

Topographic Beach Mapping Using LIDAR

11/14/2000

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The background is a solid blue color with several diagonal stripes of a slightly darker shade of blue, creating a textured effect. The stripes run from the top-left towards the bottom-right.

Topographic Beach
Mapping Using
LIDAR

Lidar Fundamentals

- Light Detection and Ranging
- High accuracy position and elevation data
- Different types of LIDAR
- Mapping and atmospheric application

Lidar Types

- Bathymetric Mapping
 - SHOALS / USACE
 - blue spectrum, water penetrating laser
 - 3 meter horizontal, 15 cm vertical
 - 4 meter grid system

Lidar Types

- Terrain Mapping
 - Green spectrum, multiple pulse return
 - Percentage of returns penetrating vegetation
 - lower return density tradeoff
 - 5 meter grid system
 - Most often used with imagery
 - Production platform

Lidar Types

- Topographic Mapping
 - ATM (Airborne Topographic Mapper)
 - Green spectrum, single return configuration
 - 77 cm horizontal, 15 cm vertical
 - Dense return data, plus passive return
 - Used for high accuracy topography
 - Research applications

ATM Mapper Development



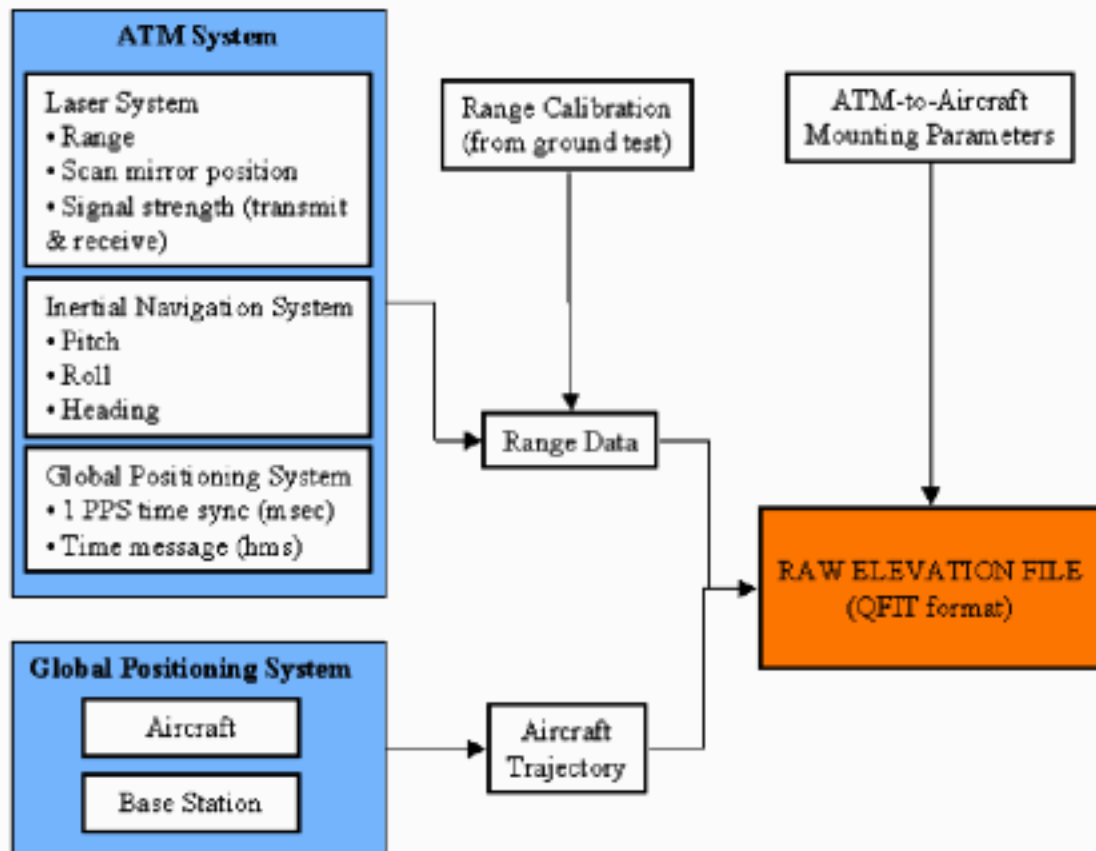
Participating Agencies

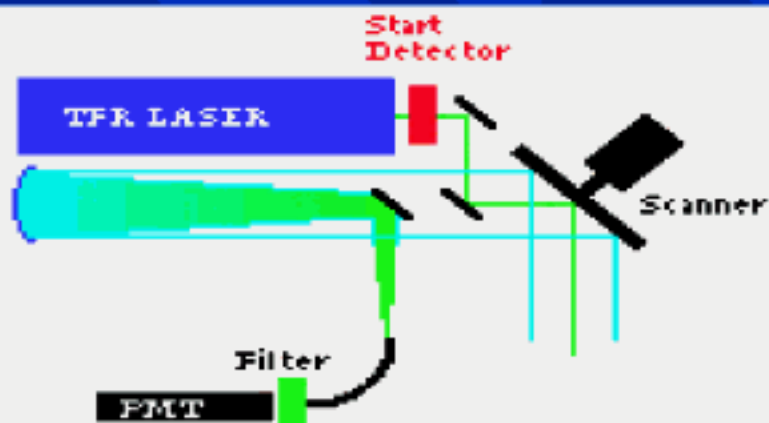
- USGS
- NASA
- NOAA
- NYS Coastal Management



Lidar Fundamentals

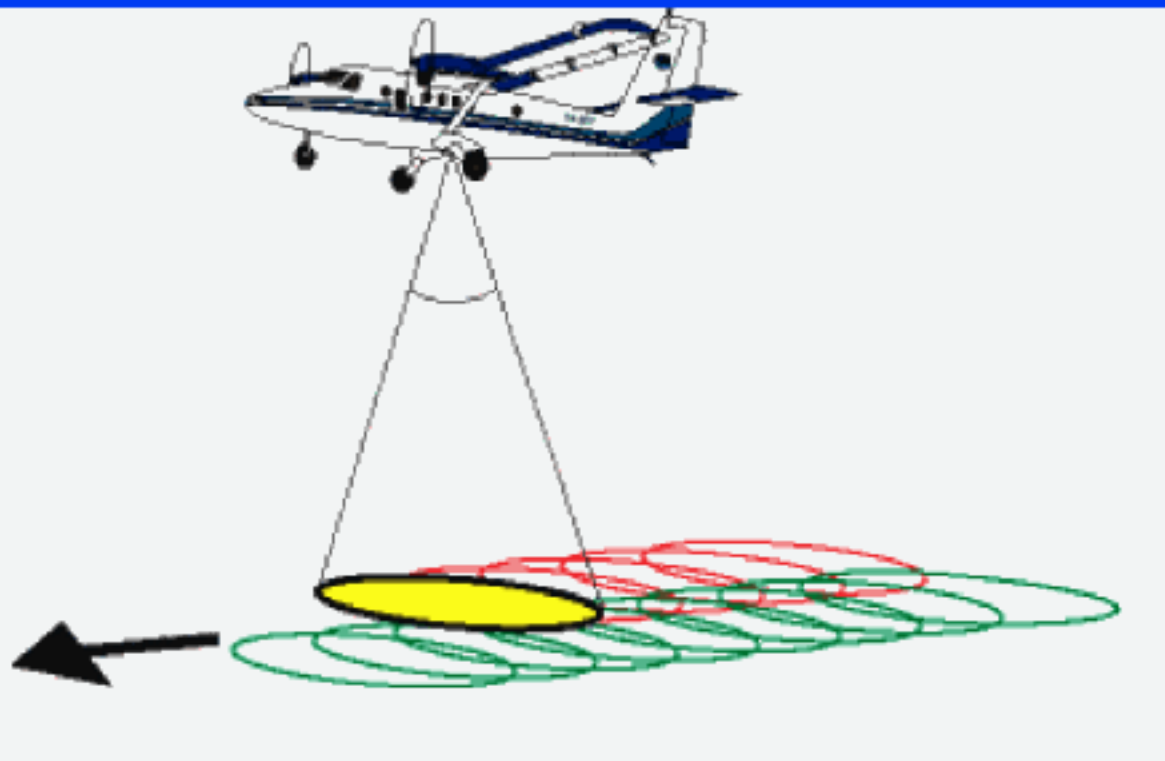
- Laser illuminated ground point
- Capture reflection pulse
- Passive and active data
- First return signal collection
- Plane trajectory via GPS
- Trigonometric solution for XYZ values





