

# National Geodetic Survey Director's Update to the HSRP

Dr. Shachak Pe'eri  
NGS Geosciences Research Division Chief  
September 24, 2024

HSRP Meeting Detroit, MI

HYDROGRAPHIC SERVICES REVIEW PANEL



# Outline

- NSRS Modernization
- Geospatial Modeling: Geopotential and Geometric Modeling
- Foundation CORS Updates
- VDatum Updates (9:30 - 10:00 am Wednesday)
- Coastal Mapping Program Updates
- Geodesy Crisis (9:30 - 10:30 am Thursday)
- New Strategic Plan Underway
- Engagement plan



# Reference systems simplified

## 3D (Geometric) Datum

WGS-84  
ITRF-xx  
SIO/MIT 92  
NEOS 90  
PNEOS 90

ITRF

## Orthometric Datum

NAVD-88

NAPGD

### Geoid models

GEOID99  
GEOID03  
GEOID09  
GEOID12B  
**GEOID22**

## Tidal Datum

LMSL

Tide models

MHHW  
MHW  
MTL  
DTL  
MLW  
MLLW



# Geospatial Infrastructure - What does that mean?

## Transportation question

**Geometric**

**ITRF-xx**

**WGS-84**

**TOPEX**

**Geopotential**

**Tidal**

**G730**

**G873**

**G1150**

**G1674**

**G1762**

**G2139**





# Geospatial Infrastructure - What does that mean?

Transportation question

Geometric

Geopotential

Tidal

EGM

xGEOID

GEOID

xGEOID14

xGEOID15

xGEOID16

xGEOID17

xGEOID18

xGEOID19

xGEOID20



# The Circle of Life

## A new geoid is born

### Why Modernize?

- **Current Datums were defined *before* GPS technology** and rely on old tech & physical survey marks in the ground

### Modernization will:

- Improve **accuracy, access, and alignment** of our positioning systems
- Provide ~\$8.7 B in benefits to the nation over 10 years, more for early adopters
- Enable better alignment of NOAA data to support a Climate Ready Nation
- Provide more Equitable Access across  $\frac{1}{4}$  of the Earth



Image modified from Disney's Lion King

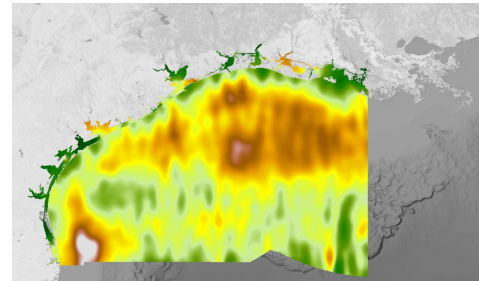


# NSRS Modernization Timeline

## Mid - Late 2024:

- ITRF2020 CORS Coordinate Functions (forecast and hindcast locations)
- VDatum release for West Gulf coast by 6/2024
- Contract work begins on Foundation CORS (with BIL funds)
- GRAV-D reflights for Gulf Coast and other specific lines

Topography of the Sea Surface (m)



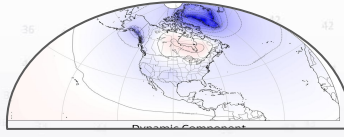
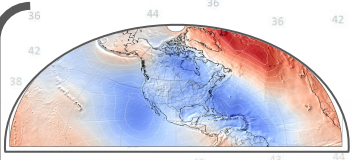
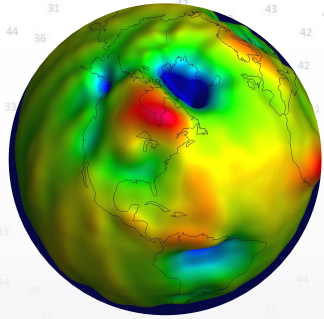
**Mid 2024 - Mid 2025:** One year **roll-out of beta products**, “domino style,” on beta website

**Mid 2025:** **Official testing** of modernized NSRS continues for at least 6 months

**Early 2026:** **FGCS vote** to make the modernized NSRS the official NSRS



# Geospatial modeling: Geoid2022 release



Geoid  
Undulation  
(Static)

Dynamic  
component

Vertical reference  
system

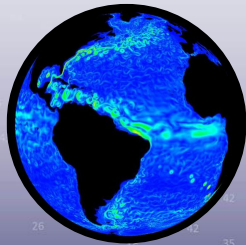
⋮

Height  
relationships

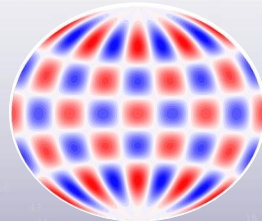
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Tidal datums

