Joint Airborne Lidar Bathymetry Technical Center of Expertise

National Coastal Mapping Program: Volume Change ArcGIS Toolbox

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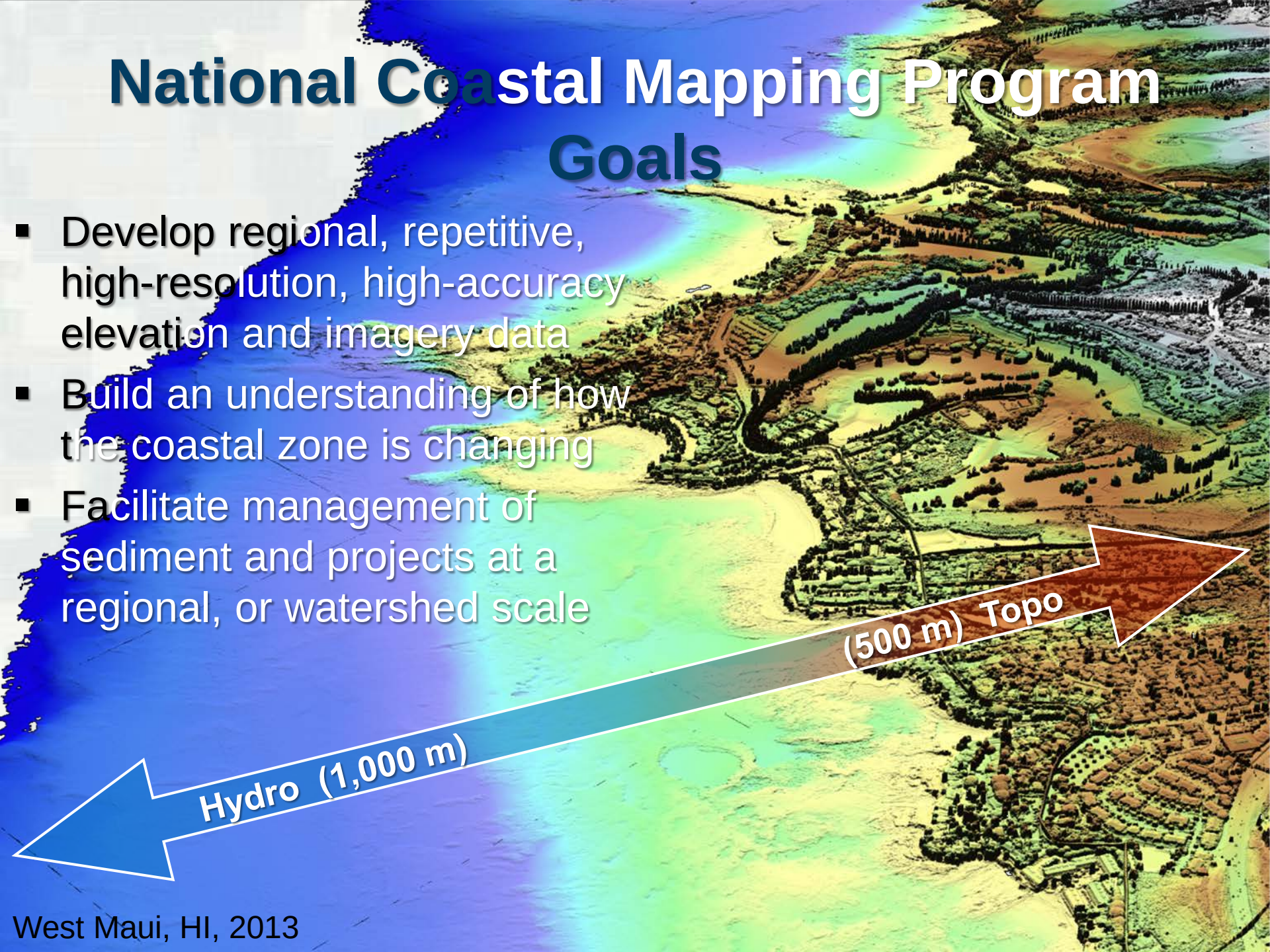
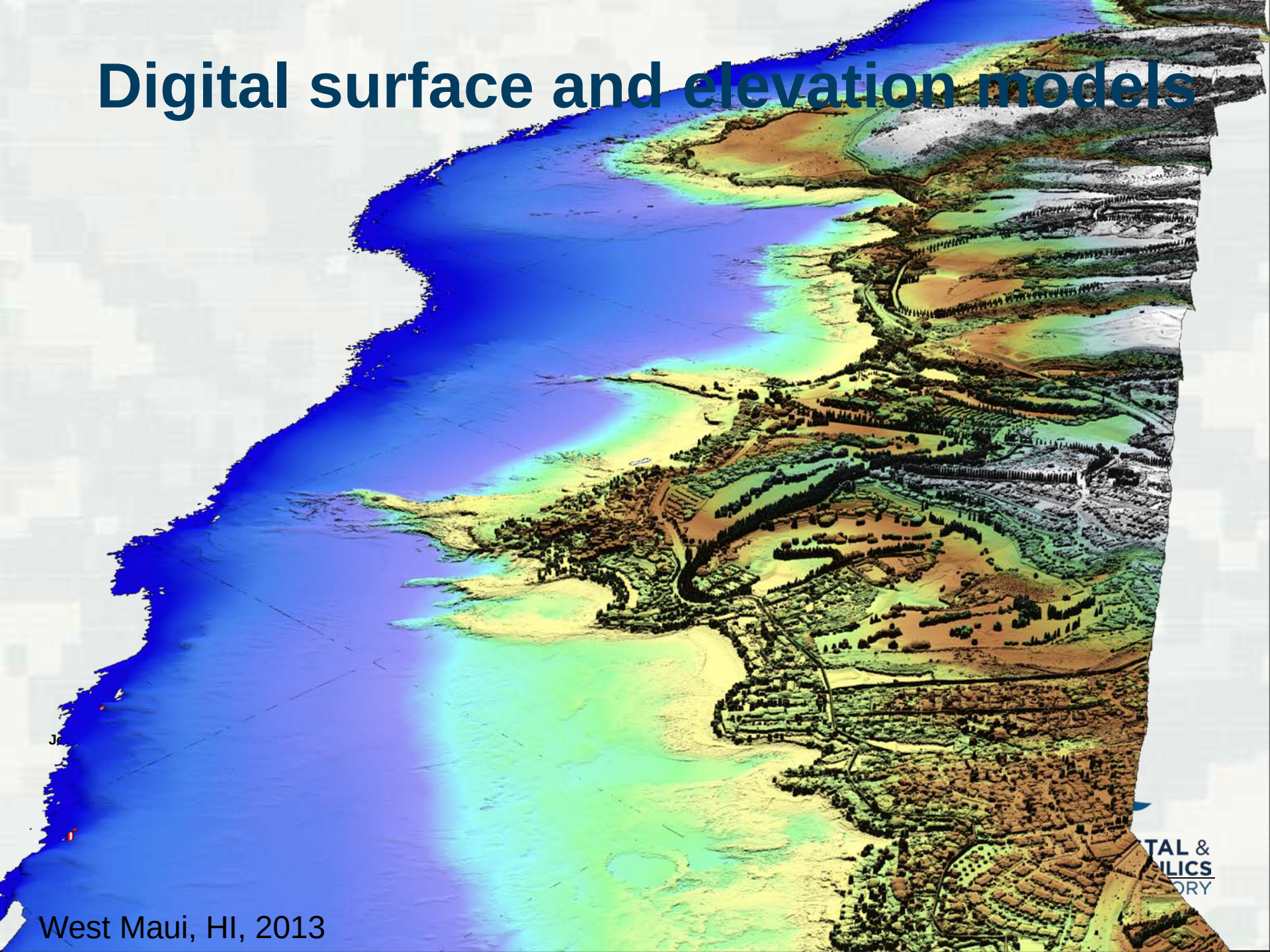
National Coastal Mapping Program Goals

