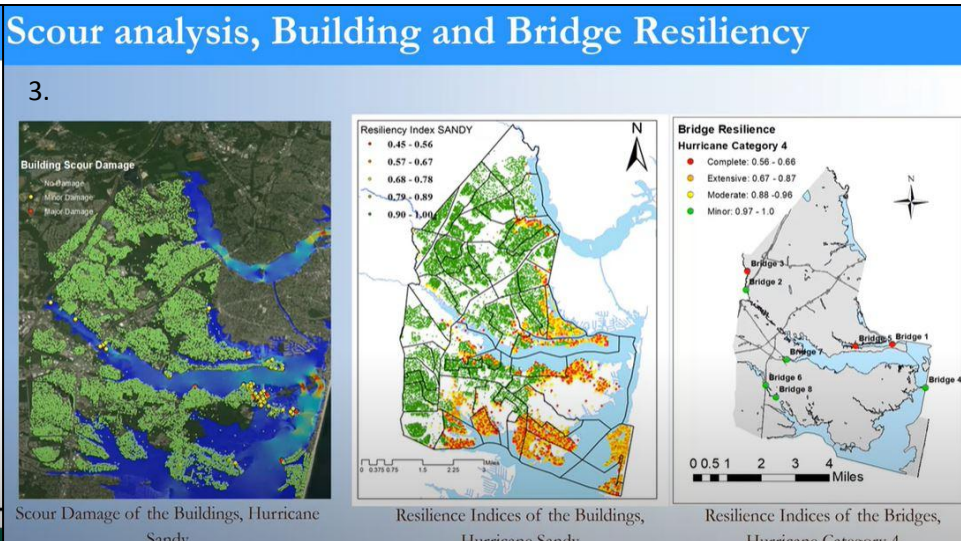
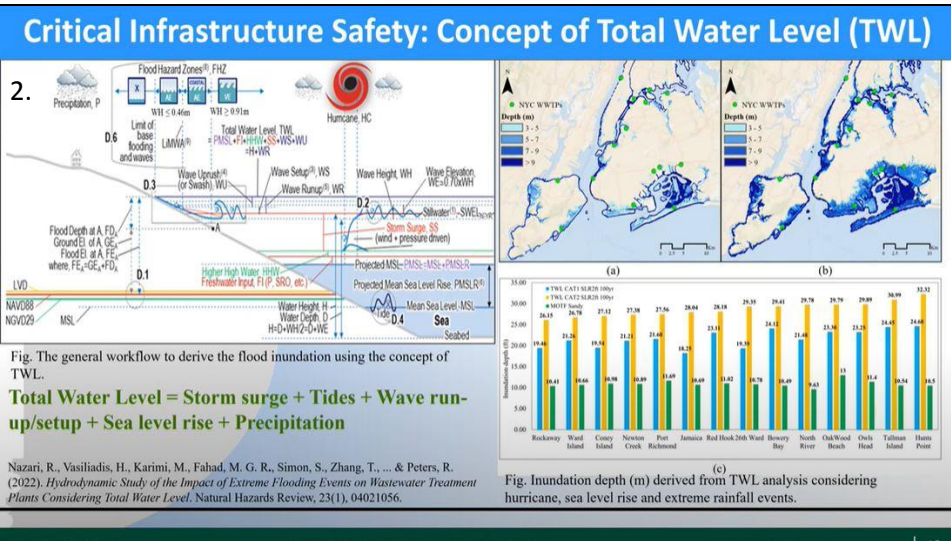
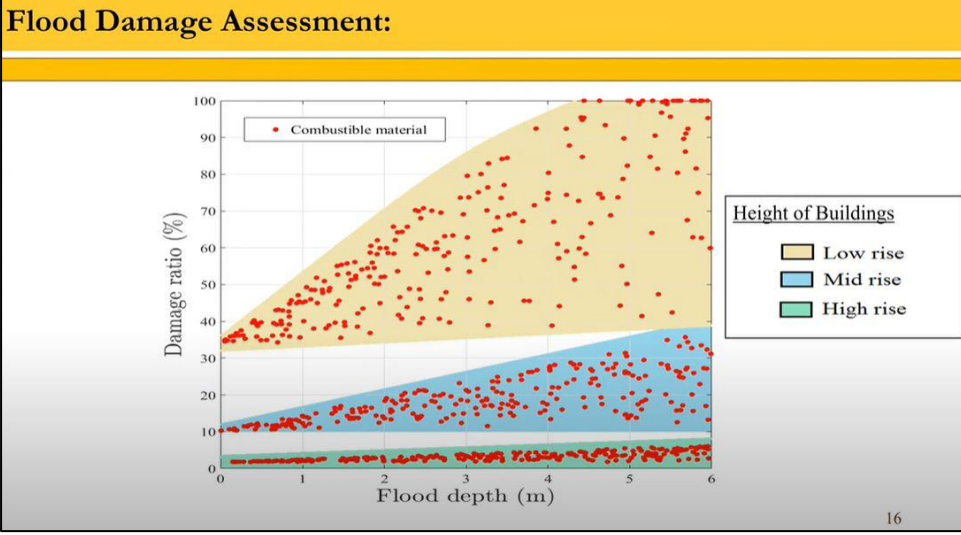
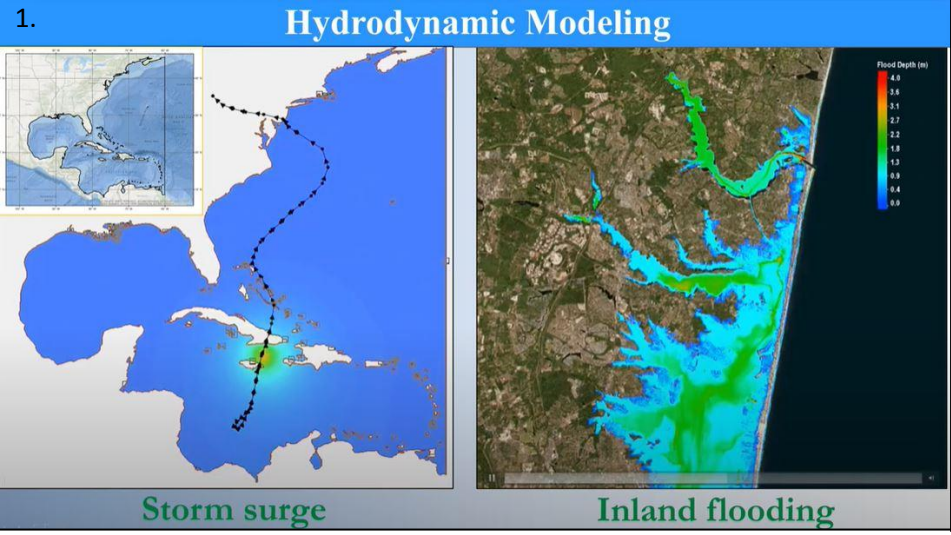
Pathfinder Establishes an End User Decision Making Framework

