

2010

Bathymetric Attributed Grids (BAGs): Discovery of Marine Datasets and Geospatial Metadata Visualization

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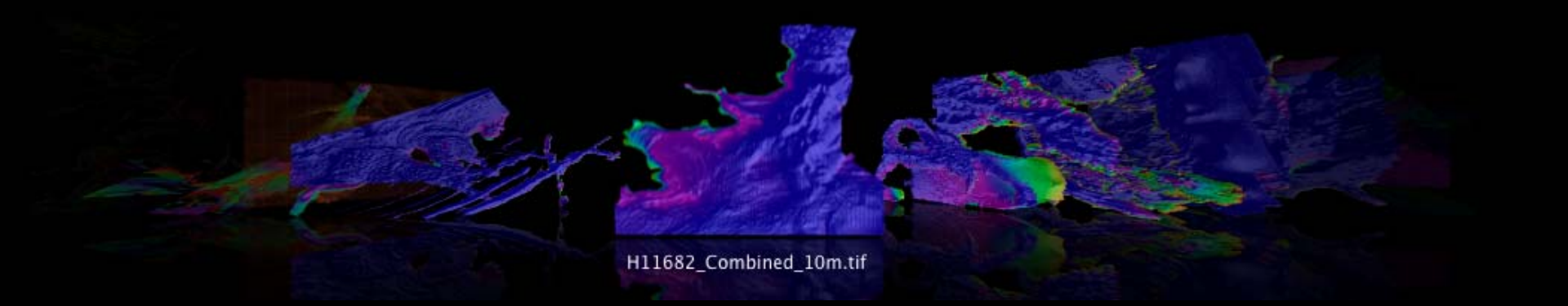
Schwehr, Kurt; Armstrong, Andy; Brennan, Rick T.; Fischman, David; Sellars, Jon; and Smith, Shep M. LT, "Bathymetric Attributed Grids (BAGs): Discovery of Marine Datasets and Geospatial Metadata Visualization" (2010). *Canadian Hydrographic Conference (CHC)*. 781.

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Authors

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H11682_Combined_10m.tif

CHC2010 - BAGS in Google Earth

Schwehr, Armstrong, Brennan, Fischman, Sellars, Smith

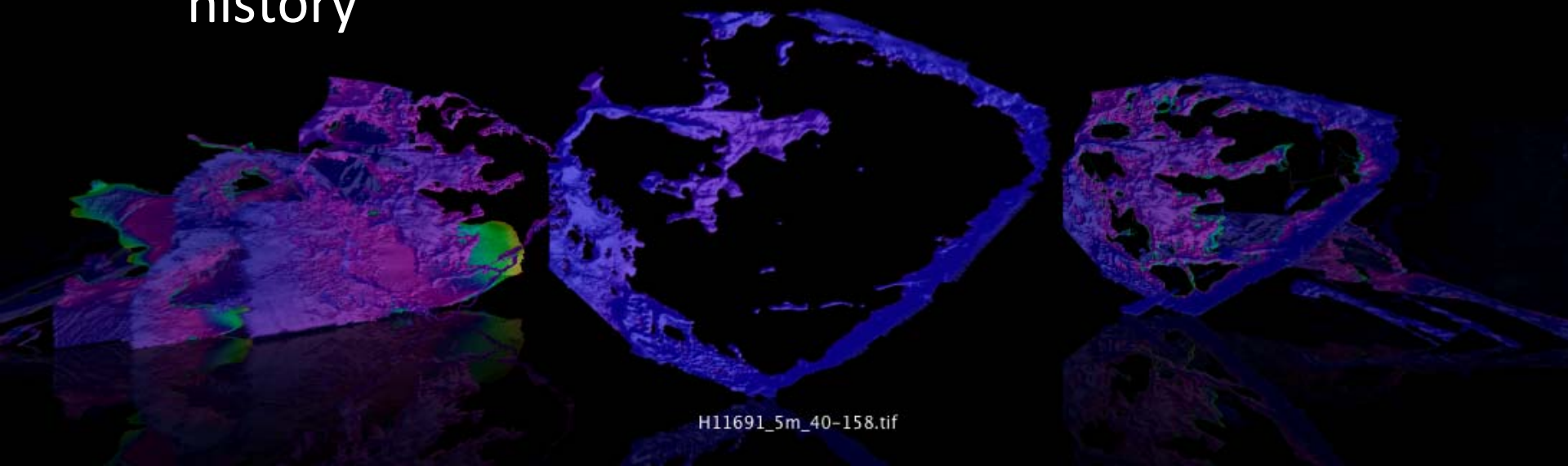


The last mile / shoulders of many



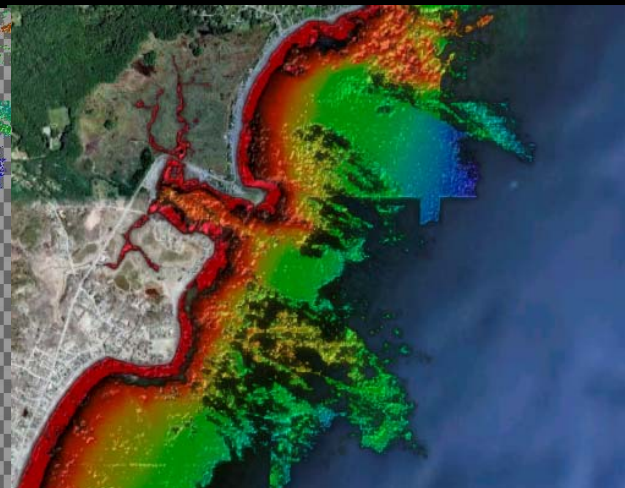
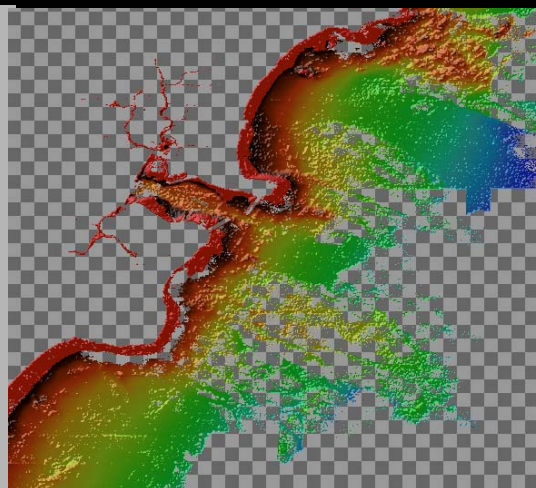
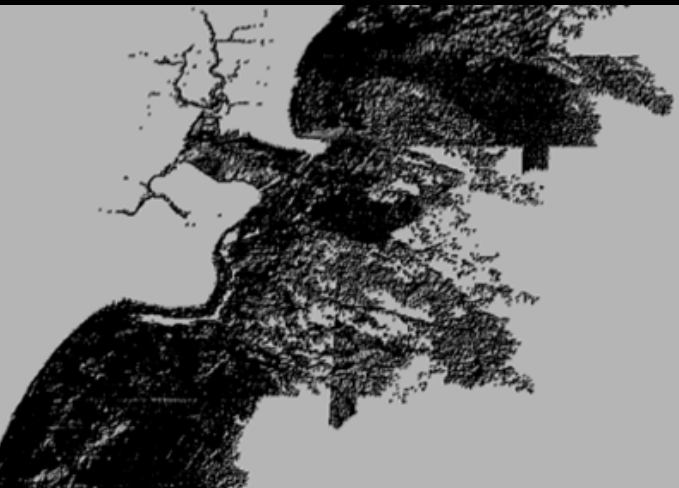
What is a BAG?

- <http://www.opennavsurf.org/>
- An “HDF5” file containing
 - Bathymetry
 - Metadata
 - Additional layers e.g. uncertainty & processing history



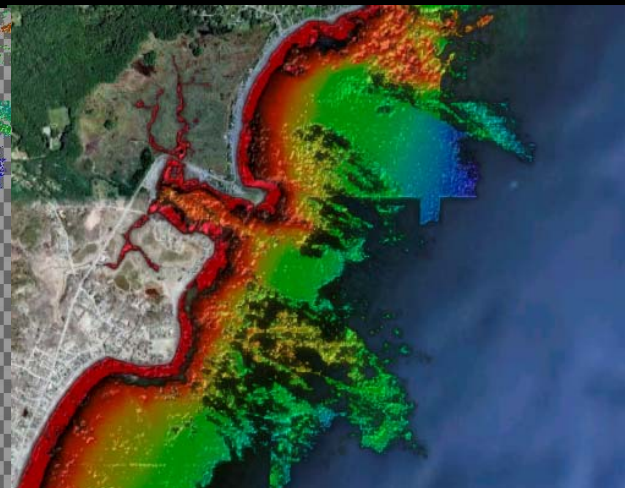
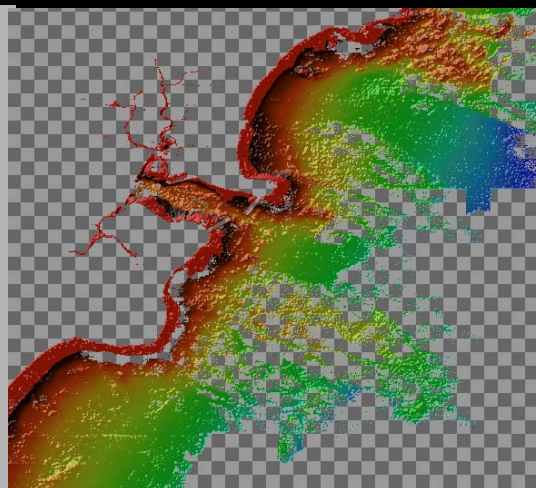
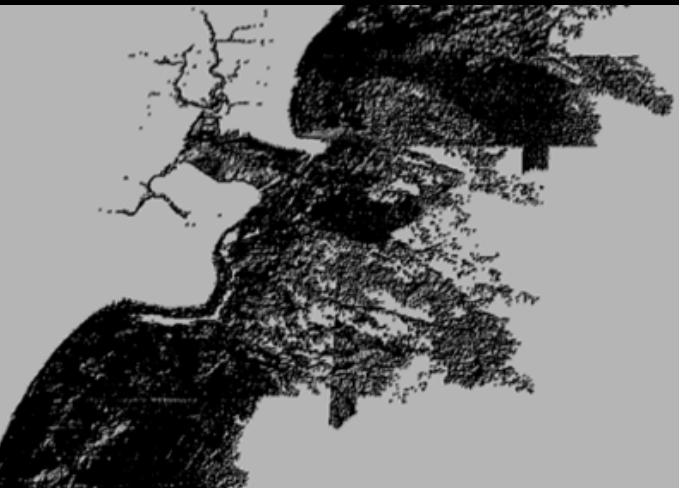
Goals

- Document pathways from BAG to Google Earth
- How well is the community doing with producing and consuming BAGs?
- Provide a place to review the bathymetry and metadata

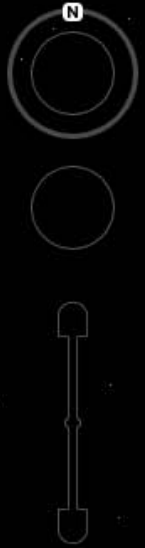


Goals

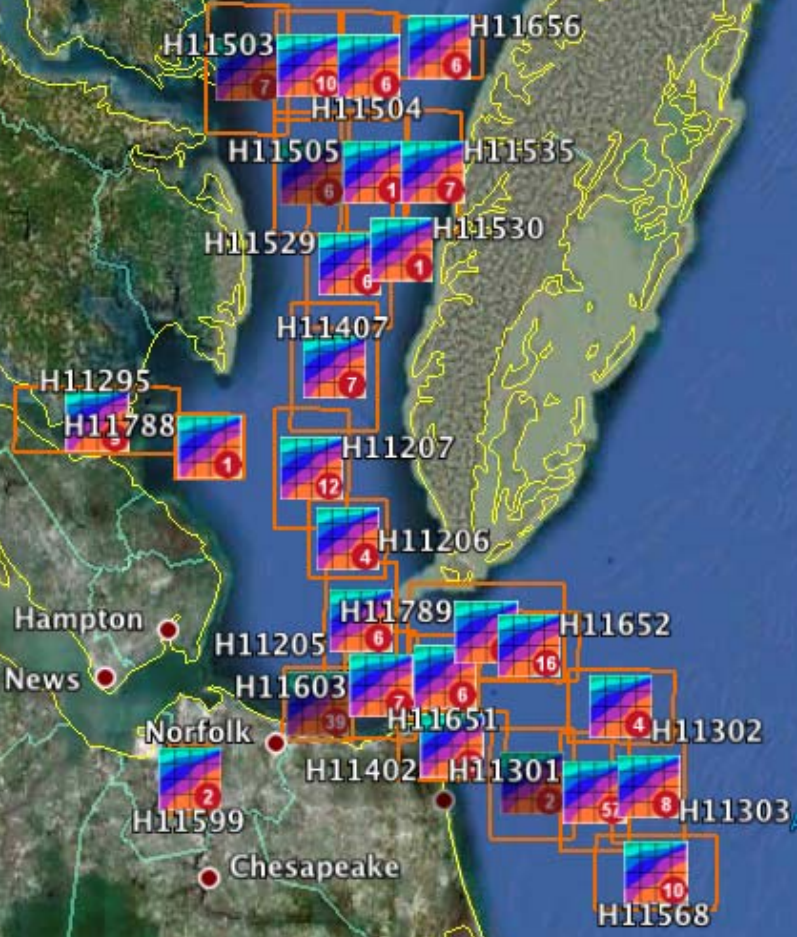
- Document pathways from BAG to Google Earth
- How well is the community doing with producing and consuming BAGs?
- Provide a place to review the bathymetry and metadata
- Increase the reuse of bathymetry products -> discoverability



A tour through the Google Earth interface for BAGs



Virginia



Norfolk Canyon

Albemarle Shelf Valley

60 km

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Image © 2010 Commonwealth of Virginia
Data SIO, NOAA, U.S. Navy, NGA, GEBCO

