ICAN
International Coastal Atlas Network

Interoperability Discussion

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Outline

- Discussion on advancing metadata and data interoperability
  - documentation of interoperability standards and conventions
- Update on high-resolution shoreline project
- OGC interop experiments?

Motivation

- Interoperability best advanced by specific projects
- Helpful to have simple model to communicate an design-to
- There is a world-wide need for more highly-resolved shorelines to connect geophysical scales to engineering scales
- Existing shoreline data products do not satisfy current needs for sea-level rise impact assessment

Global Sub-meter Shoreline Project

A Collaboration of the European Union Environment Agency, International Coastal Atlas Network, United States National Oceanographic and Atmospheric Administration

Draft Proposal Working Paper

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Contents

CHAPTER 1:GEODETIC CONTROL

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Theme Description:[7]

A geodetic control network is the wire-frame or the skeleton on which continuous and consistent mapping, Geographic Information Systems (GIS), and surveys are based. To understand the function of geodetic control, we have to realize that a map or a plane survey is a flat representation of the curved world. If we want the maps to become an authentic representation of the real world, we have to be able to "paste" small pieces of (flat) map contents onto a curved world. The Geodetic Control is the mechanism that enables us to perform this "pasting" seamlessly, accurately and consistently.

[7] The source for much of this chapter is the State of New Jersey Spatial Data Infrastructure Implementation: I-Team Strategic Plan, March 2002. (http://njgeodata.state.nj.us/)

Federal Base Network (FBN)
Cooperative Base Network (CBN)

What is needed:

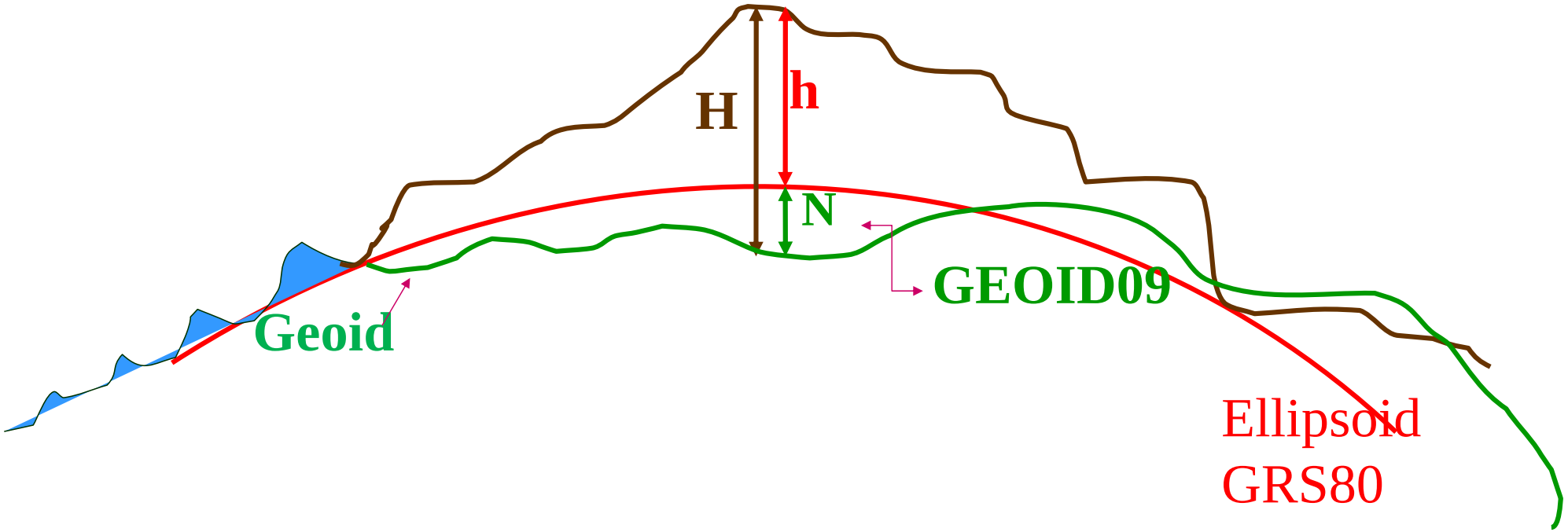
A coordinated effort by the Federal Partners Team, the HI- DOT, Hawai`i Association of Land Surveyors (HALS) and Hawai`i Office of Planning to identify entities that are willing to assist in the establishment of the FBN and CBN (http://www.ngs.noaa.gov/INFO/OnePagers/One-Pager_FBN.pdf) and enhance the vertical component of the NSRS using NGS' Height Modernization program (http://www.ngs.noaa.gov:80/Slides/HTML_Ht_Mod/index.htm).

H = Orthometric Height (NAVD 88)

h = Ellipsoidal Height [NAD 83 (1995) or NAD 83(2007)/NAD 83 (CORS96)]

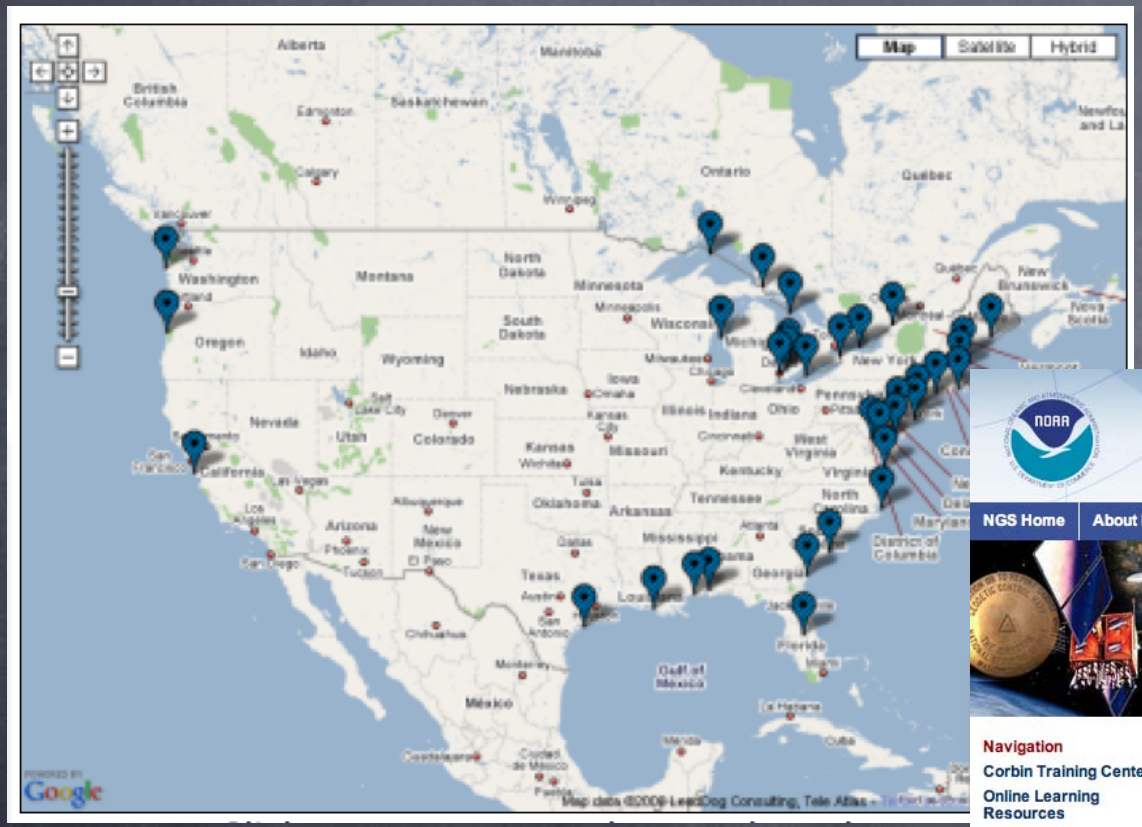
N = Geoid Height (GEOID 09)

