



Aeolus
CLIMATE STRATEGIES

Societal Uses of Earth Observations: Insurance, Energy, Agriculture, and Coastal Management

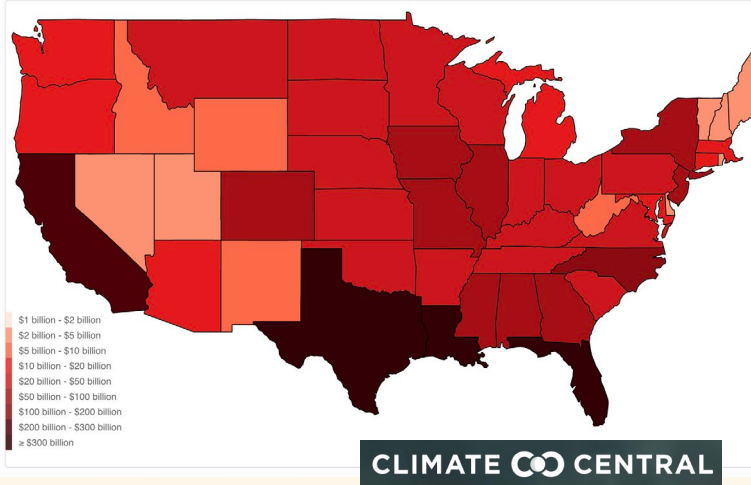
Ellen Mecray

Principal, Aeolus Climate Strategies and
Former NOAA Regional Climate Services Director

June 15, 2026, NASEM: Value of NASA Earth Observations

US Residents are Moving into Harm's Way

Disaster Costs by State



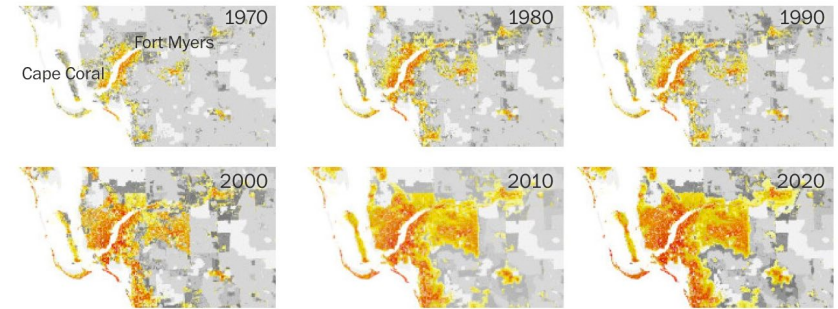
<https://www.washingtonpost.com/climate-environment/2022/09/28/florida-population-growth-hurricane-ian-path/>

Source: Map uses analysis by Stephen Strader, Geography and the Environment, Villanova University, with data from the Spatially Explicit Regional Growth Model (SERGoM)