- Develop regional, repetitive, high-resolution, high-accuracy elevation and imagery data
- Build an understanding of how the coastal zone is changing
- Facilitate management of sediment and projects at a regional, or watershed scale



West Maui, HI, 2013

Digital surface and elevation models



West Maui, HI, 2013

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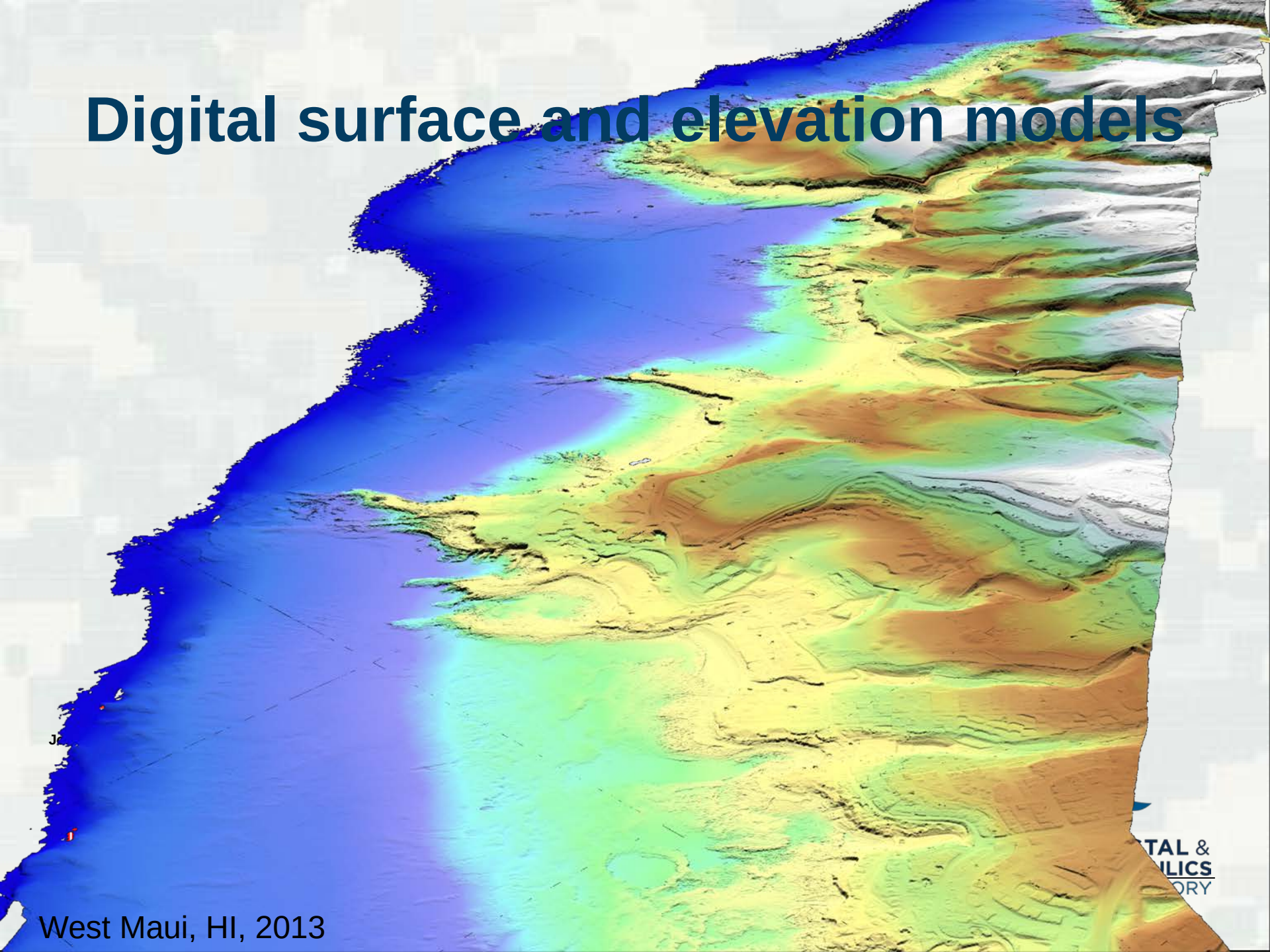
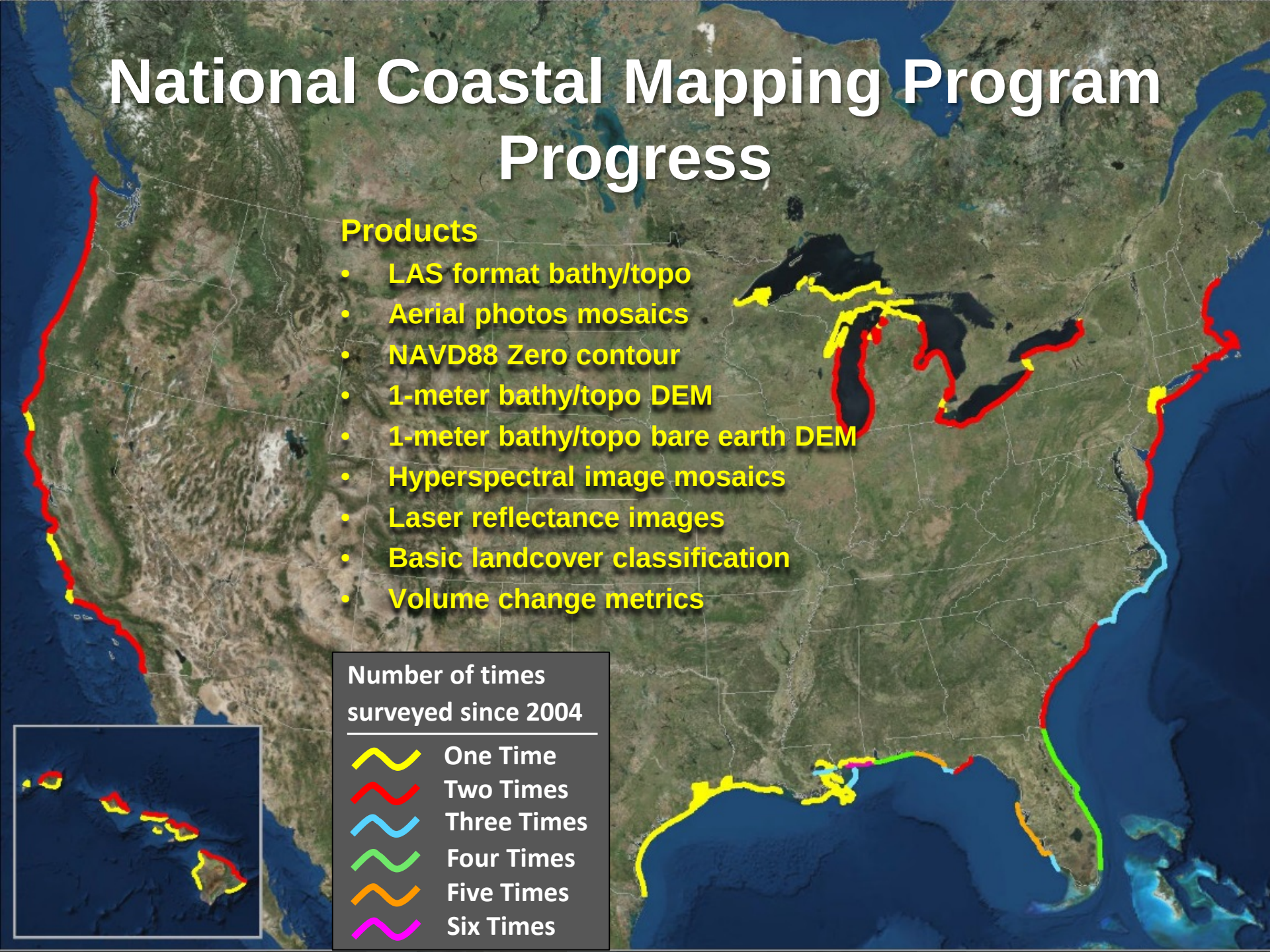


West Maui, HI, 2013

National Coastal Mapping Program Progress



NCMP Volume Change Work

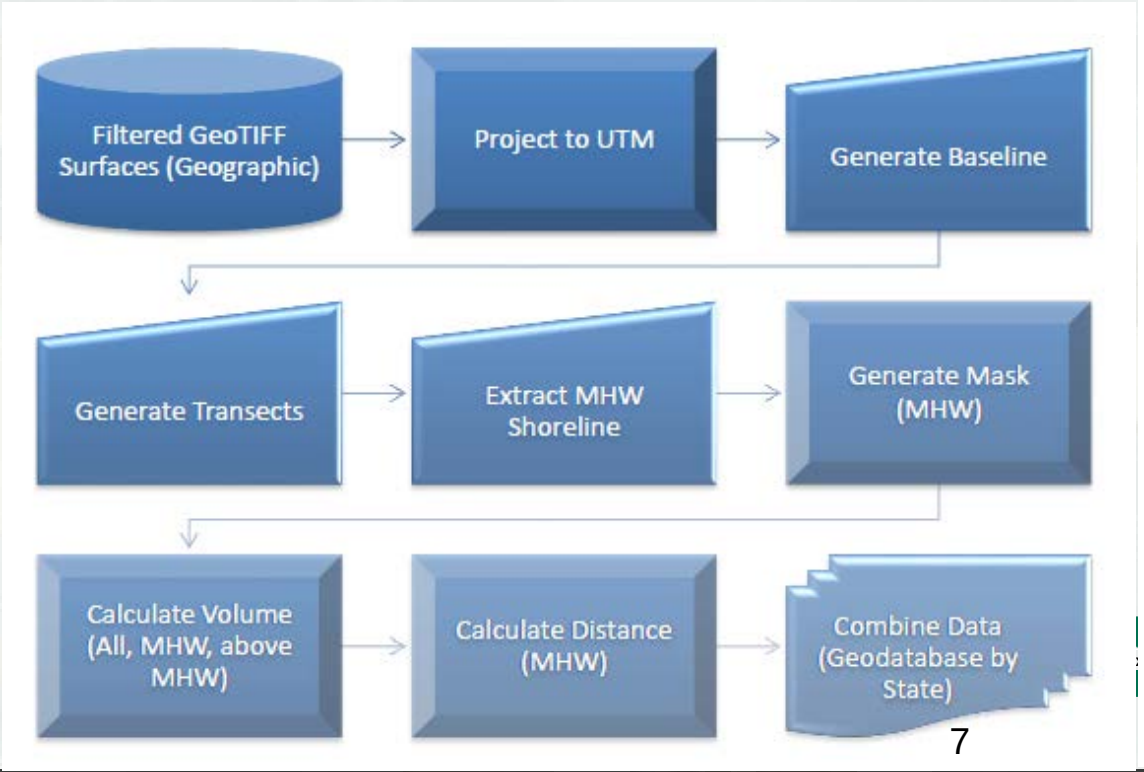
- ArcGIS toolbox – user installs on ACE-IT computer
- East Coast Volume Change
  - ME to FL
  - Changes between ~ 2004 – 2010 datasets