Data Collection





Data Characteristics

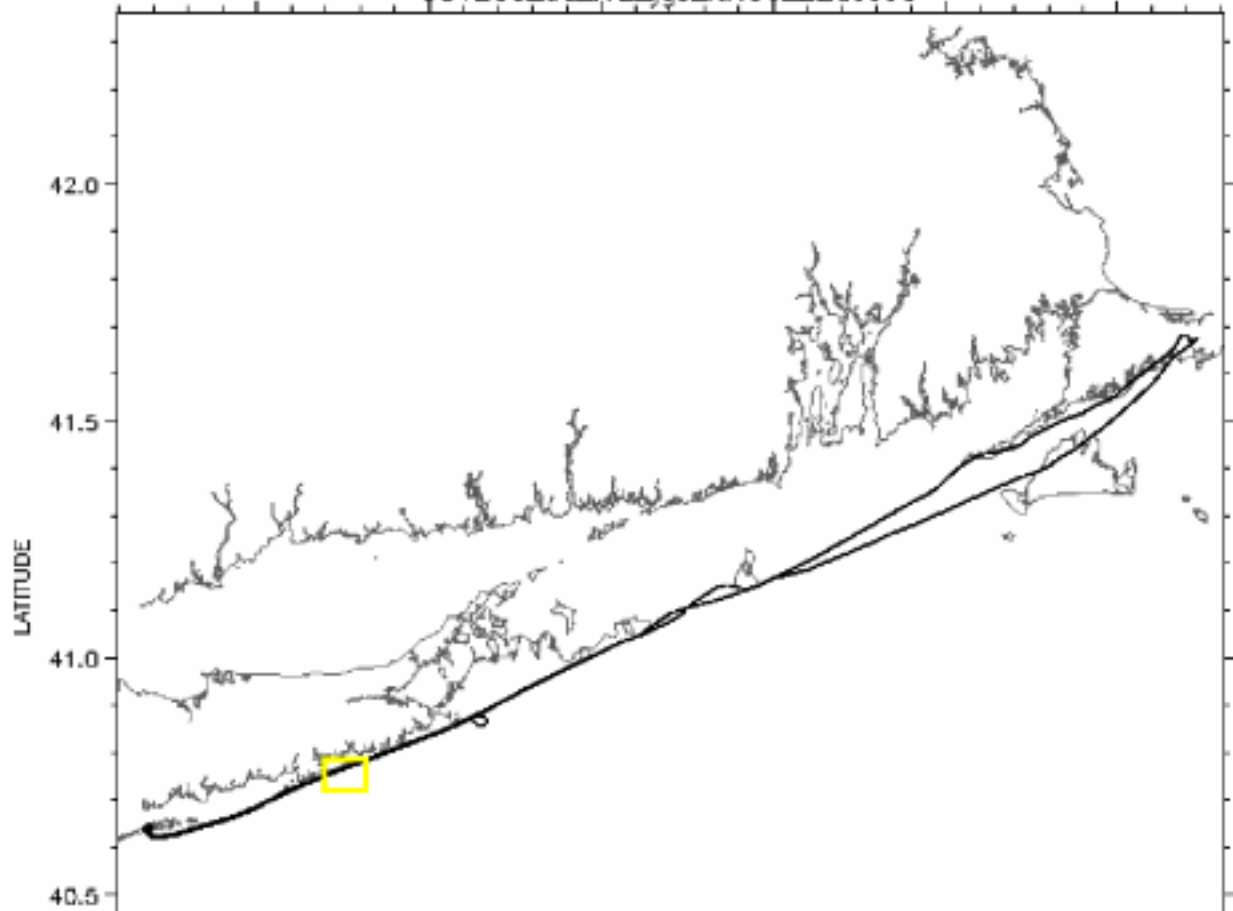
- Quality control and initial processing
- Format: binary raster or text
- Projection and datum issues
- GIS processing options
- Data volume - ~1 gigabyte for shore path