Goals:

- **Prepare** the communities
- **Optimize** the existing roadway network to reduce evacuation time
- **Minimize** damage and risks to community and its inhabitants



Multi-Scale Flood Modeling



Evacuation Planning Using Flooding Information:

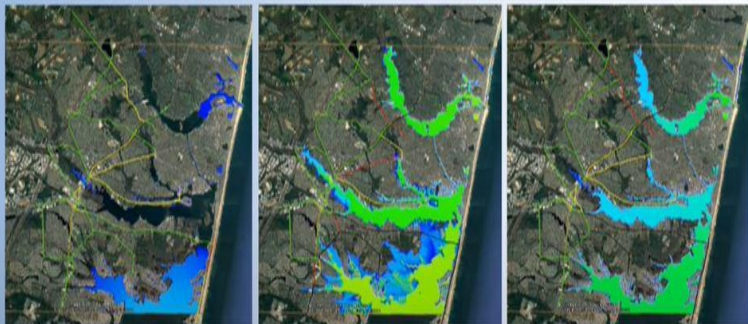
Hydrodynamic
modelling



Evacuation
simulation



Visualization



Speed of vehicles within the evacuation roads

0-5 mph

5-25 mph

25-50 mph

29

Color Coded Map of Property Resilience



Resiliency Index



Information at individual building scale

Community Meeting Flyers and Pamphlets

Color Coded Map of Property Resilience

F L O O F A X

Getting Prepared for the Next Flood is Easy

Join Us at the Brick Township Civic Center

May 1, 2018

For more information, go to:

NJFloodalert.com

Learn More About Flood Risks in Your Community



DAMAGE LEVEL
Minor

Flooding possible. No significant structural or non-structural damage (all are expected). Long term displacement from living at home is unlikely. Minor flood and wall blow-up. If any and 0-5% economic damage is predicted.