©2009 Google

lat 37.461535° lon -74.854114° elev -51 m

Eye alt 204.01 km

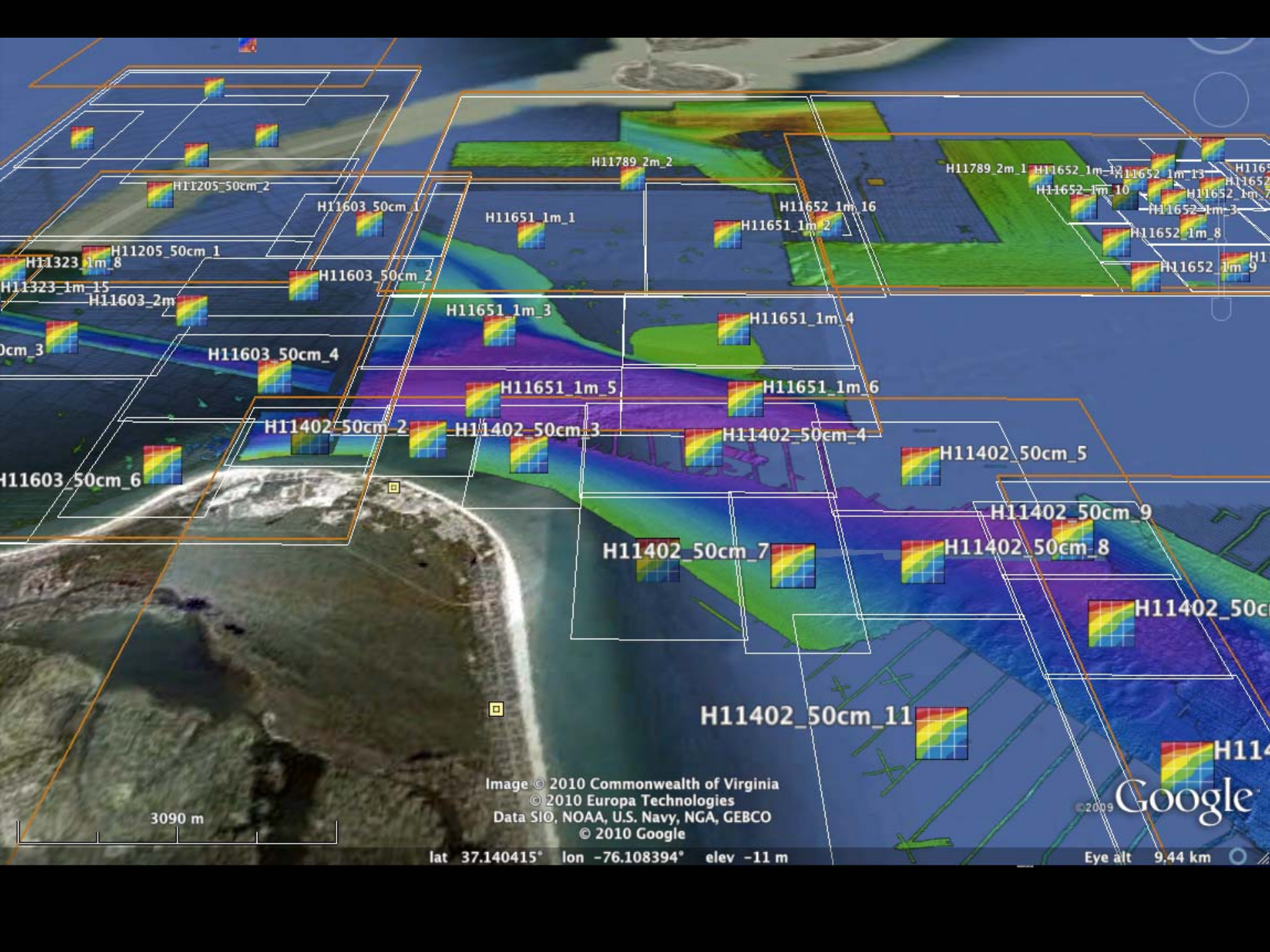
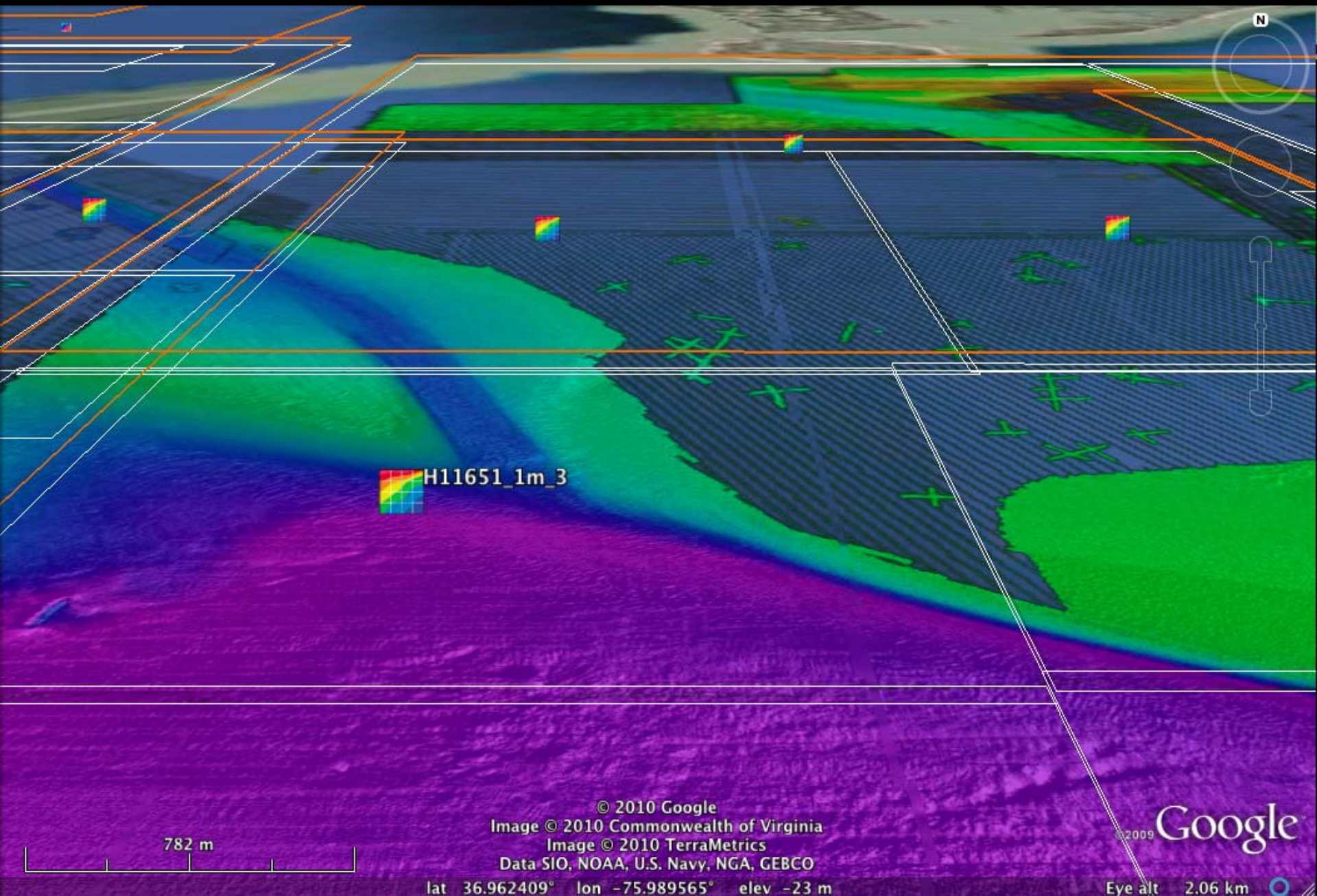


Image © 2010 Commonwealth of Virginia
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Data SIO, NOAA, U.S. Navy, NGA, GEBCO
© 2010 Google

©2009 Google

lat 37.140415° lon -76.108394° elev -11 m

Eye alt 9.44 km



H11651_1m_3

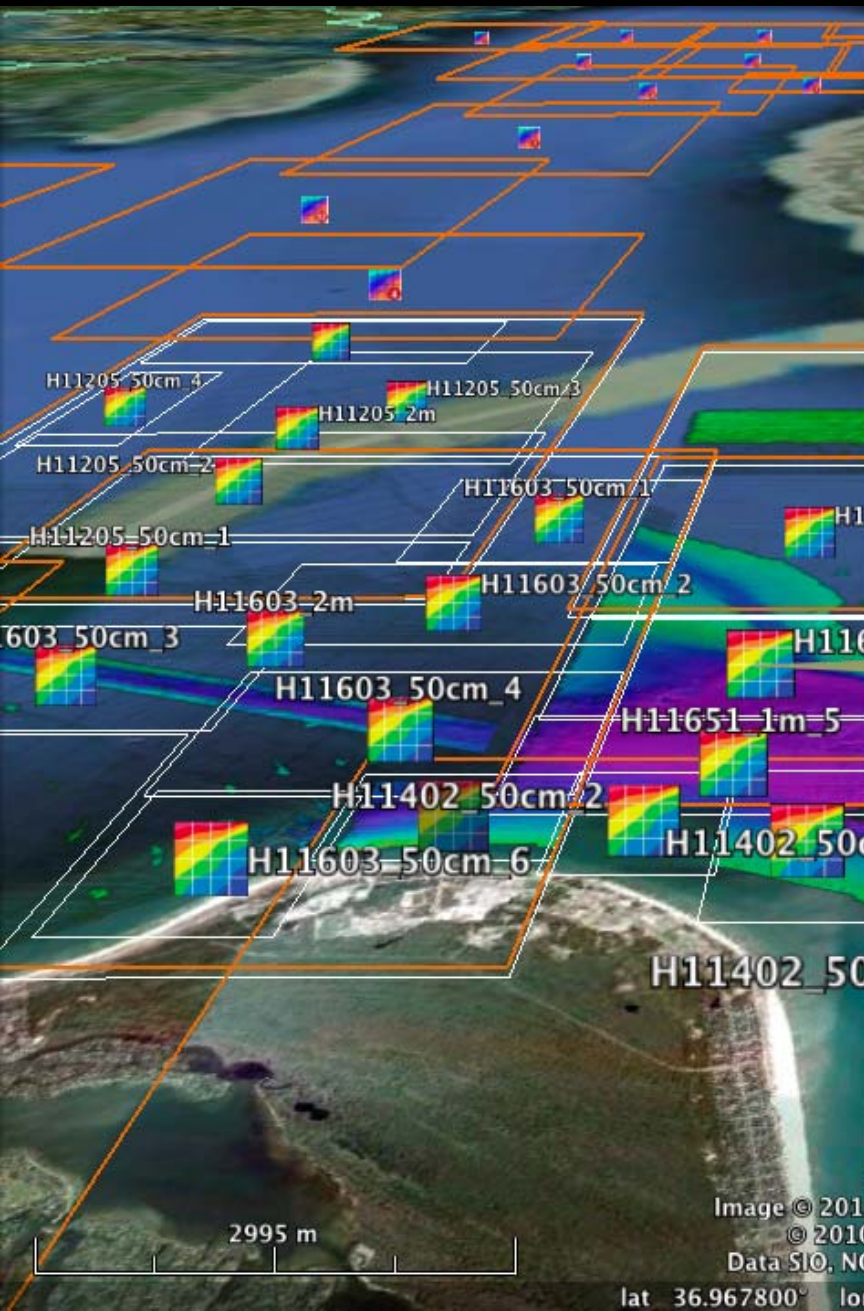
782 m

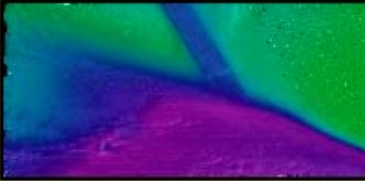
© 2010 Google
Image © 2010 Commonwealth of Virginia
Image © 2010 TerraMetrics
Data SIO, NOAA, U.S. Navy, NGA, GEBCO

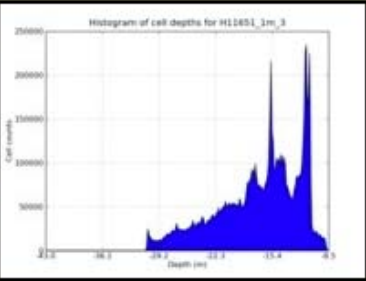
lat 36.962409° lon -75.989565° elev -23 m

2009 Google

Eye alt 2.06 km









Summary for BAG: H11651_1m_3

Resolution	1.0 x 1.0 (m/cell)
Cells	4286 x 2517 (m)
Lower left	-76.0243398127 36.9394748349
Upper right	-75.9323414249 37.0269088003
Descriptive report	H11651.pdf [NGDC]
gdalinfo	H11651_1m_3.bag.info.txt
xml metadata	H11651_1m_3.metadata.xml
Download bag	H11651_1m_3.bag.gz [NGDC]

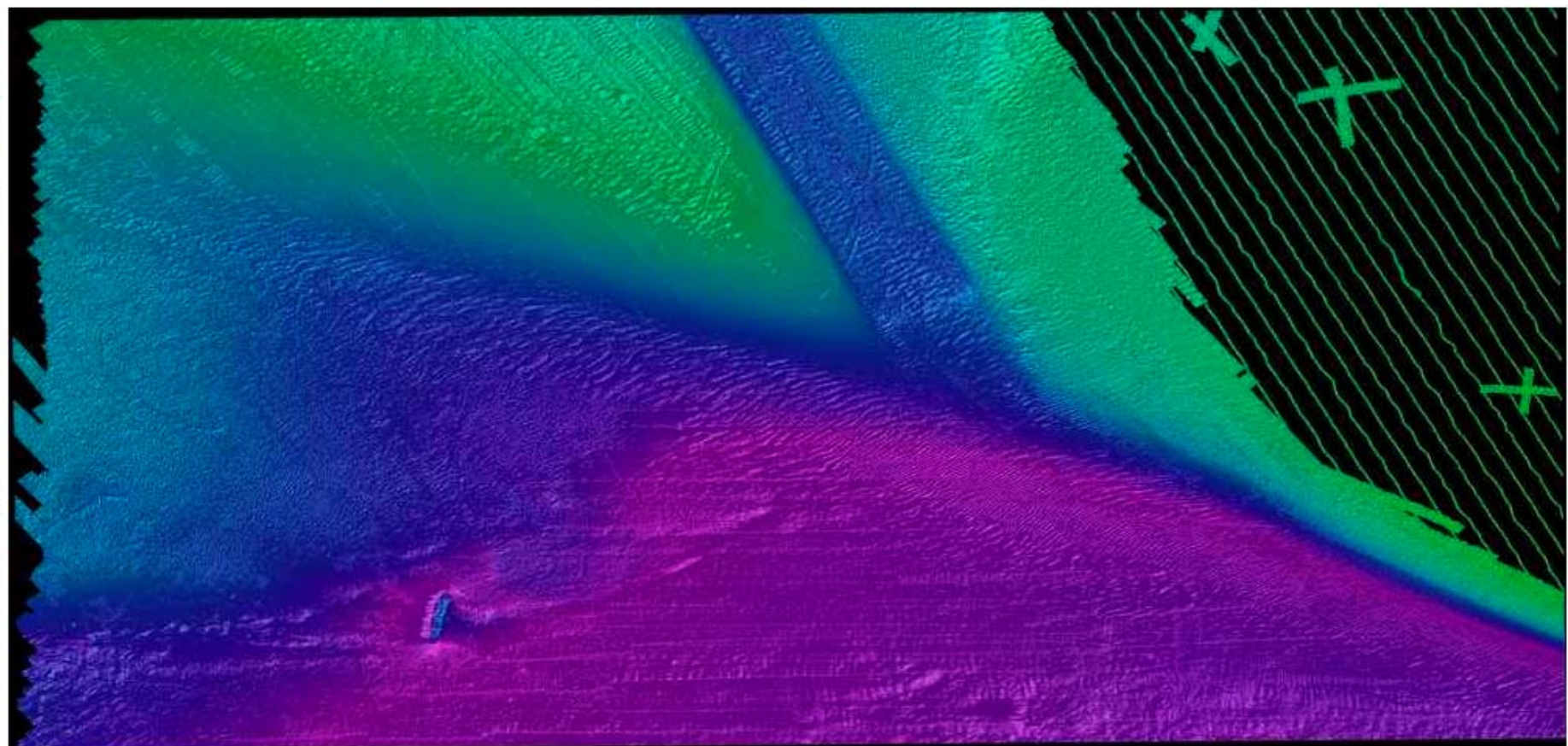
Visualization by: [Kurt Schwehr et al.](#)