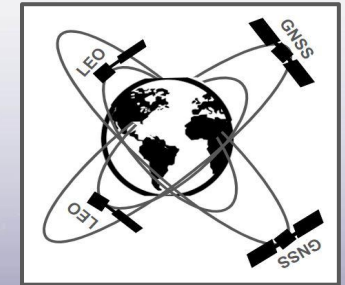
Hydrodynamic  
models



Spherical  
Harmonics



Orbit  
Determination



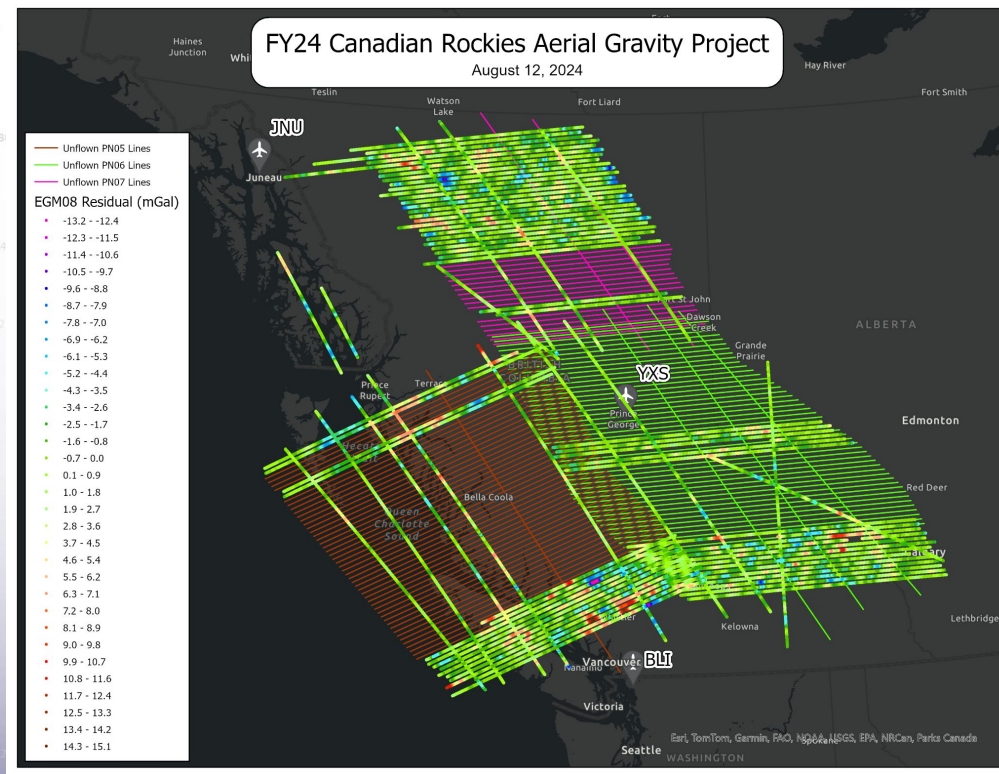
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# GRAV-D FO (Follow On)

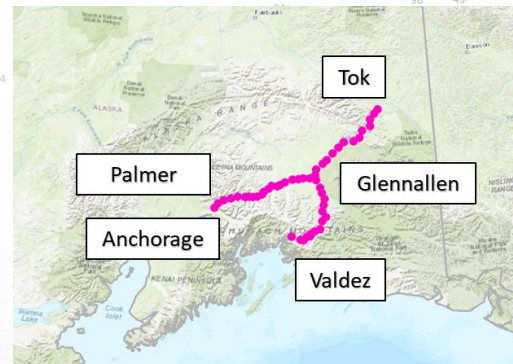
## GRAV-D FO (Follow On)

- Funded by an Interagency Agreement with NGA
- Current priority is airborne gravity data collection over the Canadian Rockies, primarily over British Columbia.
- Data will benefit NGA and NGS gravity and geopotential models.
- Next priority is Yukon and Northwest Territories.
- Looking a few years into the future it is likely that we'll collect data over Mexico as well.