WHAT TO DO

- Have a working knowledge of your community transportation and infrastructure via maps or other information.
- Consider possible personal risk factors or vulnerabilities and seek ways to minimize them.
- Participate in community organizations that enhance community readiness.
- Look for notifications via radio, web, social media and/or community contacts.
- Consider medicine and food needs, in case the situation should change.
- Continue to assess risks and incorporate risk reduction strategies.

0-5%
ECONOMIC DAMAGE PREDICTED

DAMAGE LEVEL
Extensive

Heavy structural damage to some walls and columns should be expected. Non-structural components can also expect heavy damages. Long term displacement, until complete repair (such as reconstruction), is possible. 25-50% economic damage is predicted.

WHAT TO DO

- Familiarize yourself with local emergency plans for evacuation.
- Build or restock your emergency evacuation kits. Plan for flooding and be ready to evacuate early.
- Establish or enact care plan for animals and pets.
- Be prepared to use evacuation routes and know possible alternatives and evacuation centers.
- Take note of coastal areas subject to flash flooding and storm surge.
- Avoid walking or driving through flood waters.
- Secure hazardous items away from potential water or wind exposure.
- Secure or move furniture, electrical items, and valuables to a higher level.
- Secure important personal documents, valuables, and vital medical supplies into a water proof container in an accessible location.
- Secure household items needed to shelter in place.

25-50%
ECONOMIC DAMAGE PREDICTED

DAMAGE LEVEL
Moderate

Damage of non-structural components, such as drywall and exposed utilities, can be expected. Short term displacement, until repair of damaged non-structural components, is possible. 5-25% economic damage is predicted.

WHAT TO DO

- Familiarize yourself with locations and conditions of local bodies of water.
- Secure developed points of contact among family and friends.
- Maintain communication with other valuable people in your community to avoid isolation.
- Consult with professionals regarding the condition of your home structure and potential maintenance needs.
- Build or restock your emergency and evacuation kits.

5-25%
ECONOMIC DAMAGE PREDICTED

DAMAGE LEVEL
Total Failure

Irreparable damage and complete loss of use to structural and non-structural components can be expected. Long term or permanent displacement may be possible. Greater than 50% economic damage is predicted.

WHAT TO DO

- Gather and secure all of your important documents such as birth certificates, insurance documents and banking information.
- Assess your current health status and members of your family.
- Establish a plan to remain from home for several days to weeks, if necessary.
- Take inventory of all prescription drugs and medical devices needed.
- Arrange for a safe meeting spot and share with all members of your family, in case you are separated.
- If sheltering in a place, gather several days for weeks of water and food supplies.
- Assess your current evacuation plans, routes, and community resources for mitigating risks and hazards.
- Learn to use community state, and national services to stay informed.

> 50%
ECONOMIC DAMAGE PREDICTED

Mapping Key Decisions with Pathfinders

*“Without NOAA data, none of this is possible!”
-NOAA Pathfinder*

*By accurately **identifying property flood risk**, you can....*

NOAA Data, Products, Services

High-Resolution Flood Vulnerability Maps

Government

- ✓ Decide who to evacuate, and when
- ✓ Identify at-risk groups
- ✓ Decide where to pre-position resources
- ✓ Prioritize repairs and infrastructure investments

Property Owners

- ✓ Decide where to live and when to move
- ✓ Identify how to prepare and enhance resilience
- ✓ Decide when to self-evacuate
- ✓ Determine and understand your own vulnerability



Demonstrations through Tabletop Exercises (TTX)



What if we had the future observations from GeoXO, LEO/NEON in the planning and forecasting of Hurricane Sandy? How might things change?

Pathfinders develop TTXs using synthetic data for future observations to help demonstrate how future observations/products and services would have impacted the decisions made during a past event.