H11651_1m_3.jpg (JPEG Image, 1000x477 pixels)

http://nrwais1.schwehr.org/~schwehr/bags/H10001-H12000/H11651/H11651_1m_3.jpg

H1
H11
H11
603

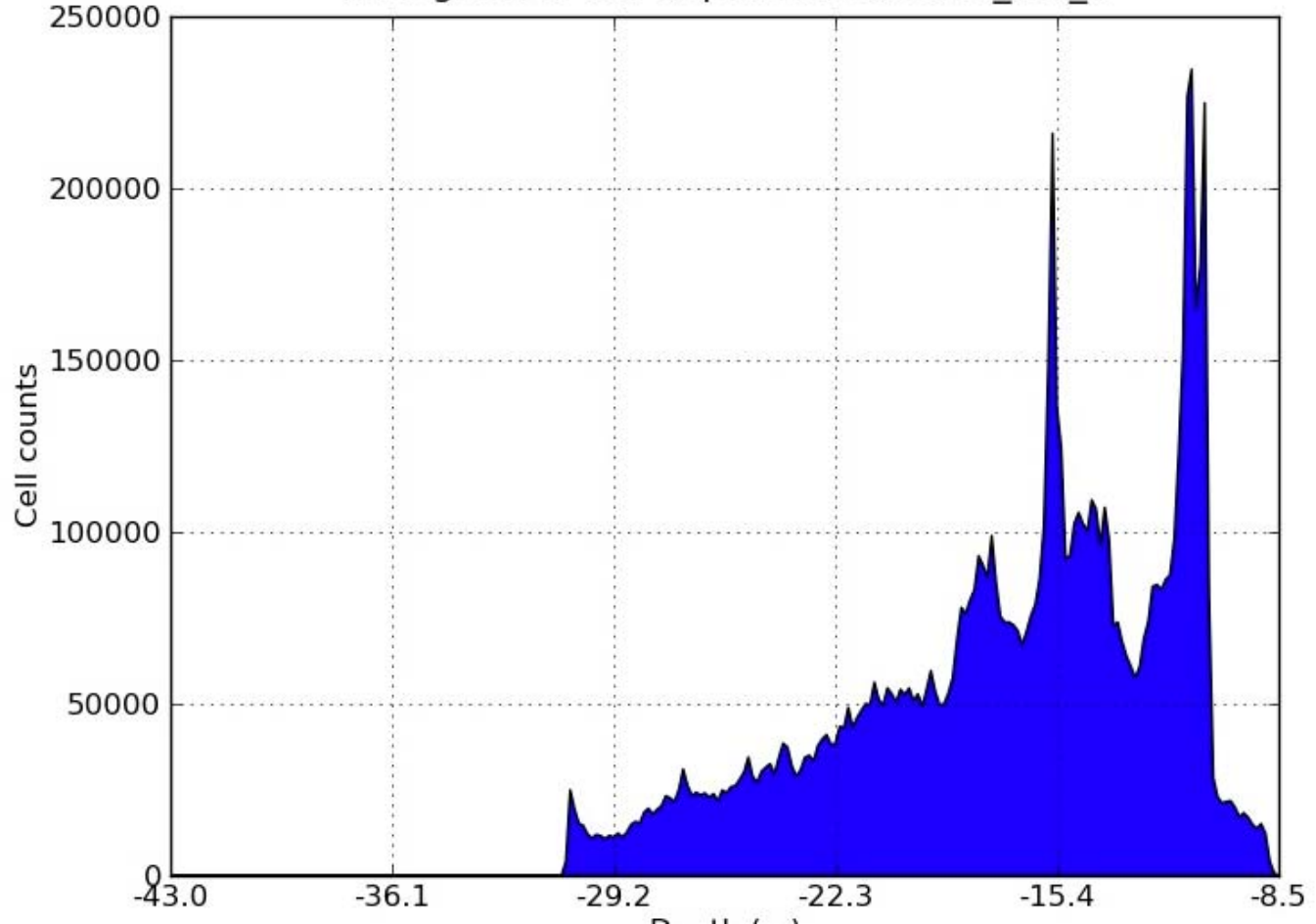
A vertical sidebar on the left side of the browser window. It contains a color calibration bar with a rainbow gradient and the number '603'. Below it, a small portion of the aerial map is visible, showing the orange survey grid.



H11651_1m_3-hist.jpg (JPEG Image, 800x600 pixels)

http://nrwais1.schwehr.org/~schwehr/bags/H10001-H12000/H11651/H11651_1m_3-hist.jpg

Histogram of cell depths for H11651_1m_3





Mozilla Firefox

http://nrwais1.schwehr.org/~schwehr/bags/H10001-H12000/H11651/H11651_1m_3.metadata.xml

BAG file created from: X:\BDB_files_ToBeUploaded\H11651\H11651_C_1m_Final.hns

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H11205_50
H11205_50
H11205_50
603 50cm

New Hampshire



13.4 km

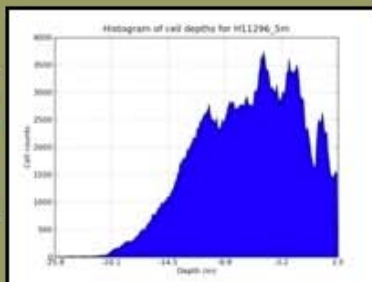
© 2010 Google

Image MassGIS, Commonwealth of Massachusetts EOE

Data SIO, NOAA, U.S. Navy, NGA, GEBCO

Image USDA Farm Service Agency

lat 42.943407° lon -70.824125° elev 13 m

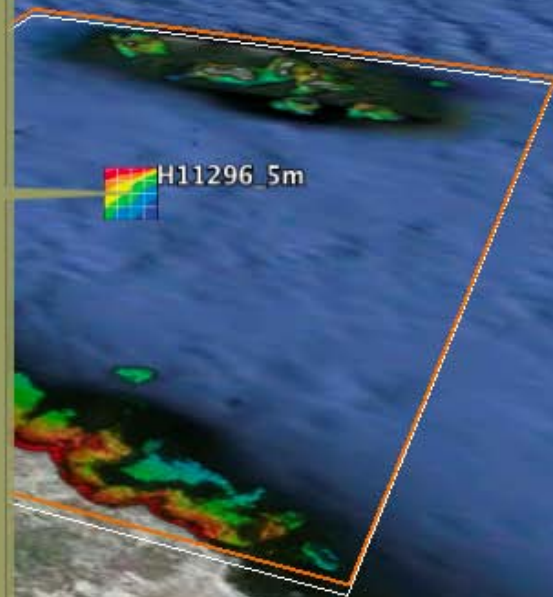


Summary for BAG: H11296_5m

Resolution	5.0 x 5.0 (m/cell)
Cells	3021 x 1597 (m)
Lower left	-70.7760890322 42.9486266248
Upper right	-70.5928700547 43.0232175933
Descriptive report	H11296.pdf [NGDC]
gdalinfo	H11296_5m.bag.info.txt
xml metadata	H11296_5m.metadata.xml
Download bag	H11296_5m.bag.gz [NGDC]



Visualization by: [Kurt Schwehr et al.](#)



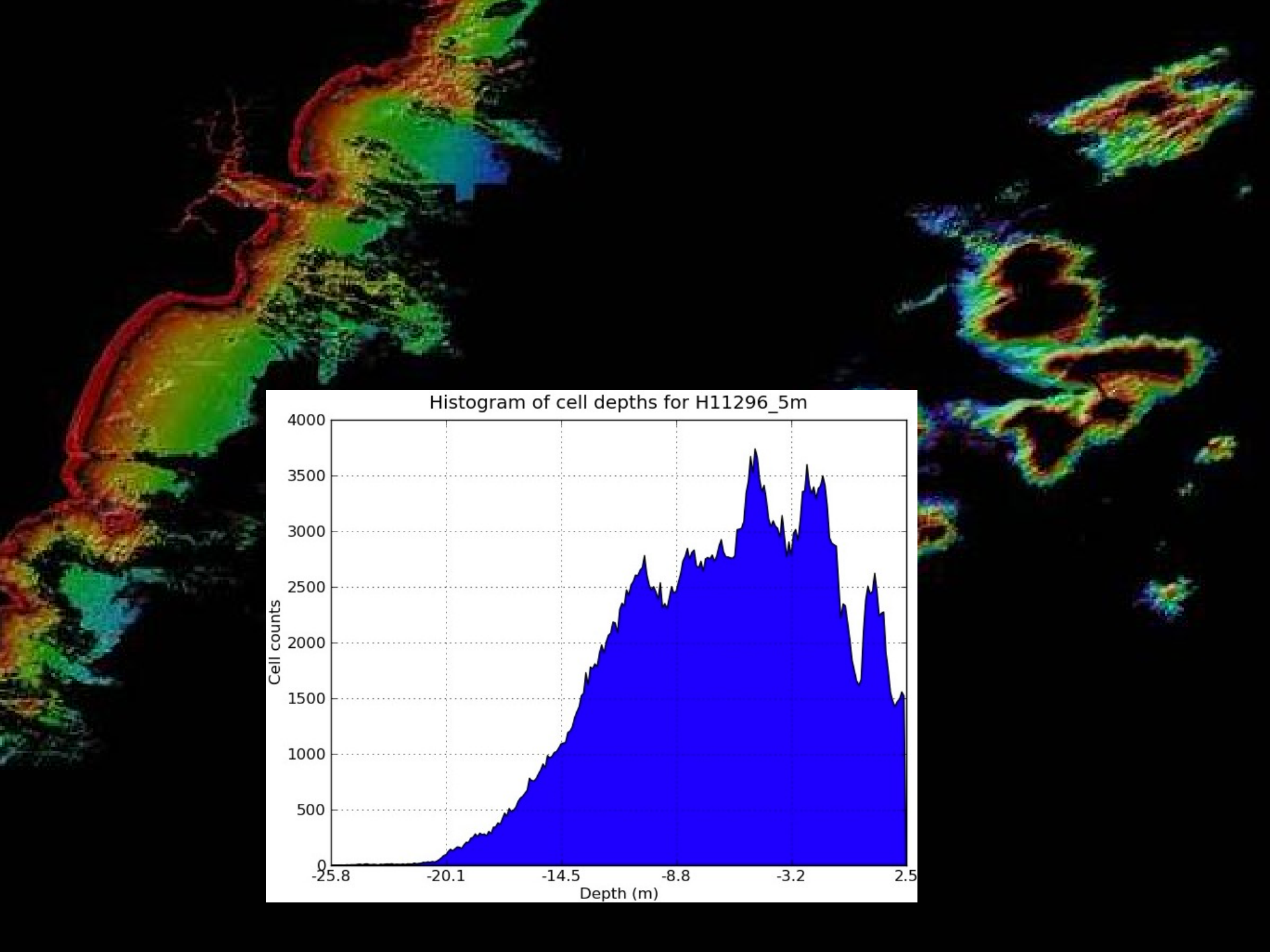
3033 m

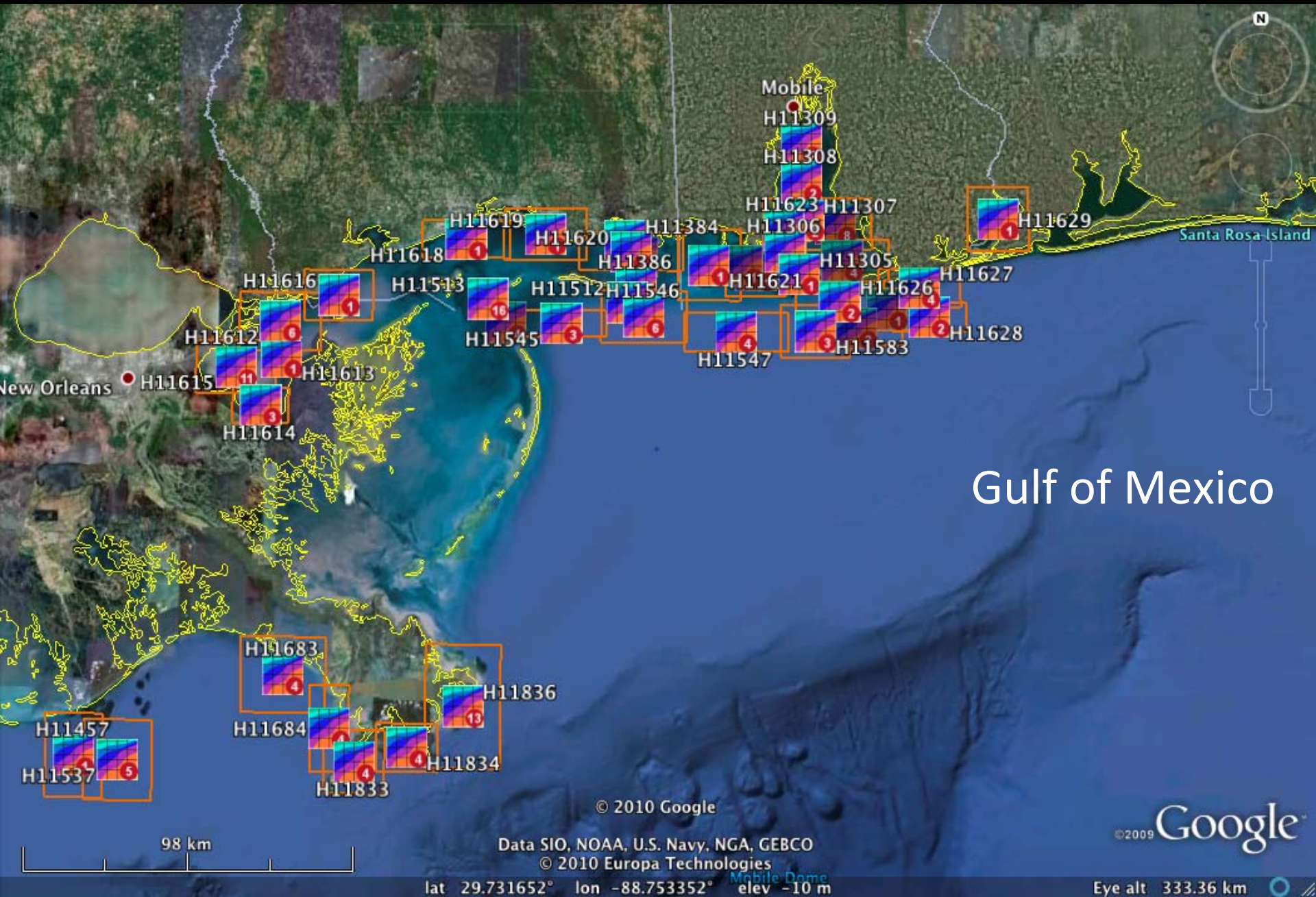
© 2010 Google
 Image © 2010 Maine GeoLibrary
 Data SIO, NOAA, U.S. Navy, NGA, GEBCO
 © 2010 Europa Technologies

