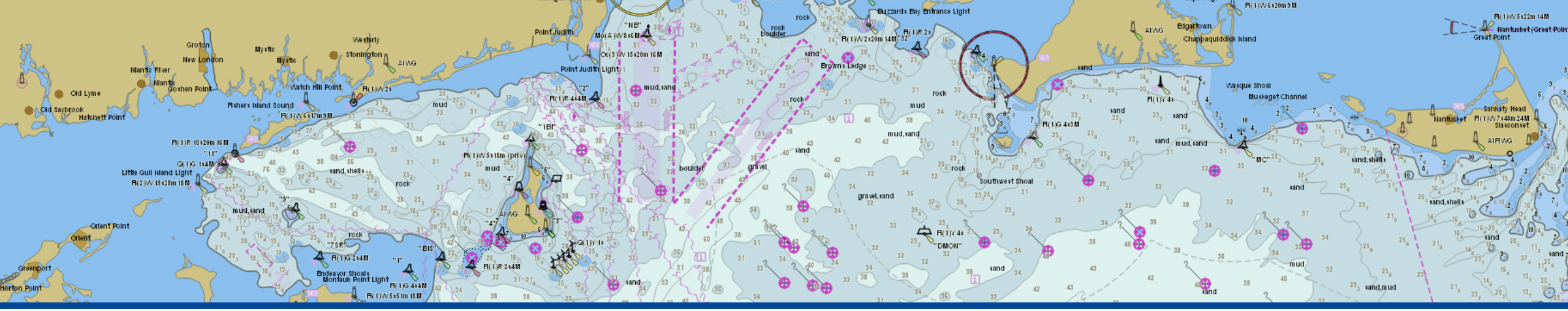


Datum Transformations

Ellipsoidal Survey to Tidal Referenced Products

LCDR Damian Manda, NOAA

24 Feb 2020

Why Datum Transformations?

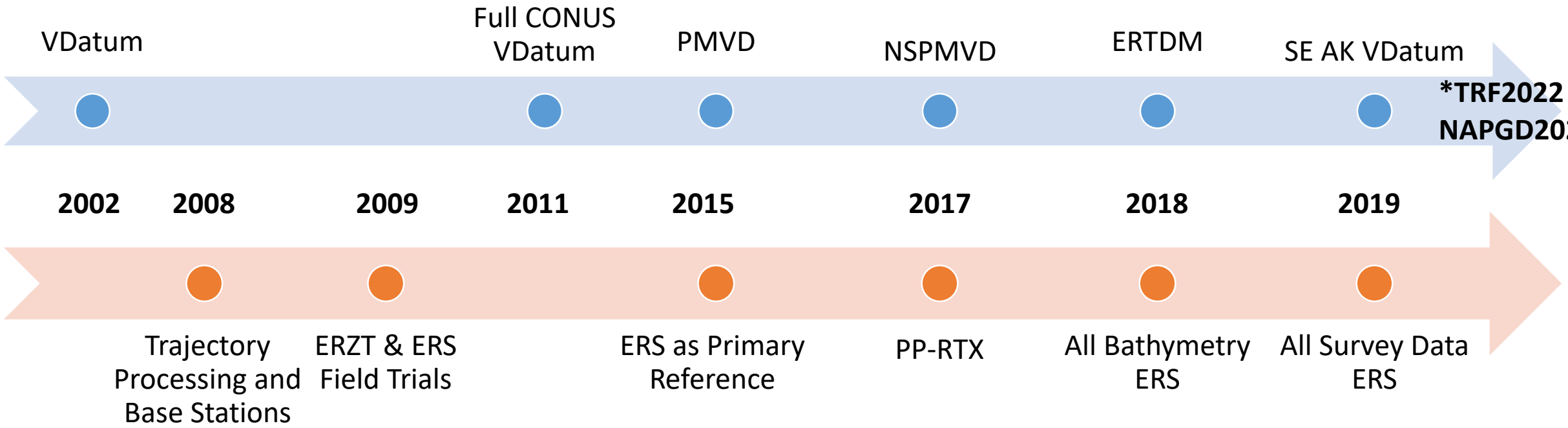
- Permits ellipsoidally referenced survey
  - Direct reference from ship to seafloor in universal frame
  - No need for reliance on tidal infrastructure during acquisition
  - **But…Chart Datum is tidal**
- Required for continuous coverage from ocean to land

Sticking points

- Datums defined by benchmarks
- Coverage of transformation models & measurements
- Uncertainty of transforms
- Accurate vertical GNSS based referencing for acquisition