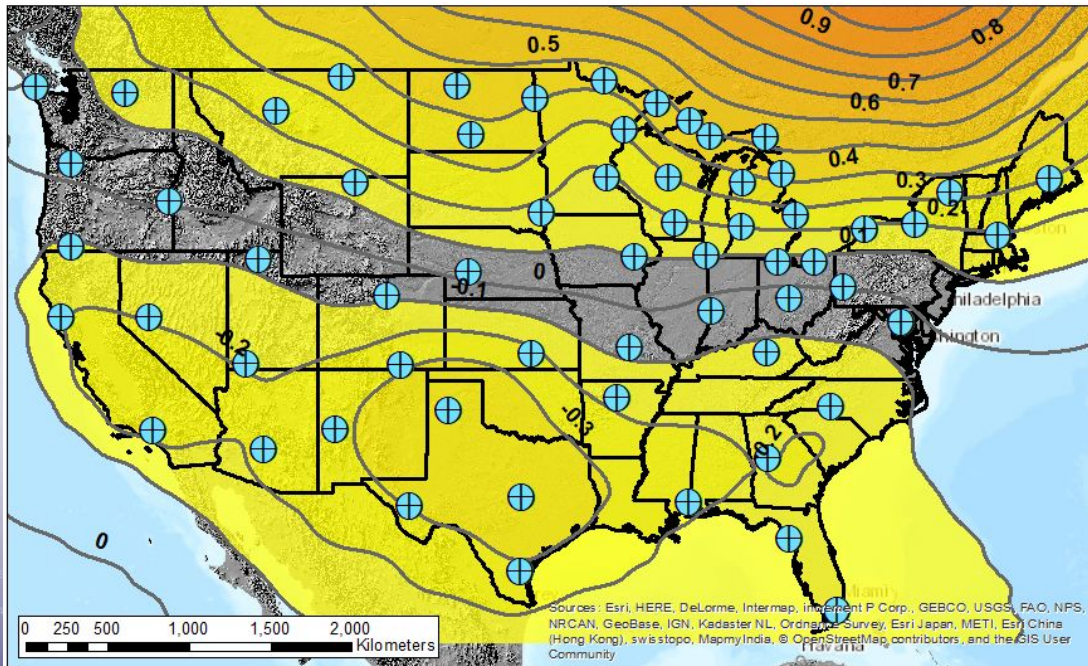


# Geoid Monitoring Service (GeMS)

Supports the DGEOD2022 product: How are geoid heights, gravity, orthometric heights, potential, and DoV changing over time? ([NOAA Technical Report 69](#))



Alaska GeMS Validation Survey



Proposed, preliminary absolute gravity network with geoid rates from GRACE in mm/yr (contour interval = 0.1 mm/yr)



Absolute gravity observation on passive mark.



Continuous relative gravity observations.



# Foundation CORs Update



## Work Completed in FY2024

### New FCORS Recons & Designs

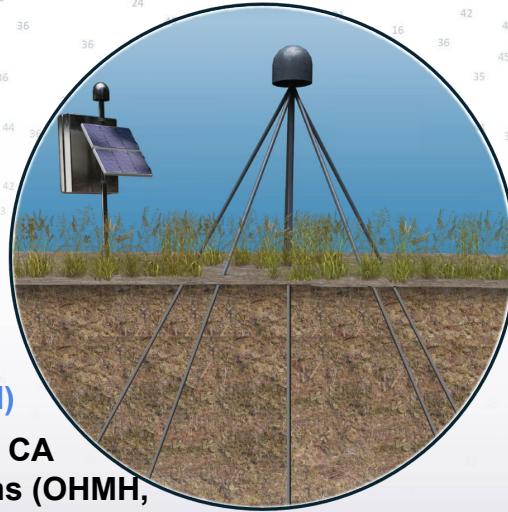
- Fort Davis, TX
- Pie Town, NM
- Horn Point, MD
- Woodford, VA
- Fan Mountain, VA
- Corbin, VA
- Virginia Key / Miami, FL
- Utqiagvik/Barrow, AK
- Billings, OK
- Cold Bay, AK
- Fairbanks, AK

### Existing Stations Operations and Maintenance (O&M)

- VIKH - Saint Croix, USVI
- CHIN - Key West, FL
- FLF1 - Miami, FL
- VAGP - Gloucester Pt, VA
- CACC - Crescent City, CA
- Six Great Lake Stations (OHMH, OHCD, BFNY, OSPA, CALU)