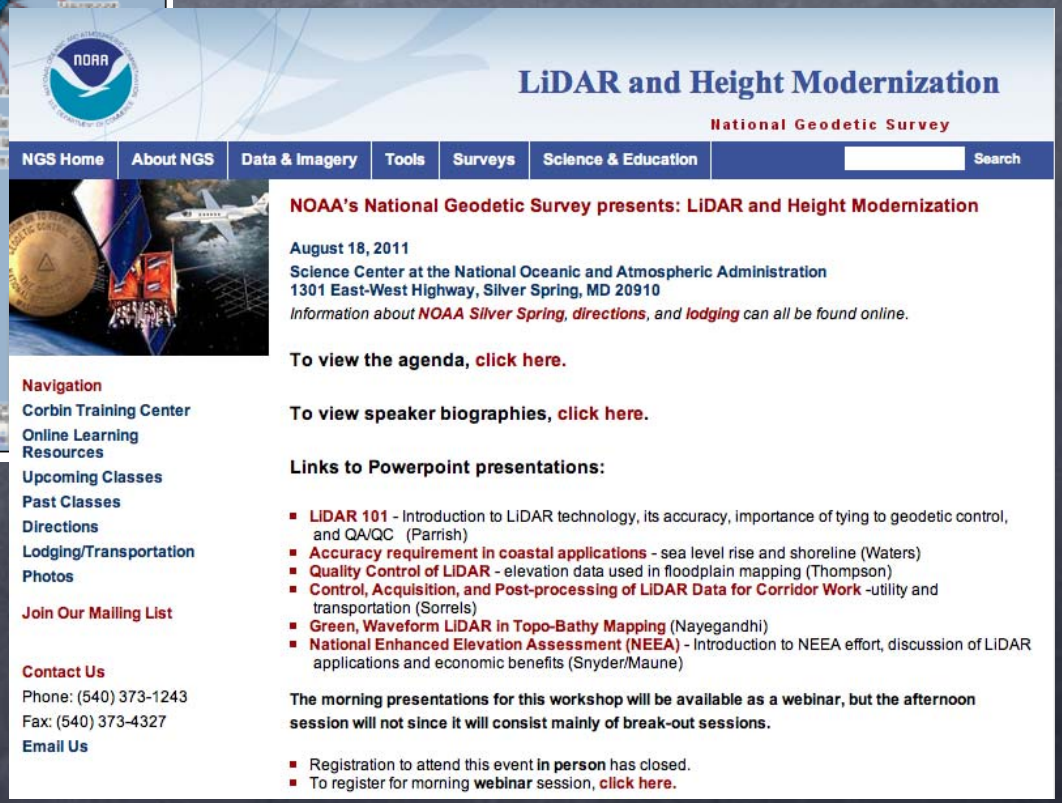
$$H = h - N$$



From D. Doyle/NGS NOAA

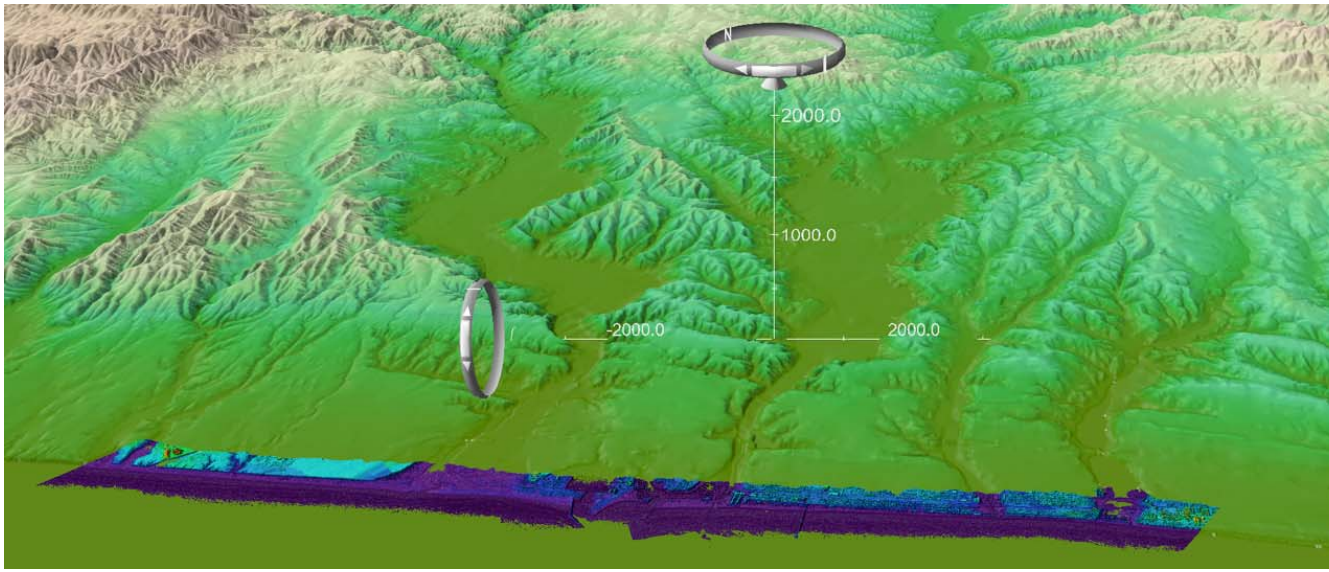
What is needed is better geodetic control at 1-100 km scales

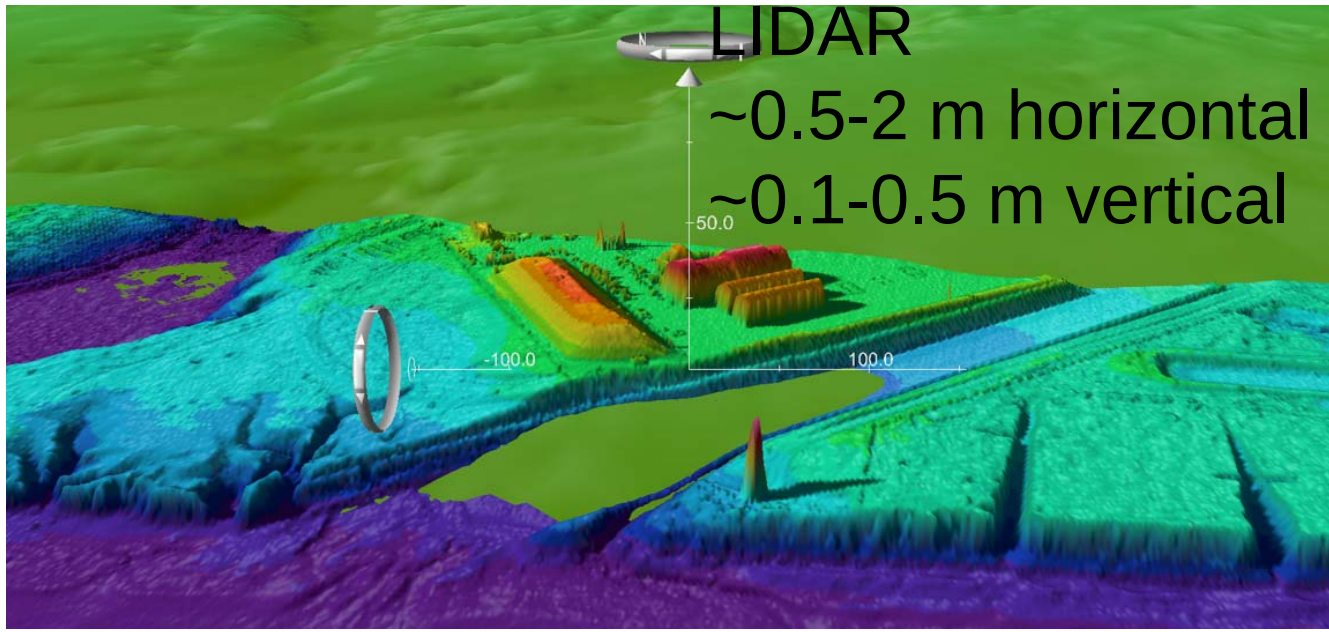




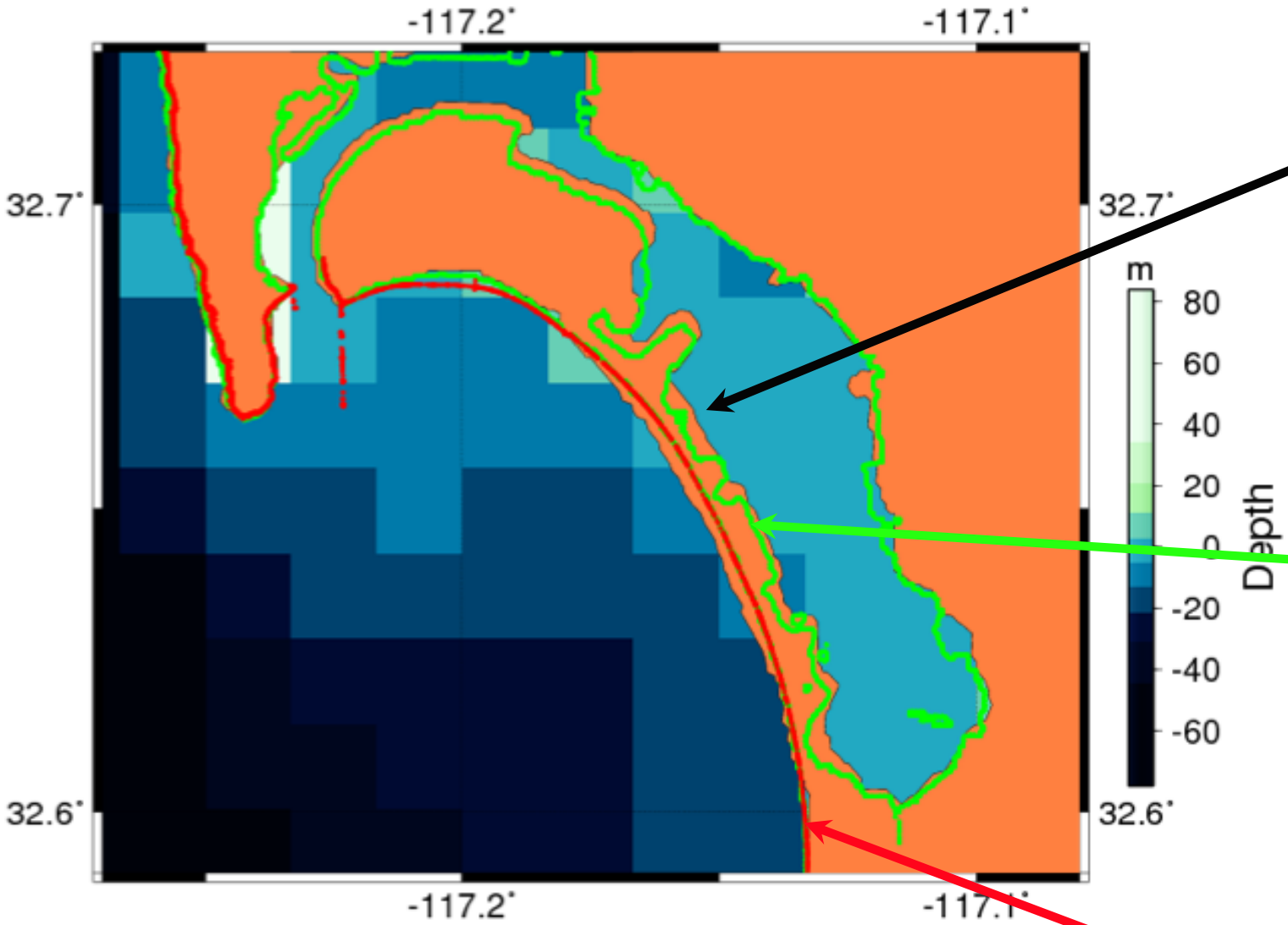
Multi-scale, Multi-resolution Data Fusion