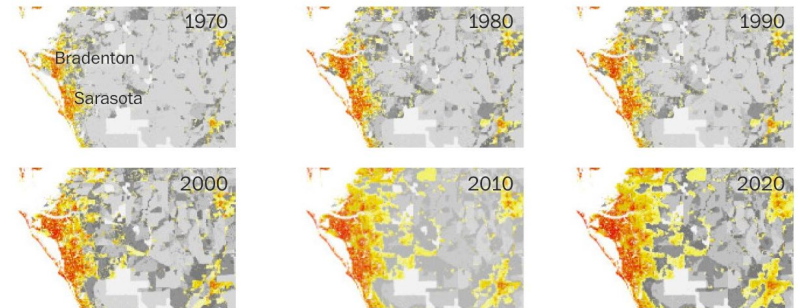
Housing density



Cape Coral–Fort Myers metro area had a 620% increase in population since 1970



North Port–Sarasota–Bradenton +280% since 1970

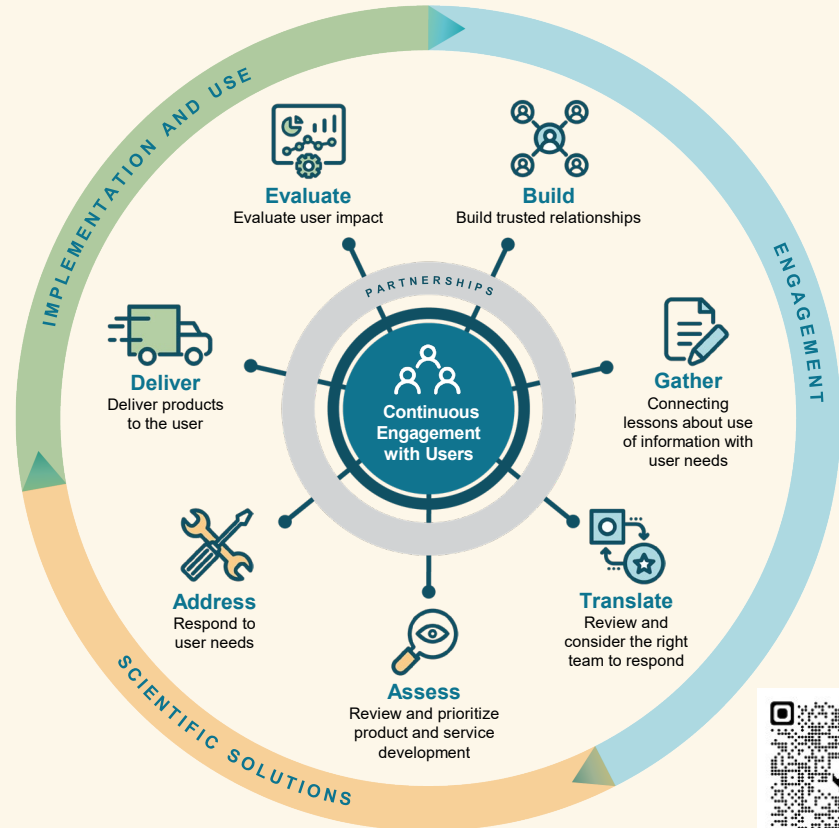


The Service Delivery Framework

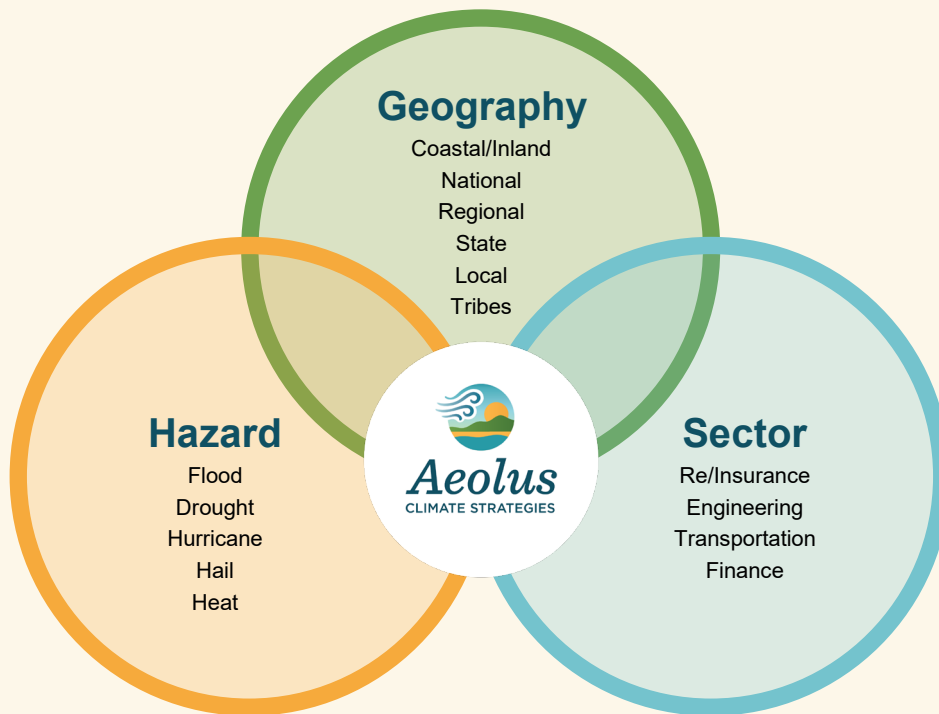
Continuous engagement is the central element for successful service delivery.

Communication that fosters mutual learning and facilitates joint dedication to achieving agreed upon needs and goals is critical to the success of engagement.

Personal involvement in all interactions with the users and partners is critical to build trust and streamline processes.



At the Critical Intersection for Climate Services



Insurance and Reinsurance

Who are they?

- Reinsurance companies
- Insurance companies
- Specialty Insurers (excess and surplus lines)
- Catastrophe (cat) modeling companies
- Brokers
- Actuaries
- State Offices of Insurance Commissioners (regulators)
- Associations
- Academics



Real-time Obs, Parametric Triggers, and Event Response

ICEYE

Insurance solutions

Hurricane Flood Wildfire Contact us

Hurricane

Gain access to ICEYE's high-resolution hurricane impact data as structured geospatial files within 24 hours of landfall—often before skies clear.