### New Standards Developed

- Various braced monument designs (shallow and deep)
- Electrical, lightning protection and grounding designs
- Reconnaissance and O&M
- Receiver configuration



## Planned Work for FY2025

### New FCORS Installations

- Fort Davis, TX
- Pie Town, NM
- Horn Point, MD
- Woodford, VA
- Fan Mountain, VA
- Virginia Key / Miami, FL
- Utqiagvik/Barrow, AK
- American Samoa

### Existing Station Upgrades

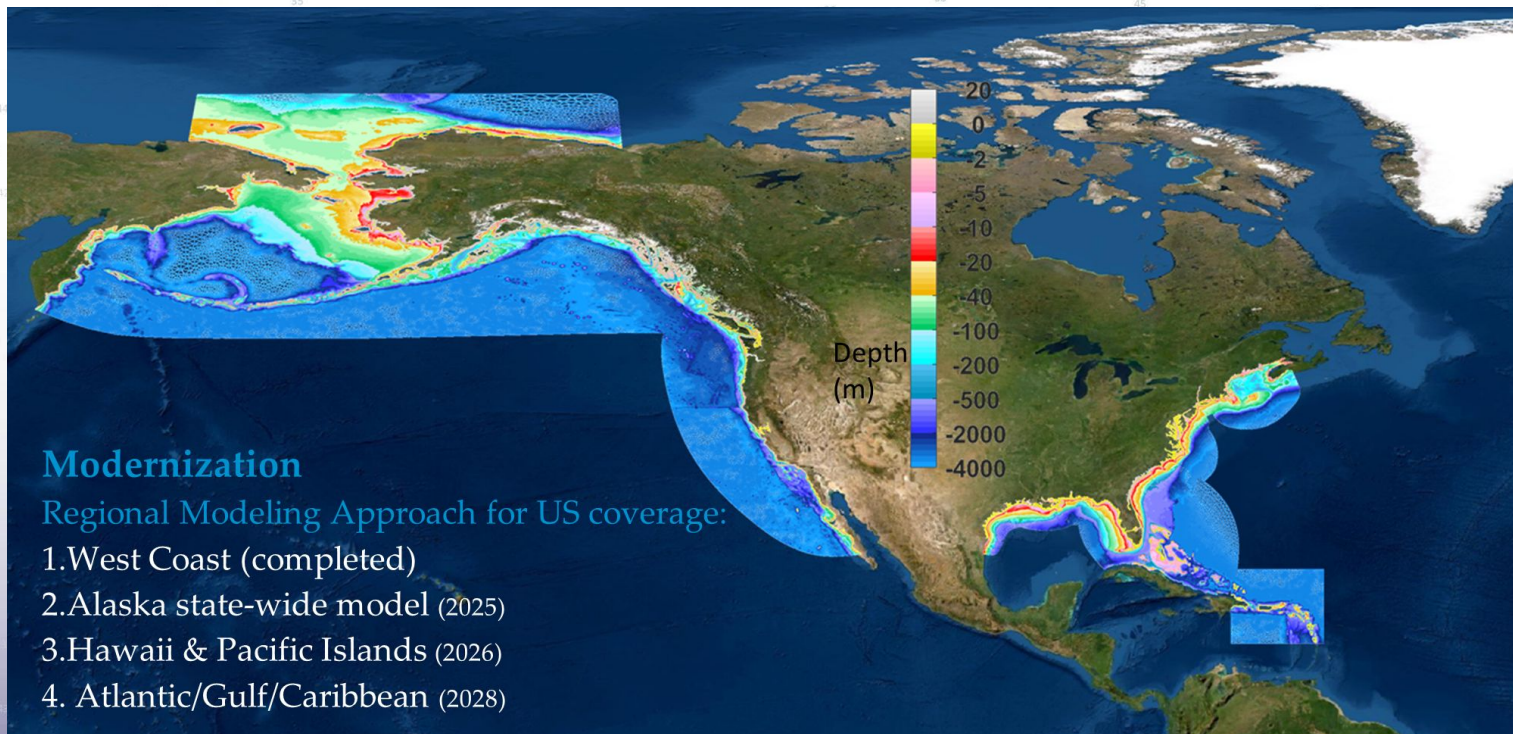
- VIKH - Saint Croix, USVI
- CHIN - Key West, FL
- FLF1 - Miami, FL

### Existing Station O&M

- Goal - perform twelve (locations: TBD)