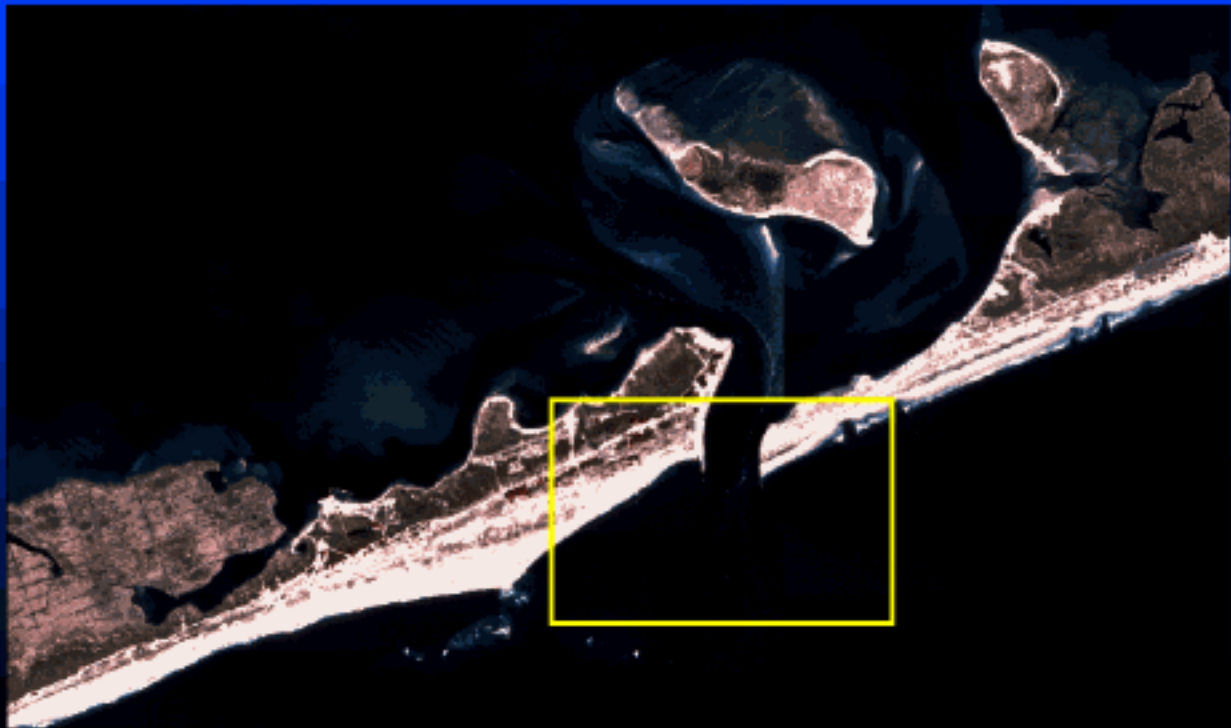
GIS/Projection Error Sources

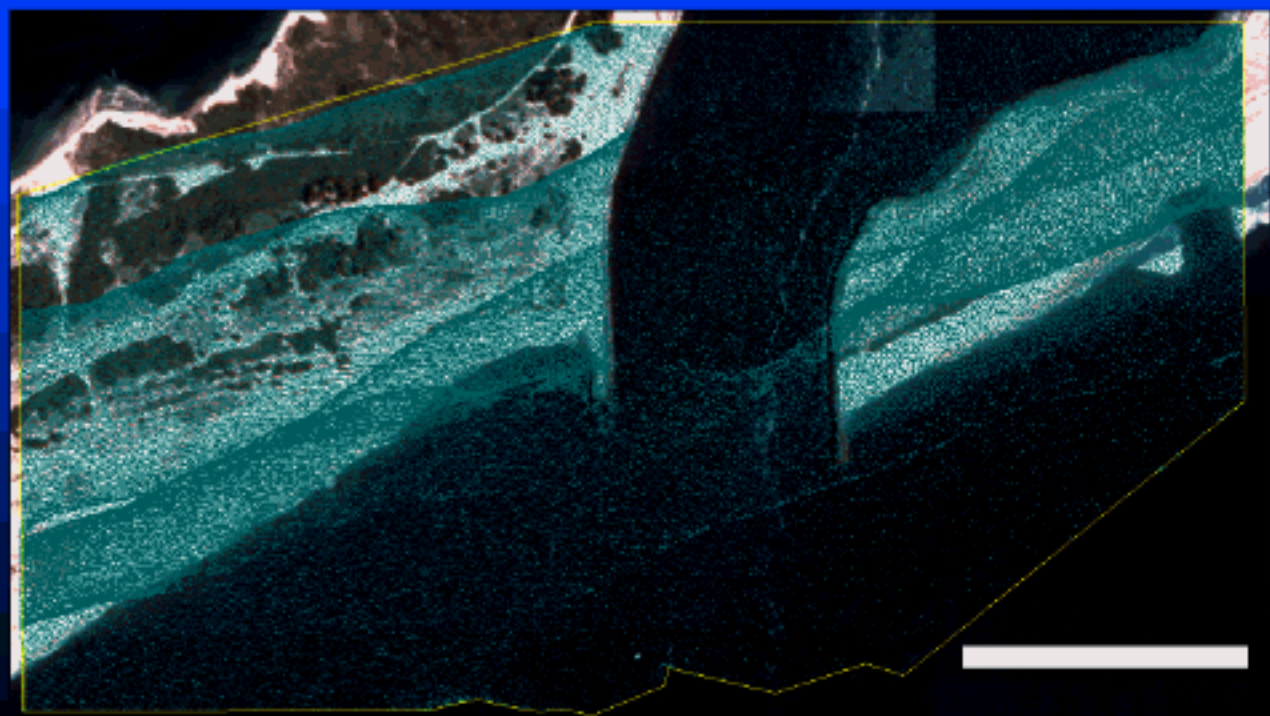
Source	Horizontal Error (cm)	Vertical Error (cm)
Collection	+77	+15.0
ITRF94-NAD83	+5	+3.4
NAD83-NAVD88	---	+4.6
NAVD88-NGVD29	---	+2.0
NAD83-NAD27	+15	---

Mission Characteristic

- Two east - west passes covering barrier/beach face
- Duplicate west - east passes
- Independent satellite constellation
- Trajectory verification
- Plane trajectory known to 15 cm