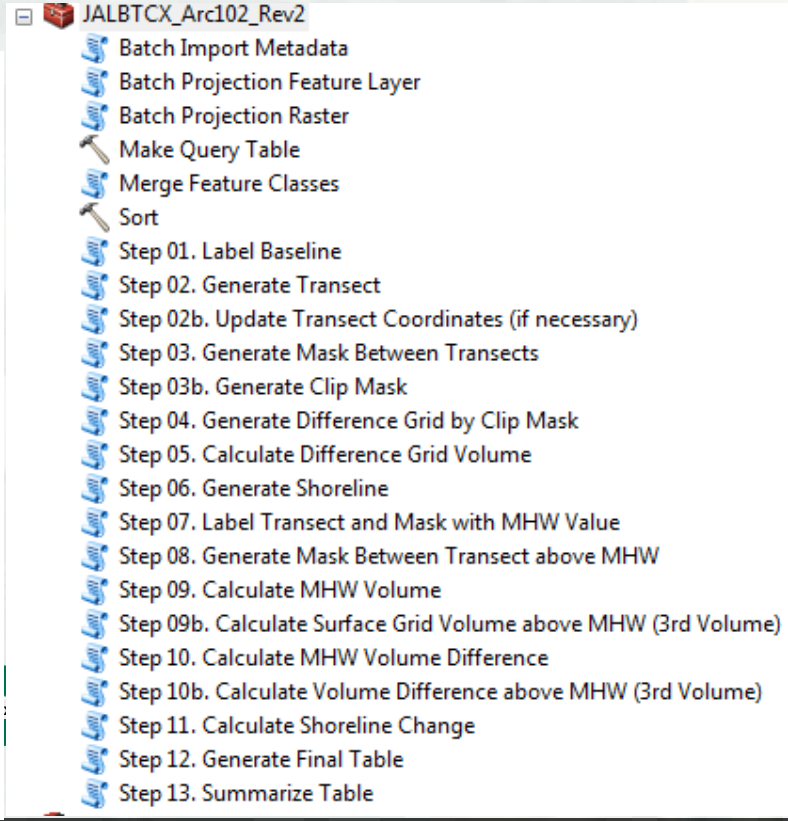
JALBTCX_Rev2

State	Start Date	End Date	Baseline Length	Number of Transects	Average Shoreline Change Rate	Volume Density Rate	MHW Volume Density Rate	Above MHW Volume Density Rate
			km	n	ft/yr	cy/ft/yr	cy/ft/yr	cy/ft/yr
ME	10/19/2005	6/19/2010	62	633	(0.4)	13.5	0.7	0.6
NH	11/01/2005	6/20/2010	15	152	(1.0)	2.6	(0.5)	(0.5)
MA	11/11/2005	5/26/2010	381	3,834	(2.8)	(2.8)	(0.9)	(0.8)
NY	10/26/2005	8/13/2010	192	1,921	6.9	4.5	4.1	4.2
NJ	9/2/2005	8/28/2010	203	2,034	0.6	2.1	2.2	2.2
DE	9/3/2005	9/11/2010	44	440	5.1	3.9	4.1	4.2
MD	9/3/2005	8/2/2010	50	505	(4.3)	2.8	2.7	2.7
VA	9/8/2005	7/28/2010	183	1,835	7.2	3.1	3.4	2.9
NC_2009	9/28/2005	8/16/2009	272	2,725	3.9	0.6	(1.3)	0.2
NC_2010	9/28/2005	5/4/2010	236	2,369	0.2	2.7	2.5	2.5
SC	1/13/2006	5/4/2010	277	2,778	2.1	2.3	1.3	0.9
GA	1/13/2006	5/4/2010	145	1,452	(0.2)	4.2	3.0	2.8
FL-E	7/1/2004	5/4/2010	587	5,875	(2.7)	6.2	1.0	0.8
FL-W	6/1/2004	6/20/2010	298	2,998	7.7	19.3	2.3	2.4
FL-NW	6/1/2004	6/20/2010	346	3,461	(9.5)	4.6	(0.2)	(0.2)
Total/ Average			3,289	33,012	0.9	4.6	1.6	1.7