- ✓ Evacuation time
- ✓ Resource planning
- ✓ Community messaging
- ✓ Self evacuation Decisions

Why should *you* care?

Benefits to NOAA

- Relationships
- Quantifiable feedback on actual uses/impact
- Demonstration of the benefits to society
- Decision making needs for products, services, training, education.
- Society's ROI regarding Satellite instruments, products and service
- User stories that trace back through our NOAA efforts.

Benefits to Society

- Relationships
- Time
- Unlocking data, access, awareness and availability
- Confidence in continuity
- Clear understanding of costs and benefits
- Informing future observations, products and services
- Service to society



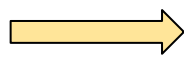
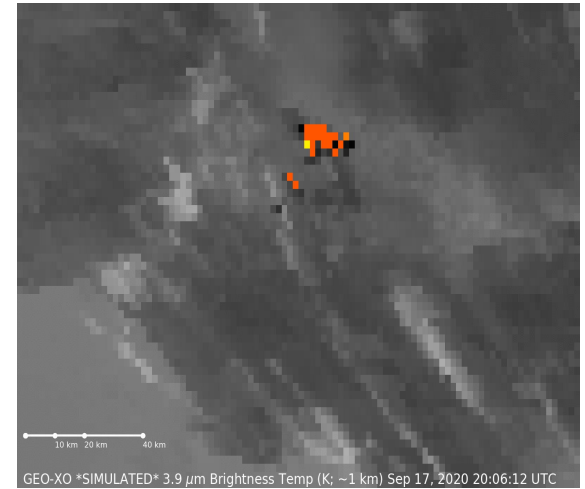
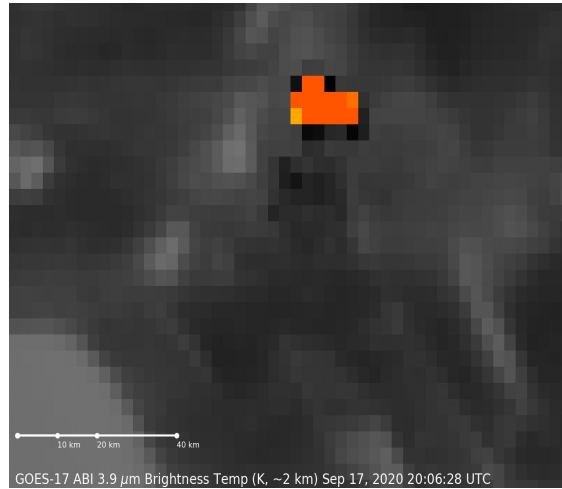
Working Together Towards Building Value Chains