lat 43.018897° lon -70.636523° elev -30 m

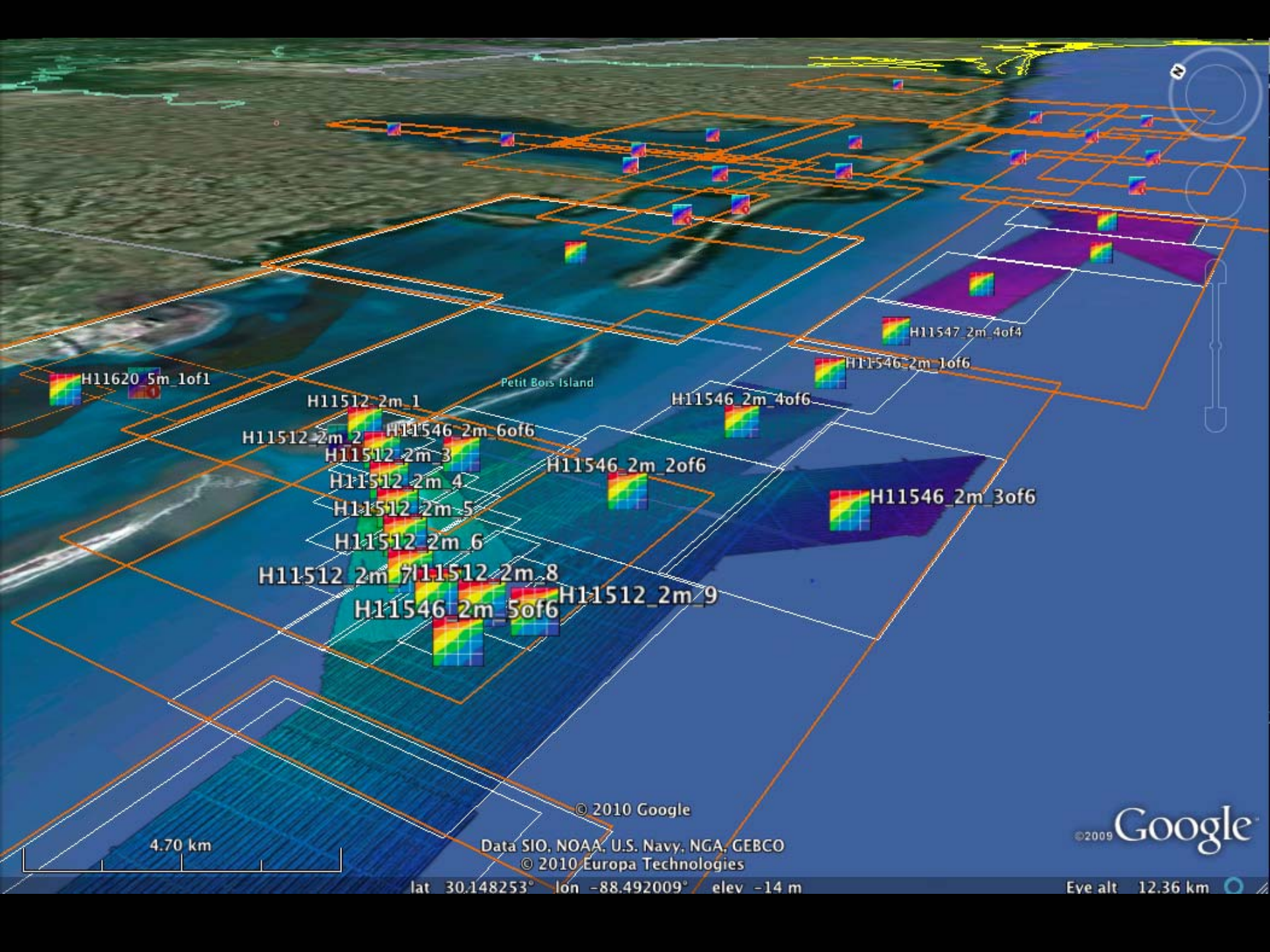
2009 Google

Eye alt 7.49 km





Gulf of Mexico



Petit Bois Island

H11620_5m_1of1

H11512_2m_1

H11546_2m_4of6

H11512_2m_2

H11546_2m_6of6

H11512_2m_3

H11546_2m_2of6

H11512_2m_4

H11512_2m_5

H11512_2m_6

H11512_2m_7

H11512_2m_8

H11512_2m_9

H11546_2m_5of6

H11547_2m_4of4

H11546_2m_1of6

H11546_2m_3of6

4.70 km

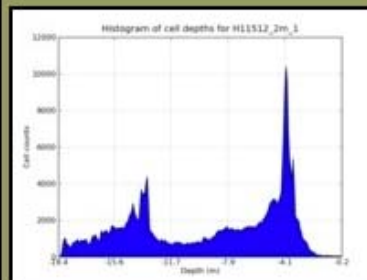
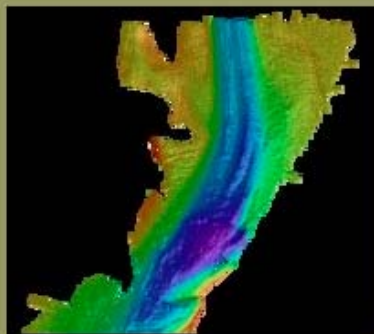
© 2010 Google

Data SIO, NOAA, U.S. Navy, NGA, GEBCO
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lat 30.148253° lon -88.492009° elev -14 m

Eye alt 12.36 km



Summary for BAG: H11512_2m_1

Resolution	2.0 x 2.0 (m/cell)
Cells	972 x 993 (m)
Lower left	-88.6010135372 30.1235799382
Upper right	-88.4984773395 30.2305775958
Descriptive report	H11512.pdf [NGDC]
gdalinfo	H11512_2m_1.bag.info.txt
xml metadata	H11512_2m_1.metadata.xml
Download bag	H11512_2m_1.bag.gz [NGDC]



Visualization by: [Kurt Schwehr et al.](#)

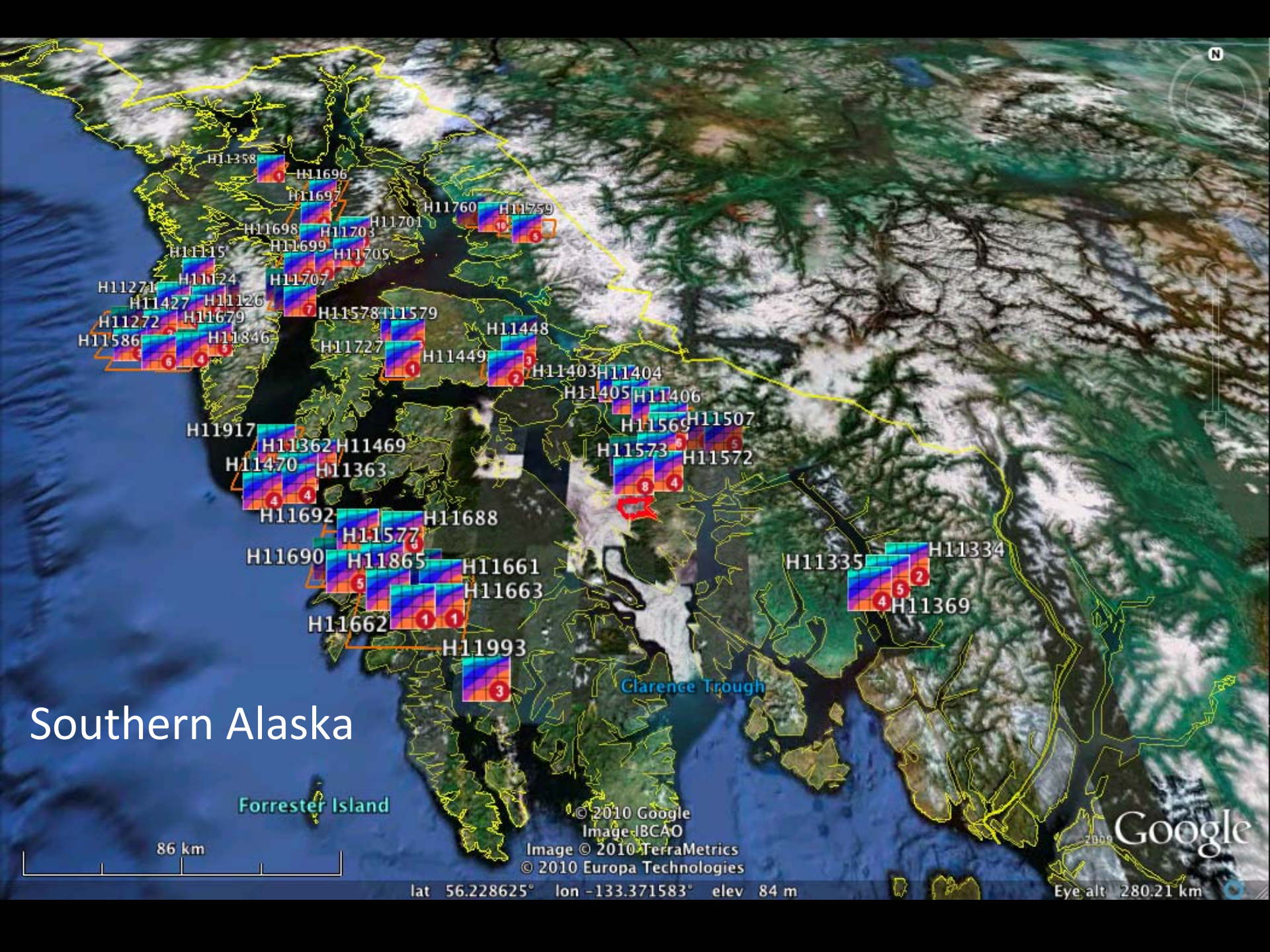
4.70 km

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© 2010 Europa Technologies

lat 30.208078° lon -88.531459° elev -4 m

©2009 Google

Eye alt 12.36 km



Southern Alaska

Forrester Island

Clarence Trough

86 km

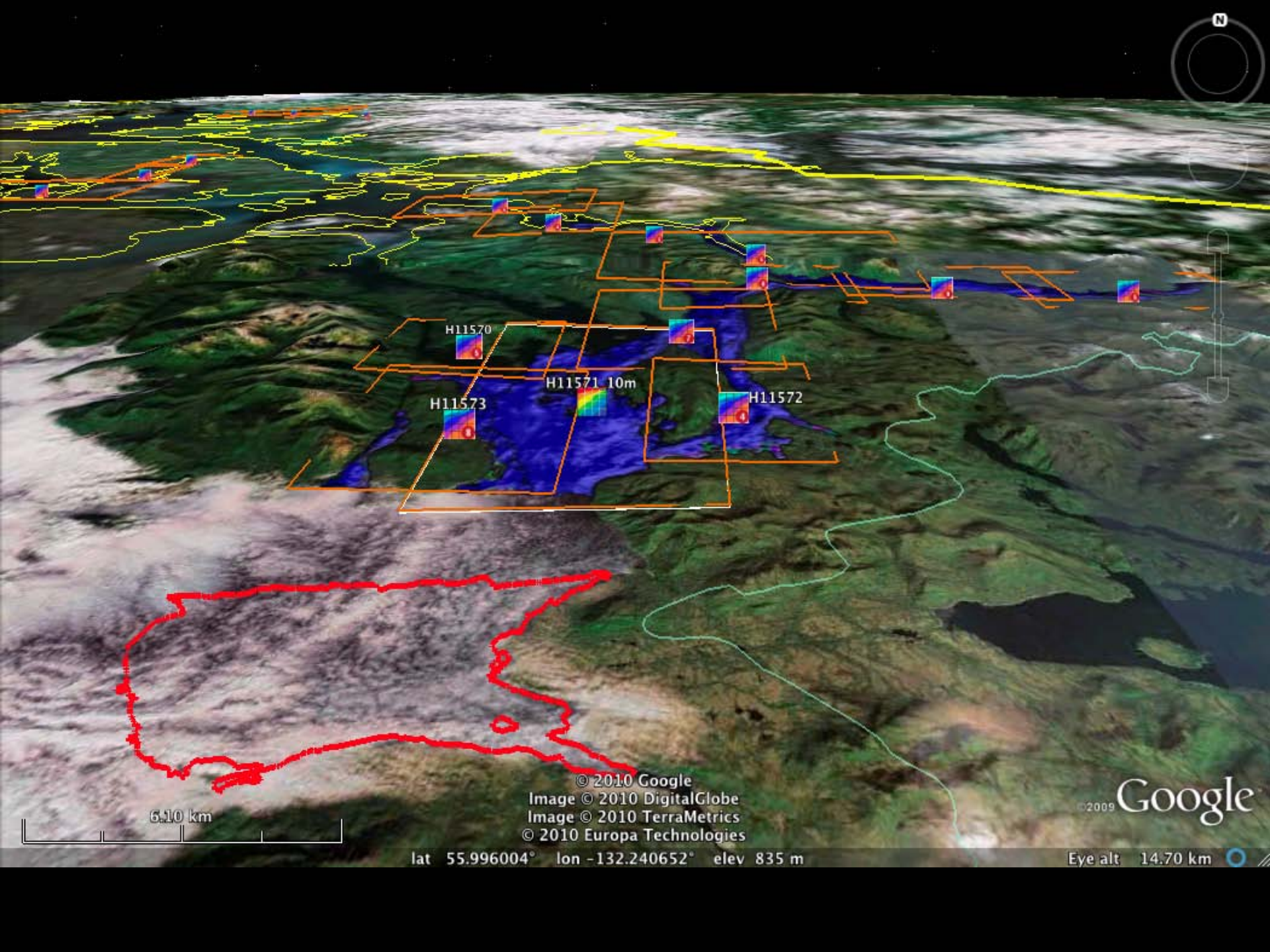
© 2010 Google
Image © 2010 TerraMetrics
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Google

lat 56.228625° lon -133.371583° elev 84 m

Eye alt 280.21 km

- H11358
- H11696
- H11697
- H11760
- H11759
- H11698
- H11703
- H11701
- H11715
- H11699
- H11705
- H11271
- H11724
- H11707
- H11272
- H11679
- H11846
- H11578
- H11579
- H11448
- H11727
- H11449
- H11403
- H11404
- H11405
- H11406
- H11569
- H11507
- H11917
- H11362
- H11469
- H11470
- H11363
- H11573
- H11572
- H11692
- H11688
- H11577
- H11690
- H11865
- H11661
- H11663
- H11662
- H11993
- H11335
- H11334
- H11369