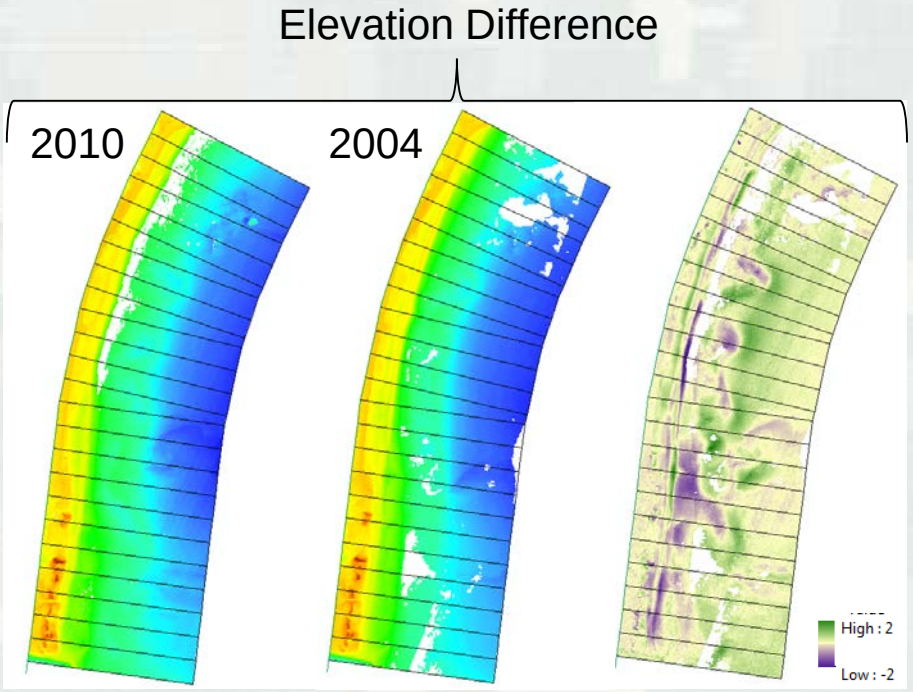
Volume Change Toolbox

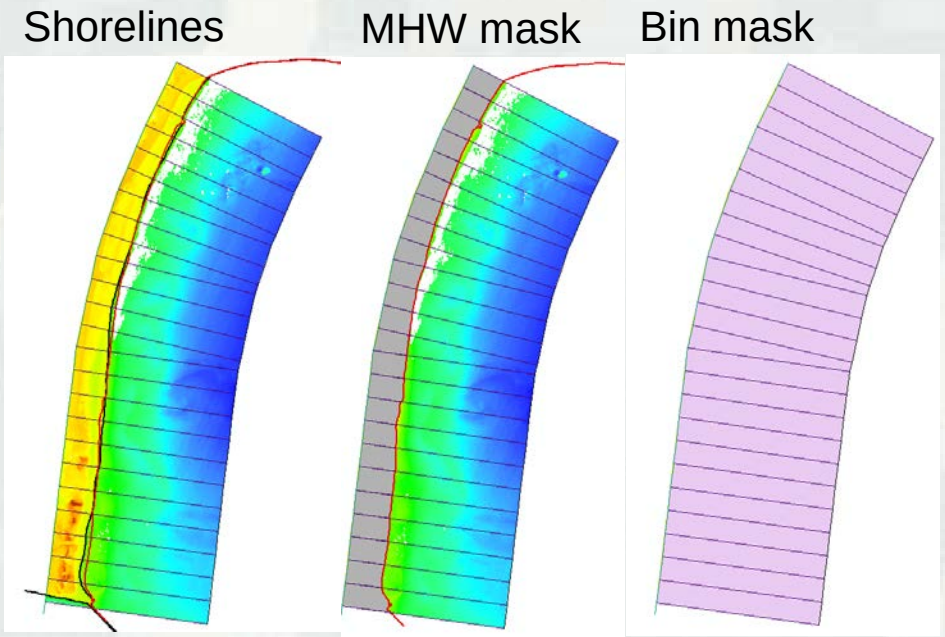
- Data Input
  - Works with standard NCMP products (DEM, shoreline)
  - Flexible enough to use other datasets (state or other agency)





Volume Change Toolbox

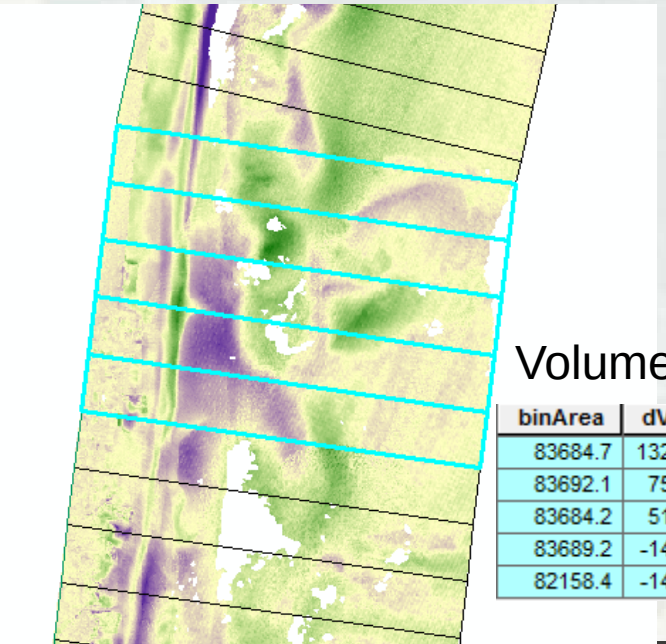




- Baseline – landward limit for quantification
- Shoreline used to create masks for subaerial volume change
- Transects set at ~ 100 m
  - R/L boundary for bin

Volume Change Toolbox: Output

- Data Output:
  - Elevation change grids
  - Volume change in bins
  - Generate elevation change maps/ volume change tables
  - Shoreline change
- User can query results for area of interest