Other TTX Co-Developed with Pathfinders



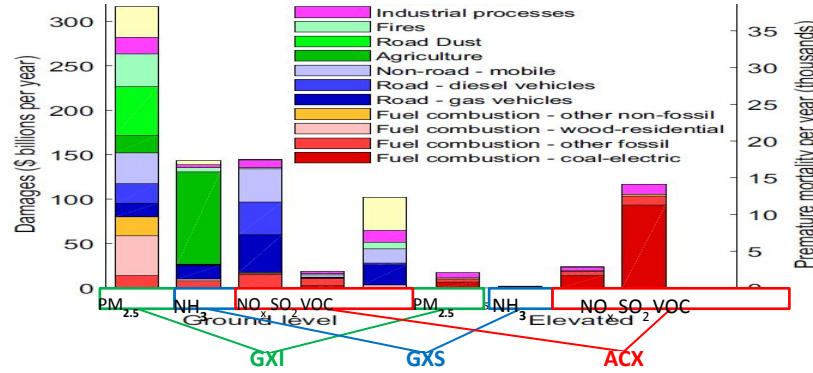
Fire Detection Value Chain



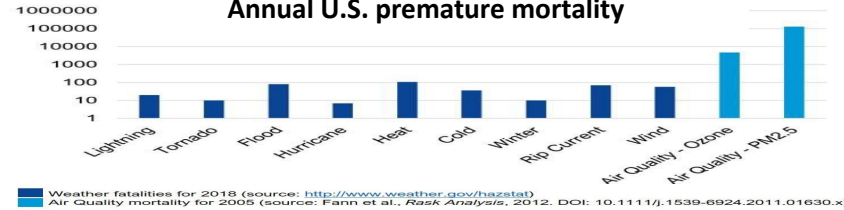
Air Quality Value Chain

U.S. Damages from Air Pollutants by Source

Goodkind et al., Proc. Natl. Acad. Sci., 2019



Annual U.S. premature mortality



Coming June 13-15, 2023



Thank You
Vanessa.Escobar@NOAA.GOV



Back-up Slides



ASU Air Quality TTX Background

- The event will bring together air quality stakeholders from the city, county, and state levels to discuss data needs, decision pathways, and the public health challenges associated with air quality
- The TTX will include **three timely scenarios** to support value chain development

Scenario	Pollutants of Concern	Notional Date
Unhealthy air quality days	PM ₁₀ , PM _{2.5}	December 25, 2022 to January 1, 2023
Extreme heat/ozone	O ₃ , VOCs	July 16 to July 23, 2022
Haboobs	PM _{2.5} and PM ₁₀	August 31 to September 6, 2022

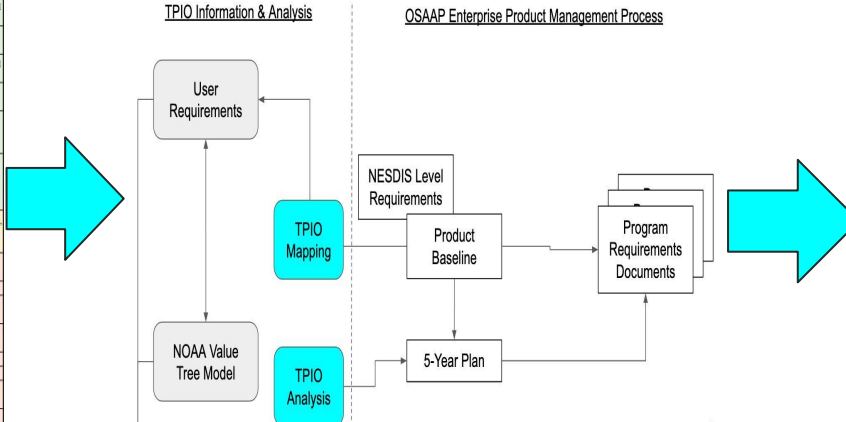


ASU Air Quality TTX Value Chain

AQ Product/Service Used by ASU Pathfinder	Found by TPIO	Location within TPIO
Aerosol Optical Depth—AquaMODIS	Yes, close	IPL - AQ & Atmospheric Composition Tab, Row 76, Product: MODIS Dust Mask Algorithm
Fires and Thermal Anomalies (Day and Night, 375m)—SeaWiFS/NPPVIERS	Yes	IPL - Fires Tab, Row 35, Product: 3-band Active Fire
Fires and Thermal Anomalies (Day and Night, 375m)—SeaWiFS/NPPVIERS	Yes	IPL - Fires Tab, Row 37, Product: Medium Active Fire
Fires and Thermal Anomalies (Day and Night, 175m)—NOAA-20/VIIRS	Yes	IPL - Fires Tab, Row 36, Product: 3-band Active Fire
Fires and Thermal Anomalies (Day and Night, 175m)—NOAA-20/VIIRS	Yes	IPL - Fires Tab, Row 38, Product: Medium Active Fire
NOAA Infrared Mapping System and Smoke Product	Yes	NOSIA-2-1 survey product: Fire and Smoke Detection Analysis: SAB (FireSmokeDet2) SAB
NOAA WSP/D Trajectory Model	Yes	NOSIA-2-1 survey product: Hybrid Single Particle Lagrangian Integrated Trajectory Model Dispersion Prediction, Regional (HYSPLIT-AR2)
Deep Blue Aerosol Optical Thickness (Land and Ocean)—SeaWiFS/NPPVIERS	Maybe, Possibly algorithm in development	Atmospheric Composition Tab, Row 114, Product: VIIRS Gridded Aerosol Optical Depth
MODIS Combined Value-Added Aerosol Optical Depth—Terra and Aqua/MODIS	No	
MALAC Aerosol Optical Depth—Terra and Aqua/MODIS	No	
Merged DTDB Aerosol Optical Depth (Land and Ocean)—Terra/MODIS	No	
Merged DTDB Aerosol Optical Depth (Land and Ocean)—Aqua/MODIS	No	
Deep Blue Aerosol Optical Depth (Land)—Terra/MODIS	No	
Aerosol Optical Depth Average Column, Monthly—Terra/MISR	No	
Dark Target Aerosol Optical Thickness (Land and Ocean)—SeaWiFS/NPPVIERS	No	
Nitrogen Dioxide—Aqua/OMI	No	