H11570

H11573

H11571 10m

H11572

6.10 km

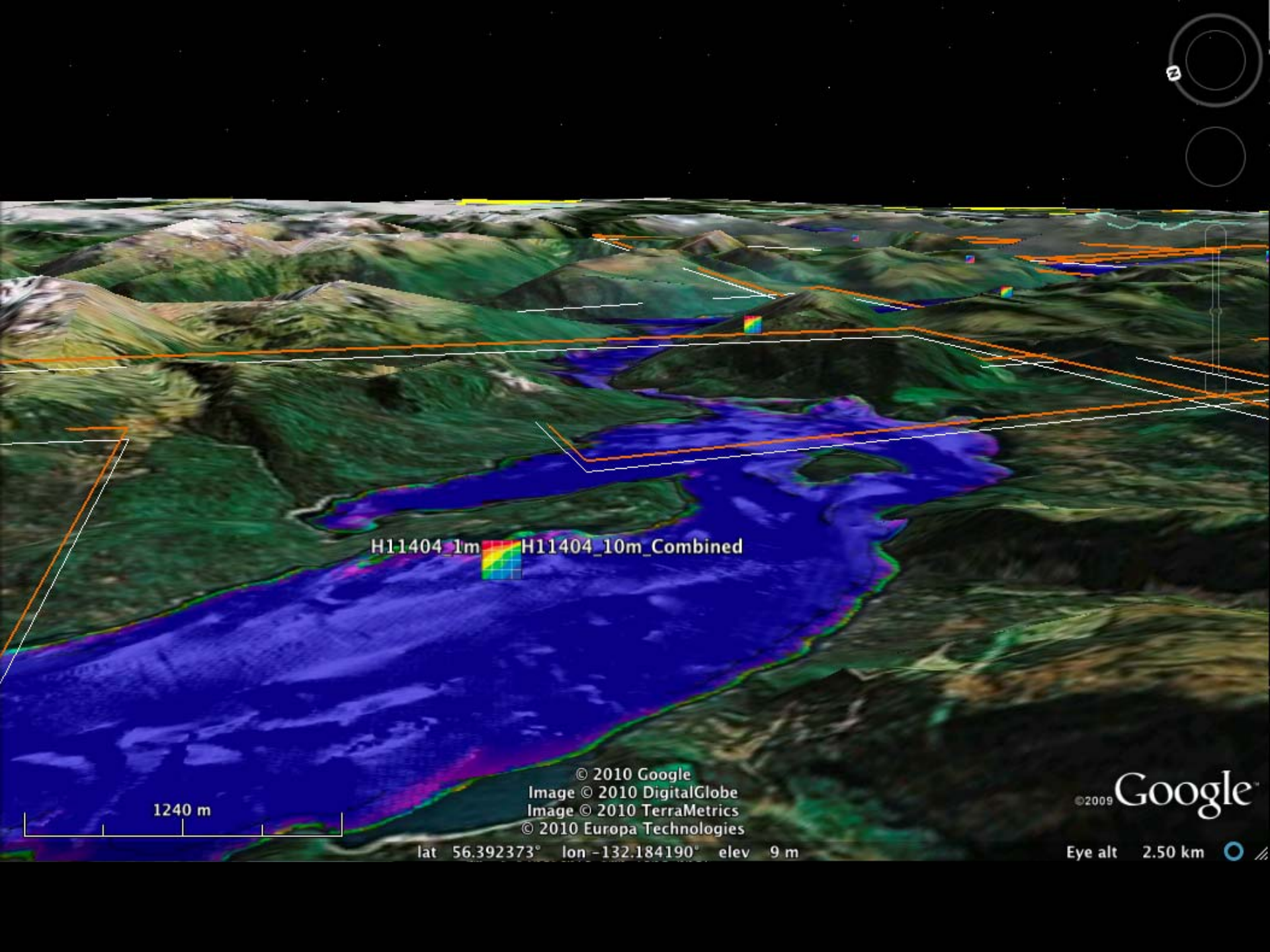


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lat 55.996004° lon -132.240652° elev 835 m

Eye alt 14.70 km



H11404_1m H11404_10m_Combined



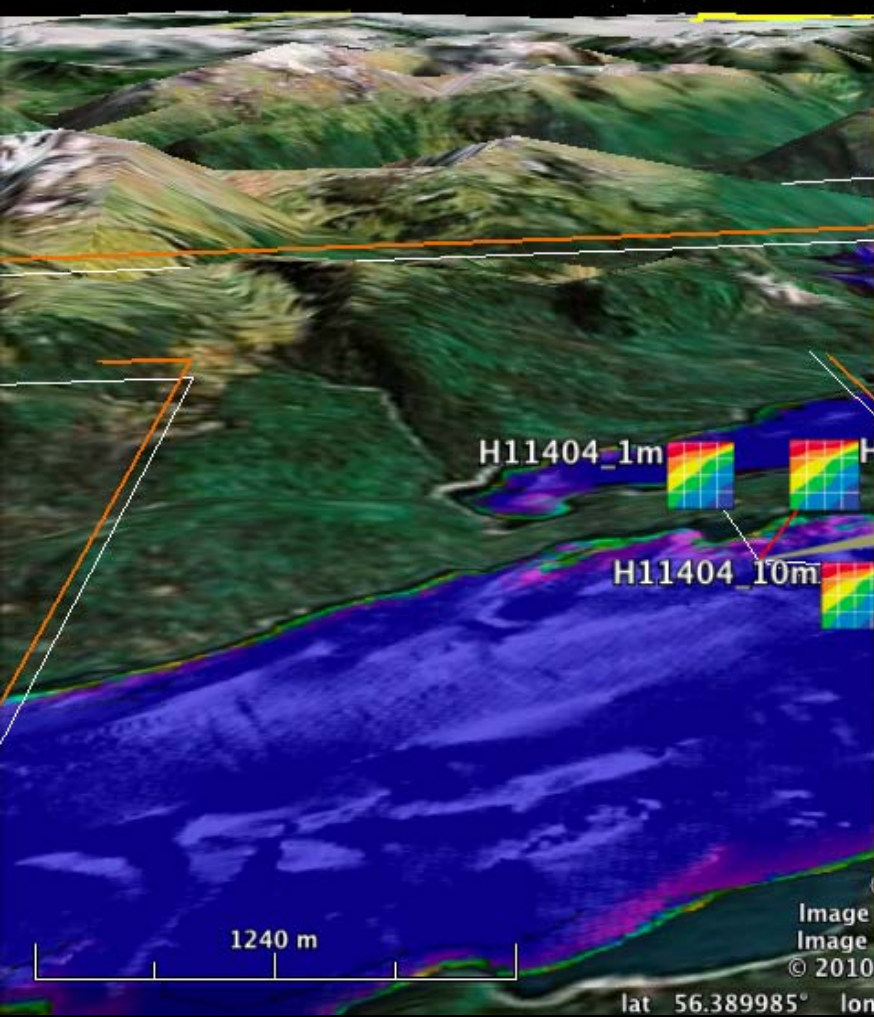
1240 m


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Image © 2010 TerraMetrics
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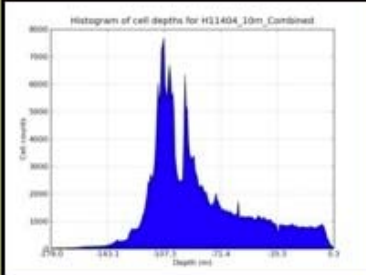
lat 56.392373° lon -132.184190° elev 9 m

©2009 Google

Eye alt 2.50 km









Summary for BAG: H11404_10m_Combined

Resolution	10.0 x 10.0 (m/cell)
Cells	959 x 1264 (m)
Lower left	-132.269322846 56.3383986067
Upper right	-132.105867396 56.4482382035
Descriptive report	H11404.pdf [NGDC]
gdalinfo	H11404_10m_Combined.bag.info.txt
xml metadata	H11404_10m_Combined.metadata.xml
Download bag	H11404_10m_Combined.bag.gz [NGDC]

Visualization by: [Kurt Schwehr et al.](#)

Image
Image
© 2010 Europa Technologies

lat 56.389985° lon -132.174913° elev 43 m

Eye alt 2.50 km

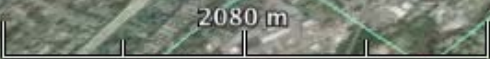
Norfolk, VA

Craney Island

Portsmouth

Portsmouth

H11599 50cm H11599 1m



© 2010 Google
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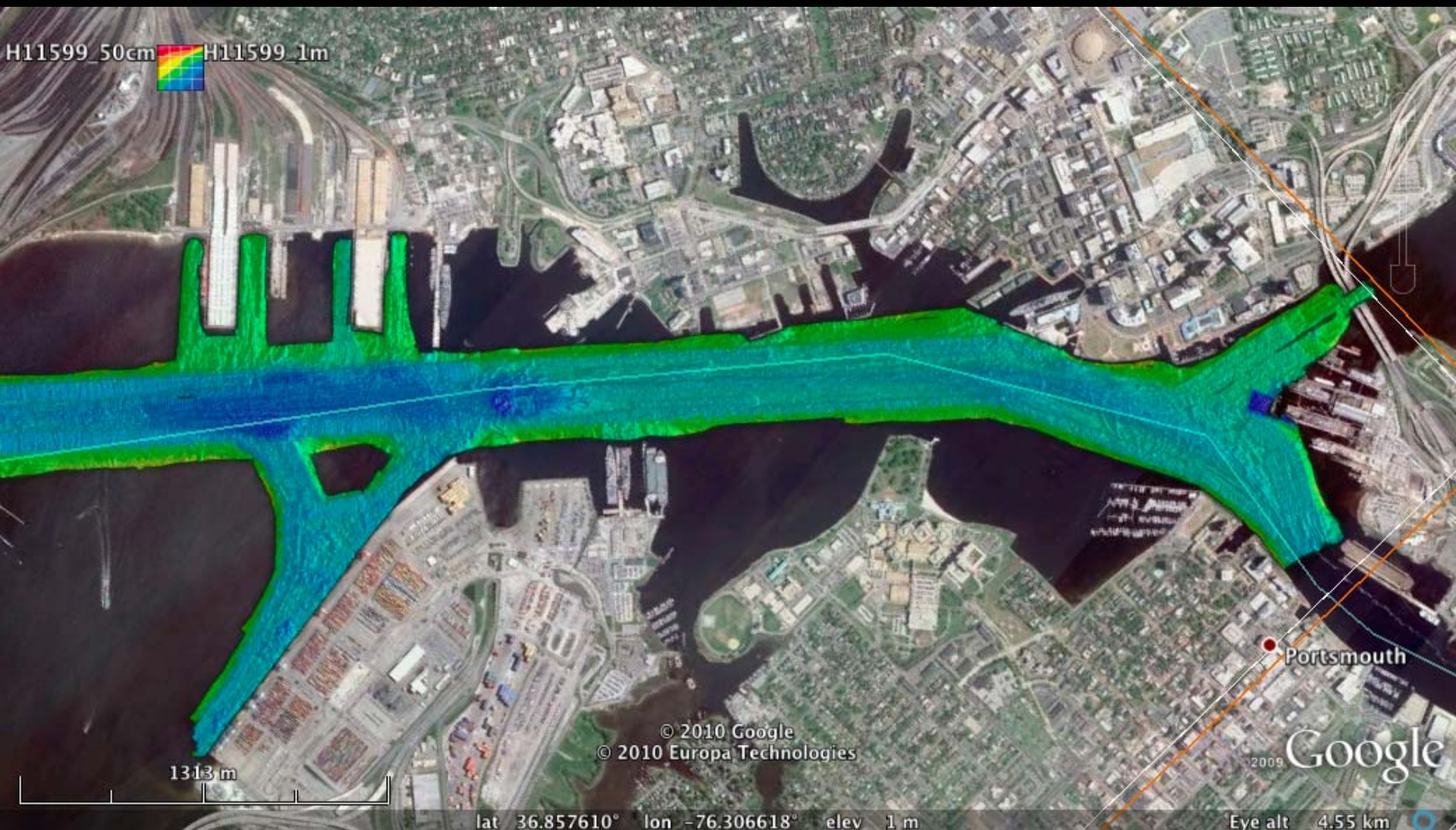
Data SIO, NOAA, U.S. Navy, NGA, GEBCO

lat 36.967895° lon -76.177019° elev -7 m

© 2009 Google

Eye alt 5.56 km

H11599_50cm H11599_1m



1313 m

© 2010 Google
© 2010 Europa Technologies

Portsmouth

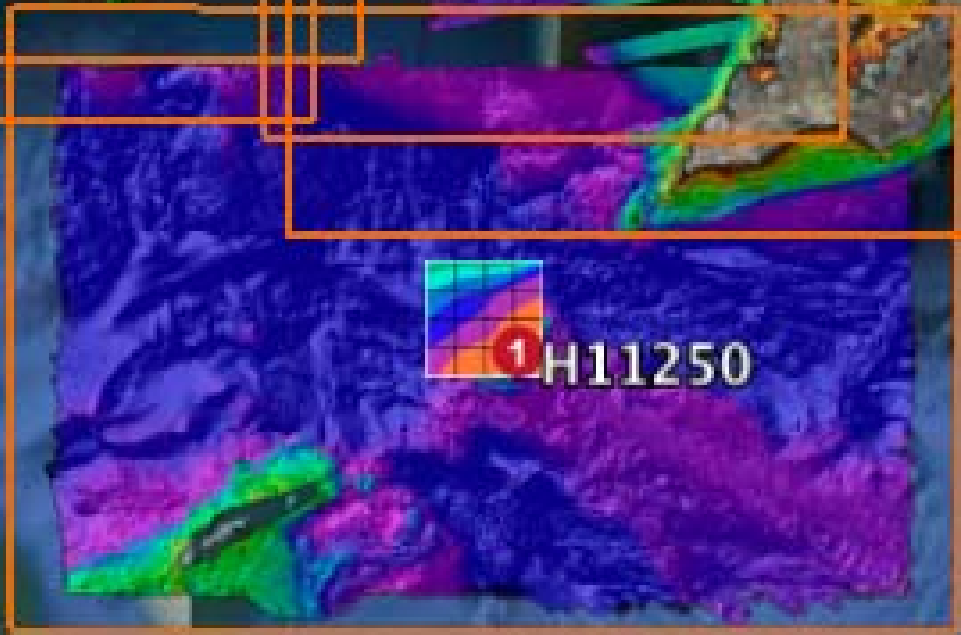
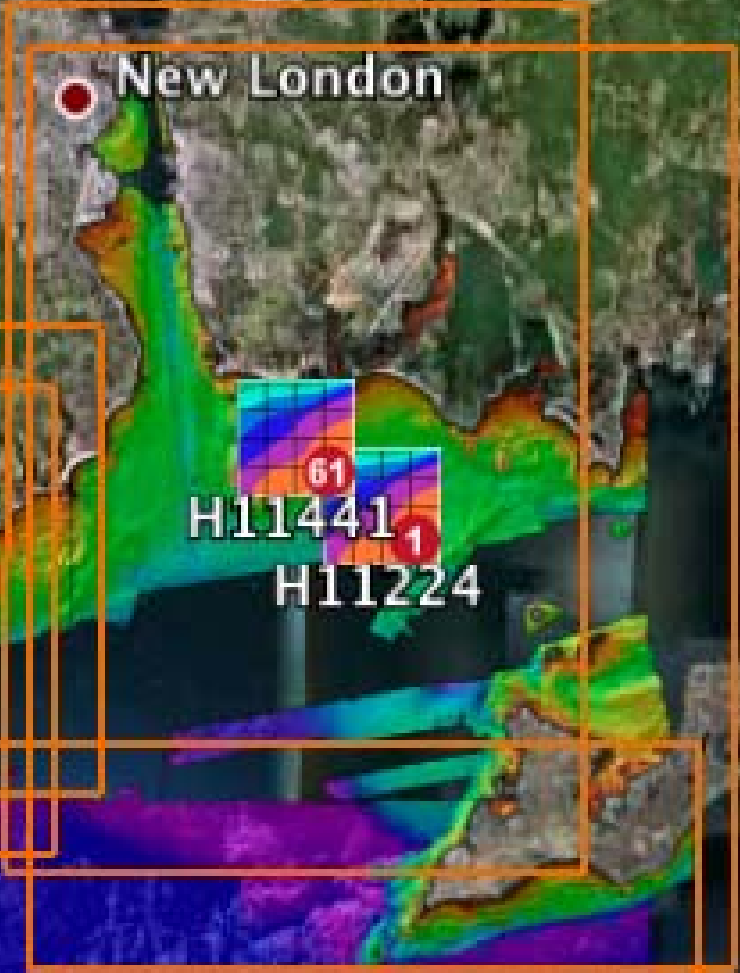
2009 Google