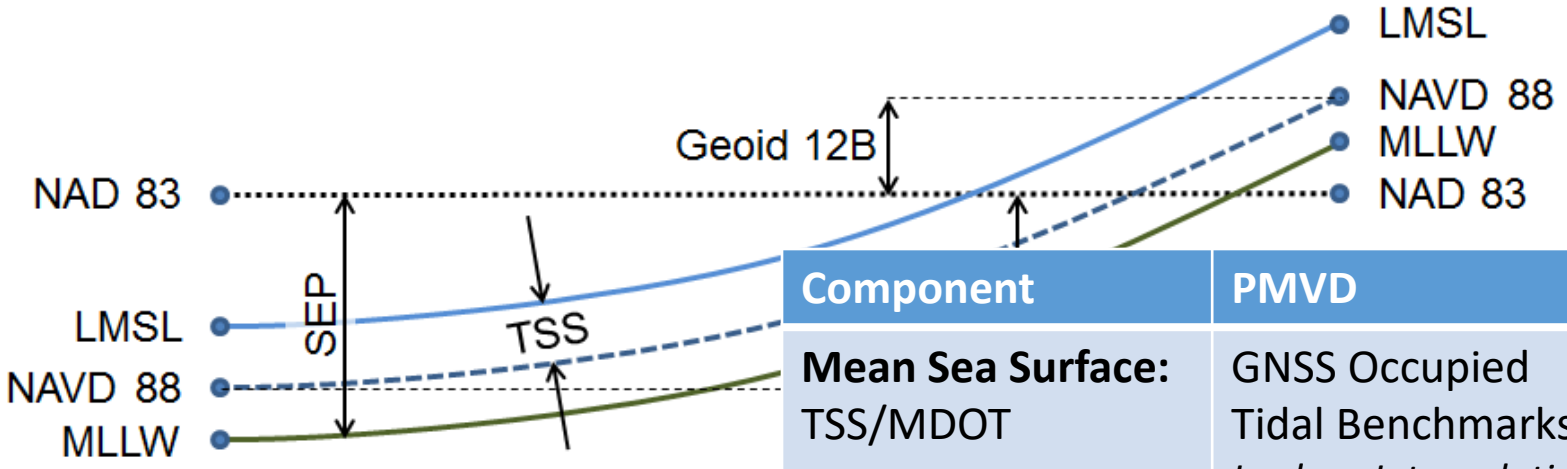
NOAA Ellipsoidal Referencing Development