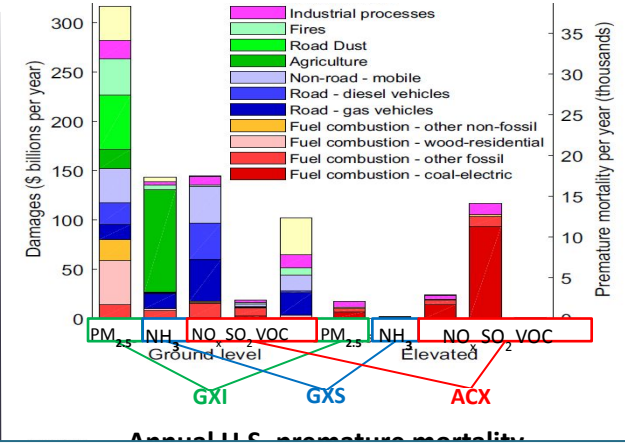
TPIO Information & Analysis

OSAAP Enterprise Product Management Process



U.S. Damages from Air Pollutants by Source

Goodkind et al., Proc. Natl. Acad. Sci., 2019

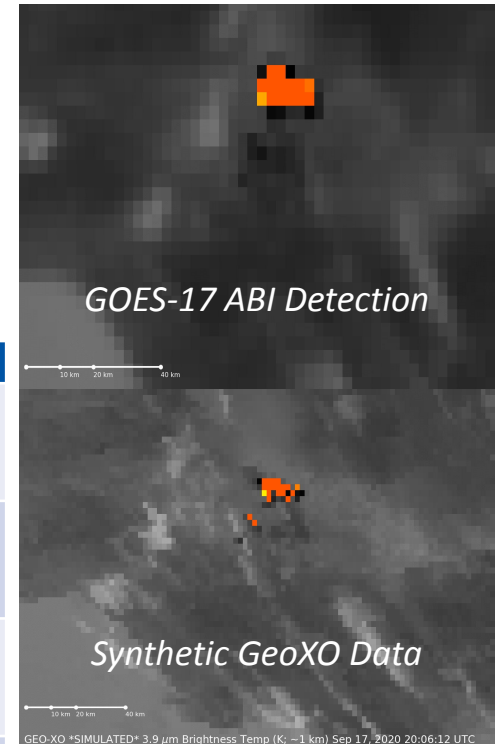


Demonstrate the value of decision made at each link in the value chain

WIFIRE Fire Response Tabletop (TTX) Background

- This TTX brought together first responders, engineers, and policymakers at the local, state, and federal levels to examine how geospatial data informs wildfire preparation and response
- The event centered on comparing how response to the 2020 Bobcat Fire might have been improved by future GeoXO data

Module	Brief Overview
1. Pre-Season	Discussing how stakeholders prepared for the 2020 fire season and key decision points and challenges in fire season forecasting and planning
2. Ignition and Detection	Exploring how initial fire ignition and spread was detected and detection limitations, difficulties tracking fire spread, and critical deployment decisions
3. Growth and Acceleration	Discussing data and products that help the fire community to track and predict fire behavior in order to protect critical infrastructure and the overall population
4. After-Action	Examining how responders use satellite data to track remaining hotspots and decide whether to demobilize resources



GEO-XO *SIMULATED* 3.9 μm Brightness Temp (K; -1 km) Sep 17, 2020 20:06:12 UTC

WIFIRE Fire Response TTX Value Chain

- The WIFIRE value chain traces how future GeoXO data will enhance WIFIRE's ability to provide critical, life-saving data to first responders before, during, and towards the end of a fire
- It demonstrates the benefits of improving spatial resolution, including faster response time and improving resource deployment