Our solution includes a 30-meter resolution Rapid Impact heat map and building-level flood depth footprint, released as GIS-compatible files and summary reports. Updates are delivered every 24 hours throughout the event, enabling insurers to track evolving conditions in near real-time.

Flood

ICEYE Flood Solutions is the world's first consistent, near real-time source of flood observation data. We keep our customers informed on what flood events we're expecting, currently observing, or actively analyzing, delivering detailed data layers and summary reports for each analyzed event.

Act faster, plan smarter, and respond better across the full flood lifecycle



<https://www.iceye.com/solutions/insurance/flood-insights>



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FLOODBASE

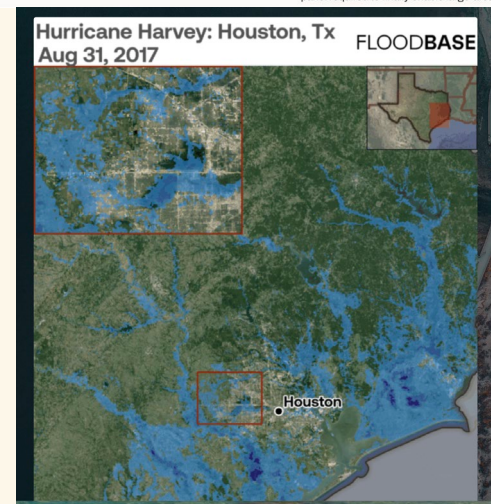
For Brokers Our Solutions Company



A new category of flood insurance

Flooding disrupts businesses, decimates revenue, and requires mobilizing people and resources. Both businesses and the public sector are exposed to the full range of loss caused by floods, yet most only purchase property policies that cover damage to physical assets.

Comprehensive flood resilience requires a new category of insurance product that provides holistic protection. By designing products that pay out based on the magnitude of flooding over a large area, Floodbase enables policies that pay out within days of an event and allow the insured to use the proceeds at their discretion. Floodbase has pioneered the science and assembled the carrier panel required to finally enable large-area flood insurance products.



<https://www.floodbase.com/flood-response>

Aerial Roof Analytics and Pricing

MOODY'S

Request A Consultation

☰

Industries served by CAPE Geospatial Analytics



Home Insurance



Commercial Insurance



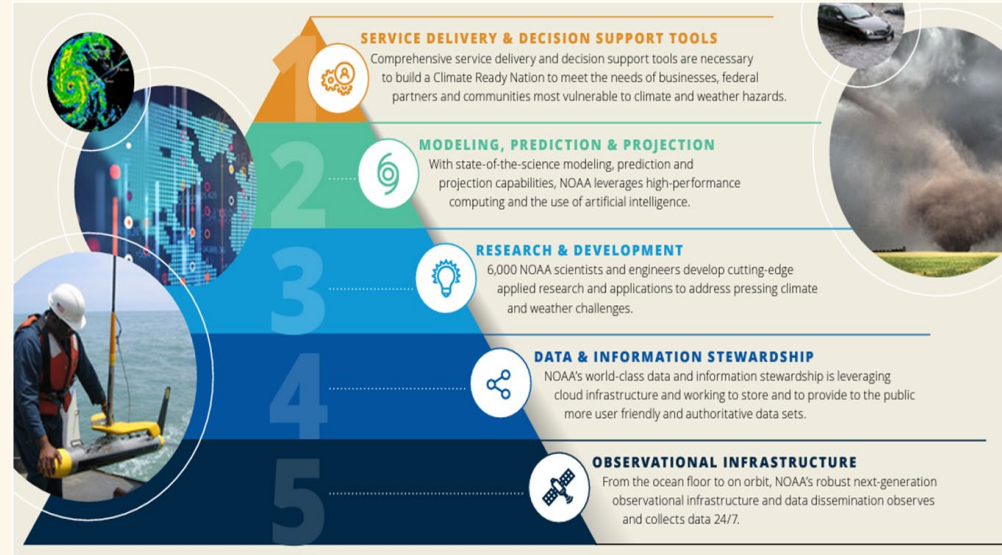
Real Estate & Mortgage



Insurance Depends on Credible Information

- Real-time observing systems
 - Platforms: Satellites, ships, buoys, drones, tide gauges
 - Calibration, collection, and transmission of data
- Historical data stewardship
 - Curation by scientists including ingest, quality control, metadata, and accessibility
 - Reference-quality datasets that are High-resolution + consistent in space and time
- Earth system model outputs
 - Physical hazard models, prediction, and risk analysis
 - Exposure management, models and derived products