Datum Transformation Development



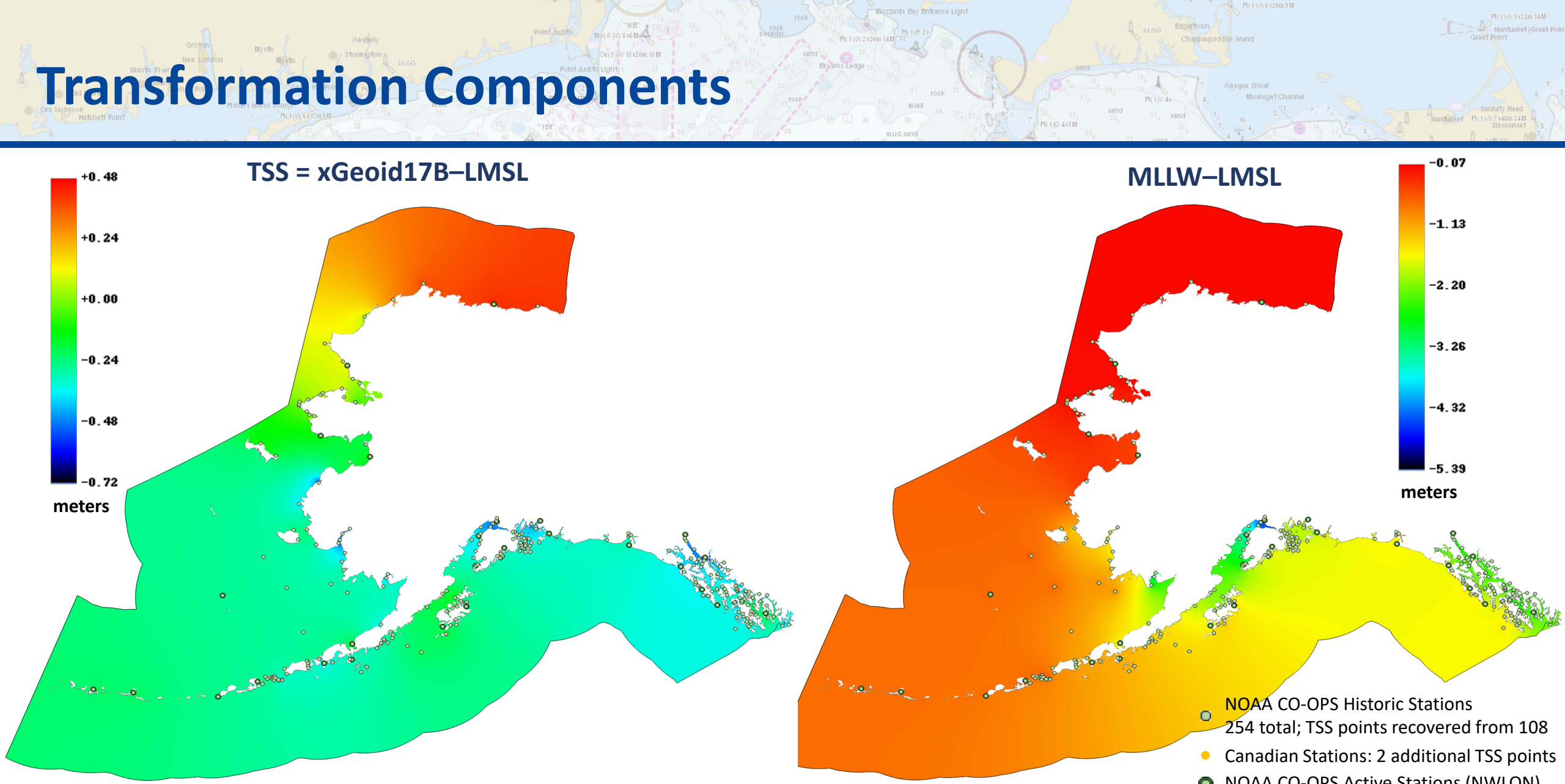
Field Methodology

Datum Model Methodology

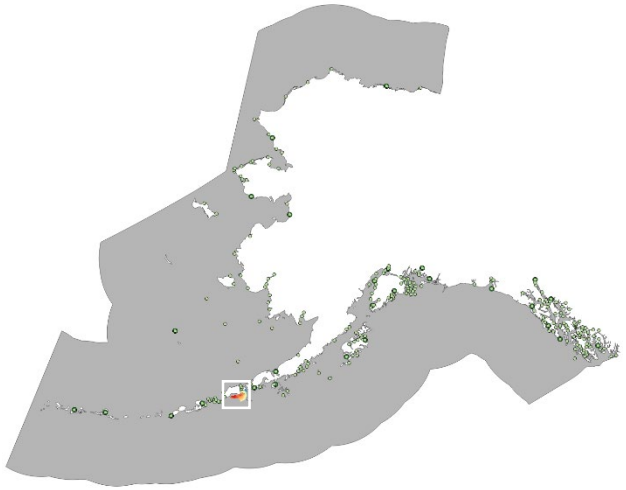


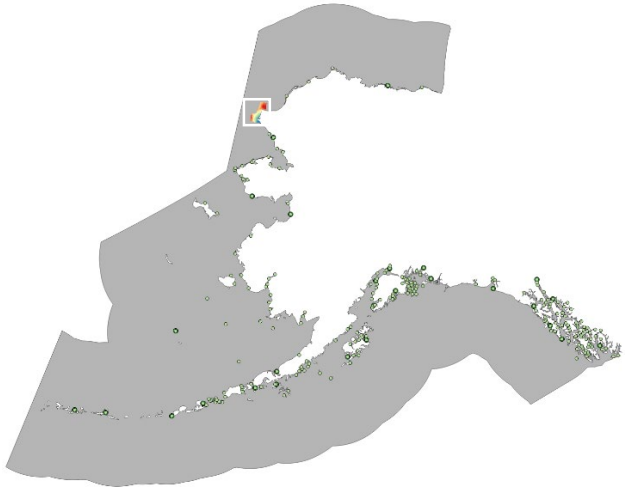
Component	PMVD	ERTDM	VDatum
Mean Sea Surface: TSS/MDOT	GNSS Occupied Tidal Benchmarks – *Laplace Interpolation*	**Inshore:** Tidal Benchmark Elevations **Offshore:** Satellite Altimetry AVISO+	Benchmark Elevation Residuals re Model – *Minimum Curvature Interpolation*
Tidal: LMSL-MLLW	TCARI From Discrete Stations	**Inshore:** TCARI **Offshore:** Satellite Altimetry based Tidal Constituents	FE Tidal Model
Ellipse to Orthometric	Geoid12B	xGeoid19	GEOIDyy

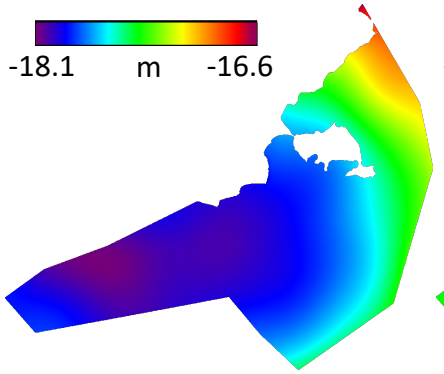
Transformation Components



Detailed Comparison

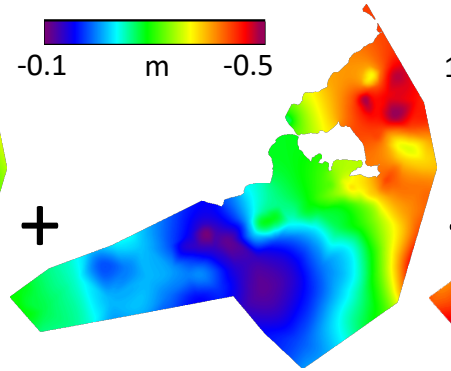






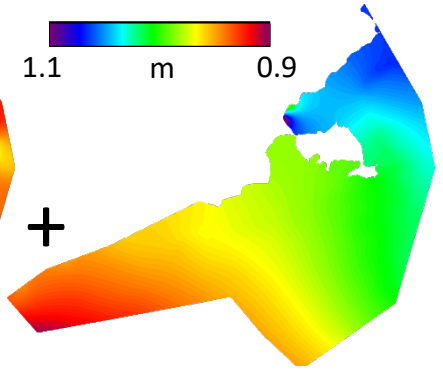
NAD83 – xGeoid17B
(geoid)

+

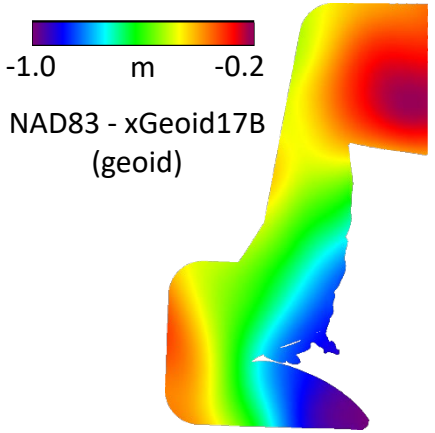


xGeoid17B – LMSL
(hybrid inshore-interpolated ties
& offshore-Aviso+ global MSS)

+

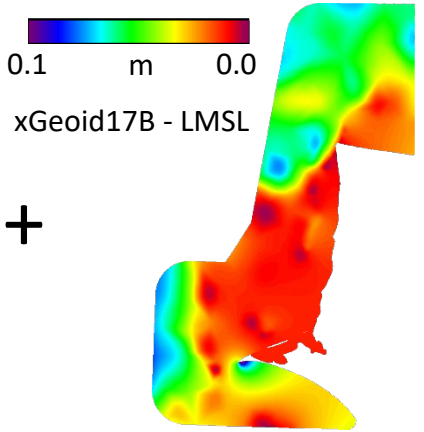


LMSL – MLLW
(hybrid inshore-interpolated ties
& offshore-FES2014 global tides)