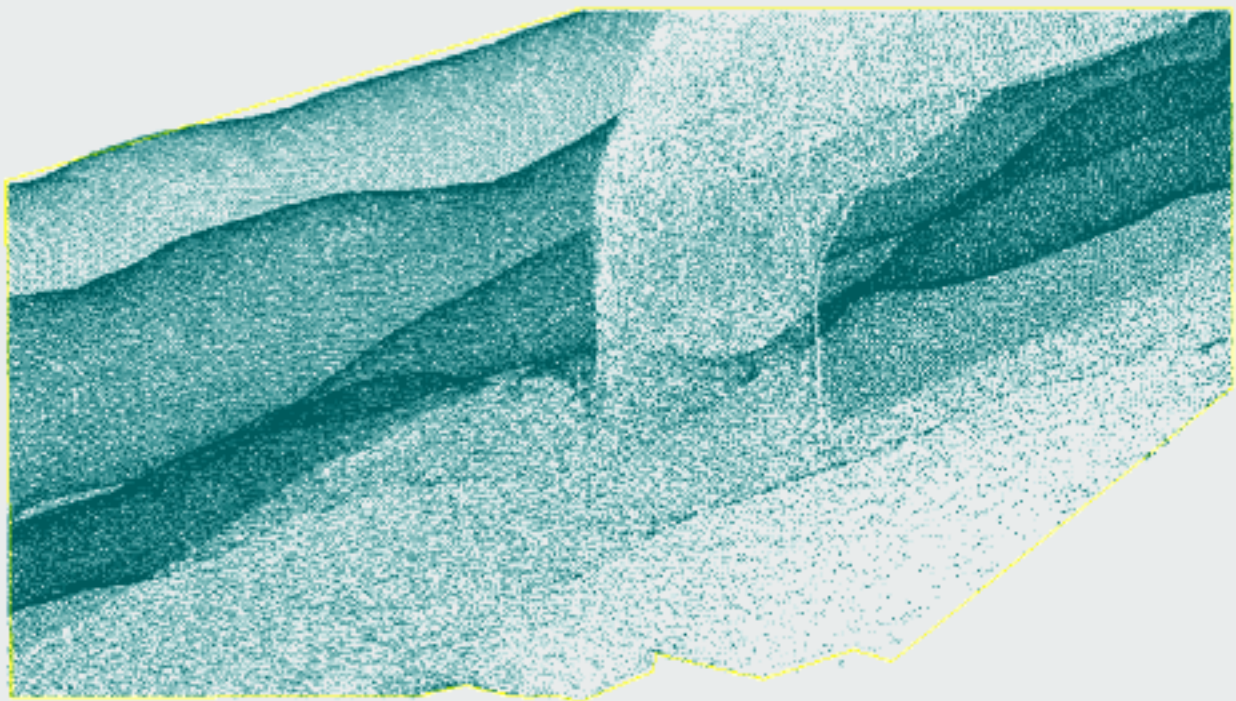




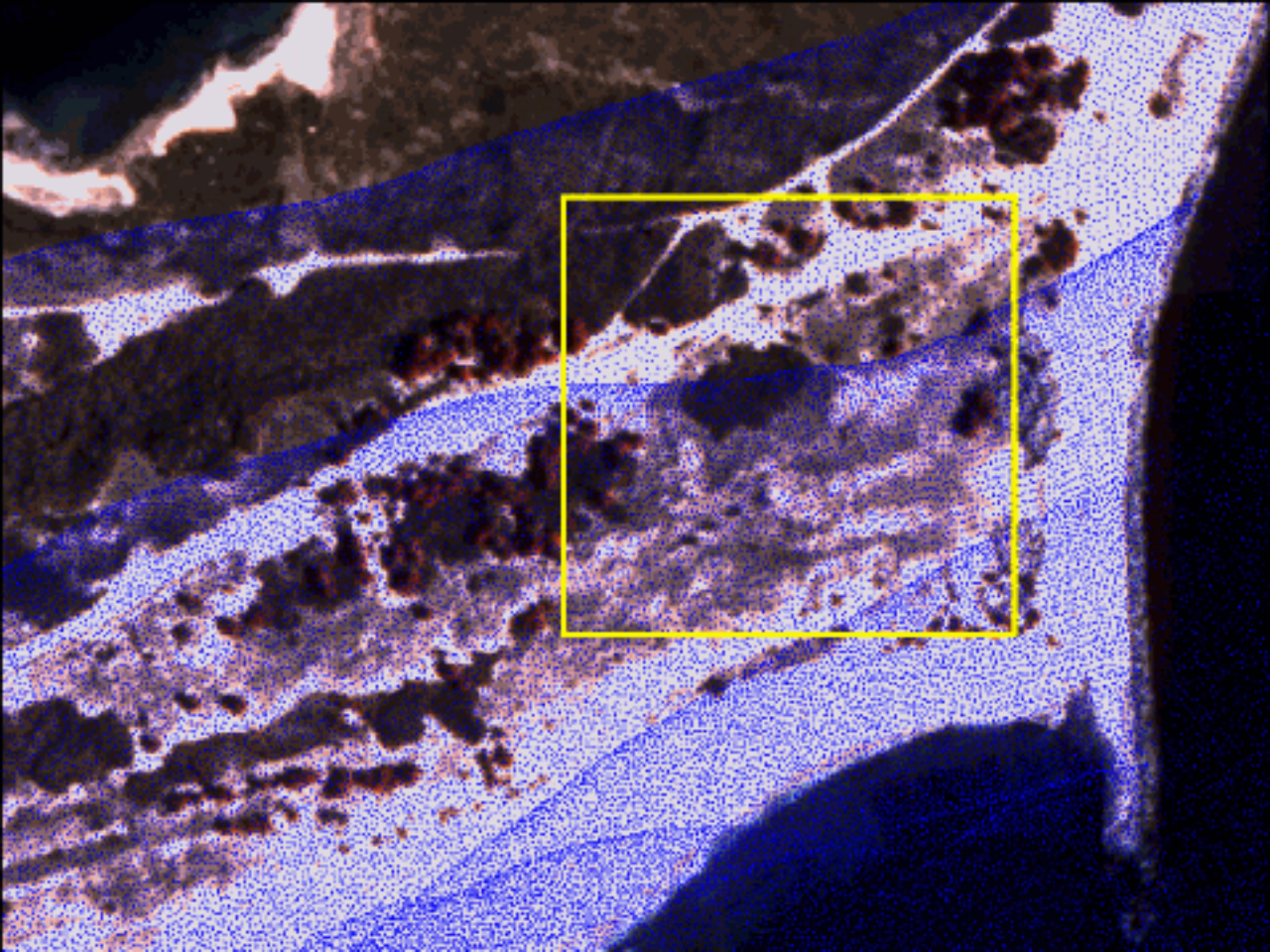


Data Processing

- Raw data
- Coincident point aggregation
- Maximum and minimum elevations
- Variable spacing
- “Binned” data and interpolated data

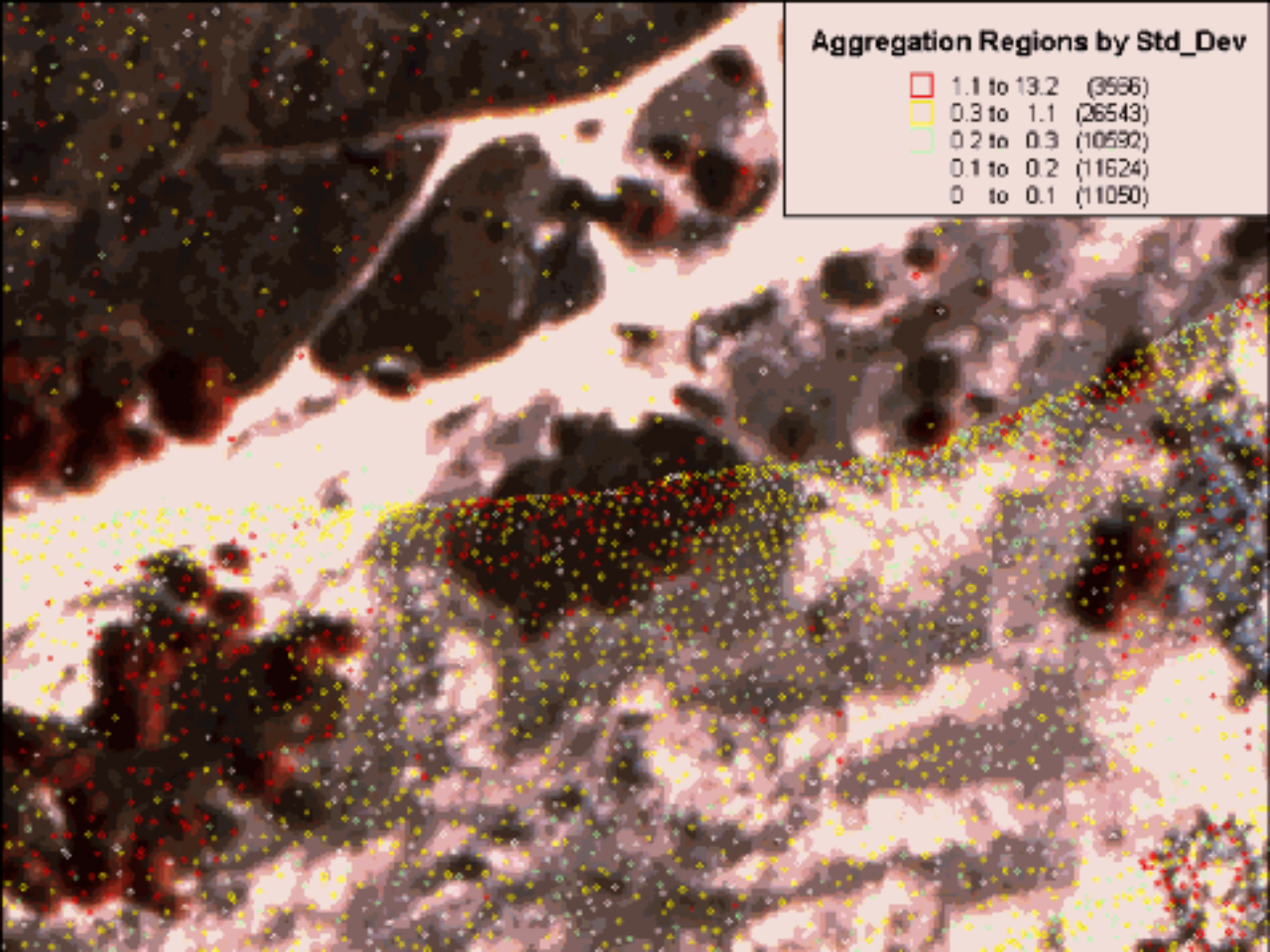






Aggregation Regions by Std_Dev

1.1 to 13.2	(3556)
0.3 to 1.1	(26543)
0.2 to 0.3	(10532)
0.1 to 0.2	(11624)
0 to 0.1	(11050)