National Elevation
Dataset 1 arc-second
~30m horizontal
+/- 2m vertical





LIDAR
~0.5-2 m horizontal
~0.1-0.5 m vertical



GSHHS Shoreline

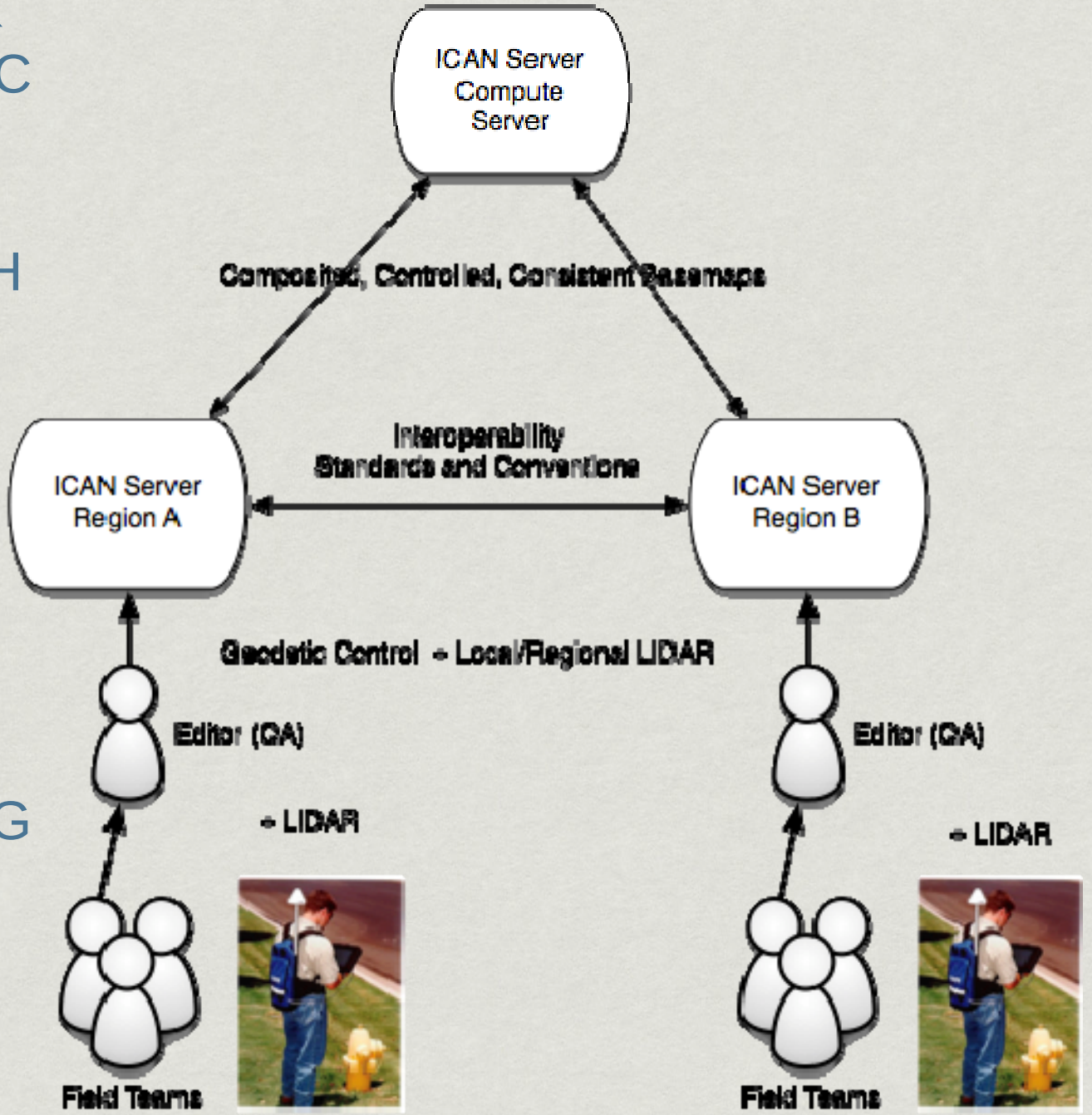
UCSD Shoreline

NOAA Draft Shoreline

Figure 2: Comparative plot of San Diego open ocean coastline dataset to draft coastline provided by NOAA. This is an example of variability in comparable sources and need for intercalibration between three-different estimates of the shoreline. The third shoreline estimate is from the GSHHS (Global Self-consistent Hierarchical High-resolution Shoreline database from NOAA (http://www.ngdc.noaa.gov/mgg/shorelinesgshhs.html) .

GLOBAL NETWORK OF LOCAL GEODETIC CONTROL TEAMS WORKING IN CONJUNCTION WITH LOCAL COASTAL ATLASES

LOW COST TECHNOLOGY USING GRASSROOTS STAFFING



http://140.194.76.129/publications/eng-manuals/em1110-1-1009/c-9.pdf

Prior Results to Build On

Sea-level Rise Risk Framework Project
Basemap Production Conventions and Procedures