# VDatum Models: Coverage, Projects, Plans



## Modernization

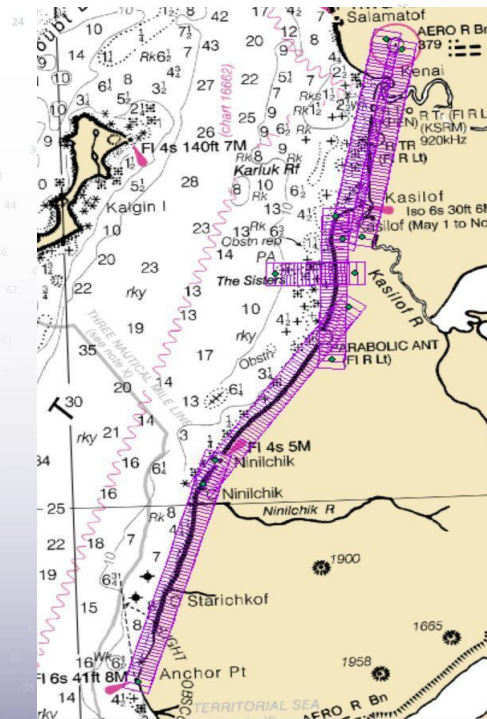
Regional Modeling Approach for US coverage:

1. West Coast (completed)
2. Alaska state-wide model (2025)
3. Hawaii & Pacific Islands (2026)
4. Atlantic/Gulf/Caribbean (2028)



# Coastal Mapping Program Highlights

- On track to deliver 7.0% of the national shoreline, updated shoreline for 57 ports, and 2000 square miles of topobathy lidar
- Continuing to collect inland bathymetry to support NWS/NWC with BIL funds (inland riverine projects).
- Ongoing contract efforts in AK supporting impacts from Typhoon Merbok
- NOAA King Air collected ~841 shoreline miles at 1:80k
- Completed 6 Projects in 2024 including two partner requested Coastal Mapping projects in Alaska! Supporting Hydro request (OCS) Kenai to Anchor Point & Mcbride Inlet

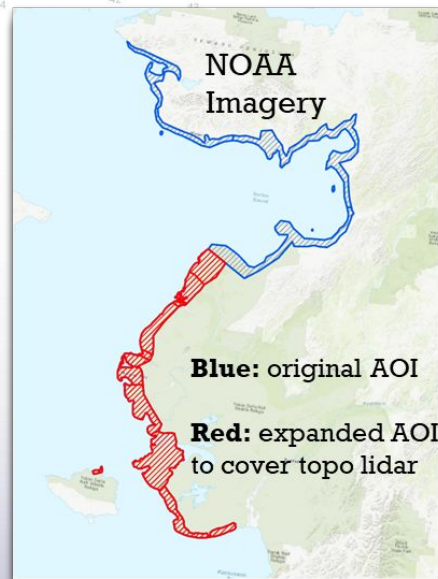


AK2107-CM-N: Kenai to Anchor Point



# Typhoon Merbok

- USGS \$6.39M for topo lidar in Typhoon Merbok Disaster Supplemental
- NOAA/USGS combined requirements for Norton Sound and expanded existing NOAA project
- MOA leveraged NOAA contract for both imagery and topo lidar signed May 4, 2023
- Coastal topography, modeling, shoreline products planned