NOAA's Information Ecosystem



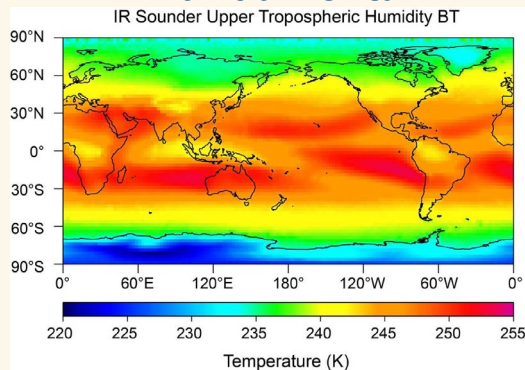
NOAA's Climate Data Records (CDRs)

Climate Data Records Program:

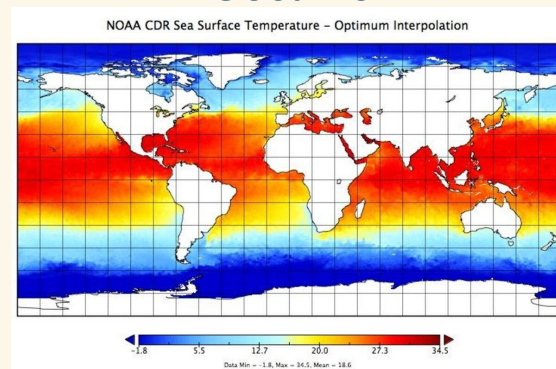
*Robust, sustainable
and scientifically
sound climate
records that
provide trustworthy
information on how,
where and to what
extent the
environment is
changing*