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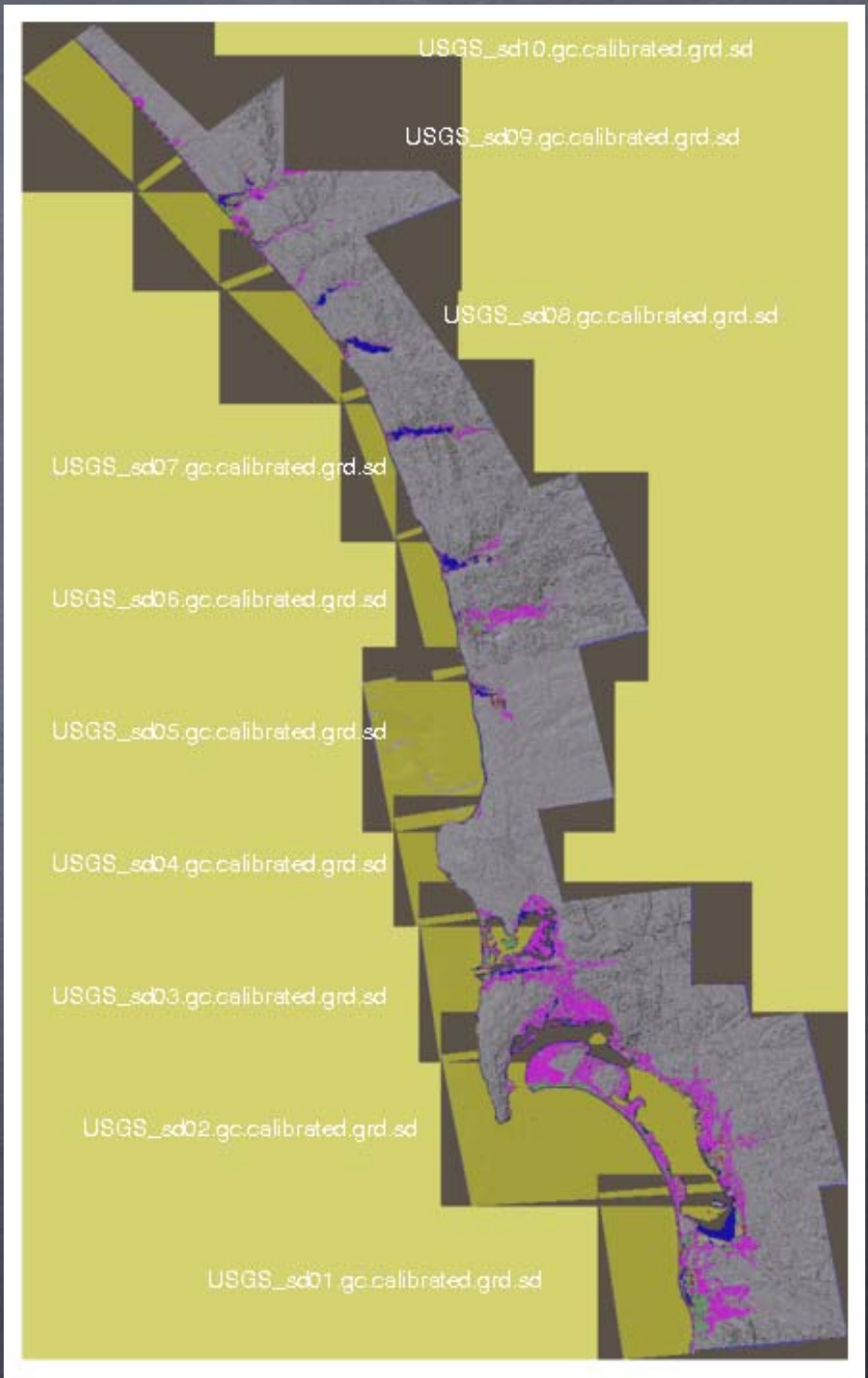
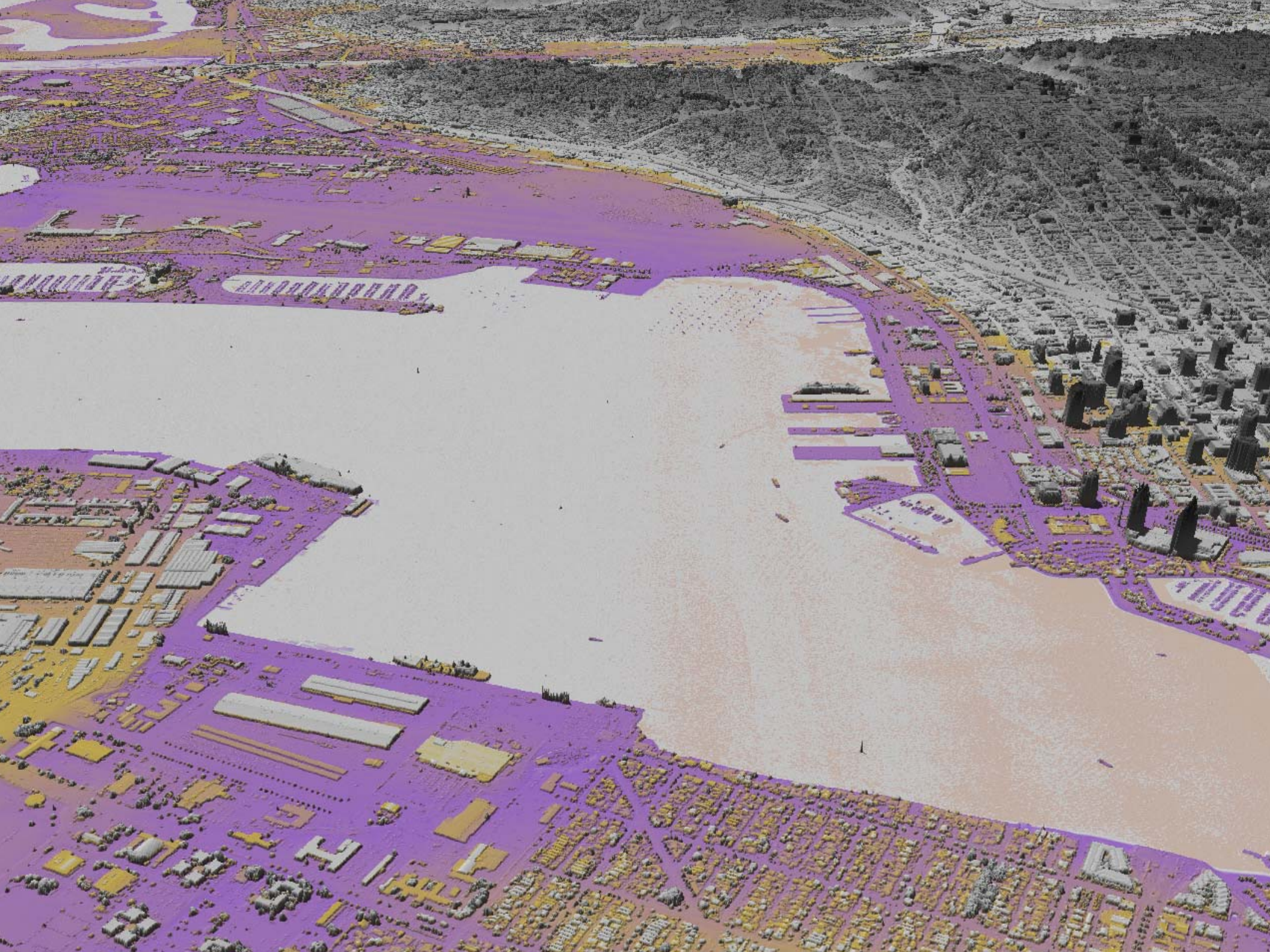
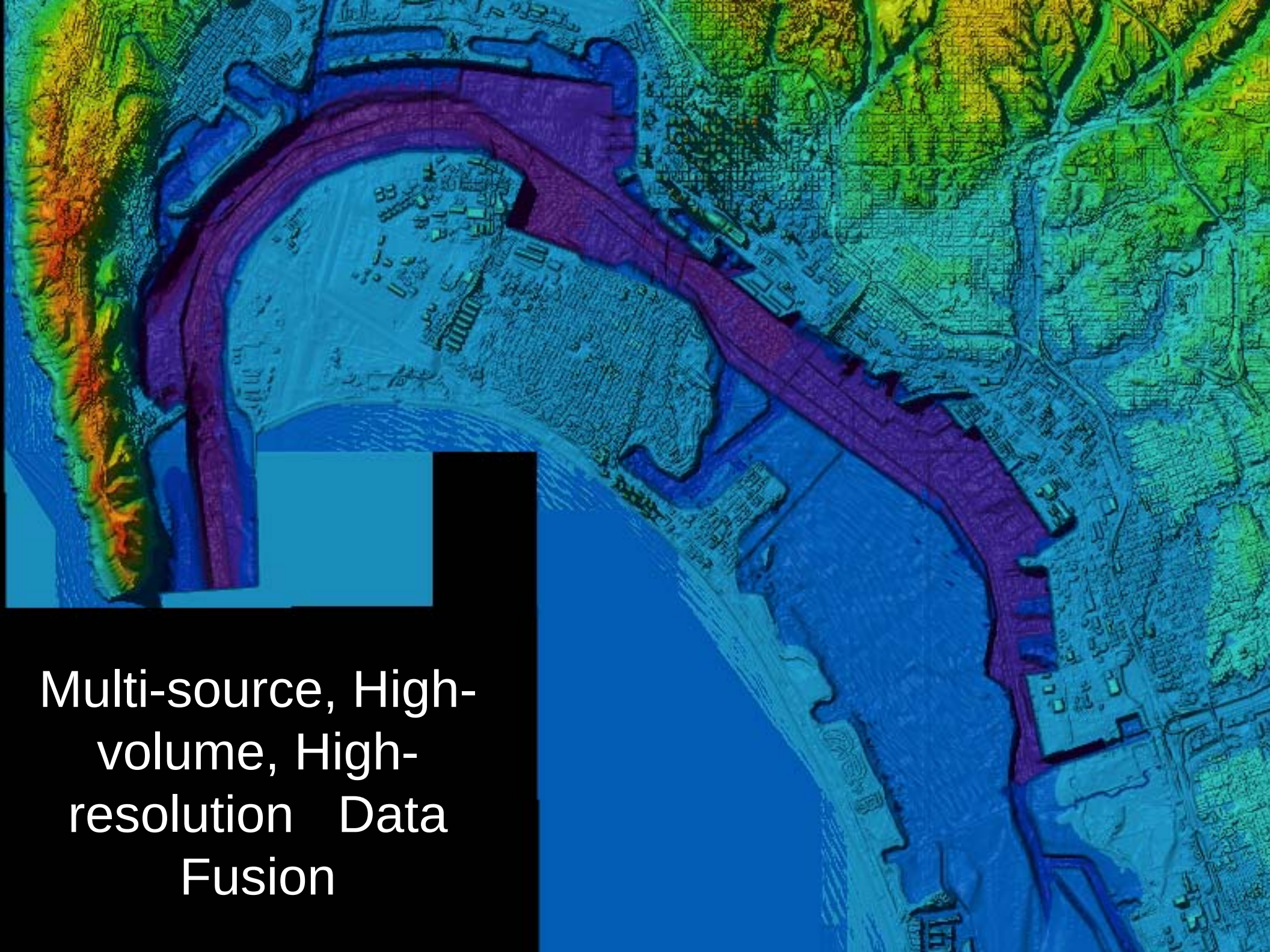
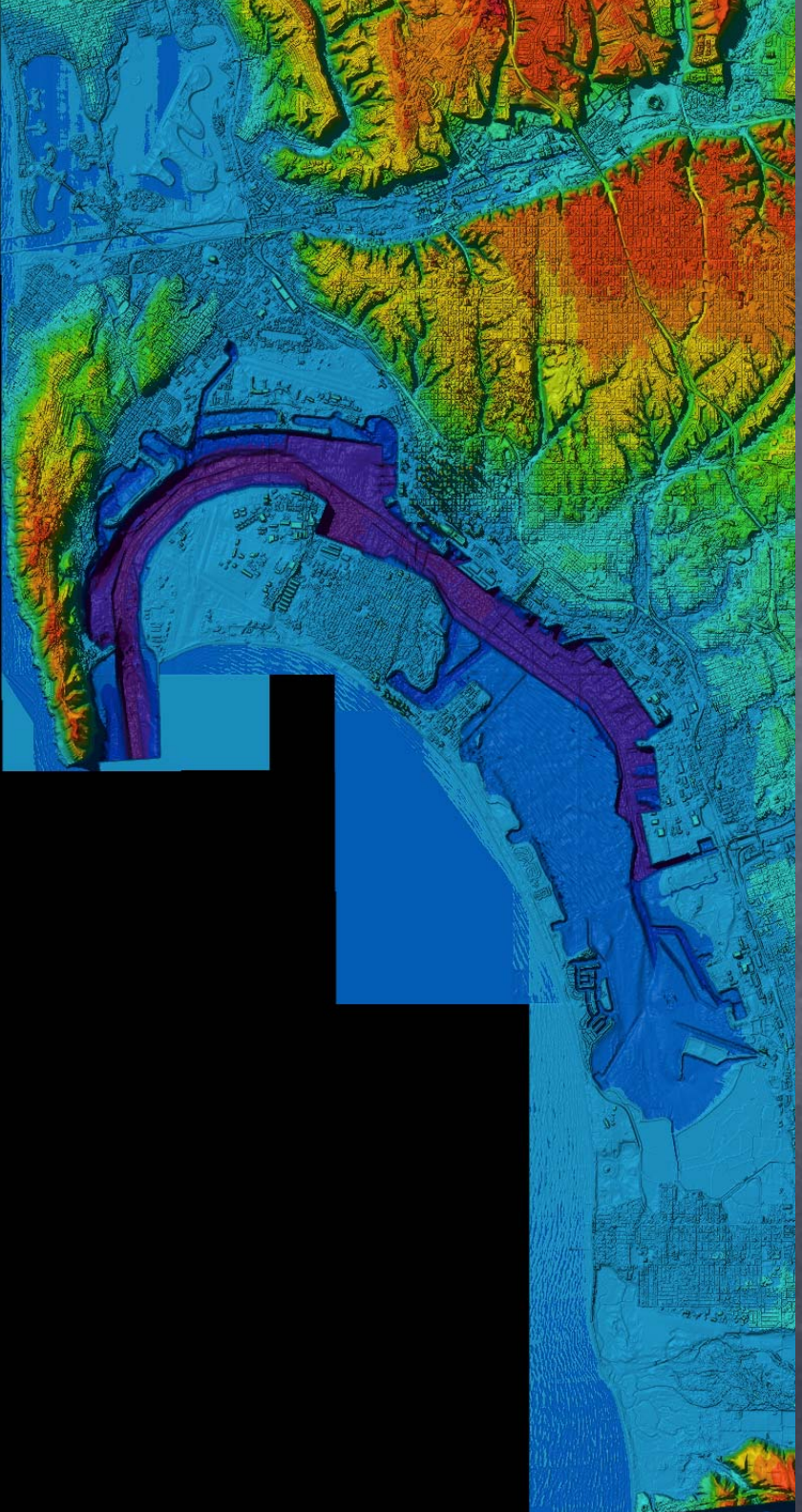
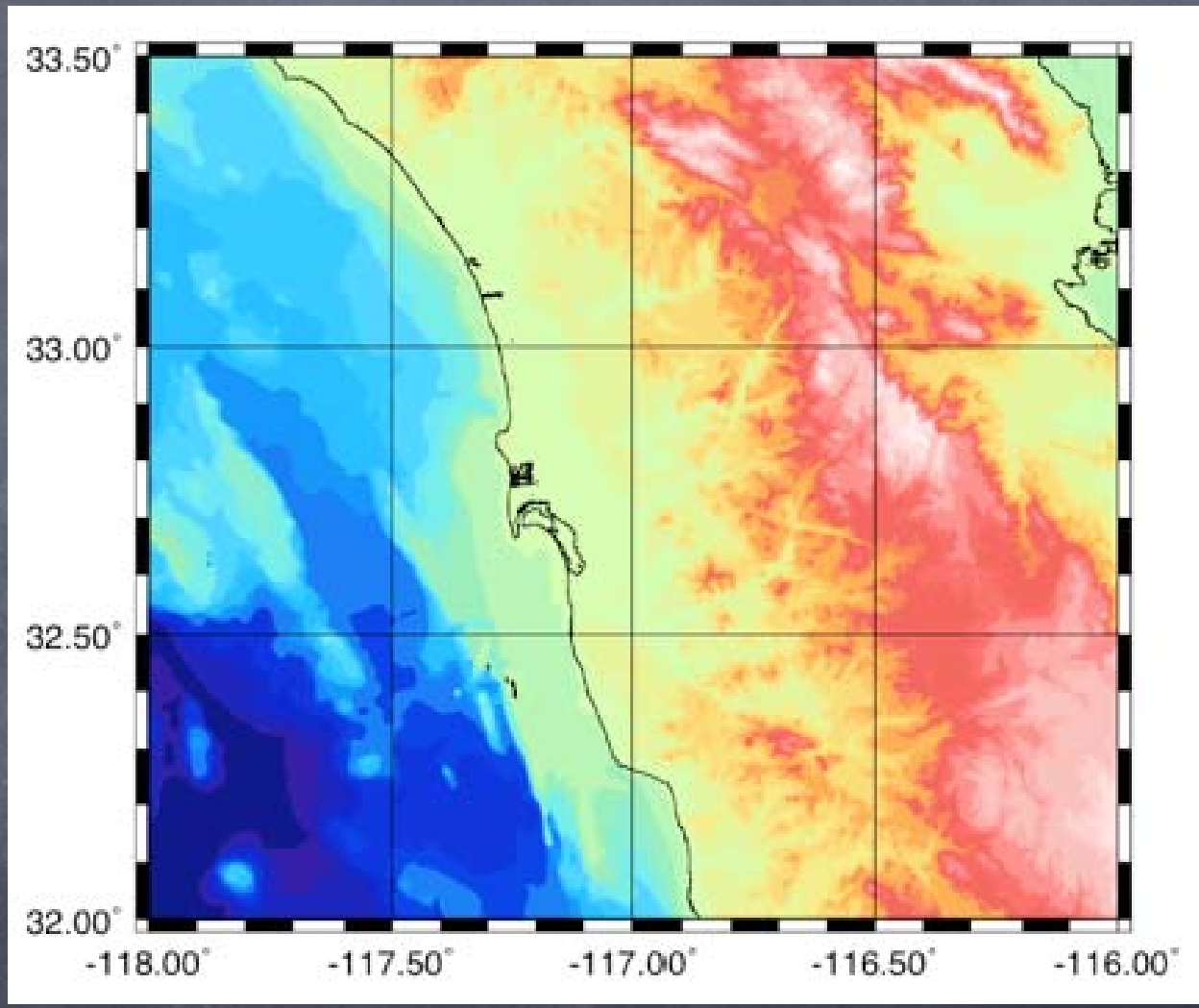
Integration of Multi-source LIDAR Data Tiles