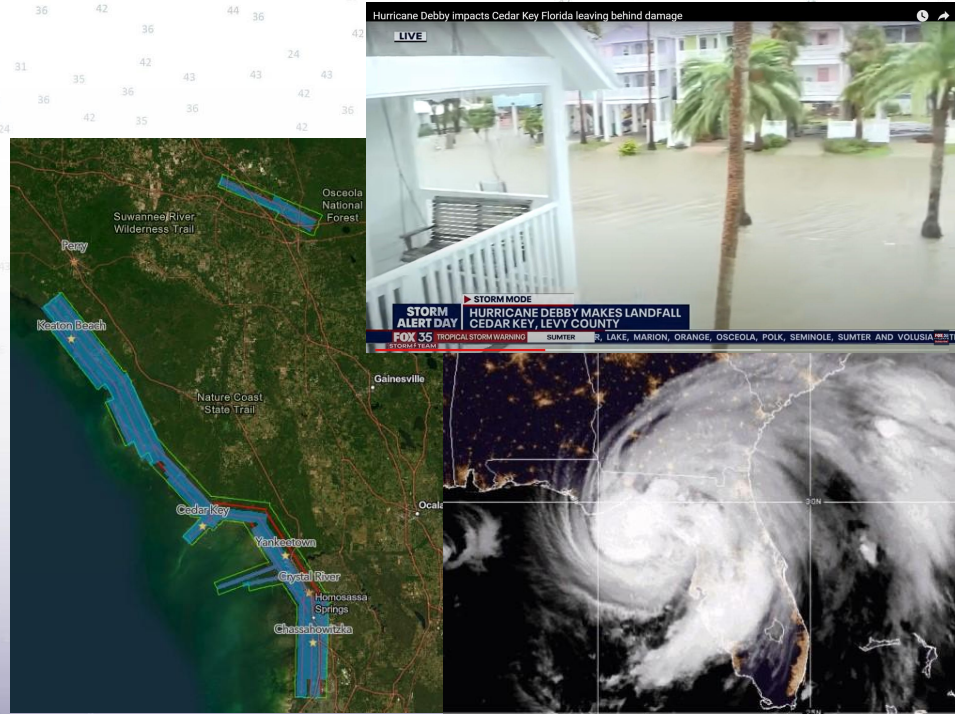
U.S. Mapping Coordination  
A Collaboration Site for Mapping Data Acquisition



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# Emergency Response Imagery

- Early August: Program/Crew were Mission Assigned by FEMA to conduct post damage Emergency Response imagery collection for **Hurricane Debby** in FL big bend region
- Crew flew 3 flights in challenging cloudy conditions
- NOAA imagery was utilized to identify non-surge related flooding/damage assessments that were missed by initial model runs

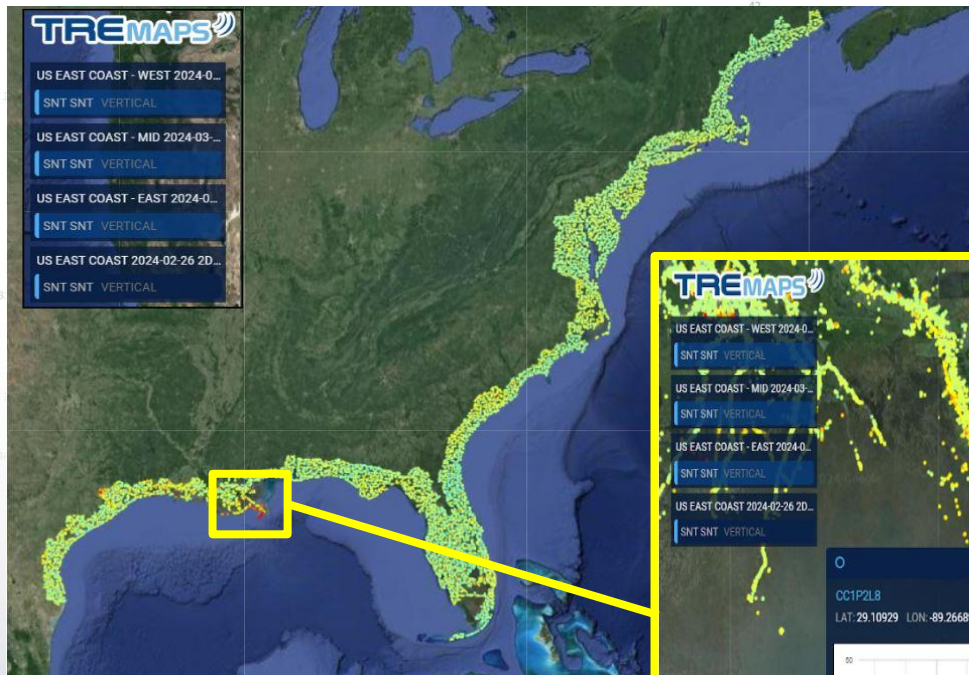


	Images	km <sup>2</sup>	Flight Hours
N65RF King Air	4600	2308	11.1





- US EAST COAST - WEST 2024-0...
- SNT SNT VERTICAL
- US EAST COAST - MID 2024-03...
- SNT SNT VERTICAL
- US EAST COAST - EAST 2024-0...
- SNT SNT VERTICAL
- US EAST COAST 2024-02-26 2D...
- SNT SNT VERTICAL