Fundamental

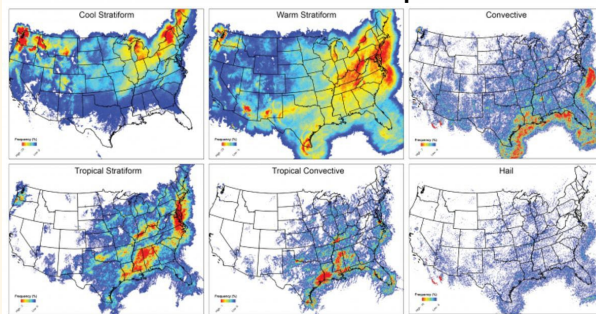


Oceanic



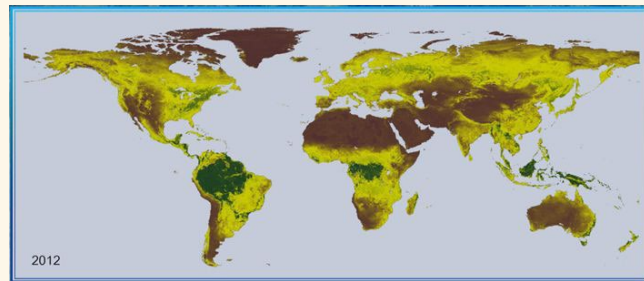
Atmospheric

NEXRAD Quantitative Precip Estimates



Terrestrial

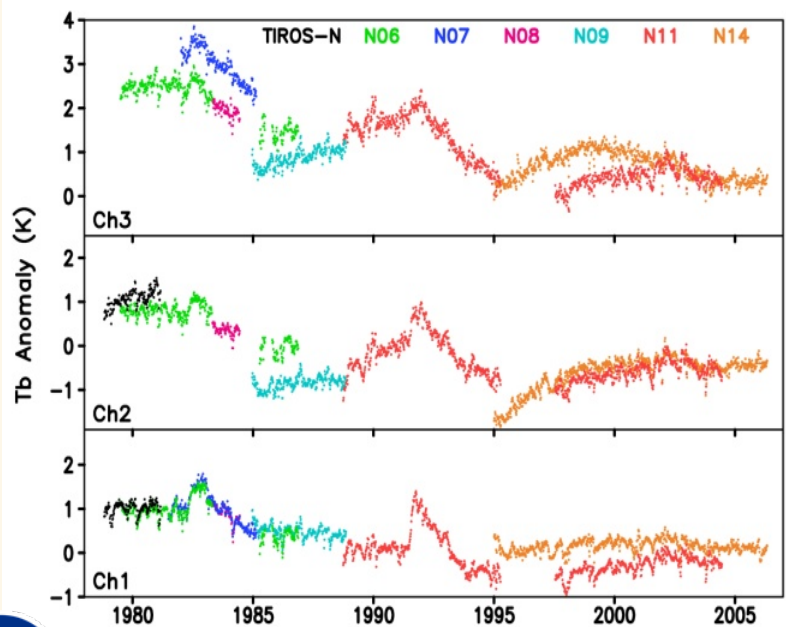
Leaf Area Index and FAPAR



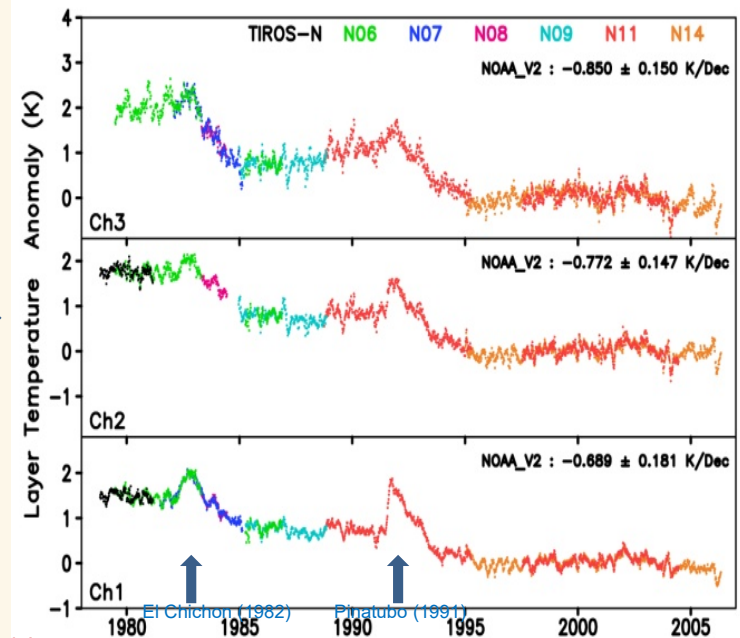
Climate Time-Scales Exceed a Satellite's Longevity: Build a Climate Data Record (CDR)

Stratospheric Sounding Unit (SSU) onboard early NOAA satellites (1979-2006)

Raw Data Record



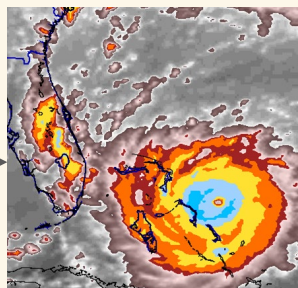
Climate Data Record



Zou et al. 2014



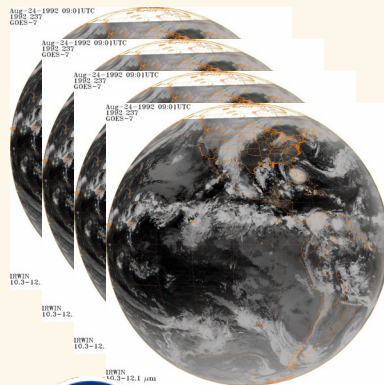
NOAA



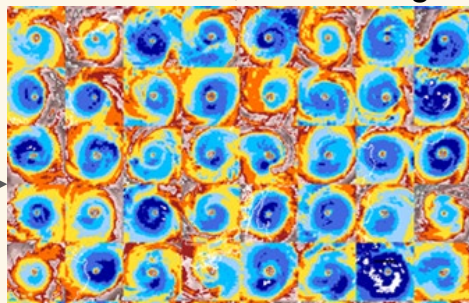
Intensity: 140 kt
Cat 5

Civil/Personal Use:
Protect property
Evacuate personnel

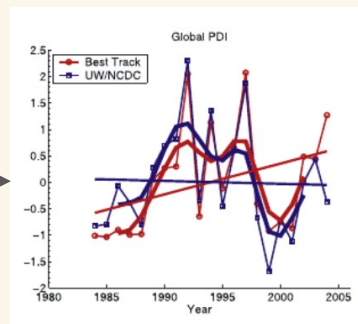
What is the long term risk? Where/how are patterns changing? HURSAT CDR