Multi-source, High-volume, High-resolution Data Fusion




33.50°
33.00°
32.50°
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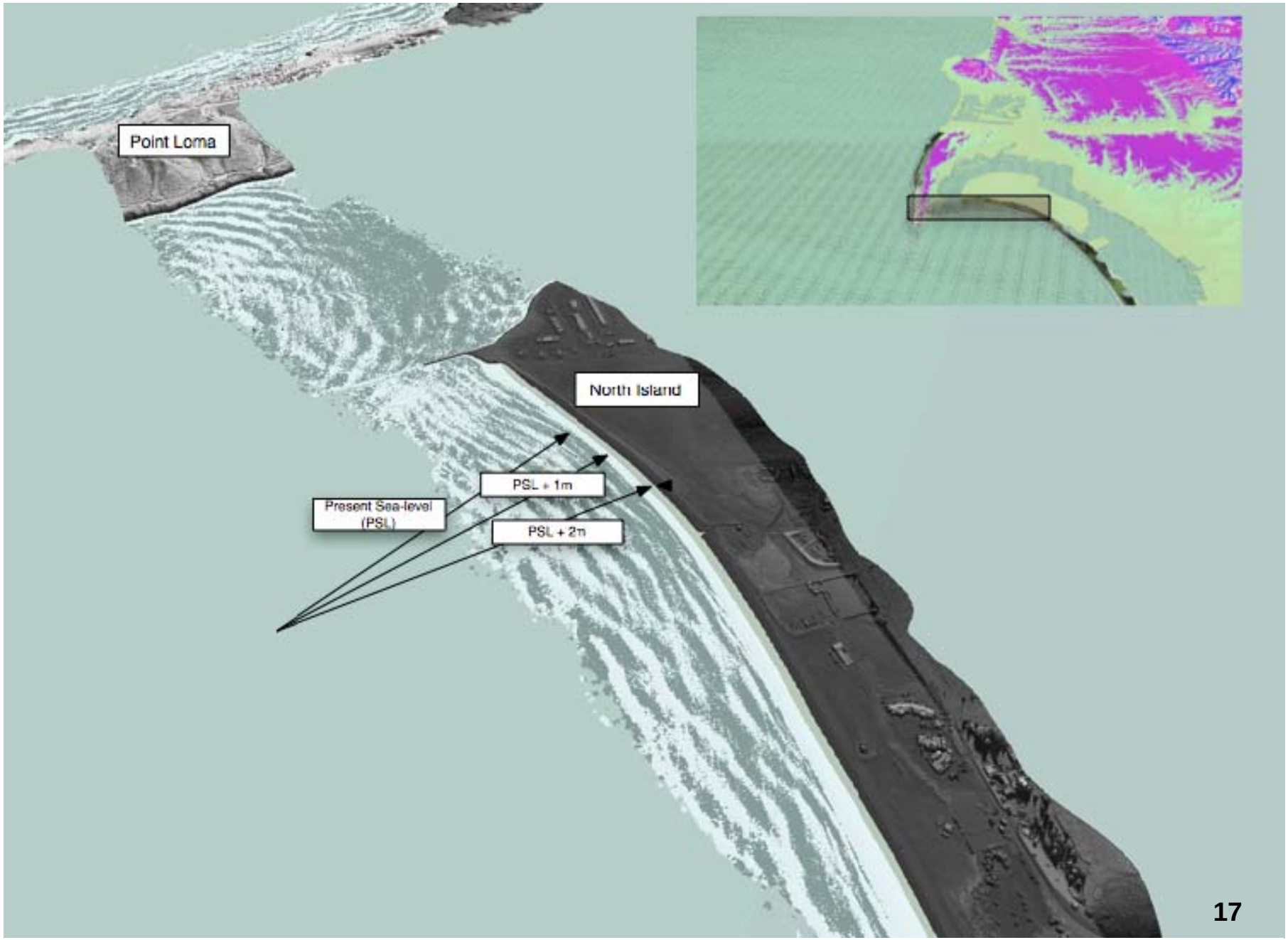
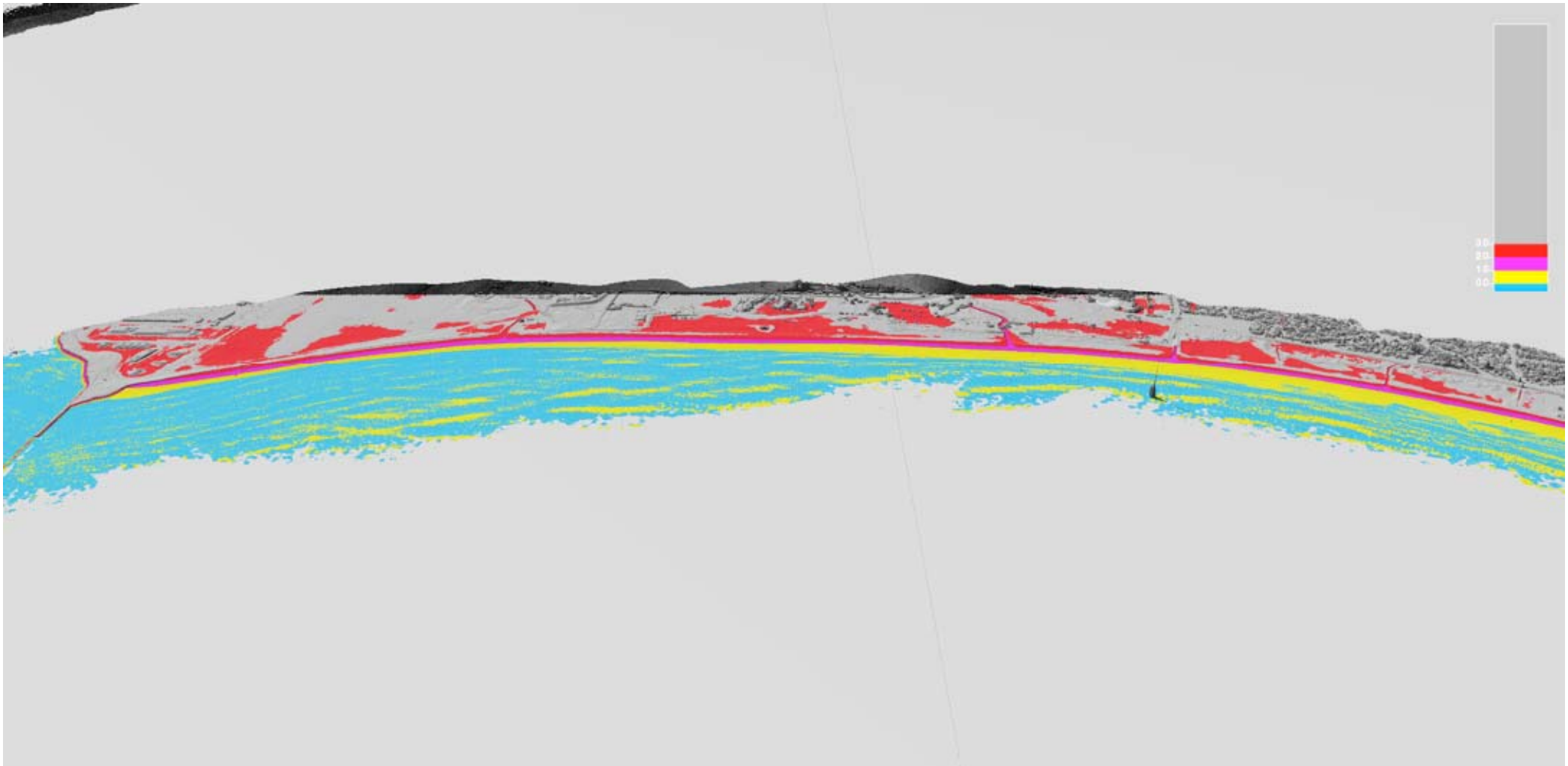
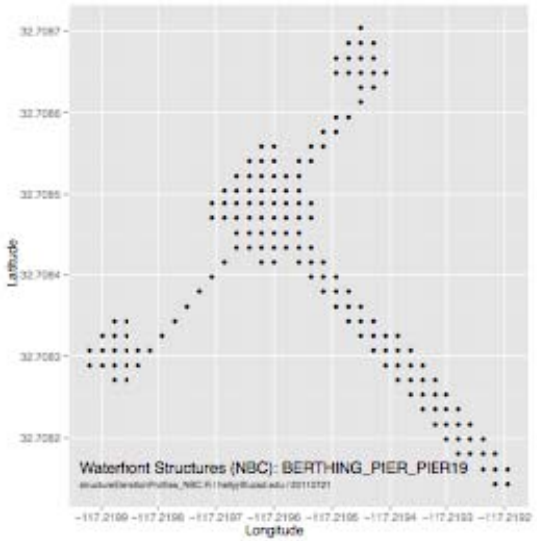
-116.50°
-116.00°