# Vertical Land Motion and possible impacts to tidal observations

TREMAPS

US EAST COAST - WEST 2024-0...  
SNT SNT VERTICAL

US EAST COAST - MID 2024-03...  
SNT SNT VERTICAL

US EAST COAST - EAST 2024-0...  
SNT SNT VERTICAL

US EAST COAST 2024-02-26 2D...  
SNT SNT VERTICAL

Search

US EAST COAST 2024-02-26

Details Downloads Links

Deliverable code: USST241344BL02  
Delivery code: USST241344  
Sat [band]: Sentinel [C]  
Sentinel [C]  
Category: VERTICAL  
Start time: 2017-03-01  
End time: 2023-05-11

CC1P2L8  
LAT: 29.10929 LON: -89.26689 ACC [mm/yr]: -2 VEL\_V [mm/yr]: -19.8 V\_STDEV\_V: 0 VEL\_AVG [mm/yr]: -19.8

unit: mm

Regression Detrend Multiple TS Averaging

CHART DATA

Google

Keyboard shortcuts Imagery ©2024 TerraMetrics 10 km

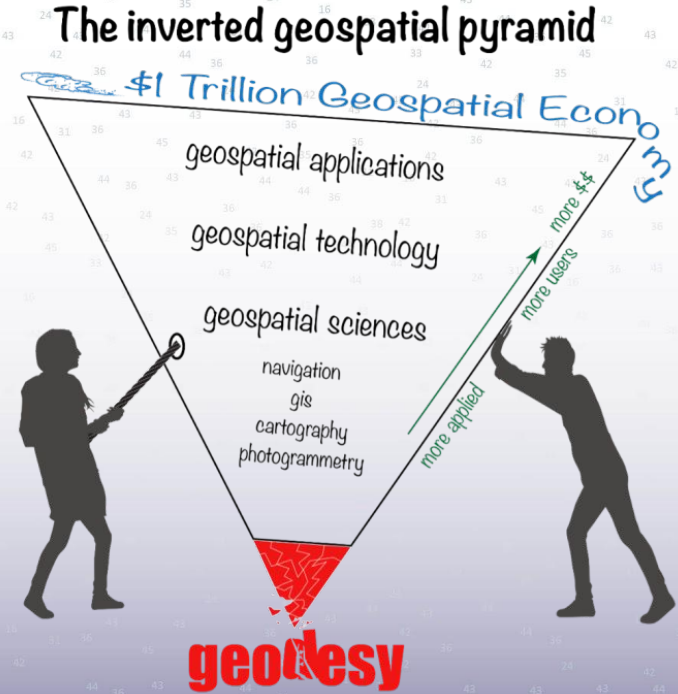
## InSAR Permanent Scatterers





# Addressing the Geodesy Crisis

- Geospatial Modeling Grants
- Geodesy Community of Practice
- Undergraduate Internship Program Pilot



The entire geospatial economy is supported by geodesy!



# Geospatial Modeling Grants

- NGS awarded ~ \$4 million in grant funding in response to the Geospatial Modeling Grant.
- Projects will directly address the nationwide deficiency of geodesists.
- In addition, these projects will develop tools and models to advance the modernization of the National Spatial Reference System (NSRS)
- PI's from Scripps and Oregon State at HSRP session on March 7th

UC San Diego



SCRIPPS INSTITUTION OF  
OCEANOGRAPHY



MICHIGAN STATE  
UNIVERSITY



Oregon State  
University



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# Geodesy Community of Practice Update

## Technical Working Group Synergistic Topics

### Participants:

- National Geospatial-Intelligence Agency (NGA), Office of Geomatics
- NOAA, National Geodetic Survey (NGS)
- National Aeronautics and Space Administration (NASA)
- Department of Interior, United States Geological Survey (USGS)

### Meetings planned:


- **April, 2024:** CoP Spring Working Group Leads meeting at **NASA HQ in DC**
- **October, 2024:** CoP Fall Summit, in **Boulder, CO**

Data Sharing
Equipment Sharing
Software Sharing
Production Collaboration
Modeling Collaboration
Capabilities Enhancements (Developing Software, Developing Hardware, Enhancing Processes)
Data Standards Development & Cooperation
Certification Program(s)
Professional Training/Cross Training/Detail Assignments
Cooperative Agency Research Opportunities
Opportunities to Link and Leverage National and International Geodesy Forums



# Undergraduate Internship Program Pilot

- Hired 3 Pathways interns from the Chesapeake, VA area
- Coordinated effort between NGS, CO-OPS, and OCS
- Program will hire additional interns each year, and possibly branch out to other locations in the future
- Current students are pursuing degrees in Geographic Information Systems (GIS) and will be exposed to field and office work across all programs.