NAD83 - xGeoid17B
(geoid)

+



xGeoid17B - LMSL

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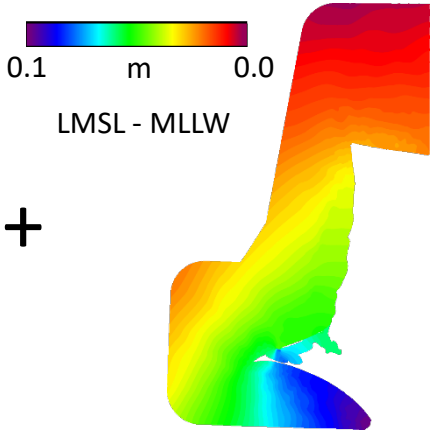
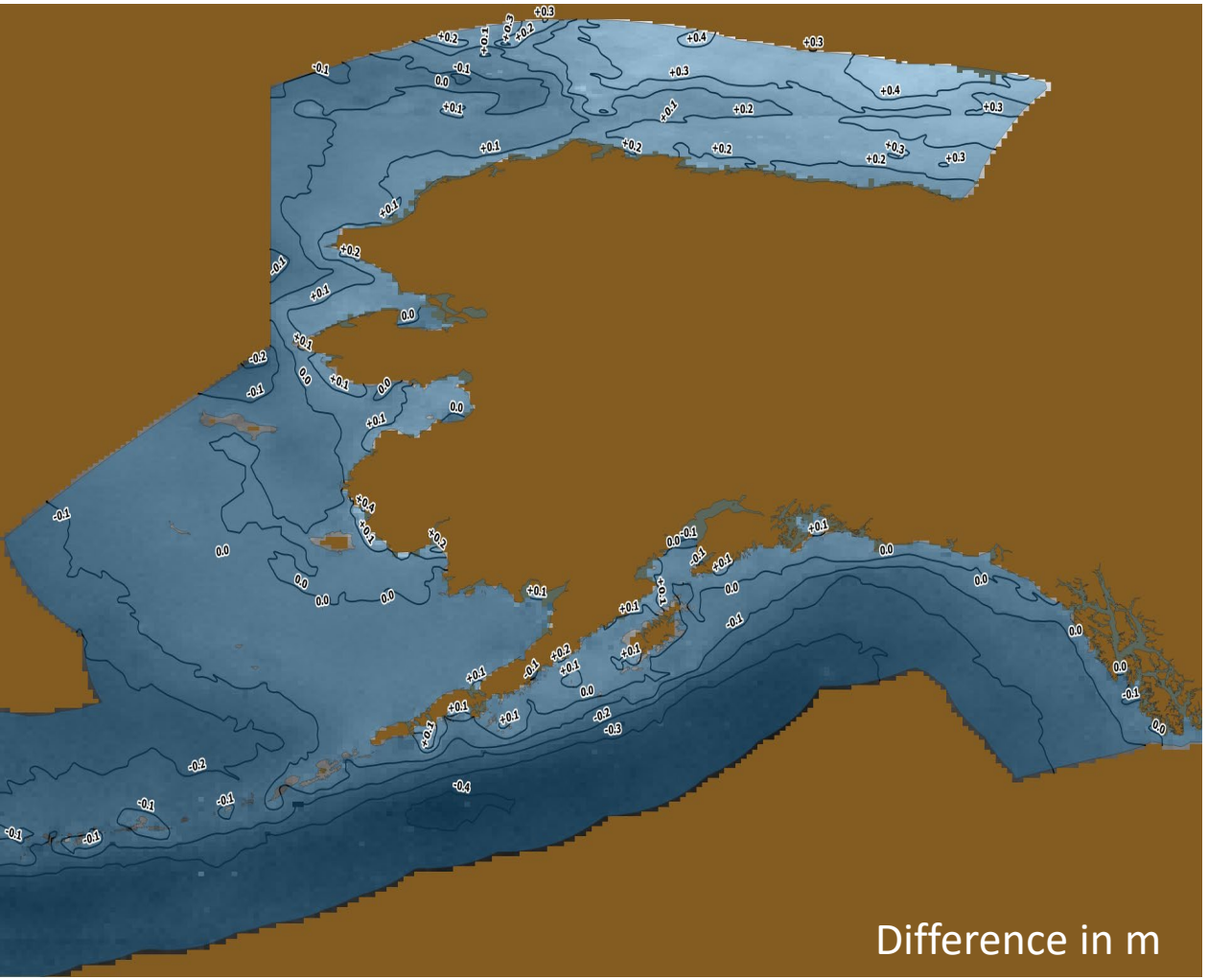
+