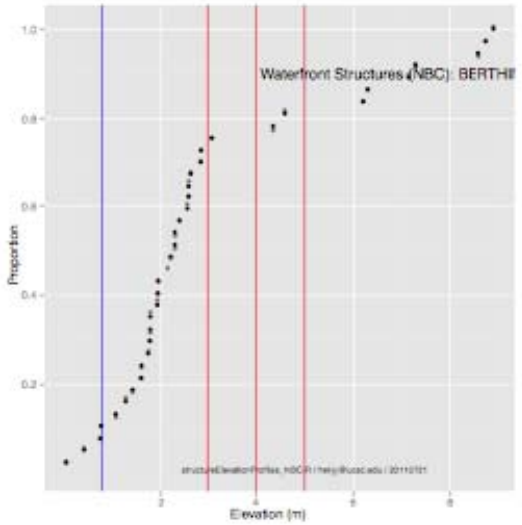
Cutting-planes at Water Elevations

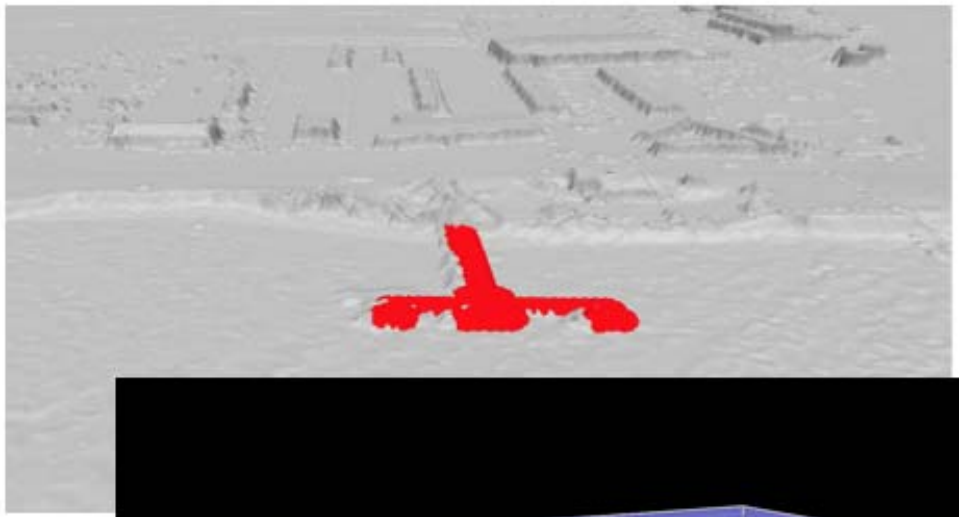


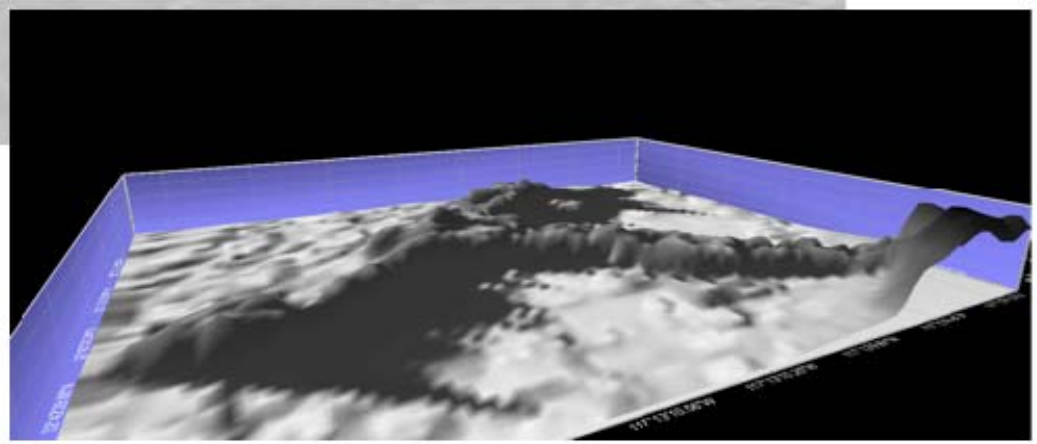
Colormapping Water Elevation

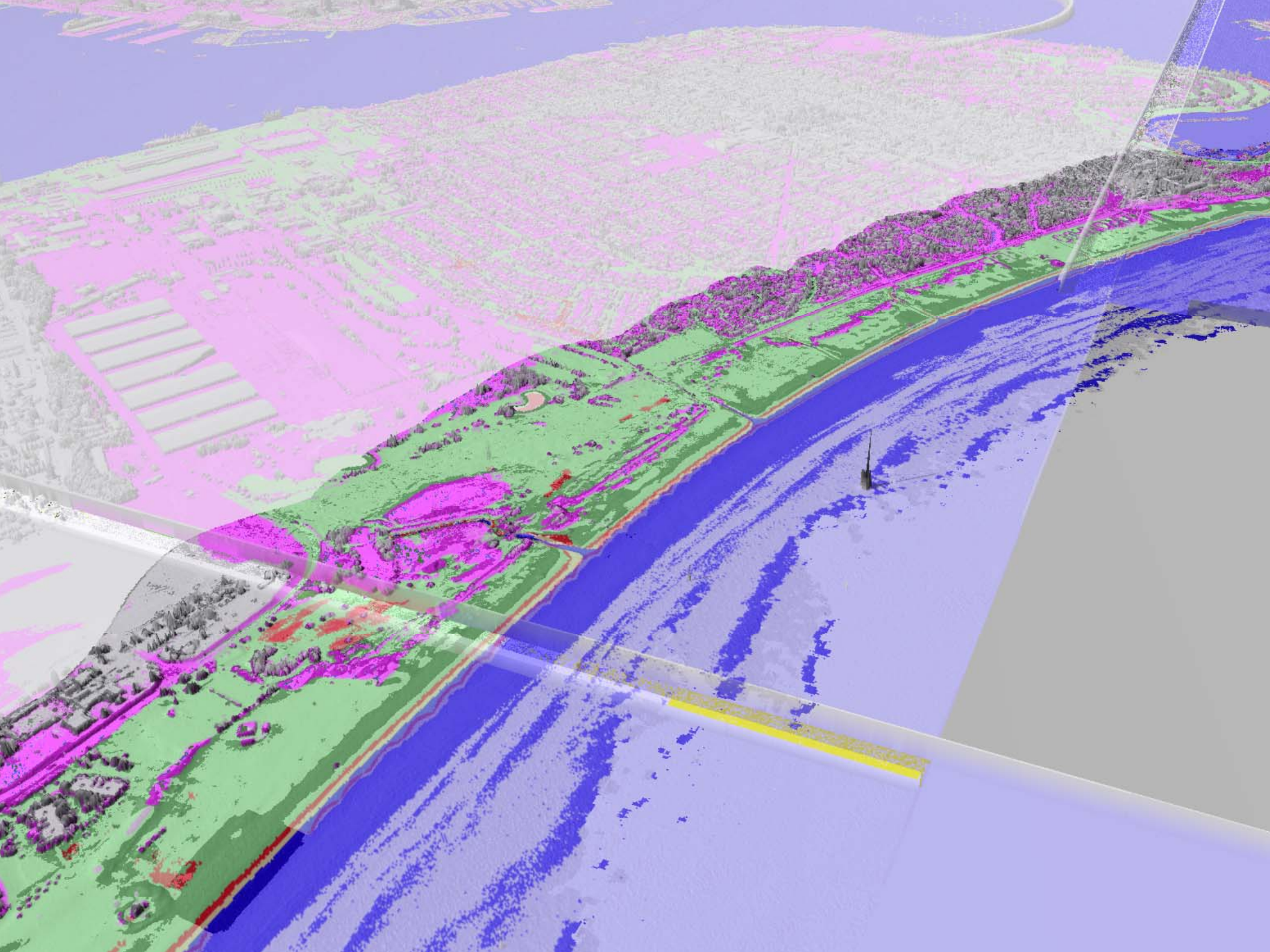



Latitude
Longitude
Waterfront Structures (NBC): BERTHING_PIER_PIER19


Proportion
Elevation (m)
Waterfront Structures (NBC): BERTHI







Calibration Point Selected Along the Coast Using Google Earth	Longitude	Latitude	SIO LIDAR Elevation March 2006 Dataset (median meters, scale factor 100000)	Delta (meters)	ACOE LIDAR 2002 Dataset (95th percentile, meters, scale factor 10000) CPEN DelMar001	CPEN DelMar002	SD001	SD002
BM010_SanClementePier_01	-117.622367	33.41833	N/A	N/A	N/A	N/A	N/A	N/A
BM010_SanClementePier_02	-117.621228	33.418965	N/A	N/A	N/A	N/A	N/A	N/A
BM100	-117.456675	33.285718	26.9731	35.54413	N/A	-8.57103	N/A	N/A
BM200	-117.434015	33.26001	19.0981	35.388	-16.2899	N/A	N/A	N/A
BM300_OceansidePier_01	-117.387512	33.192397	9.5789	34.9601	-25.2812	N/A	N/A	N/A
BM300_OceansidePier_02	-117.385187	33.193786	8.6276	35.5798	-26.9522	N/A	N/A	N/A
BM400	-117.300752	33.054753	25.193	N/A	N/A	N/A	N/A	N/A
BM500	-117.260445	32.934302	7.5203	N/A	N/A	N/A	N/A	N/A
BM600_SIOPier_01	-117.25636	32.866792	9.6829	N/A	N/A	N/A	N/A	N/A
BM600_SIOPier_02	-117.255326	32.866498	9.6823	N/A	N/A	N/A	N/A	N/A
BM700	-117.244418	32.667457	10.7351	N/A	N/A	N/A	N/A	N/A
BM800	-117.218369	32.68917	N/A	N/A	N/A	N/A	N/A	N/A
BM900_ImperialBeachPier_01	-117.135423	32.579568	9.0182	N/A	N/A	N/A	N/A	N/A
BM900_ImperialBeachPier_02	-117.132839	32.579549	5.42740	N/A	N/A	N/A	N/A	N/A
MEAN				35.368008				

Calibration Point Selected Along the Coast	Median Elevation (meters) SIO LIDAR (median)	USGS HiRes (maximum)	Delta (SIO LIDAR - other)	Longitude	Latitude
BM100	26.9132	26.96	-0.0468	-117.456675	33.285718
BM200	19.1881	18.966	0.2221	-117.434015	33.260010
BM300	8.6323	8.700	-0.0677	-117.384604	33.194125
BM400	24.2630	24.65	-0.387	-117.300752	33.054753
BM500	7.3803	7.13	0.2503	-117.260445	32.934302
BM600	3.72075	3.710	0.01075	-117.252042	32.769040
BM700	10.6601	10.5572	0.1029	-117.244418	32.667457
BM800	3.7553	3.74	0.0153	-117.218369	32.689170
BM900	16.5980	17.877	-1.279	-117.122764	32.534508