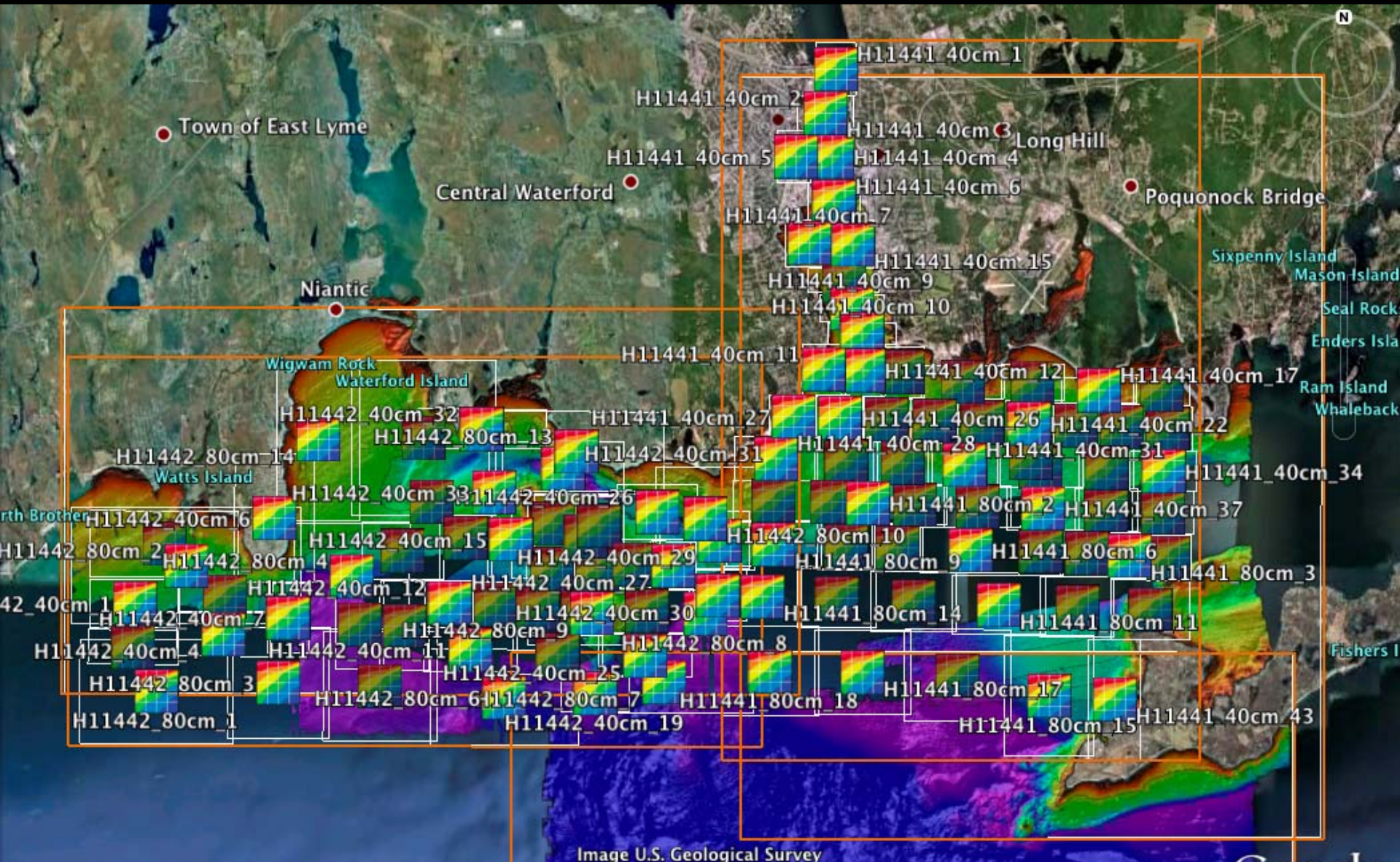
lat 36.857610° lon -76.306618° elev 1 m

Eye alt 4.55 km

CT

New London





Town of East Lyme

Central Waterford

Niantic

H11441_40cm_2

H11441_40cm_5

H11441_40cm_7

H11441_40cm_9

H11441_40cm_10

H11441_40cm_11

Wigwam Rock
Waterford Island

H11442_40cm_32

H11442_80cm_13

H11441_40cm_27

H11442_40cm_31

H11441_40cm_12

H11441_40cm_17

H11441_40cm_26

H11441_40cm_22

H11441_40cm_31

H11441_40cm_34

H11442_80cm_14

Watts Island

H11442_40cm_33

H11442_40cm_26

H11441_40cm_28

H11441_40cm_31

H11441_40cm_34

North Brother

H11442_40cm_16

H11442_40cm_15

H11442_40cm_29

H11442_80cm_10

H11441_80cm_9

H11441_80cm_6

H11442_80cm_2

H11442_80cm_4

H11442_40cm_12

H11442_40cm_27

H11442_40cm_30

H11441_80cm_14

H11441_80cm_11

H11442_40cm_1

H11442_40cm_7

H11442_80cm_9

H11442_40cm_11

H11442_80cm_8

H11441_80cm_14

H11441_80cm_11

H11442_40cm_4

H11442_40cm_11

H11442_80cm_8

H11442_80cm_8

H11441_80cm_14

H11441_80cm_11

H11442_80cm_3

H11442_80cm_6

H11442_80cm_7

H11442_80cm_7

H11441_80cm_18

H11441_80cm_17

H11442_80cm_1

H11442_80cm_6

H11442_40cm_19

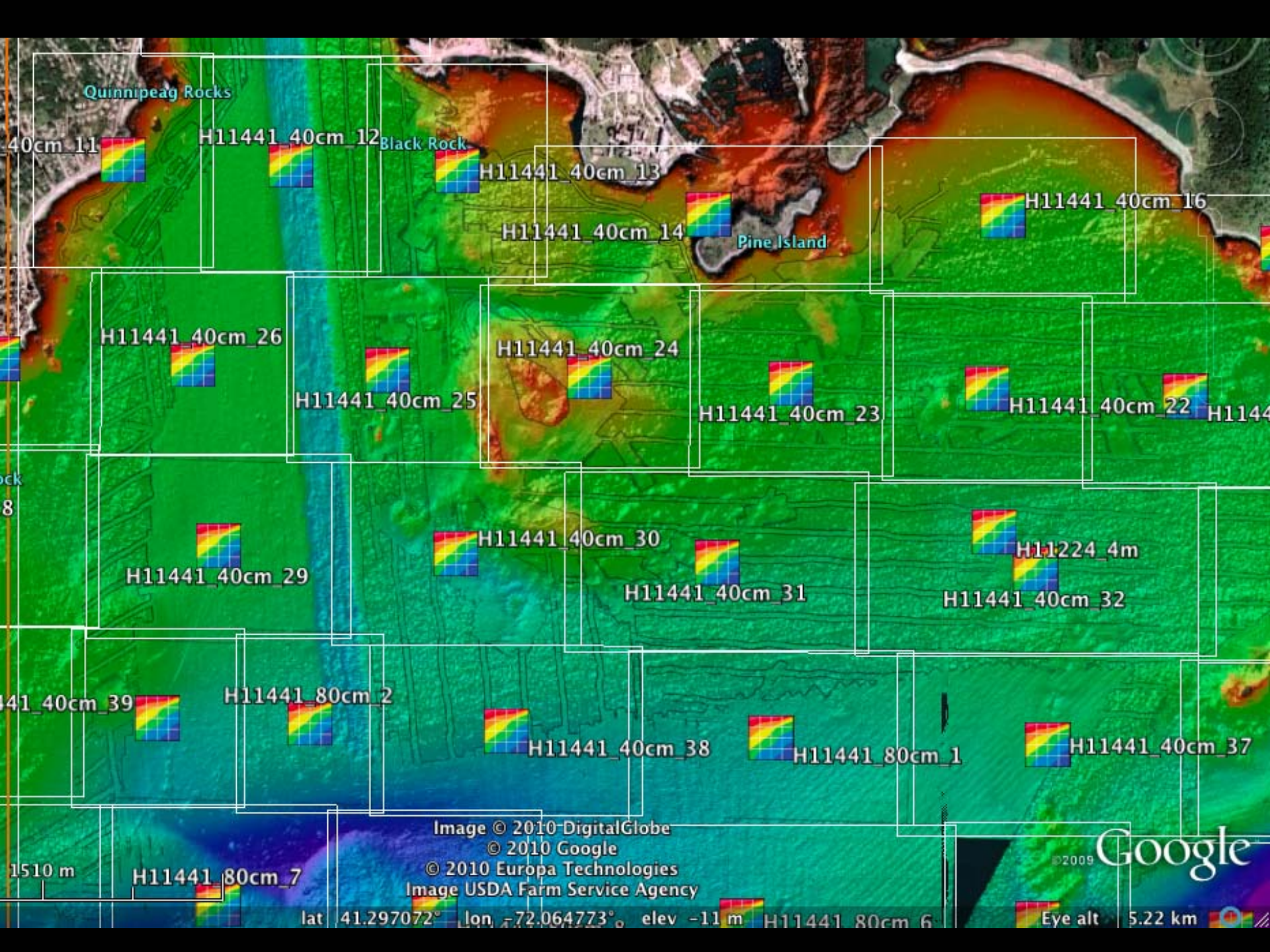
H11441_80cm_18

H11441_80cm_17

H11441_40cm_43

Fishers I

Image U.S. Geological Survey



Quinipeag Rocks

H11441_40cm_11

H11441_40cm_12

Black Rock

H11441_40cm_13

H11441_40cm_14

Pine Island

H11441_40cm_16

H11441_40cm_26

H11441_40cm_24

H11441_40cm_25

H11441_40cm_23

H11441_40cm_22

H11441_40cm_21

H11441_40cm_29

H11441_40cm_30

H11441_40cm_31

H11224_4m

H11441_40cm_32

H11441_40cm_39

H11441_80cm_2

H11441_40cm_38

H11441_80cm_1

H11441_40cm_37

H11441_80cm_7

Image © 2010 DigitalGlobe

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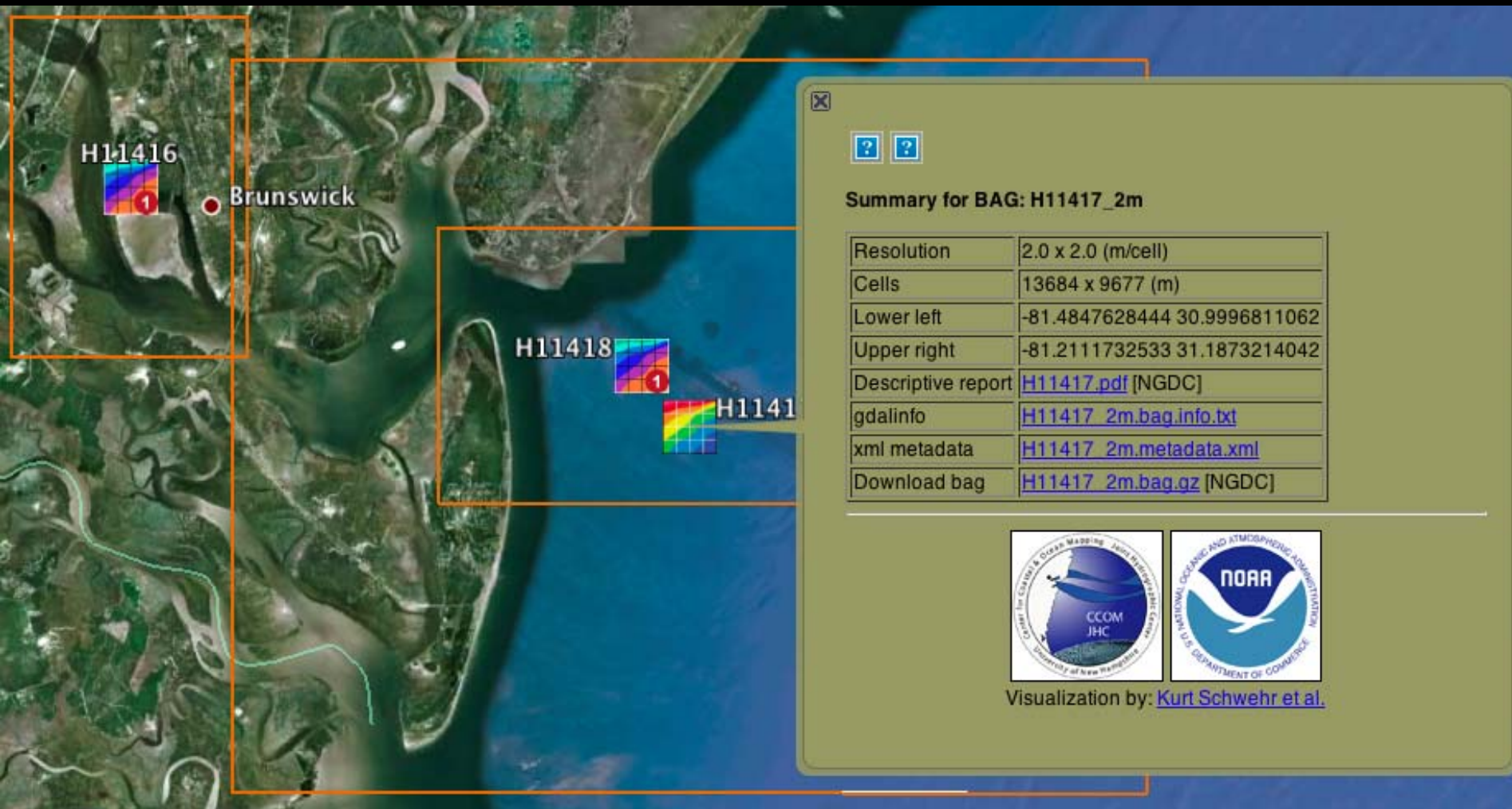
Image USDA Farm Service Agency