3200+ storms, 200K images



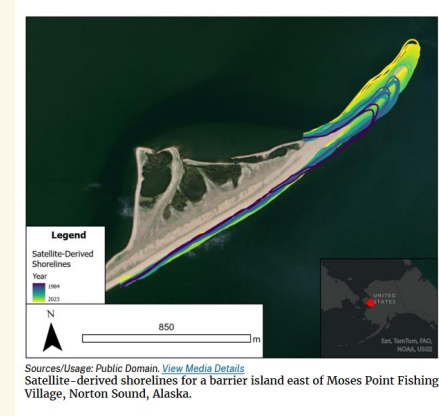
Objective Intensity Algorithm



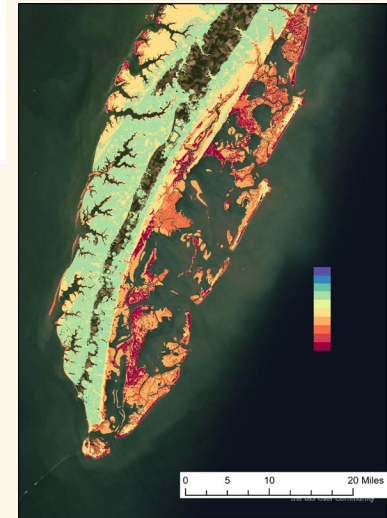
Industry Use:
Adaptation.
Invest in
improved
structures

Satellite-derived Shoreline Change

- Landsat and Sentinel 2 imagery used for satellite-derived shorelines and coastal landcover
- Future use will probably include Harmonized Landsat – Sentinel 2 (HLS2) surface reflectance products
- CSDA imagery allows USGS to:
 - Map coasts at sub-meter to few-meter resolution
 - Fill gaps between Landsat/Sentinel revisits
 - Validate and improve automated shoreline extraction tools
- ICESat-2 lidar bathymetry data product (ATL24) has potential to provide nearshore bathymetry data



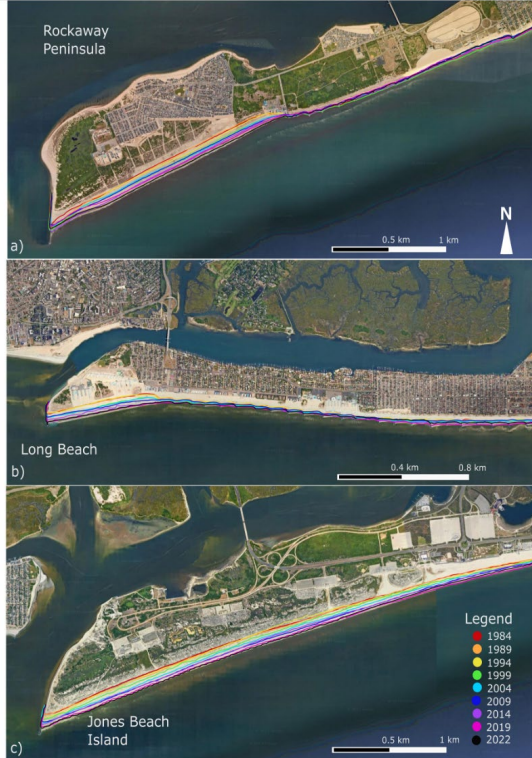
Island progradation, Norton Sound, AK. (Lundine et al., 2025)



Coastal Change Likelihood, Chesapeake, VA (WHCMSC, 2023)

Shoreline Changes Measured Over Time

Landsat and Sentinel2 imagery shows accretion at the west end of the barrier islands on Long Island (NY)



Janda et al., 2025

Shorelines varying seasonally in Southern CA from thousands of CoastSat images

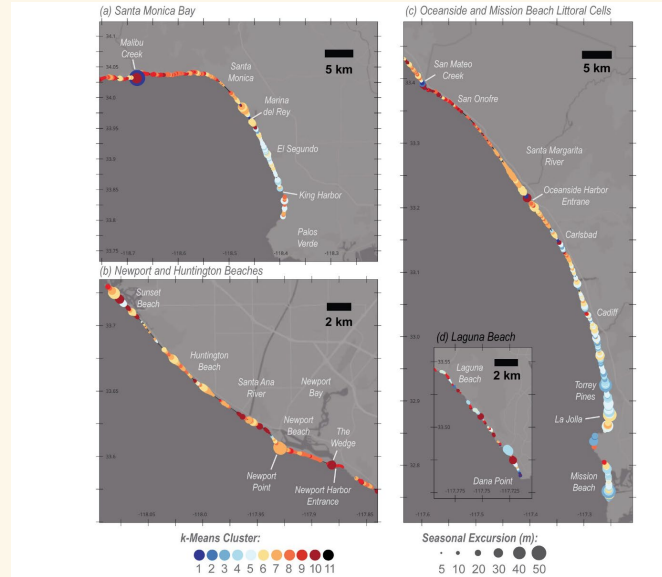


Figure 13. Geographical patterns of the k -means clusters and the seasonal shoreline excursion of three littoral cells of southern California.