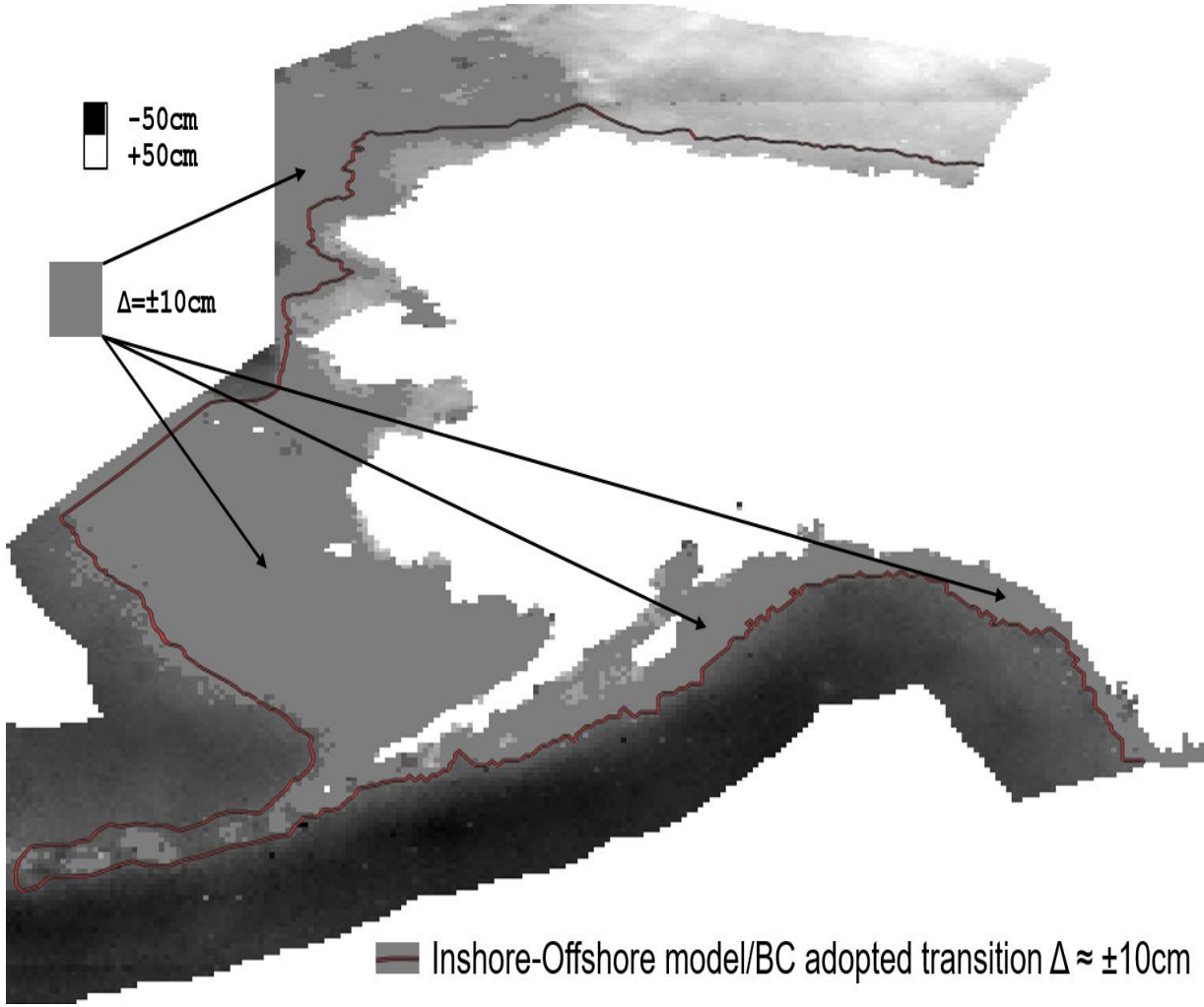


LMSL - MLLW

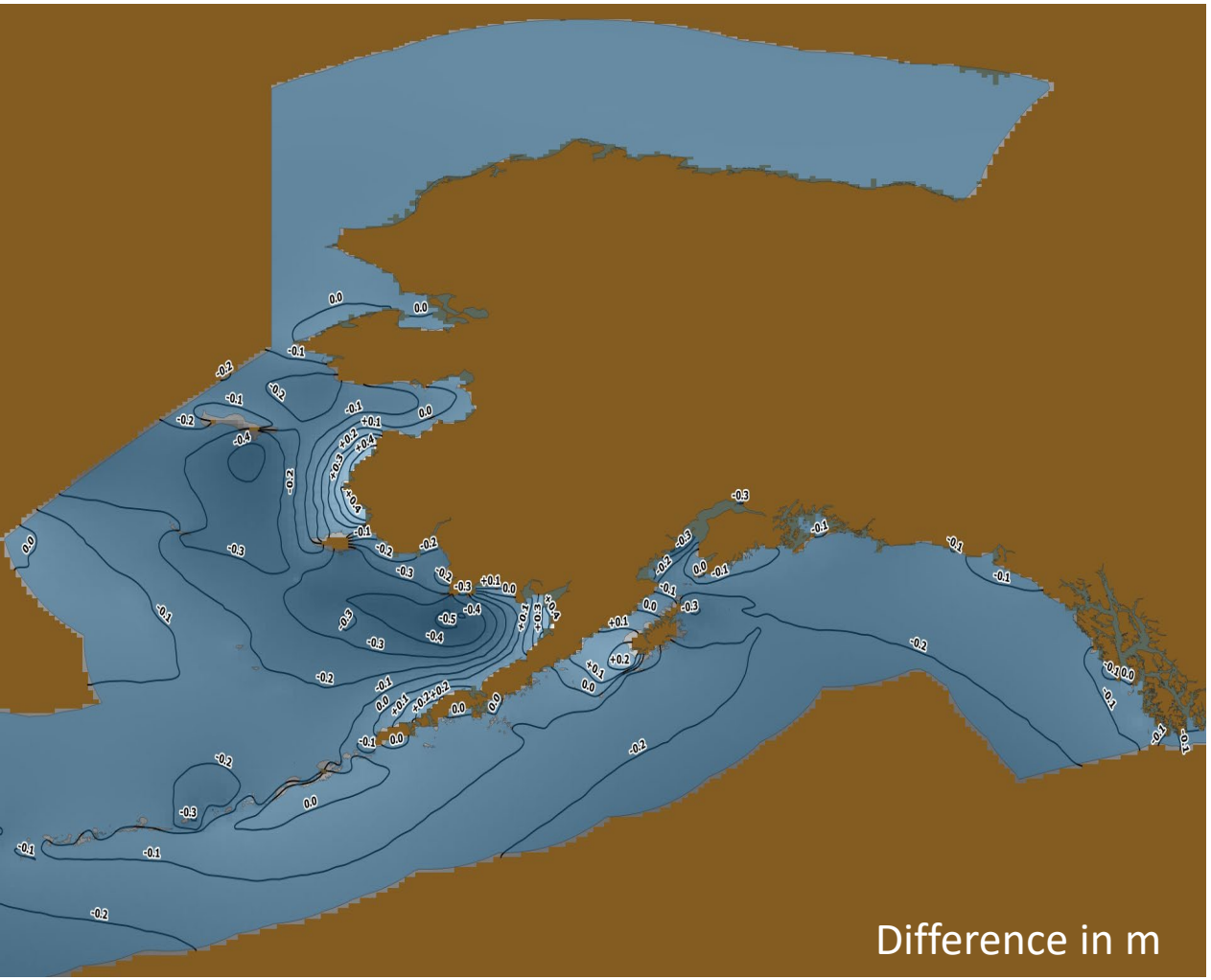
(hybrid inshore-interpolated ties
& offshore-FES2014 global tides)