X_Aggn	Y_Aggn	Minimum	Average	Maximum	Expected	Number	Std_Dev
1,328,850	221,269	12.52	20.0625	27.605	20.0625	2	10.6867
1,328,860	221,267	21.755	21.811	21.867	21.811	2	0.0791969
1,328,870	221,264	23.091	23.801	24.511	23.801	2	1.00409
1,328,880	221,271	18.944	18.944	18.944	18.944	1	0
1,328,880	221,272	19.098	19.098	19.098	19.098	1	0
1,328,890	221,270	21.083	21.083	21.083	21.083	1	0
1,328,890	221,269	16.598	16.598	16.598	16.598	1	0
1,328,900	221,267	14.498	14.498	14.498	14.498	1	0
1,328,910	221,268	13.835	13.835	13.835	13.835	1	0
1,328,910	221,265	12.477	12.6475	12.818	12.6475	2	0.241123
1,328,930	221,269	11.969	11.969	11.969	11.969	1	0
1,328,930	221,264	11.266	11.266	11.266	11.266	1	0
1,328,940	221,264	11.056	11.350	11.66	11.350	2	0.427093
1,328,940	221,271	11.365	11.365	11.365	11.365	1	0
1,328,950	221,271	11.26	11.465	11.67	11.465	2	0.269914
1,328,960	221,268	10.817	10.9025	10.988	10.9025	2	0.120914

Triangulation

"\Vm\Creation Method" = "TIN Interpolator (2.1)"

"\Vm\Z_Column" = "_COL3"

"\Vm\Solution Method" = "5th Order"

"\Vm\Cell Size" = "5"

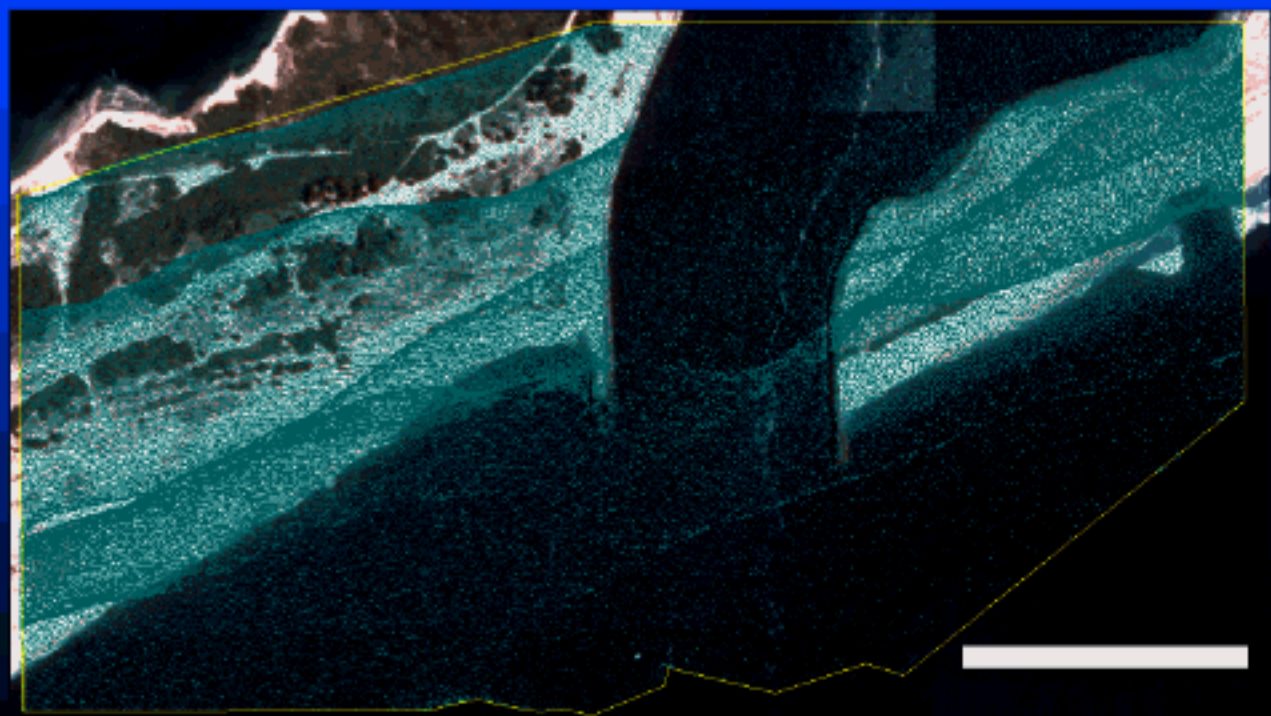
"\Vm\Max Triangle Side Length" = "100"

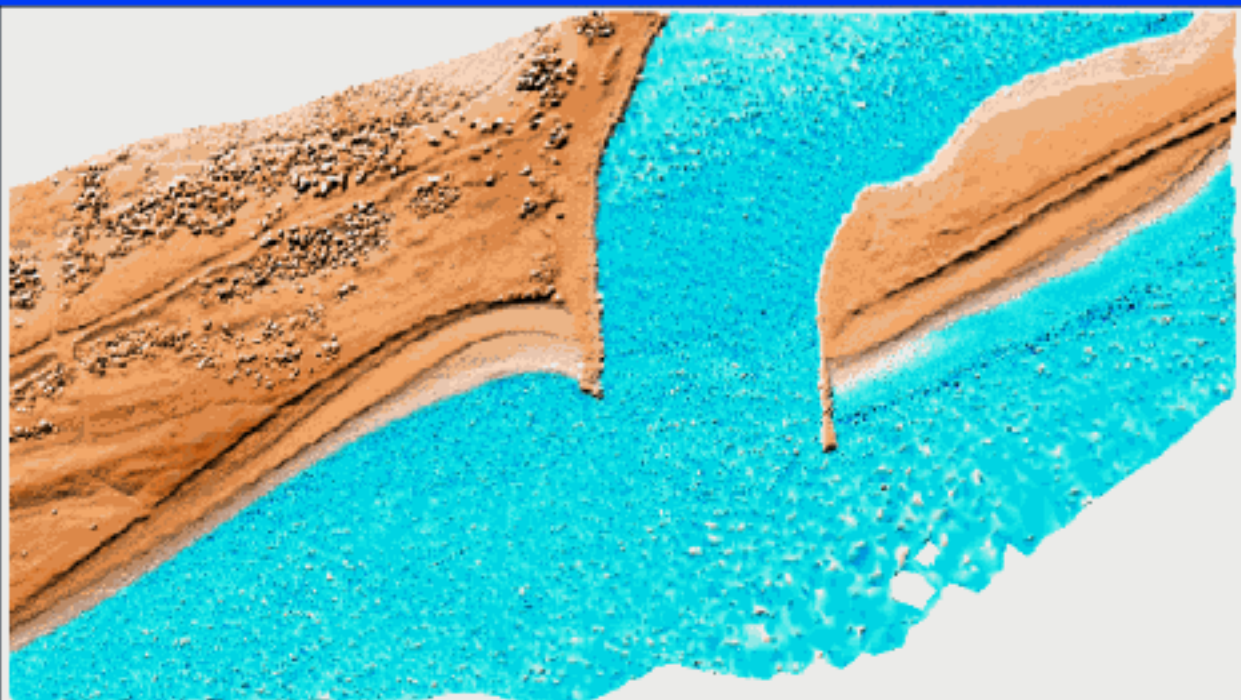
"\Vm\Coincident Point Distance" = "1"