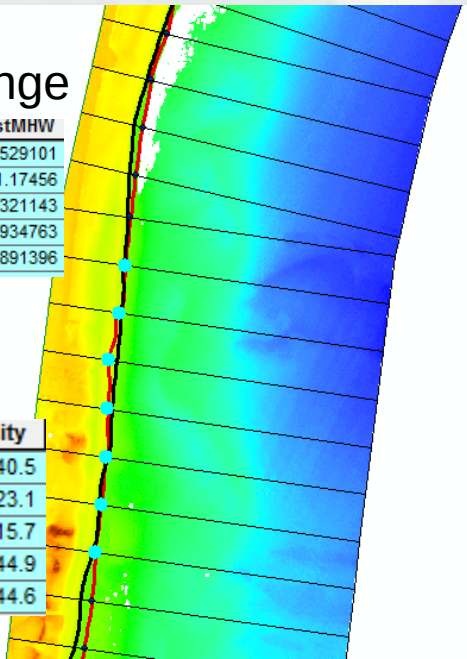


Shoreline Change

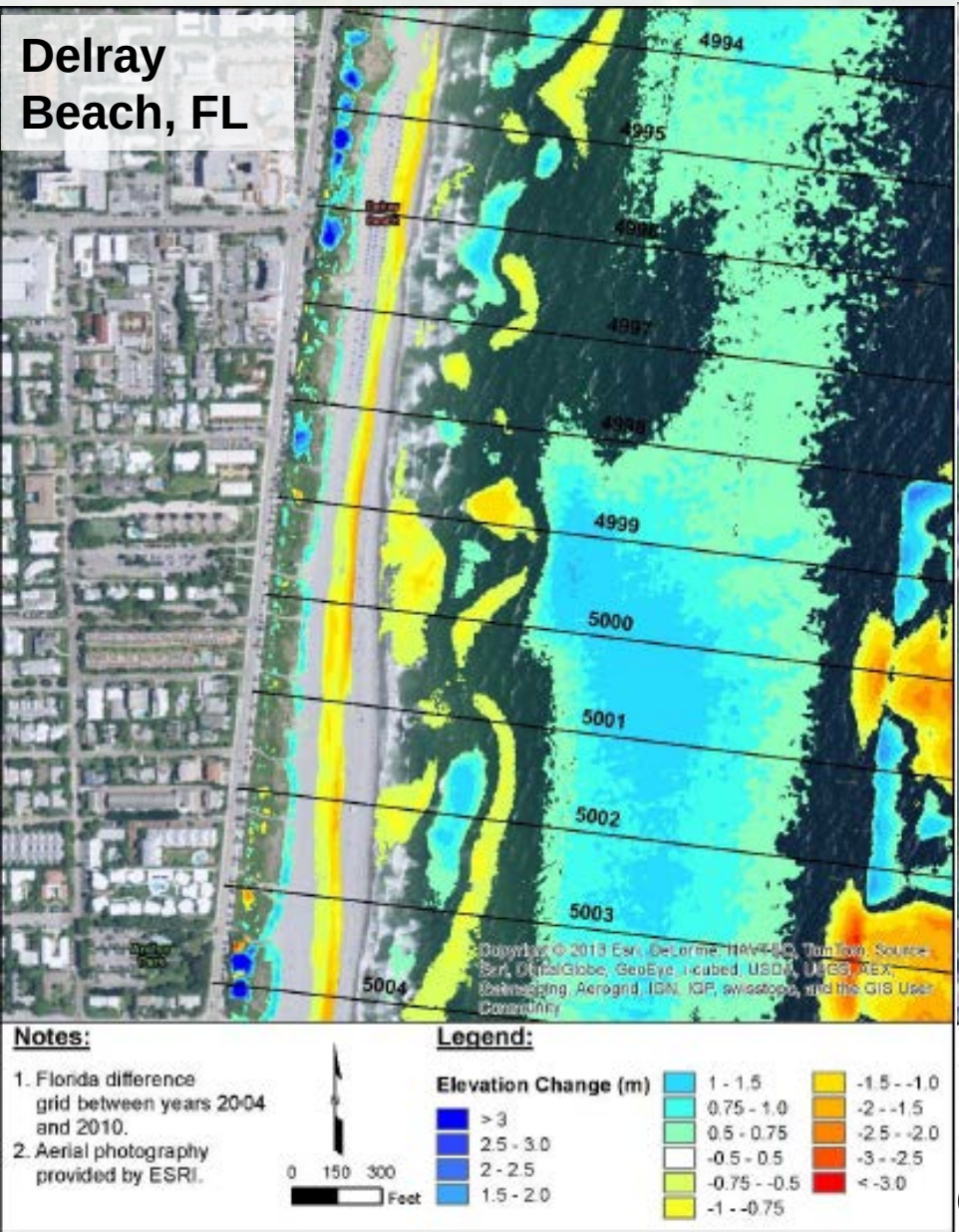
dMHW	dMHW_Rate	Start_Date	End_Date	bDistMHW	aDistMHW
-2.50573	-0.540909	20051101	20100620	147.034831	144.529101
4.838496	1.04448	20051101	20100620	146.336064	151.17456
16.556167	3.57396	20051101	20100620	137.764975	154.321143
9.229728	1.99241	20051101	20100620	147.705035	156.934763
3.309921	0.714509	20051101	20100620	157.581475	160.891396