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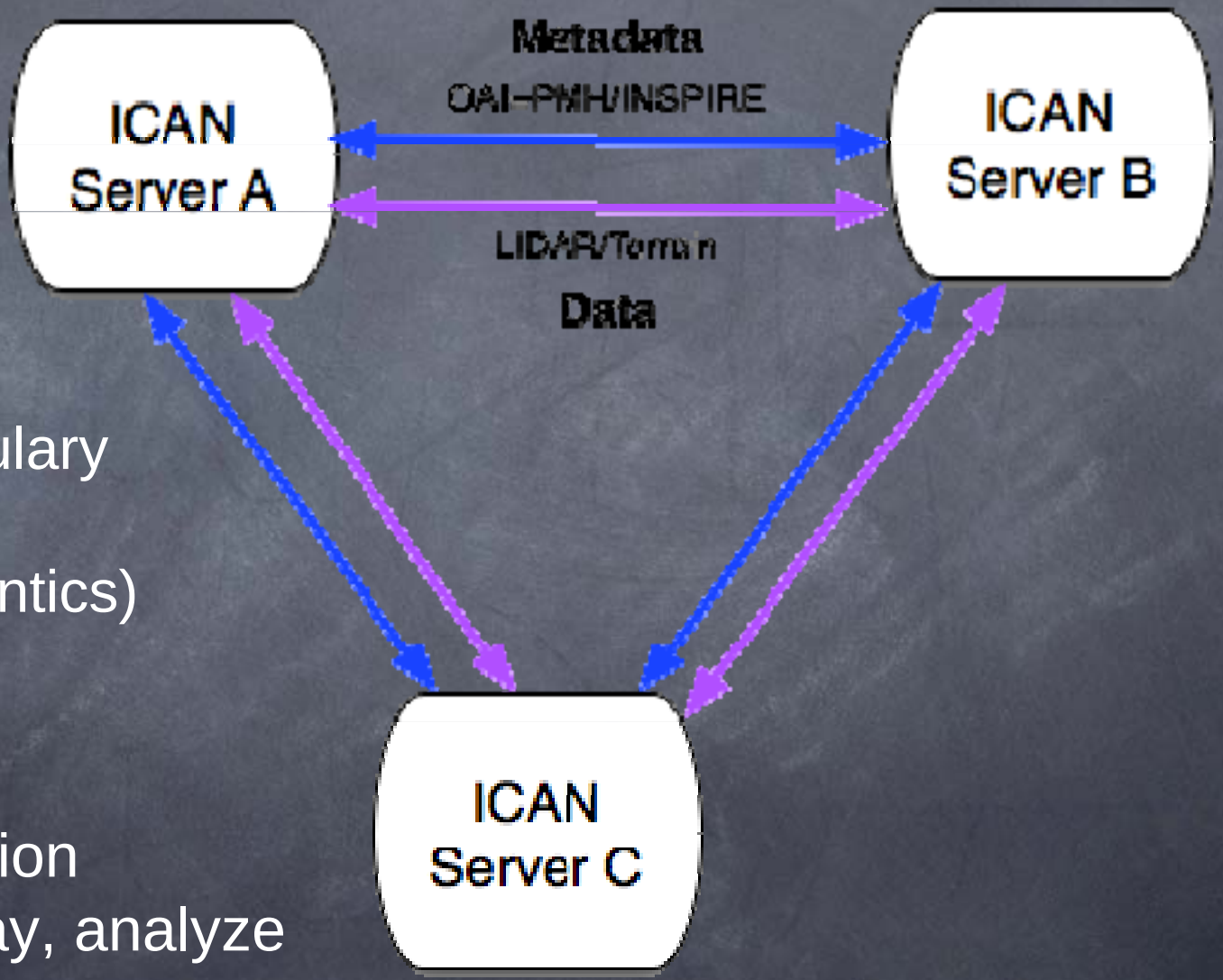
2-Channel Interoperability Model



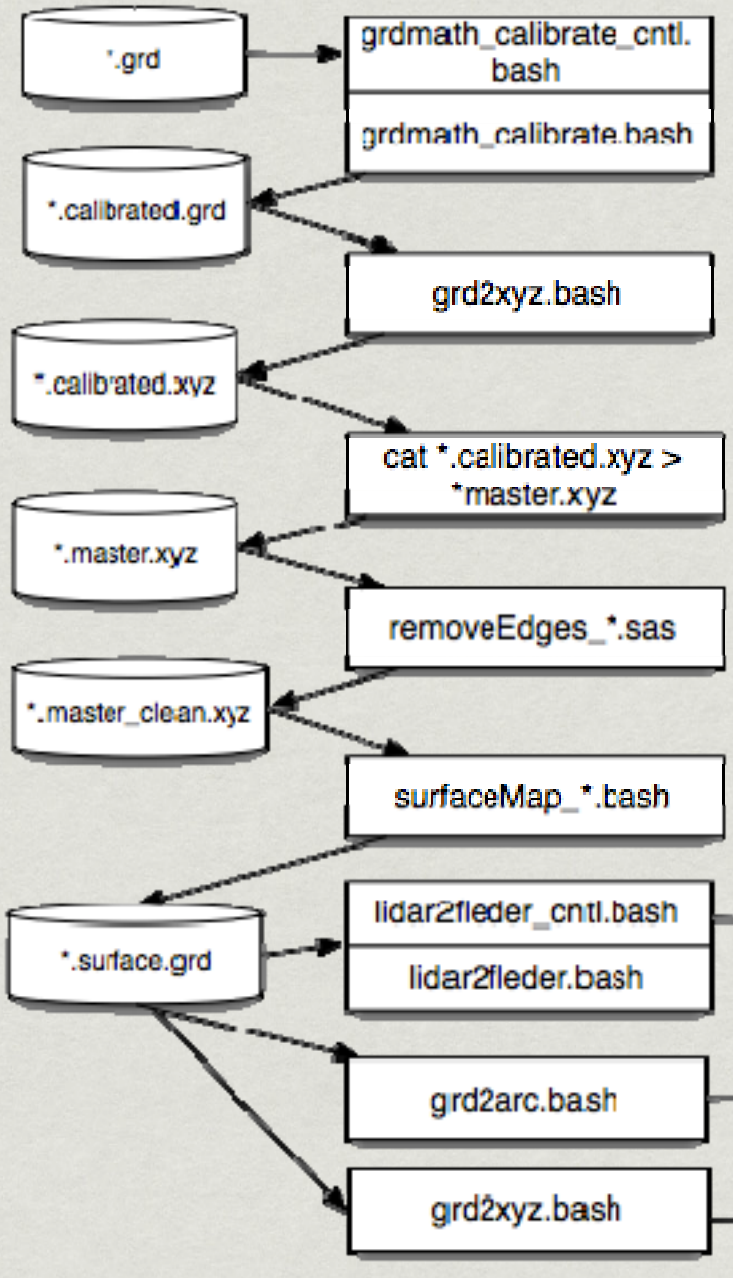
- Metadata
- Controlled Vocabulary (Dictionary)
- Thesaurus (Semantics)

- Data
- ogr2ogr formats
- 3-levels of resolution
  - browse, display, analyze

Input

GMT netCDF Files
Geographic Coordinates
after conversion from native formats and UTM
11N projections (typically ArcGrid to Geotiff to
netCDF using gdal_translate and gdalwarp)

Procedure and Software Implementation with Intermediate Products



Data Interoperability Products

Output

GMT netCDF Files
Geographic Coordinates
NAD83/NAVD88
Calibrated to SIO Coastal LIDAR

```
-f format_name: output file format name, possible values are:
     -f "ESRI Shapefile"
     -f "MapInfo File"
     -f "TIGER"
     -f "S57"
     -f "DGN"
     -f "Memory"
     -f "BNA"
     -f "CSV"
     -f "GML"
     -f "GPX"
     -f "KML"
     -f "GeoJSON"
     -f "GMT"
     -f "SQLite"
     -f "ODBC"
     -f "MSSQLSpatial"
     -f "PostgreSQL"
     -f "PCIDSK"
     -f "DXF"
     -f "Geoconcept"
     -f "GeoRSS"
     -f "GPSTrackMaker"
     -f "PGDump"
     -f "GPSBabel"
     -f "GFT"
     -f "CouchDB"
```

ogr2ogr formats

OGC Interoperability Experiment?

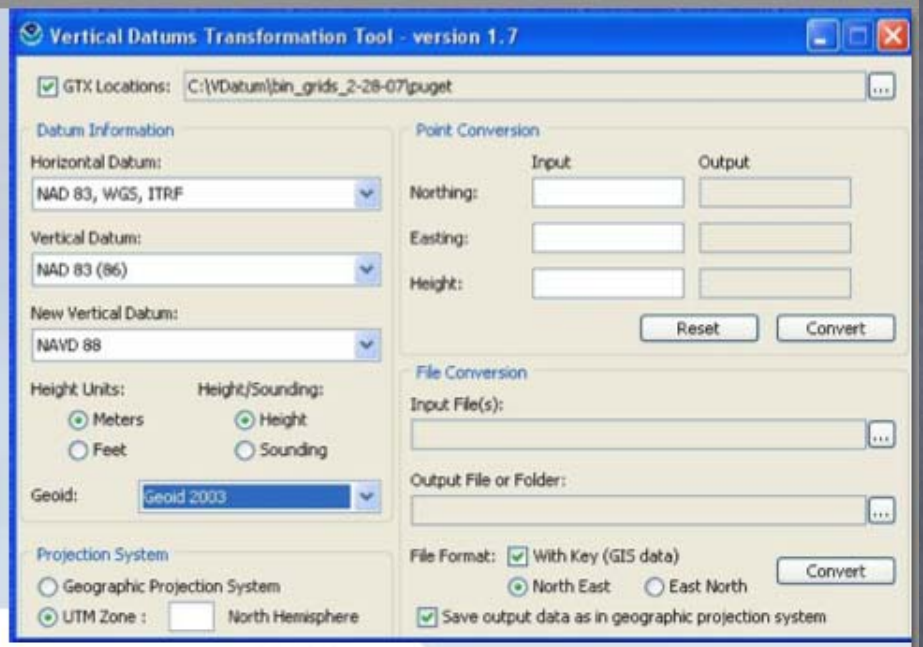
- Were ICAN to do an ‘OGC Interoperability Experiment’
  - Intellectual property rights agreement is too restrictive to permit University of California staff to participate in
  - UCAR has current interoperability project with OGC
  - What do we need the OGC for?
- How does it benefit ICAN?