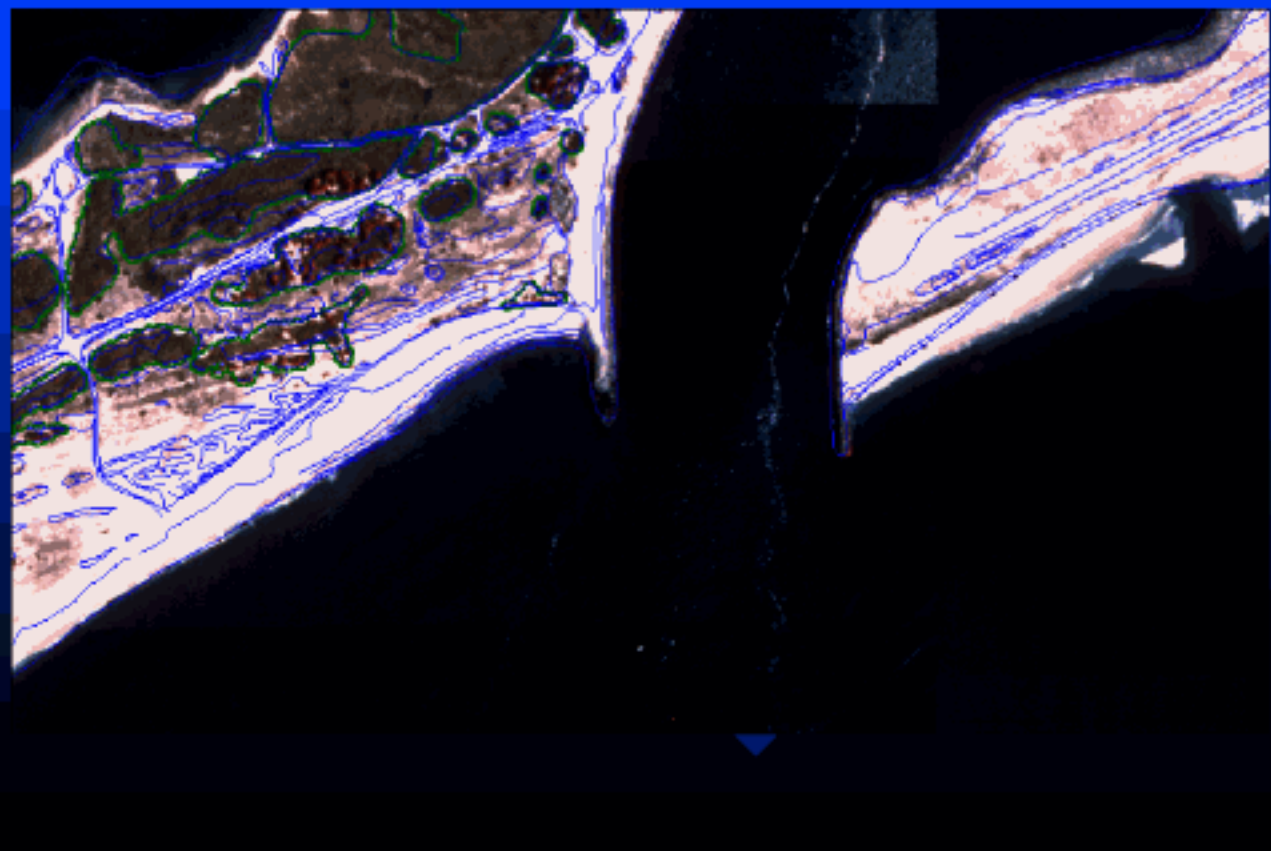
"\Vm\Coincident Point Method" = "Minimum"

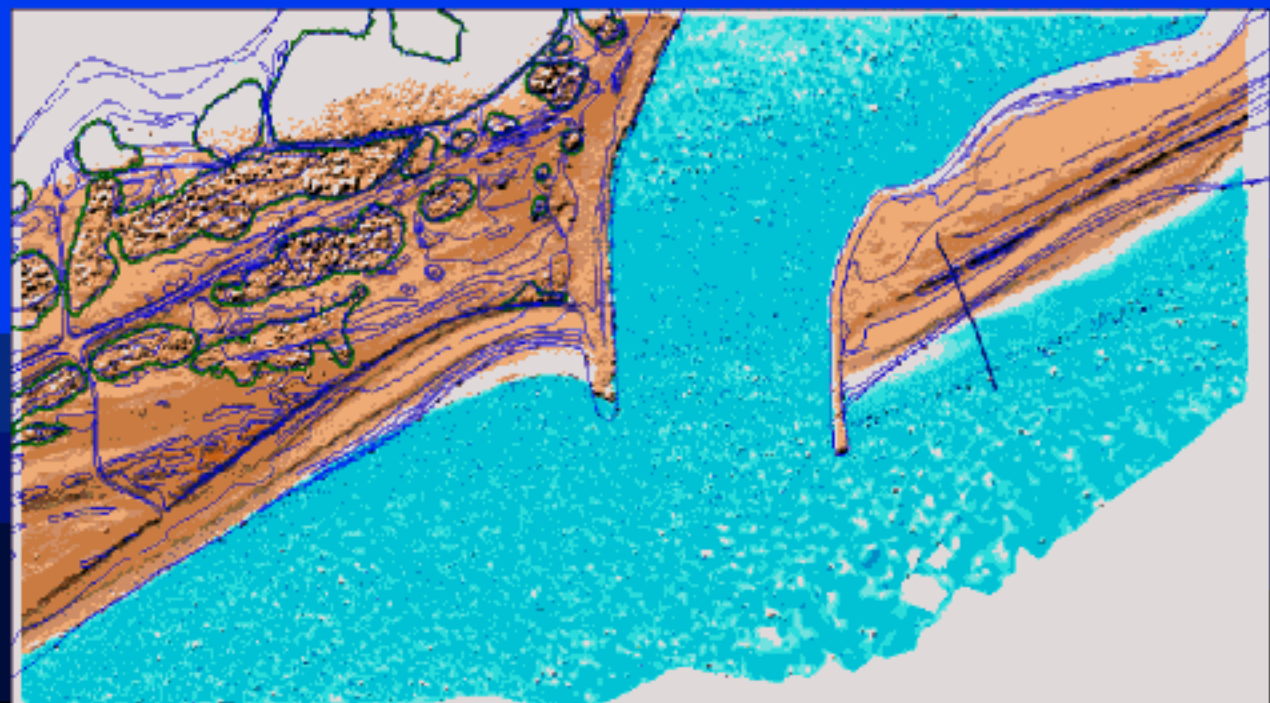
"\Vm\Weighting Factor" = "2"

"\Vm\Weighting Exponent" = "1"