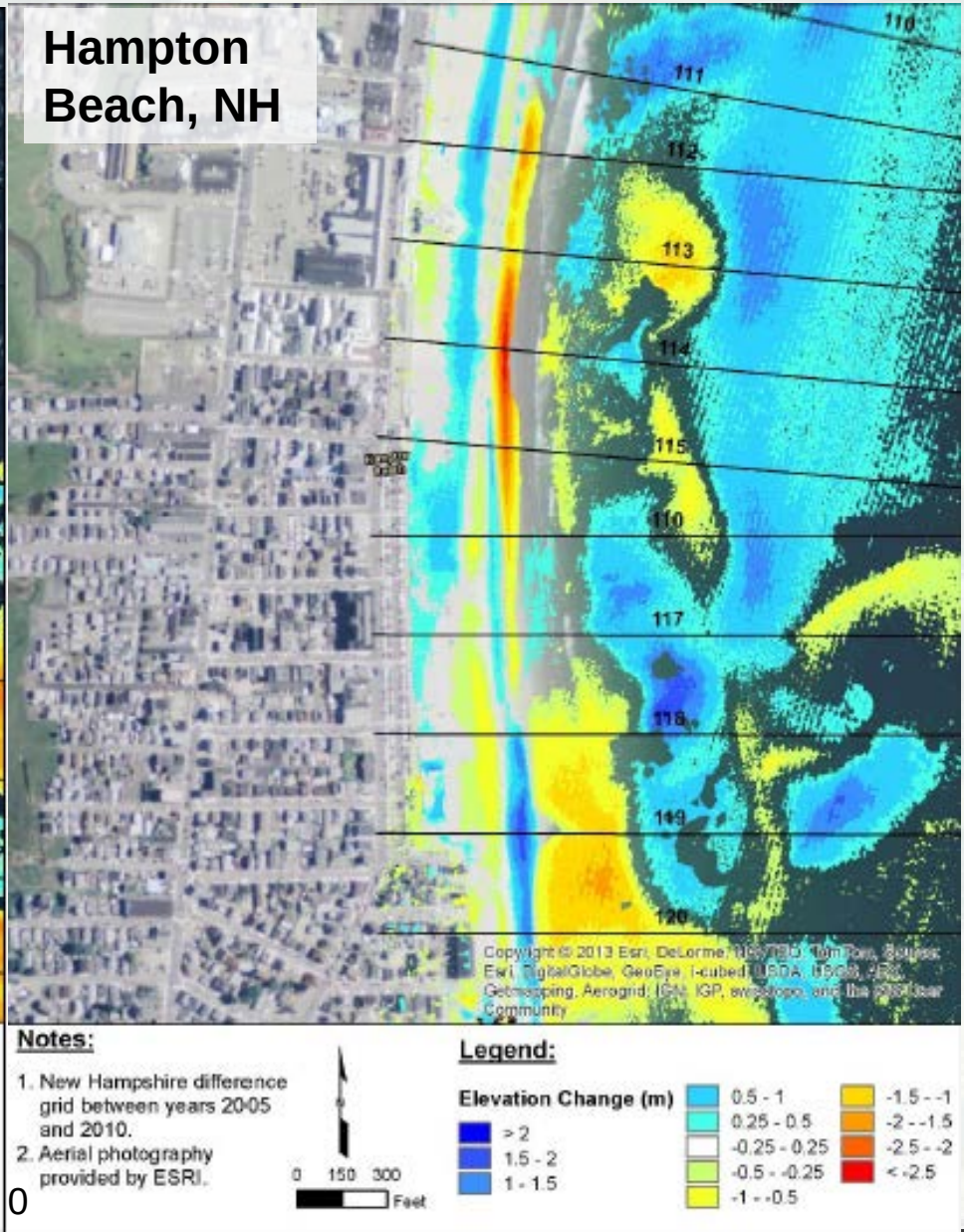
Volume Change

binArea	dVol	Accretion	Erosion	dMin	dMax	dMean	STD	dDensity
83684.7	13287	22634	-9347	-1.37	1.81	0.16	0.48	40.5
83692.1	7567	16965	-9398	-1.27	2.48	0.1	0.49	23.1
83684.2	5156	21120	-15964	-1.7	2.11	0.07	0.62	15.7
83689.2	-1472	8923	-23650	-2.03	2.16	-0.18	0.58	-44.9
82158.4	-1464	7255	-21904	-1.45	1.59	-0.18	0.44	-44.6



Elevation Change Maps





Volume Change Results

- Number of transects – indicates coverage between datasets
- Total Volume – all volume in bin included
- Subaerial Volume – use in places with limited bathy coverage
  - MHW – shoreline used as mask; ideal for areas with consistent shoreline coverage
  - Above MHW – all volume in bin above MHW elevation – used in areas with shoreline gaps

					Shoreline Change		Total Volume Change			Subaerial Volume Change					
State	Start Date	End Date	Baseline Length	Number of Transects	Shoreline Change Transects	Average Shoreline Change Rate	Volume Change Bins	Volume Change	Volume Density Rate	MHW Volume Change Bins	MHW Volume Change	MHW Volume Density Rate	Above MHW Volume Change Bins	Above MHW Volume Change	Above MHW Volume Density Rate
			km	n	n	ft/yr	n	cy	cy/ft/yr	n	cy	cy/ft/yr	n	cy	cy/ft/yr
ME	10/19/2005	6/19/2010	62	633	618	(0.4)	507	10,484,905	13.5	458	461,491	0.7	507	493,861	0.6
NH	11/1/2005	6/20/2010	15	152	151	(1.0)	146	576,221	2.6	146	(102,923)	(0.5)	146	(104,329)	(0.5)
MA	11/11/2005	5/26/2010	381	3,834	2,314	(2.8)	2,927	(12,421,390)	(2.8)	1,912	(2,628,698)	(0.9)	2,907	(3,633,203)	(0.8)
NY	10/26/2005	8/13/2010	192	1,921	1,888	6.9	1,902	13,516,298	4.5	1,875	11,970,664	4.1	1,903	12,486,843	4.2
NJ	9/2/2005	8/28/2010	203	2,034	1,934	0.6	2,008	7,024,004	2.1	1,914	7,049,070	2.2	2,005	7,297,172	2.2
DE	9/3/2005	9/11/2010	44	440	424	5.1	430	2,790,908	3.9	423	2,865,815	4.1	430	2,966,179	4.2
MD	9/3/2005	8/2/2010	50	505	493	(4.3)	501	2,299,254	2.8	491	2,144,006	2.7	501	2,174,693	2.7
VA	9/8/2005	7/28/2010	183	1,835	529	7.2	867	4,332,400	3.1	516	2,801,376	3.4	868	4,099,915	2.9
NC_2009	9/28/2005	8/16/2009	272	2,725	1,226	3.9	2,671	2,021,227	0.6	1,143	(1,877,459)	(1.3)	2,405	691,407	0.2
NC_2010	9/28/2005	5/4/2010	236	2,369	2,266	0.2	2,216	8,950,640	2.7	2,109	7,999,458	2.5	2,205	8,379,313	2.5
SC	1/13/2006	5/4/2010	277	2,778	2,572	2.1	2,685	8,547,796	2.3	2,487	4,700,815	1.3	2,662	3,404,534	0.9
GA	1/13/2006	5/4/2010	145	1,452	1,299	(0.2)	1,376	8,157,012	4.2	1,235	5,156,707	3.0	1,354	5,338,208	2.8
FL-E	7/1/2004	5/4/2010	587	5,875	4,275	(2.7)	5,666	67,767,960	6.2	4,232	7,918,114	1.0	5,649	9,191,807	0.8
FL-W	6/1/2004	6/20/2010	298	2,998	2,265	7.7	2,960	113,242,294	19.3	2,107	9,550,520	2.3	2,892	13,906,998	2.4
FL-NW	6/1/2004	6/20/2010	346	3,461	1,166	(9.5)	2,752	23,051,869	4.6	1,106	(455,950)	(0.2)	2,712	(1,019,446)	(0.2)
Total/ Average			3,289	33,012	23,420	0.9	29,614	260,341,398	4.6	22,154	57,553,006	1.6	29,146	65,673,952	1.7