Warrick et al., 2025

Shorelines moving over time in Northern AK

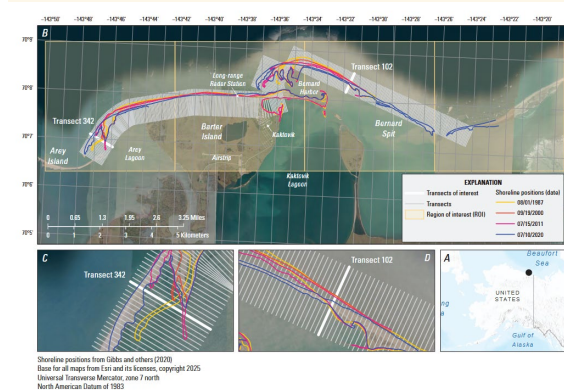
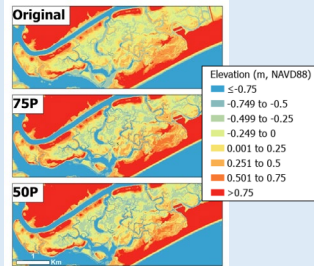


Figure 2. Historical shoreline positions for Barter Island and neighboring Bernard Spit and Aray Island, Alaska, 1987-2020. A, study area location; B, site view with regions of interest (ROIs), transects, and representative traditionally sourced in situ shorelines; C, detailed view of transect 342 on Barter Island's western side showing evolution of barrier spit; and D, detailed view of transect 102 at Bernard Spit showing retreat between 1987 and 2020.

O'Neill et al., 2025

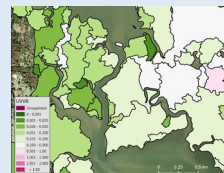
Improving/integrating field and geospatial data

DEM products with reduced elevation error



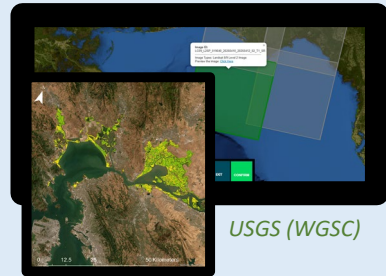
USGS (WARC)

Marsh unit delineation

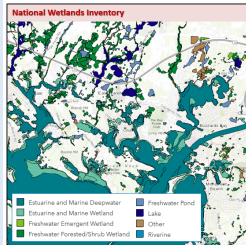


USGS (WHCMSC)

Cloud-based wetland biomass mapping



Data library sources: NOAA, USFWS, USGS



Office for Coastal Management
NATIONAL ESTUARINE
RESEARCH RESERVES

SECOORA

NOAA TIDES & CURRENTS

C-CAP Data

N. Herold (OCM)

Synthetic DEM

TWI

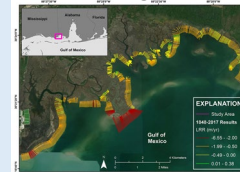


Field-based accretion,
flood frequency



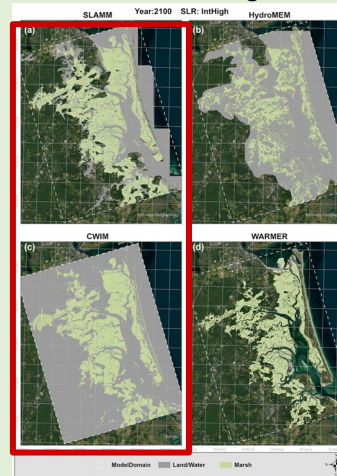
USGS (SPCMSC)

Shoreline
change



Forecasting future wetland transformations

Individual model predictions
of marsh extent/migration



Ensemble prediction



Thorne, Buffington, Carr (WERC/EESC)
Enwright, Osland, Stagg (WARC)
Passeri, Woodruff, Jenkins (SPCMSC)
Ganju, Defne, Ackerman (WHCMSC)
Meckley, Familkhalili, Herold (NOAA)

Translating science to application



Marsh Modeling Community of
Practice, Model Output Dashboard,
Data Library, Web Viewer

Buckel, Atkins, Bost (NOAA)