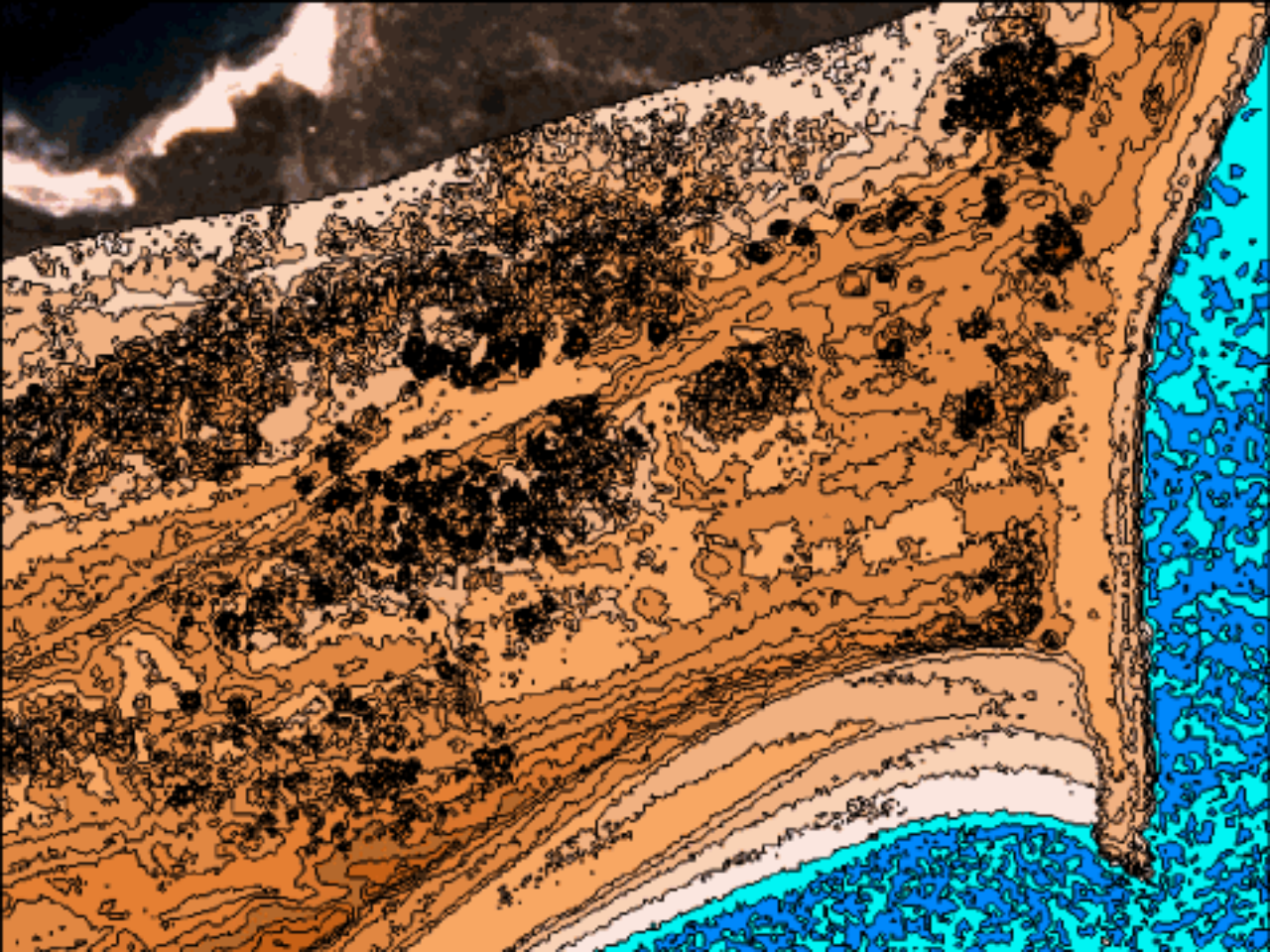


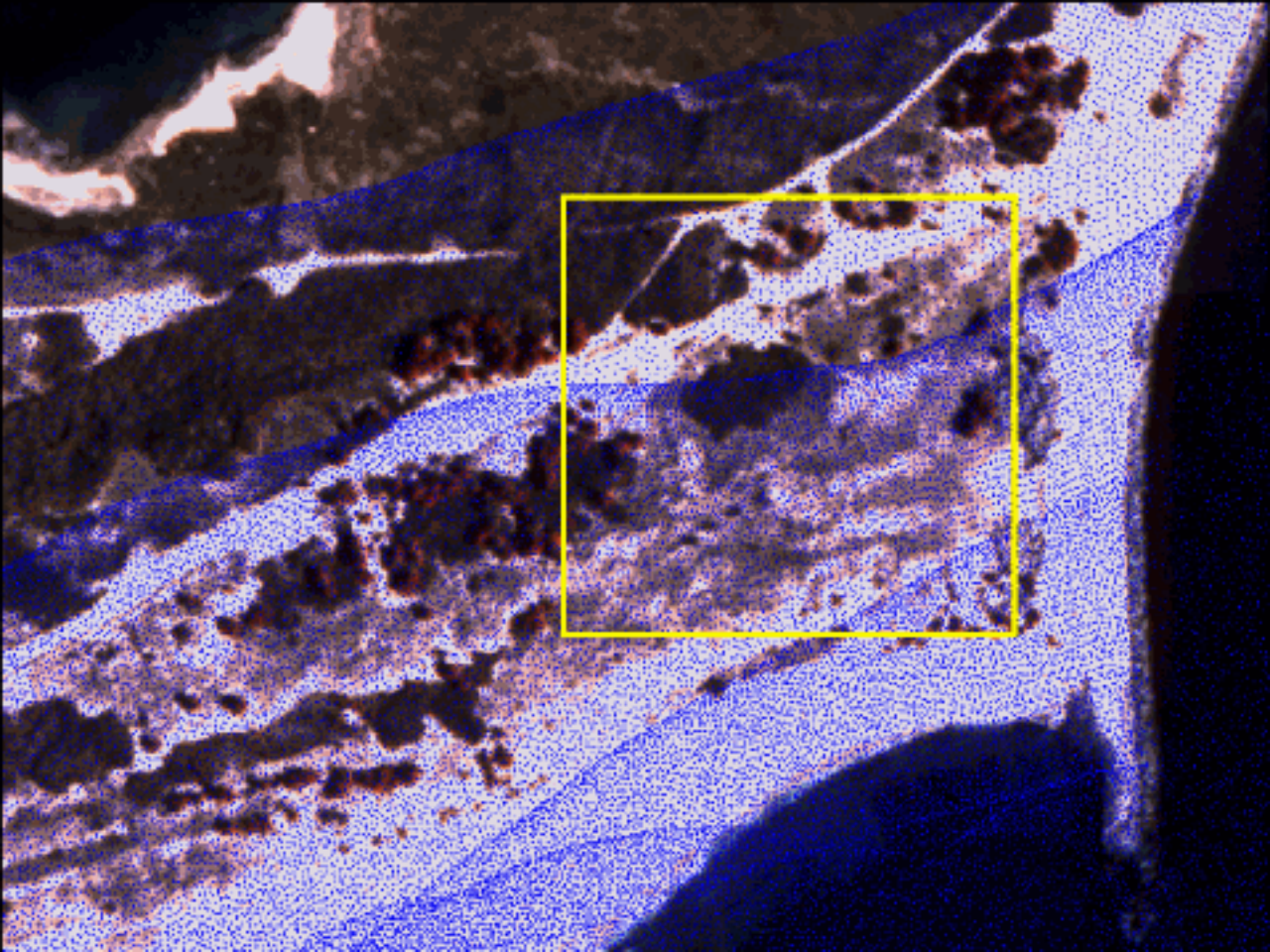


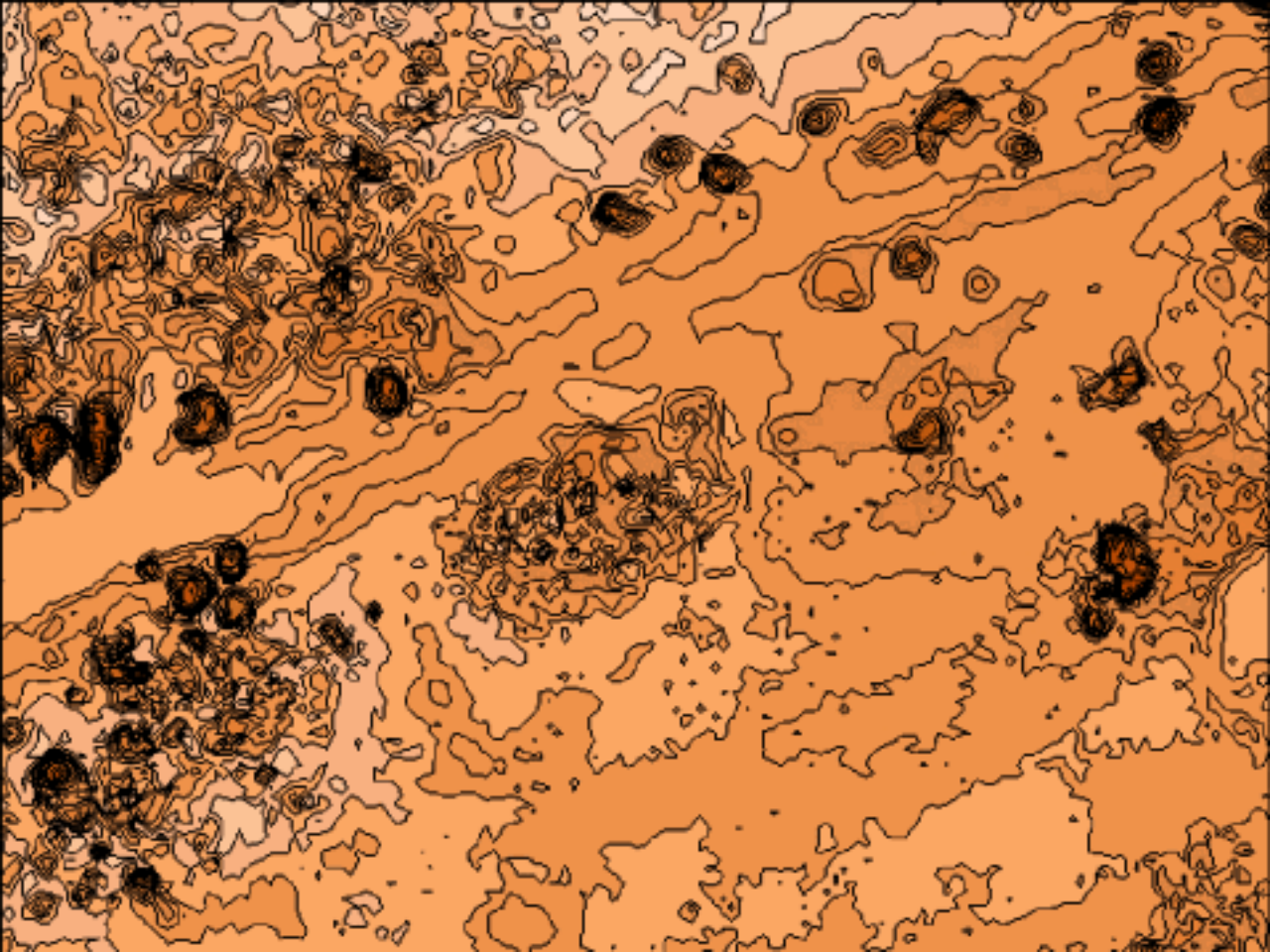


Applications

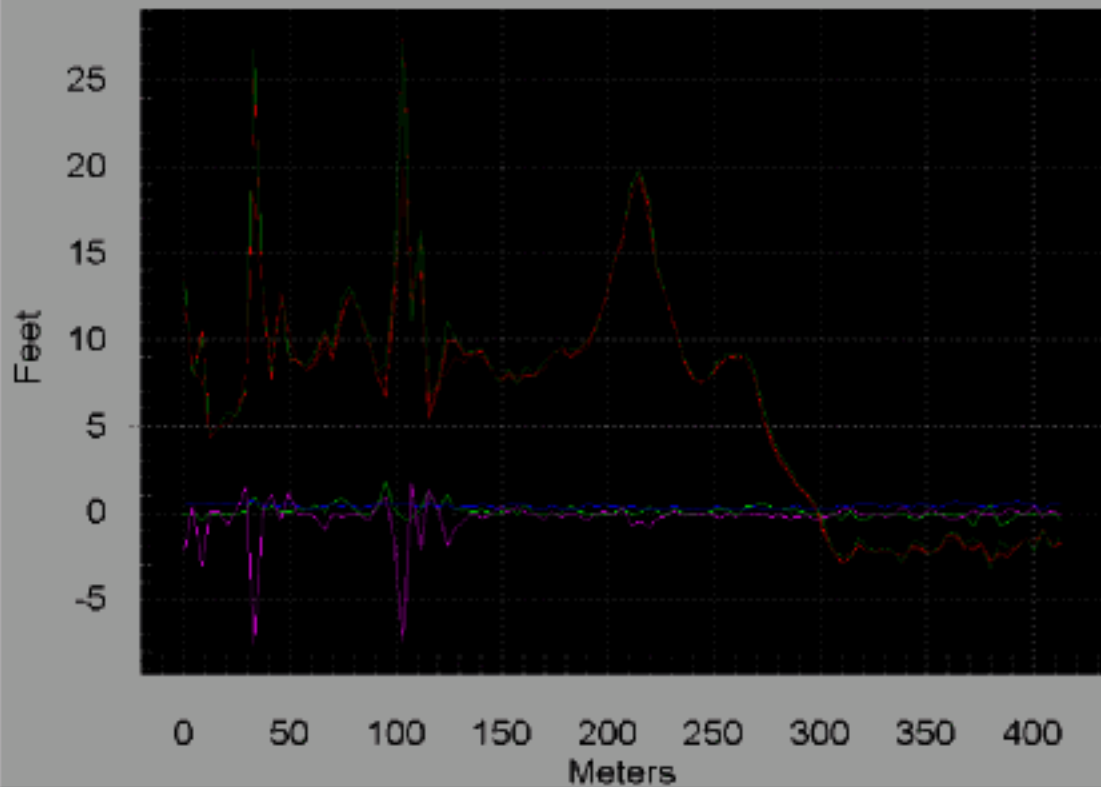
- Coastline mapping
- Contouring
- Supplement / replace baseline transects
- Base elevations for post-storm analysis
- Change analysis: area and volume

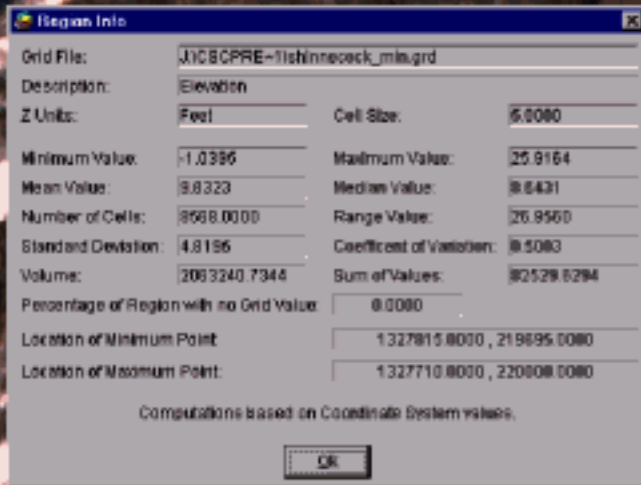






Cross Section





Conclusions

- Highly accurate data
- Validated with coincident transects
- Base elevation surface
- Greater detail than transects
- Future volumetric change analysis