Toolbox Value

- **Operations**: provide streamlined method to generate volume/shoreline change datasets on a regional scale
- **Planning**: generate map products that can be used to communicate between agency partners to identify priority areas that would benefit from beneficially using sediment
- **R&D**: provide input for SBAS (Sediment Budget Analysis System)

FLORIDA AND US EAST COAST BEACH CHANGE METRICS DERIVED FROM JALBTCX LIDAR DATA

Prepared for:

USACE JALBTCX
and
Northrop Grumman

Prepared by:

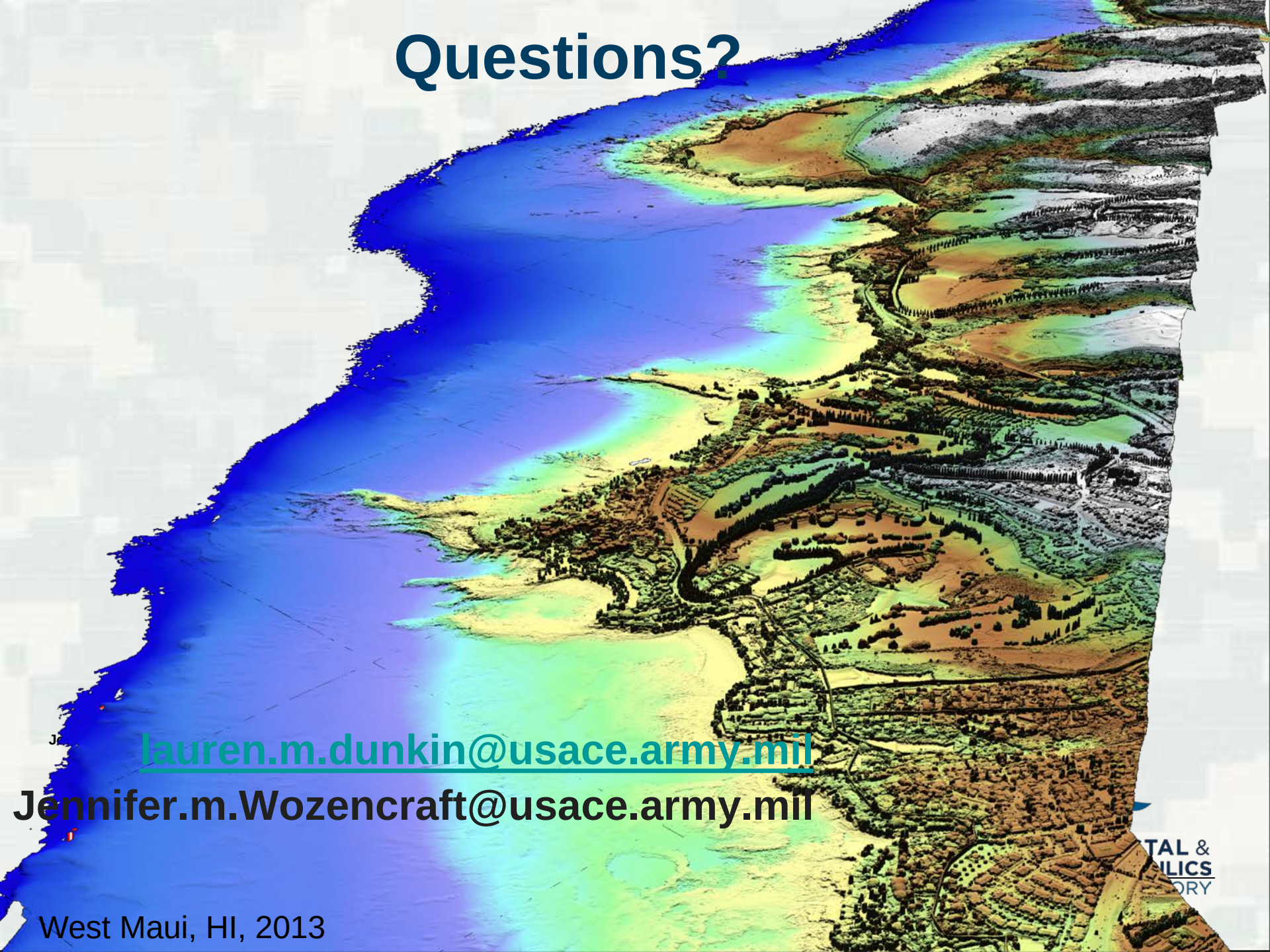
CB&I Environmental & Infrastructure, Inc.

January 2016

Improvements

- Shoreline
  - Vdatum – use NOAAs vertical datum transformation to derive shoreline (MHW)
  - Improve extraction code
  - Swash zone filtering
- Change maps
  - Automate change map generation

Questions?



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