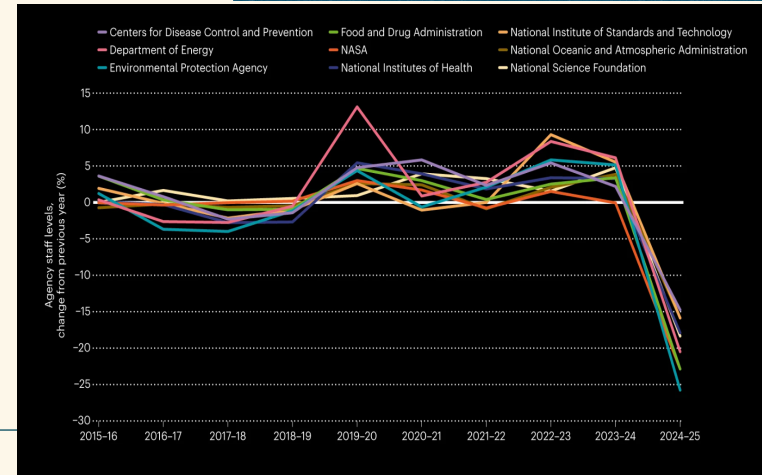
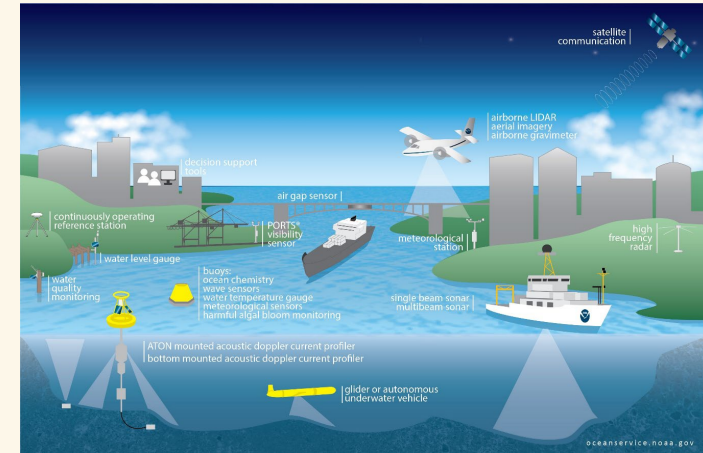
Kotowicz (SPCMSC)

Davis (PLACE / MS State)



The risks to weather and climate data and information

- Observing systems and research cuts
 - Ship and aircraft maintenance– lost days
 - Buoy and in-situ observations reduced (gages)
 - Proposed elimination of science missions and research centers
- Substantial workforce reductions
 - 20% across federal agencies, some even more
 - Skewed to longer-career scientists with eligibility
 - Loss of institutional memory and years of experience
- Severe administrative restrictions
 - Grant and contract review processes
 - Hiring caps (1 hire for every 4 vacancies)
- Diminished data quality?
 - Foundational datasets
 - Forecasting systems
 - Unvalidated data products and services



Dataset Statistics DEMO



Dataset Statistics

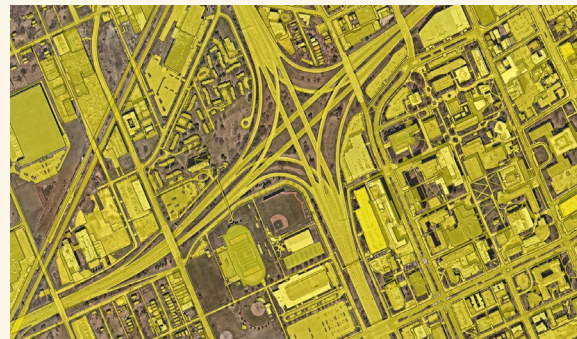




▶ NOAA Hurricane Database	2d ago	
▶ LANDFIRE Full Extent Downloads	2d ago	
▶ NCEI NEXRAD Level-II Data Archive	2d ago	
▶ NHC Tropical Cyclones	2d ago	
▶ NOAA Global Forecast System (GFS)	2d ago	
▶ Integrated Global Radiosonde Archive (IGRA)	2d ago	
▶ NOAA Storm Events	2d ago	
▶ SPC Storm Reports	2d ago	
▶ USGS Earthquake Hazards	2d ago	
▶ NOAA NDBC Buoys	2d ago	
▶ NOAA National Water Model (NWM)	2d ago	

Take-Homes

- The (Re)Insurance industry uses earth observations (remotely-sensed and in situ) for real-time event response
- Long-term, trusted, open-source, reference-quality federal datasets are critical for foundational understanding, validation of vendor obs, and for parametric insurance
 - Landsat is a great example, used for exposure modeling and land use (both for vegetation mapping and mapping the built environment)
- Private companies rely on high-quality datasets for calibration and value-add private innovation.



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Thank you

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