©2009 Google

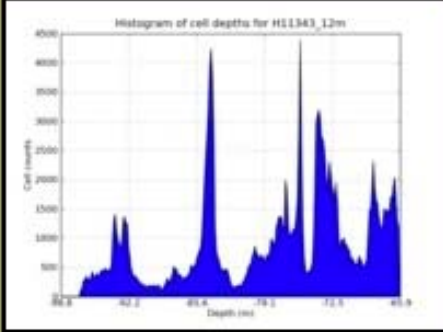
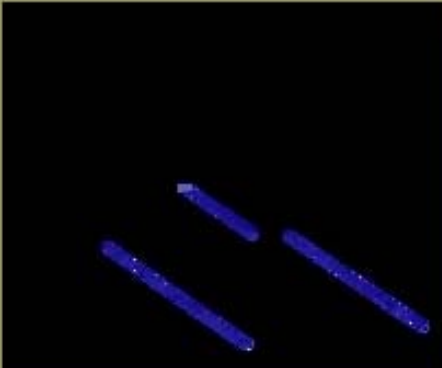
lat 41.297072° lon -72.064773° elev -11 m H11441_80cm_6

Eye alt 5.22 km

Very large grid files





Clip to Extent

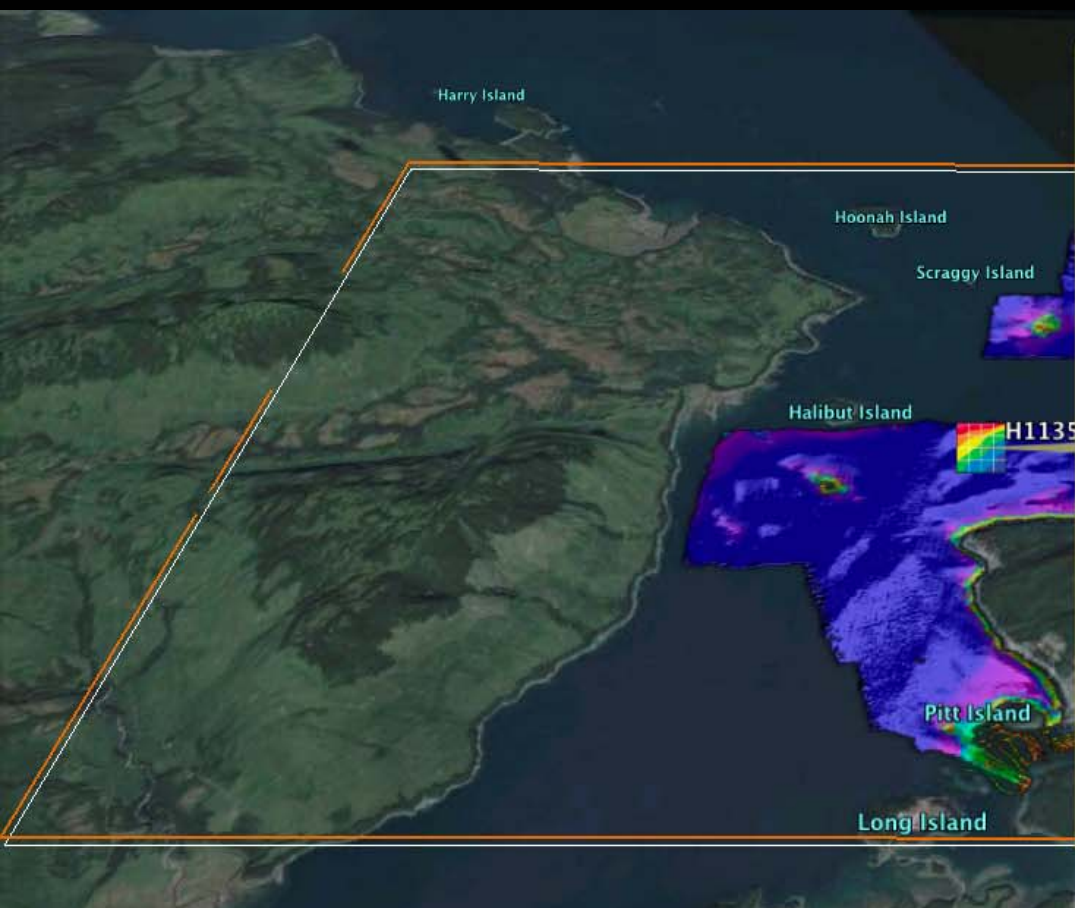


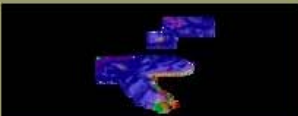
Summary for BAG: H11343_12m

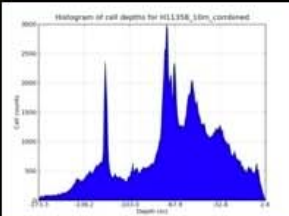
Resolution	12.0 x 12.0 (m/cell)
Cells	5138 x 4775 (m)
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Upper right	-93.672066154 28.447333855
Descriptive report	H11343.pdf [NGDC]
gdalinfo	H11343_12m.bag.info.txt
xml metadata	H11343_12m.metadata.xml
Download bag	H11343_12m.bag.gz [NGDC]



Visualization by: [Kurt Schwehr et al.](#)









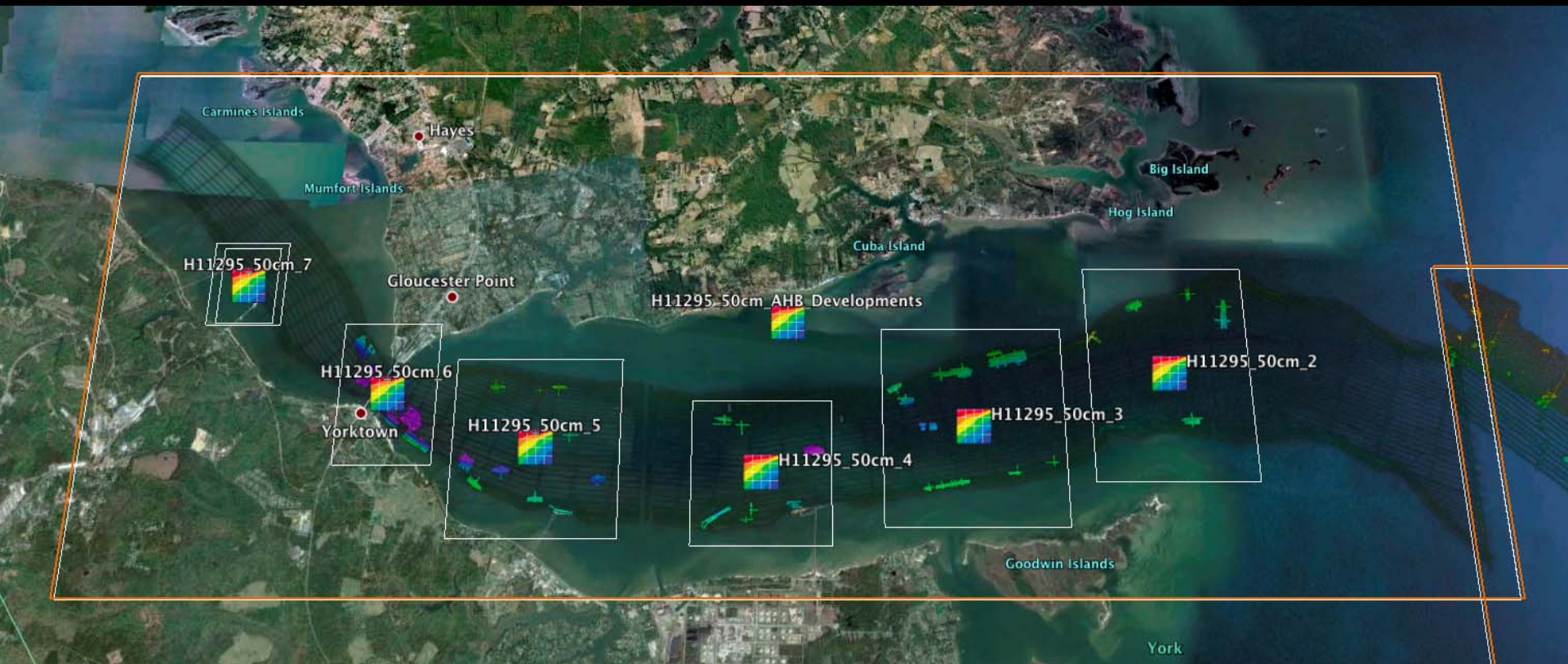
Summary for BAG: H11358_10m_combined

Resolution	10.0 x 10.0 (m/cell)
Cells	1607 x 1144 (m)
Lower left	-135.601536777 58.0930624145
Upper right	-135.330071151 58.1967605566
Descriptive report	H11358.pdf [NGDC]
gdalinfo	H11358_10m_combined.bag.info.txt
xml metadata	H11358_10m_combined.metadata.xml
Download bag	H11358_10m_combined.bag.gz [NGDC]

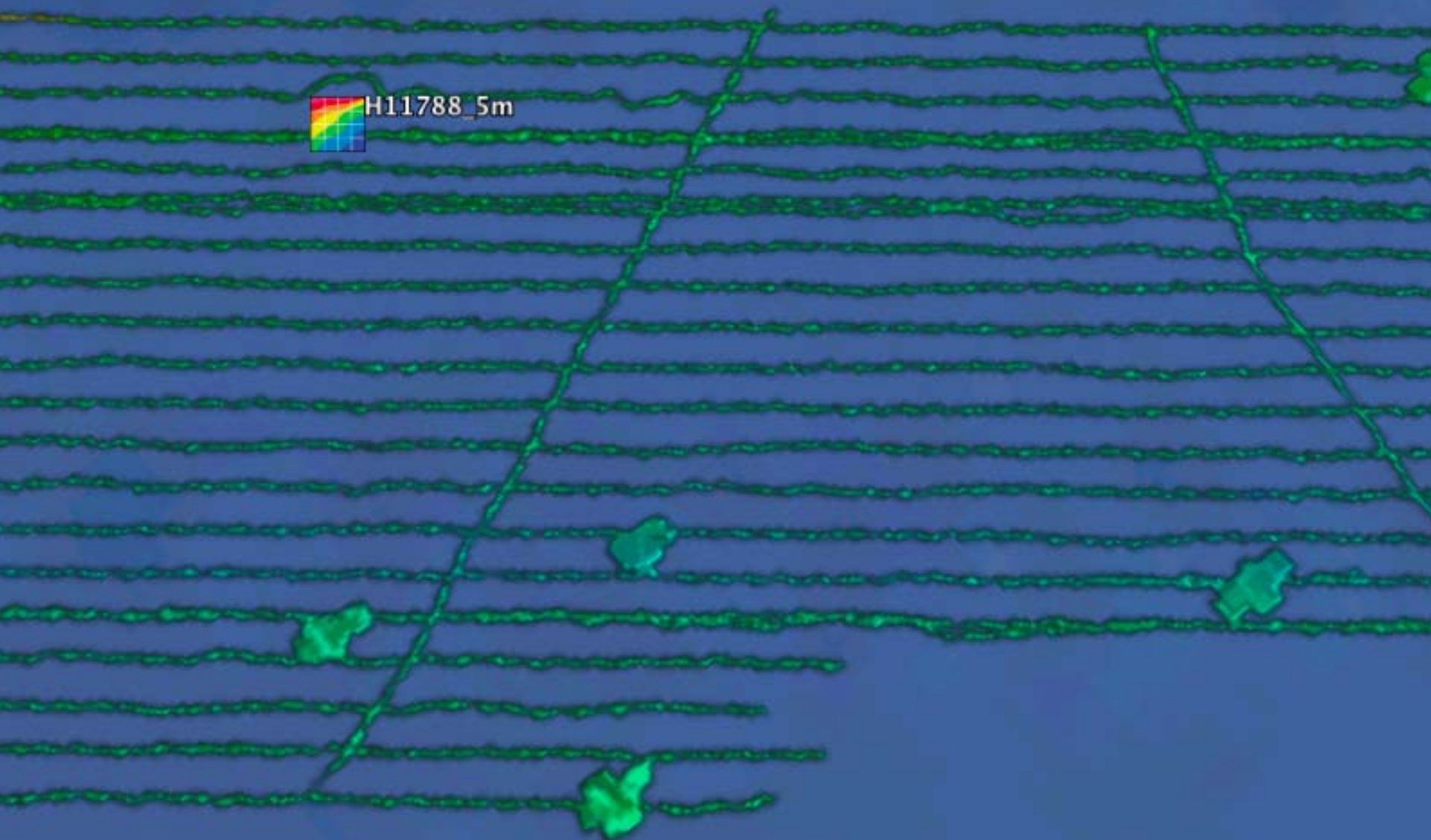
Visualization by: [Kurt Schwehr et al.](#)

Various types of data

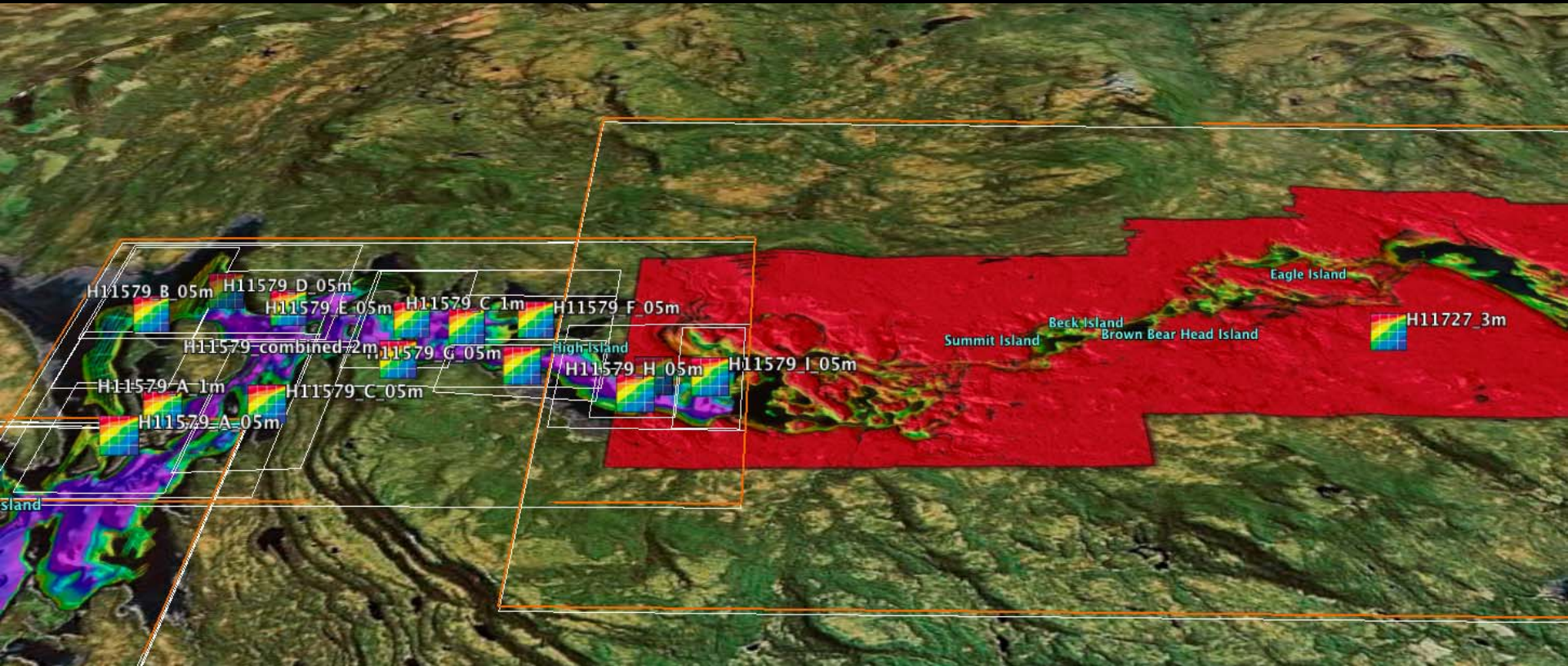


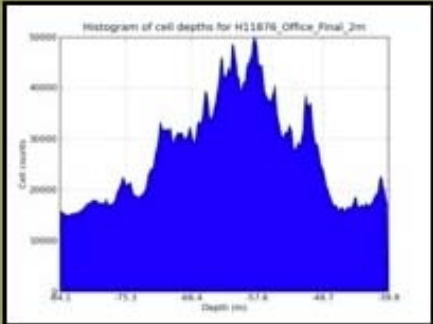


H11788_5m



Topo coverage





Summary for BAG: H11876_Office_Final_2m

Resolution	2.0 x 2.0 (m/cell)
Cells	6436 x 9384 (m)
Lower left	-117.377716831 32.7618838835
Upper right	-117.240665046 32.9315380872
Descriptive report	H11876.pdf [NGDC]
gdalinfo	H11876_Office_Final_2m.bag.info.txt
xml metadata	H11876_Office_Final_2m.metadata.xml
Download bag	H11876_Office_Final_2m.bag.gz [NGDC]