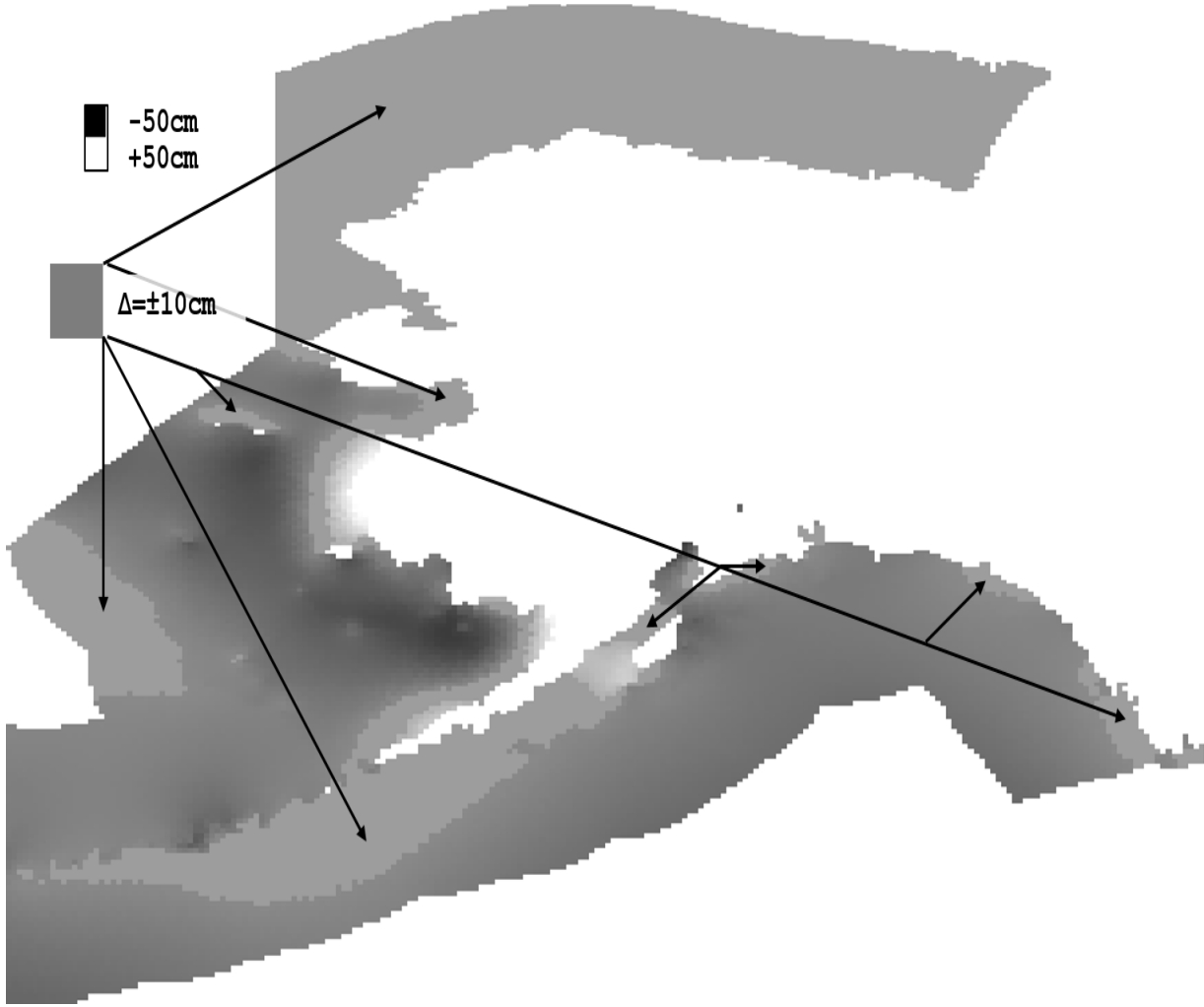
Inshore – Offshore Difference TSS



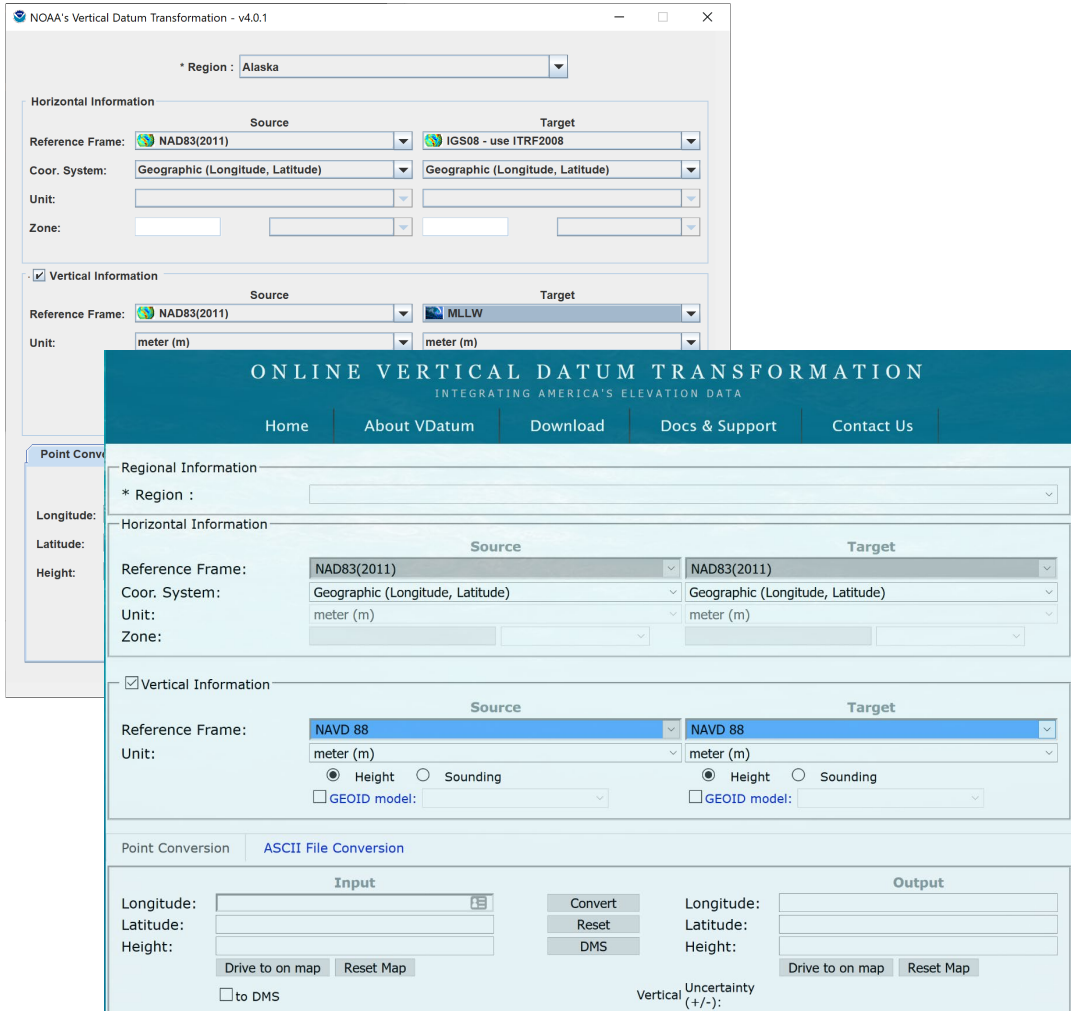


Inshore – Offshore Difference Tidal