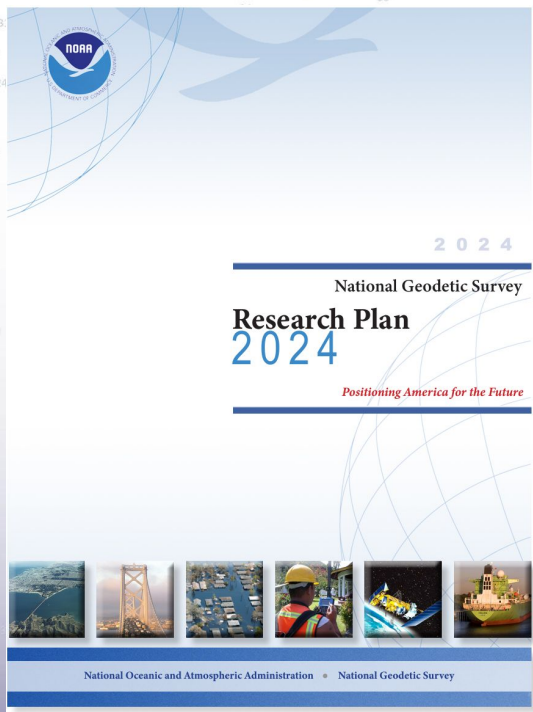


The screenshot shows the NOAA National Geodetic Survey website. The header includes the NOAA logo and the text "National Geodetic Survey" with the tagline "Positioning America for the Future". A navigation menu contains links for "NGS Home", "About NGS", "Data & Imagery", "Tools", "Surveys", "Science & Education", and a search bar. The main content area is titled "National Geodetic Survey: Student Opportunities" and includes sections for "Education Opportunities", "Student Opportunities", "Grant Opportunities", and "Contact Us". The "Student Opportunities" section states that program application deadlines will be posted here. The "Grant Opportunities" section highlights "The Pathways Program". The "Contact Us" section includes an "Overview" paragraph describing the program's purpose and a photograph of a person using a surveying instrument in a field. The "Program Details" section explains that students selected for the Pathways Program will perform on-the-job training assignments as student trainees.





# New Research and Strategic Plans



NGS recently released a new Research Plan and is currently working on an updated Strategic Plan.



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# Communicating research results

Beta release of NSRS Modernization data and a limited set of tools by **2025**, for at least 6 months of beta testing, FGCS approval and adoption in **2026**

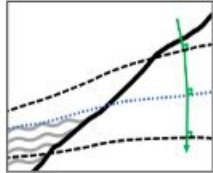



## Recent Announcements:

NGS Research Plan and the **NGS Research pages** are publicly available: [geodesy.noaa.gov/RESEARCH/](https://geodesy.noaa.gov/RESEARCH/)



Many of the NOAA's National Geodetic Survey's (NGS) operations start with [research](#). NOAA's NGS research requires a multidisciplinary approach, centered around geodesy using satellite observations, rooted in open science and open source methods, and driven by stakeholder needs.

Such applied research requires investigation into the needs for both the short and long-term planning horizons to communicate NGS' research and investment to governmental partner agencies, academic collaborators, and commercial industry.

<p><b>Geopotential Datums</b></p>  <p>The vertical reference for land and marine applications &amp; coastal zone management.</p>	<p><b>GNSS Technology Research</b></p>  <p>Advancing GNSS technology research to support the national PNT resiliency.</p>
<p><b>Climate-scale Geodesy</b></p>  <p>Monitoring the Earth systems using geodetic technologies.</p>	<p><b>Research collaborations</b></p>  <p>Collaboration and engagement with federal, industrial and academic partners.</p>

For additional information about our mission, staff and research projects, visit the [About Us page](#). [Publications page](#) has detailed information on peer review publications, trade journals, technical memos/reports, conference papers and presentations.



# Engagement Events (FY25 Q1-Q2)

NGS has several upcoming events for sharing information to stakeholders about NSRS Modernization:

- American Geophysical Union (**Washington, DC - December 6**)
- National Academies' Transportation Research Board (**Washington, DC January 2025**)
- Coastal GeoTools (**Wilmington, NC January 2025**)
- ESRI FedUC (**Washington, DC February 2025**)
- GeoWeek (**Denver, February 2025**)