Visualization by: [Kurt Schwehr et al.](#)

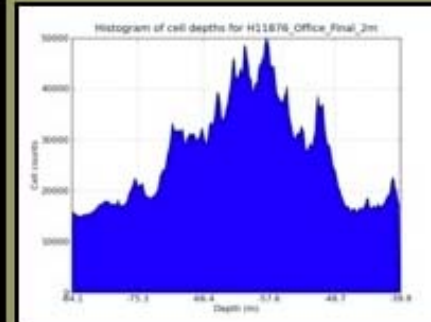
Image U.S. Geological Survey
 © 2010 Google
 © 2010 Europa Technologies
 Data SIO, NOAA, U.S. Navy, NGA, GEBCO



lat 32.851812° lon -117.299658° elev -34 m

H11876_Office_Final_2m

H11876_Office_Final_4m



Summary for BAG: H11876_Office_Final_2m

Resolution	2.0 x 2.0 (m/cell)
Cells	6436 x 9384 (m)
Lower left	-117.377716831 32.7618838835
Upper right	-117.240665046 32.9315380872
Descriptive report	H11876.pdf [NGDC]
gdalinfo	H11876_Office_Final_2m.bag.info.txt
xml metadata	H11876_Office_Final_2m.metadata.xml
Download bag	H11876_Office_Final_2m.bag.gz [NGDC]



Visualization by: [Kurt Schwehr et al.](#)

Image U.S. Geological Survey

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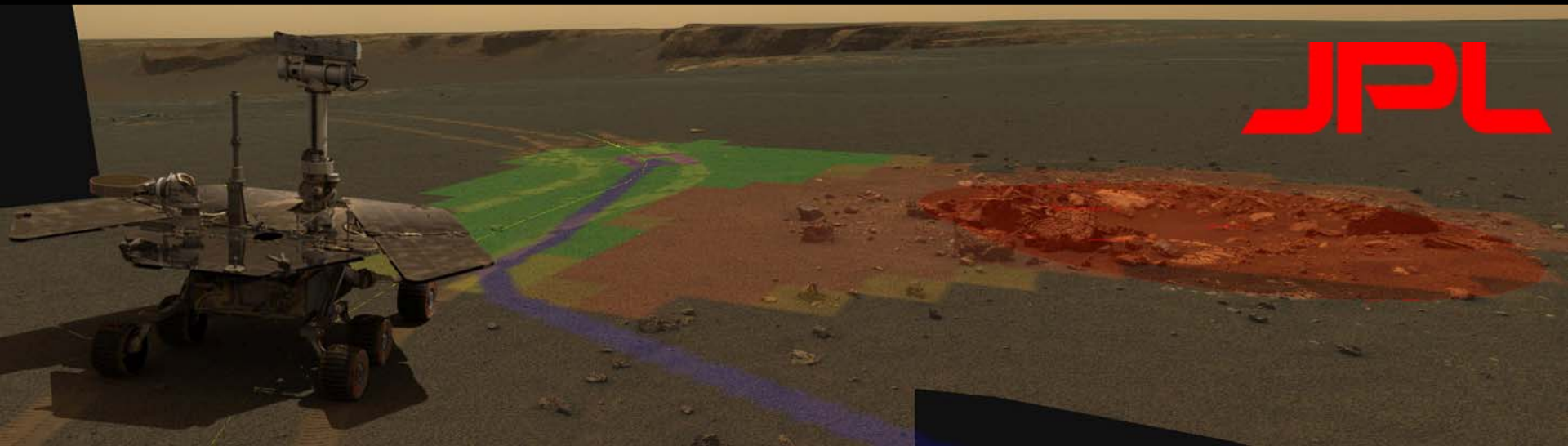
Data SIO, NOAA, U.S. Navy, NGA, GEBCO

lat 32.851812° lon -117.299658° elev -34 m

3.38 km

File naming conventions

Managing many thousands of files



File naming conventions

inst = (1 alpha character) MER science instrument identifier.

Valid values for MER camera instruments:

"P" - Pancam

"N" - Navcam

"F" - Front Hazcam

"R" - Rear Hazcam

"M" - Microscopic Imager

"E" - Descam

Valid values for MER instruments not described in this SIS:

"A" - APXS

"B" - Mössbauer

"T" - Mini-TES

"D" - RAT ("D" for Drill)

sc1k = (9 integers) Starting Spacecraft Clock time.

prod = (3 alpha characters) Product Type identifier of input data. Product types are differentiated as having camera-induced distortion removed ("linearized") or not removed (nominal), and, as being Thumbnail-sized or not. Four special flag characters follow:

- Beginning "E" – Type of EDR, which are raw with no camera model "linearization" or radiometric correction. If no beginning "E", then it is an RDR.
- Ending "T" – EDR or RDR that is Thumbnail -sized.
- Ending "L" – If no beginning "E", denotes an RDR that is "Linearized", except for Thumbnail sized RDRs.
- Ending "N" – If no beginning "E", denotes an RDR that is ThumbNail-sized and "LiNearized".

Valid values for MER camera instrument input data products:

Data Product	Non-linearized (NOMINAL)	Linearized
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File naming conventions

2P123456789IOF0103P2210L2C1.IMG

Mission MER-A ("2"), Pancam instrument ("P"), SCLK 123456789 ("123456789"), Radiometrically-corrected RDR calibrated to I/F radiance factor ("IOF"), Site 1 ("01"), Position 3 ("03"), Seq p2210 ("P2210"), left Eye ("L"), Filter position 2 ("2"), produced by Cornell U. ("C"), product version 1 ("1"), PDS-labeled ("IMG").

2M123456789EFF0103P2901M0F2.IMG

Mission MER-A ("2"), Microscopic Imager instrument ("M"), SCLK 123456789 ("123456789"), Full Frame EDR ("EFF"), Site 1 ("01"), Position 3 ("03"), Sequence p2901 ("P2901"), Monoscopic ("M"), no Filter ("0"), produced by USGS/Flagstaff ("F"), product version 2 ("2"), PDS-labeled ("IMG").

<http://surveys.ngdc.noaa.gov/mgg/NOS/coast/>

- B00001-B02000: Older EEZ surveys
- D00001-D02000: Preliminary surveys
- F00001-F02000: Field edits
- H00001-H02000: Hydrographic Surveys
- H02001-H04000: Hydrographic Surveys
- H04001-H06000: Hydrographic Surveys
- H06001-H08000: Hydrographic Surveys
- H08001-H10000: Hydrographic Surveys
- H10001-H12000: Hydrographic Surveys
- H12001-H14000: Hydrographic Surveys
- L00001-L02000: Lake surveys
- L02001-L04000: Lake surveys
- W00001-W02000: Non-NOS surveys

Index of /mgg/NOS/coast/H10001-H12000/H11301/BAG

<u>Name</u>	<u>Last modified</u>	<u>Size</u>	<u>Description</u>
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 Parent Directory		-	
 H11301_50cm_1.bag.gz	31-Jul-2009 14:27	10M	
 H11301_50cm_2.bag.gz	31-Jul-2009 14:28	11M	
 H11301_50cm_3.bag.gz	31-Jul-2009 14:28	12M	
 H11301_50cm_4.bag.gz	31-Jul-2009 14:29	14M	
 H11301_50cm_5.bag.gz	31-Jul-2009 14:30	1.1M	
 H11301_50cm_6.bag.gz	31-Jul-2009 14:31	12M	
 H11301_50cm_7.bag.gz	31-Jul-2009 14:31	2.5M	
 H11301_50cm_8.bag.gz	31-Jul-2009 14:31	7.6M	
 H11301_50cm_9.bag.gz	31-Jul-2009 14:31	608K	
 H11301_50cm_10.bag.gz	31-Jul-2009 14:28	21M	
 H11301_50cm_11.bag.gz	31-Jul-2009 14:28	19M	
 H11301_50cm_12.bag.gz	31-Jul-2009 14:28	15M	
 H11301_50cm_13.bag.gz	31-Jul-2009 14:28	15M	
 H11301_50cm_14.bag.gz	31-Jul-2009 14:28	1.0M	
 H11301_50cm_15.bag.gz	31-Jul-2009 14:28	18M	

What would we like to encode?

- Survey Number
- Region P, A, G, etc., O (Pacific, Atlantic, Gulf of Mexico, Other)
- SUREND – S57 end of survey pings date – Year
- Instrument/Sensor type(s) used to grid
- Grid cell size (already in the name)
- Depth range (broad categories)

File naming conventions

Sensor Type

- **S** = Single beam sonar
- **M** = Multibeam
- **T** = Topo lidar
- **L** = bathy Lidar
- **G** = predicted from Gravity
- **C** = lead line or similar from a Cable/Chain
- **R** = Radar, e.g. SRTM

How and when to use the naming convention?

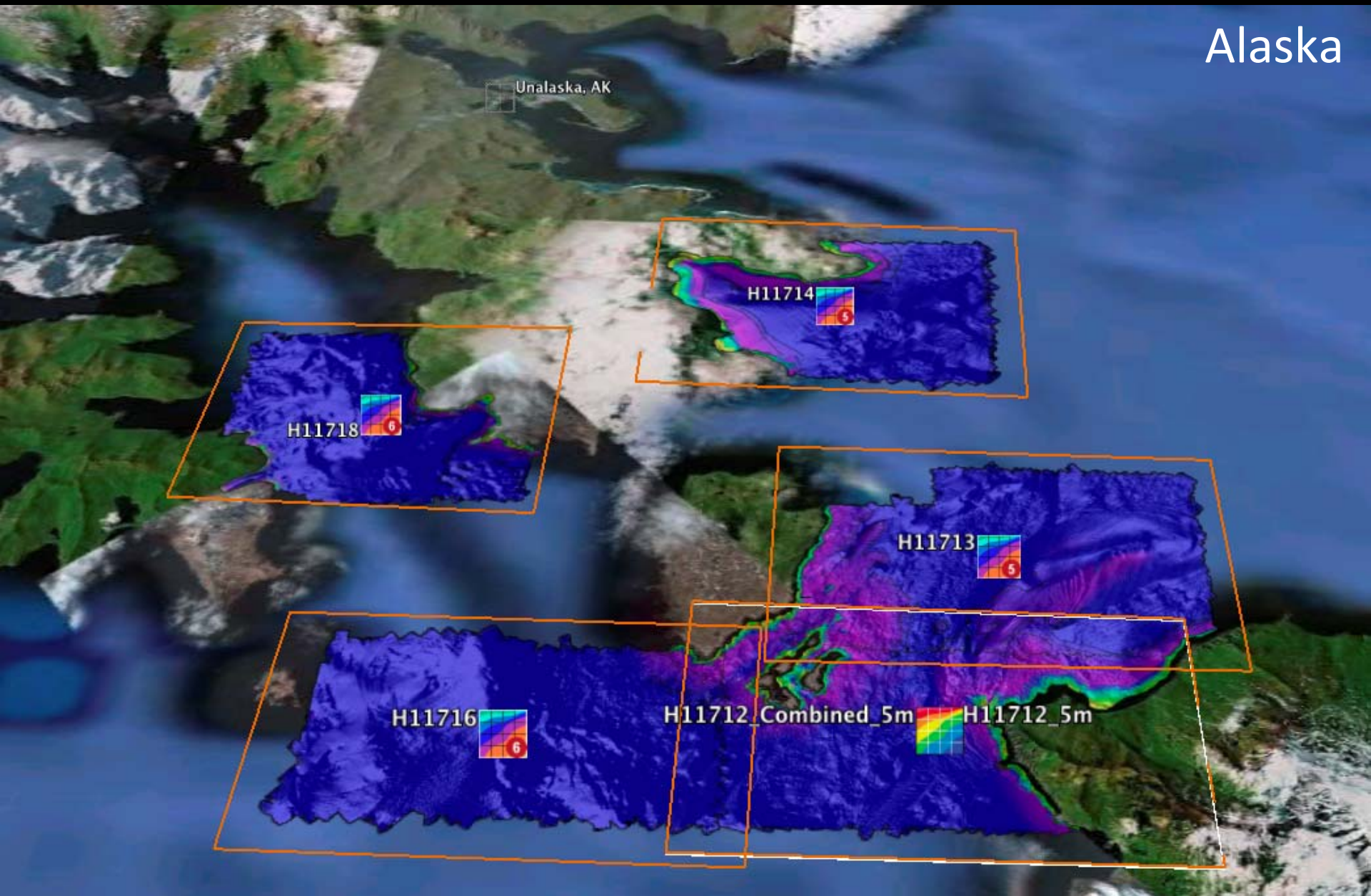
- Must be automatically generated from the metadata inside the BAG
- Must have tools that expand out the name
- Must not lose the embedded metadata!
- Primarily for the NGDC archive website
- *Checksums*, not filenames, should be used to compare if files are the same

Where to next?

- Improve and test the metadata
- Make sure all of our tools can read BAGs
- Add stddev, backscatter and sidescan?
- Deploy a Google Earth visualization to the NGDC web site
- Work on a file naming convention

Fantastic data for other uses

Alaska



For more info:
<http://tinyurl.com/bags-chc2010>