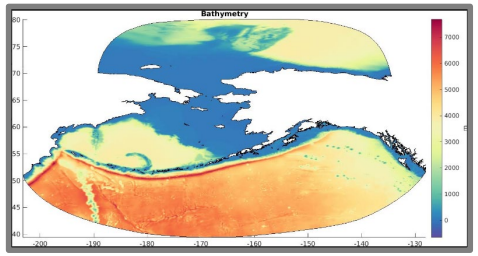


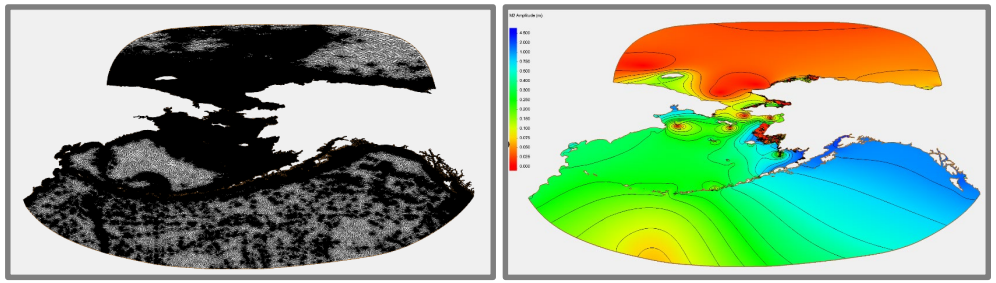


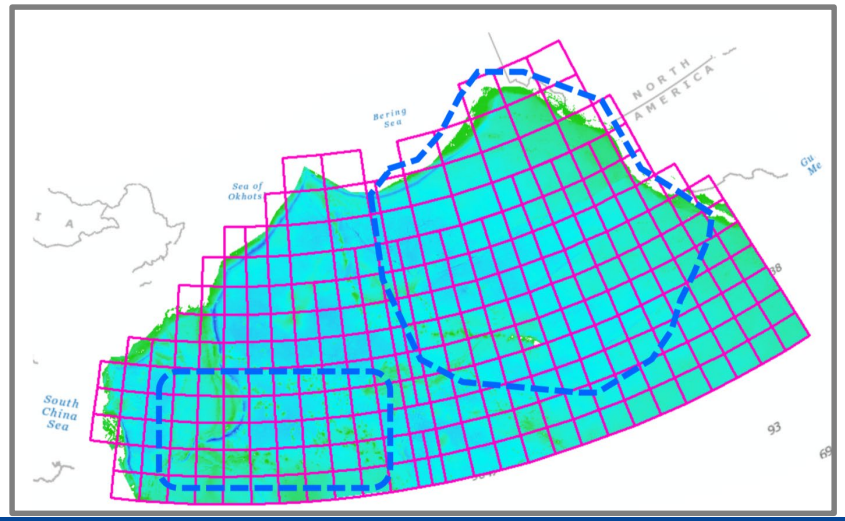
VDatum Coverage 2020



VDatum Development







Upcoming Developments:

West Coast Update - FY2021 Q4

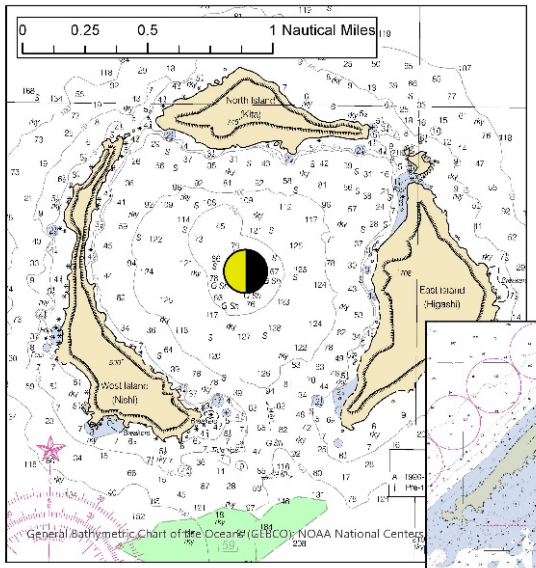
Pacific Basin R&D – FY2021

Exploratory Full Alaska Model

Expansion of spatially varying uncertainty

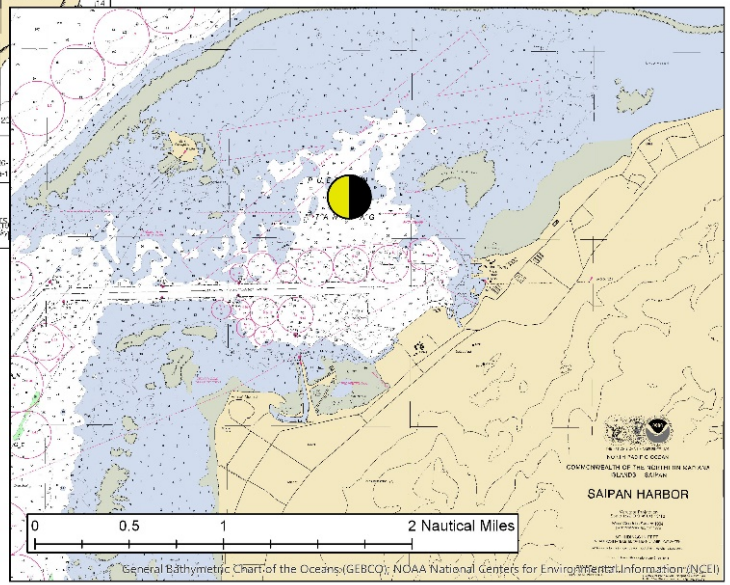
Continued updates to VDatum software and web interface

Tide Buoy

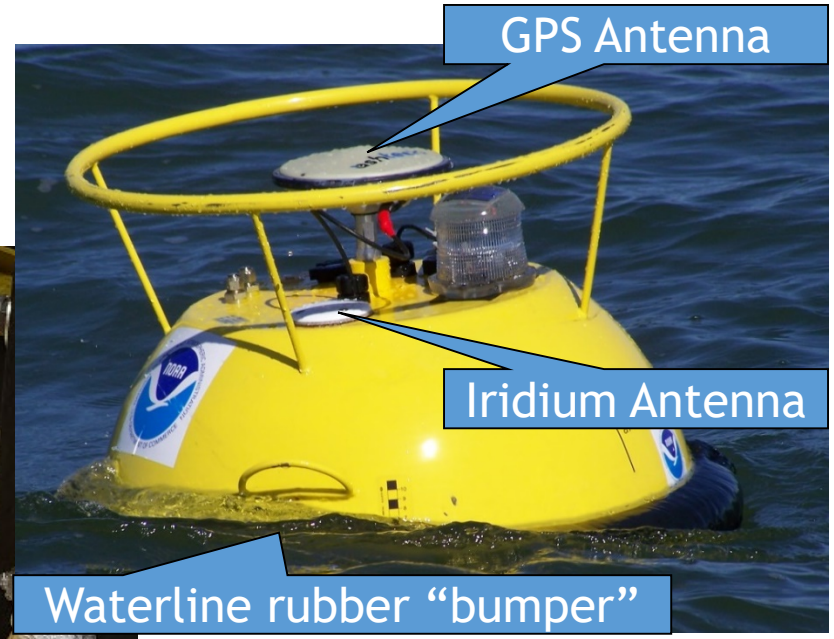


OPR-T381-RA-20
Mariana Islands Hydrographic Survey Water Level Data
Proposed Locations for >30 Day Tide Buoy Deployments

Maug Islands Near 145.221E, 20.022N, ~20 - 60m Water Depth
Saipan Harbor Near 145.726E, 15.237N, ~7m Water Depth



~0.6 meter diameter tide buoy



2020 Planned Deployments – Mariana Islands

Future of Datums & ERS

- NGS 2022 Datums – [NA|CA|PA|MA]TRF2022, NAPGD2022
  - Changing definition of TSS
- Streamlined access to benchmark databases
  - Ellipsoid ties to benchmarks directly available
- Full US Tide Zoning web map, TCARI tools
- Additional tide buoys