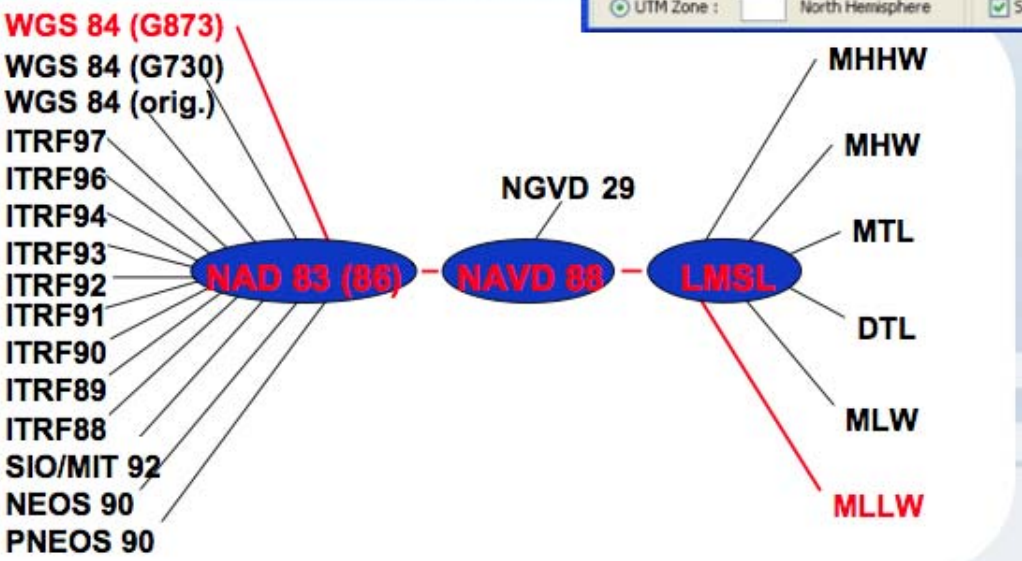
Backup

NOAA Tool for Datum Conversion

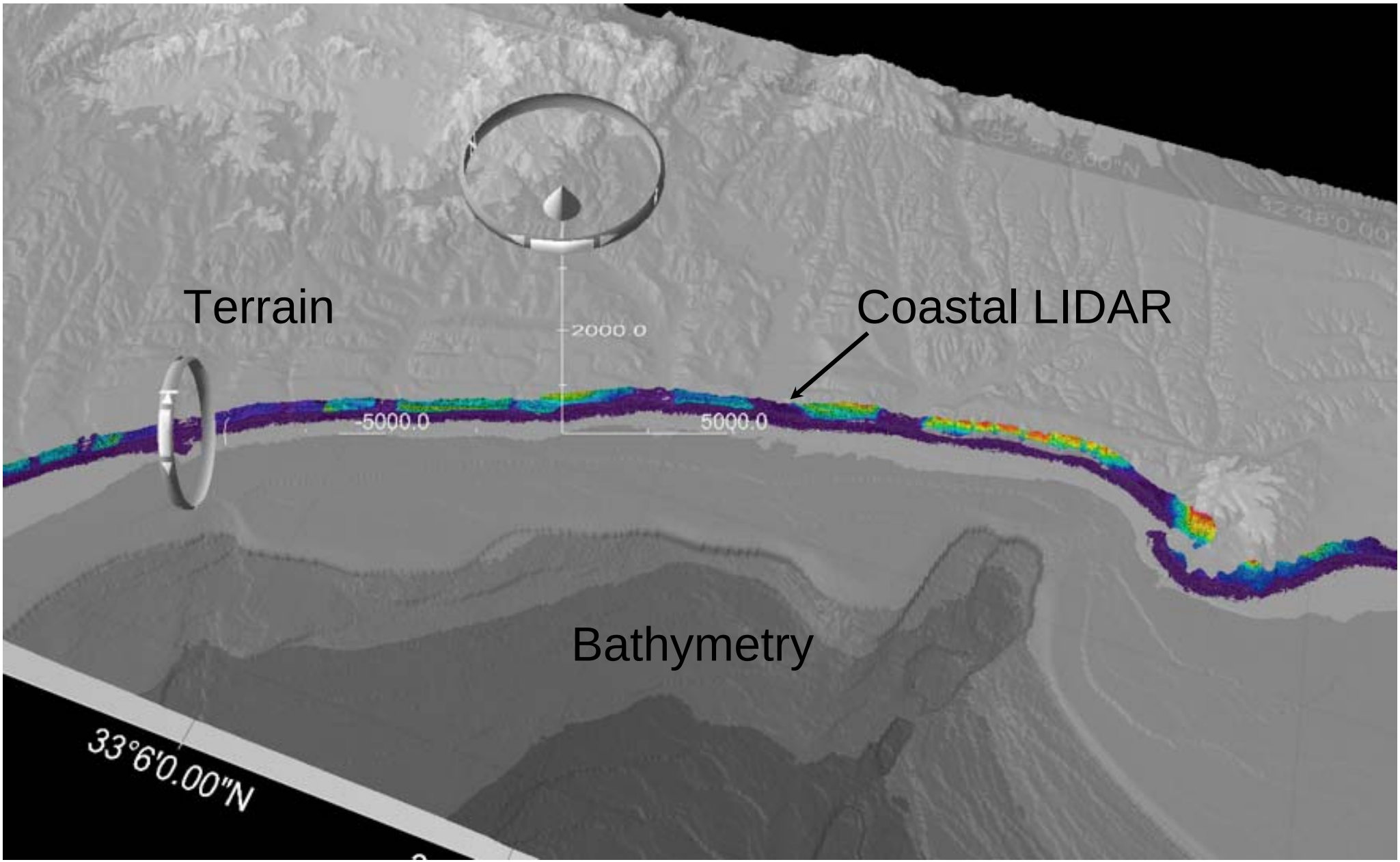
VDatum

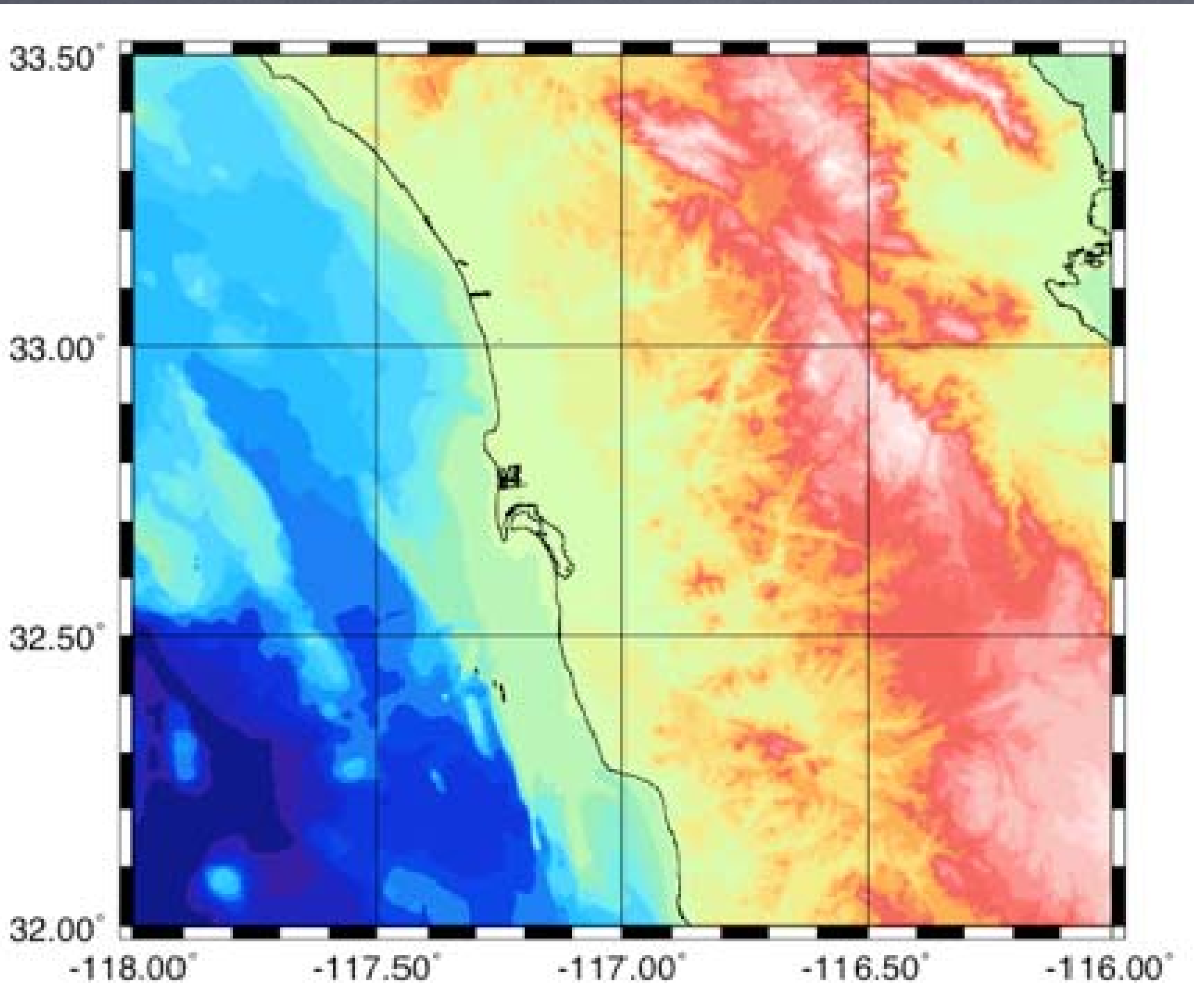
Enables coastal elevations from a variety of different sources to be accurately compared or merged





Geophysical Basemap




33.50°
33.00°
32.50°
32.00°
-118.00°
-117.50°
-117.00°
-116.50°
-116.00°

Definition: Horizontal/Geometric Datum – All such datums are comprised of 8 primary elements: 3 - Definition the origin of the coordinate system 3 - Definition of the orientation of the coordinate system 2 - Definition of the reference ellipsoid used to express the latitude and longitude values

This is where WGS 84 and GRS 80 can get to be a little confusing. The name World Geodetic System 1984 (WGS 84) is used by the Defense Department, National Geospatial-Intelligence Agency (NGA) to mean both the ellipsoid and the datum [4]. The Geodetic Reference System 1980 (GRS 80) (`http://www.gfy.ku.dk/~iag/HB2000/part4/grs80_corr.htm`) is the most contemporary reference ellipsoid recommended by the International Association of Geodesy. GRS 80 is not a datum, only part of a datum definition. For all practical purposes the size and shape of the WGS 84 and GRS 80 ellipsoids can be considered identical. It is the datums that they help to define (the first 6 parameters) that can be quite different. This is where NAD 83 and WGS 84 (the datum, not the ellipsoid) can be different - around 1 m each in latitude/longitude and ellipsoid height (*pers. comm., Dave Doyle, NGS*).

However, since this only addresses the horizontal datum explicitly but implicitly imposes the vertical reference to be the ELLIPSOID (i.e., GRS80), the elevations in these data have to be corrected to be compatible with NAVD88 used in the other data sources for this basemap. This was done using the *grdmath_calibrate.bash* procedure (cf. source code listings) after the bias was calculated relative to the SIO Coastal LIDAR at the pier locations listed in Table **??**.

GSHHS - A Global Self-consistent, Hierarchical, High-resolution Shoreline Database

GSHHS is a high-resolution shoreline data set amalgamated from two databases in the public domain. The data have undergone extensive processing and are free of internal inconsistencies such as erratic points and crossing segments. The shorelines are constructed entirely from hierarchically arranged closed polygons. The data can be used to simplify data searches and data selections, or to study the statistical characteristics of shorelines and land-masses. It comes with access software and routines to facilitate decimation based on a standard line-reduction algorithm.

Availability of the GSHHS data

- **Download GSHHS data version 2.2.0 (July 15, 2011)**

  The link above is to the NGDC server, GSHHS data are also available for direct download from the SOEST server. Please see the readme.txt file for documentation.

More information about GSHHS

- **GSHHS is developed and maintained by**

  Dr. Paul Wessel, SOEST, University of Hawai'i, Honolulu, HI. wessel@soest.hawaii.edu, and

  Dr. Walter H. F. Smith, NOAA Laboratory for Satellite Altimetry, National Oceanographic Data Center, Silver Spring, MD. Walter.HF.Smith@noaa.gov.

- **Processing and assembly of the GSHHS data is described in:**

  Wessel, P., and W. H. F. Smith, A Global Self-consistent, Hierarchical, High-resolution Shoreline Database, *J. Geophys. Res., 101, #B4, pp. 8741-8743*, 1996.