Earth Surface Dynamics

Supporting Information for

Relationships between regional coastal land cover distributions and elevation reveal data uncertainty in a sea-level rise impacts model

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Introduction

This supplement includes a figure and tables that provide background information on 1) the coastal response model introduced in Lentz et al. (2016), as well as 2) confusion matrices used to compare land cover data sources and predictions of elevation when land cover data were used as inputs (and vice versa). The coastal response model figure is modified from previous publications (Lentz et al., 2015; 2016), and the table shows the general land cover groupings used in Lentz et al. (2016). The confusion matrices show the distributions of data in each category for the full 30 m x 30 m Northeastern U.S. region, totaling more than 42 million grid cells. The diagonal fields in the confusion matrices (upper left cell to lower right) show where predicted values matched observed values; accuracy rates reported in the captions are calculated as the sum of the diagonal divided by the total number of cells.

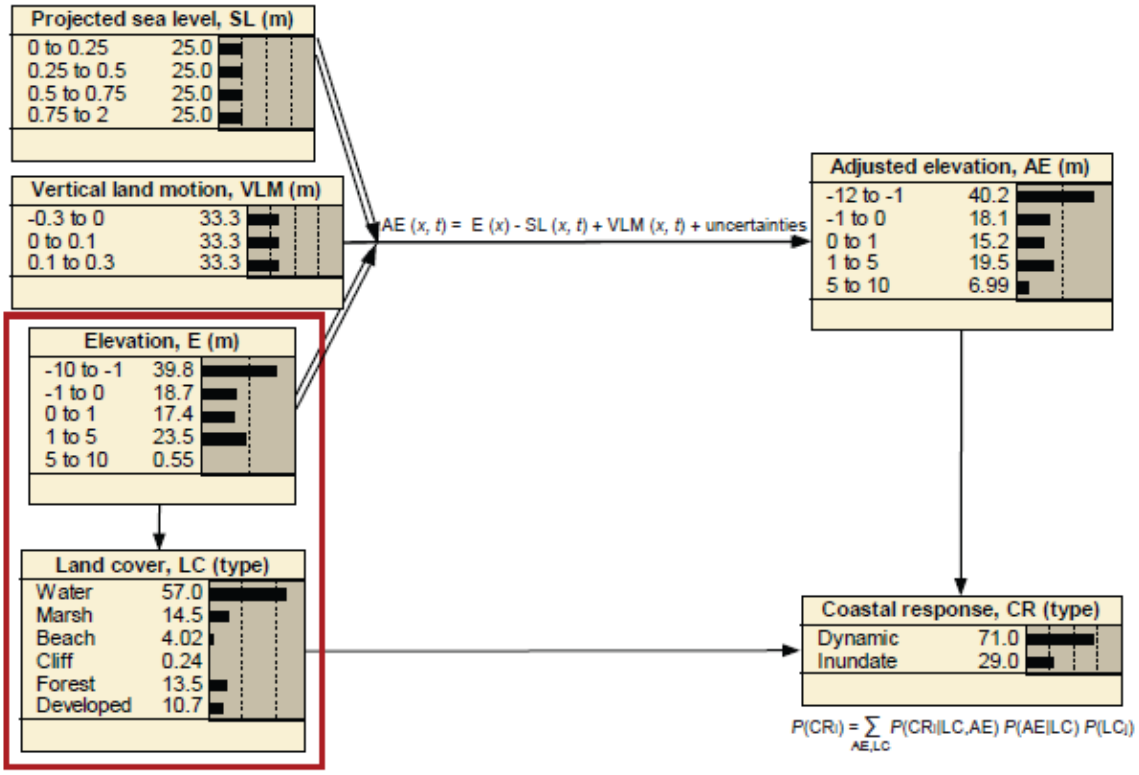

Figure S1. Diagram showing Bayesian network coastal response model, including data inputs (left) and predicted outcomes (right), including adjusted elevation (inundation model equivalent) and coastal response. Horizontal bars shown in the boxes represent prior distributions (probability of occurrence) for each parameter. Uniform distributions for sea-level and vertical land motion parameters provide an equal likelihood of occurrence until a time step is specified. Correlation among nodes are shown by the arrows between them. Equations show deterministic and probabilistic equations used to generate conditional probabilities, where *x* and *t* indicate spatial and temporal dependence, and joint correlations of occurrence *i*, at a specific location, *j*. Red box highlights E-LC relationship trained via Bayes theorem (equation 1) and further tested in this paper. Modified from Lentz et al. (2015, 2016).

Land Cover Category*	Included DSL Classes*	CCAP/DSL comparison	Included CCAP Classes
Subaqueous	Bays, lakes, rivers, marine and estuarine subtidal, and deepwater	Subaqueous	Open Water, Palustrine Aquatic Bed, Estuarine Aquatic Bed
Marsh	Salt and freshwater marshes, bogs, swamps, fens, wetland forests, intertidal aquatic beds, and reefs	Marsh	Palustrine Forested Wetland, Palustrine Scrub/Shrub Wetland, Palustrine Emergent Wetland, Estuarine Forested Wetland, Estuarine Scrub/Shrub Wetland, Estuarine Emergent Wetland
Beach	Dune and swale/sandy beach (including bluffs), marine and estuarine intertidal unconsolidated shore	Bare Land	Unconsolidated Shore, Bare Land
Rocky	Rocky outcrops and shores, marine and estuarine intertidal rock bottom		
Forest	Forests, woodlands, grasslands, agricultural, shrub lands	Non-Marsh Vegetation	Cultivated Land, Pasture/Hay, Grassland, Deciduous Forest, Evergreen Forest, Mixed Forest, Scrub/Shrub
Developed	All National Land Cover Dataset developed classes (open space, low, medium, and high density), roads, active and abandoned railroad tracks	Developed	High Intensity Developed, Medium Intensity Developed, Low Intensity Developed, Developed Open Space

Table S1. The land-cover classes falling within the six generalized land-cover categories, from Lentz et al. (2015) and as reclassified for use in comparison with Coastal Change Analysis Program (CCAP) data.

	C-CAP Land Cover						
DSL Land Cover	**Subaqueous**	**Marsh**	**Bare land**	**Non-Marsh Vegetation**	**Developed**	**Total**	**User's accuracy (%)**
Subaqueous	22027171	625725	238956	121072	170173	23183097	95
Marsh	376230	5432643	40901	319470	120669	6289913	86.4
Bare Land	961149	386365	390012	63422	39551	1840499	21.2
Non-Marsh Vegetation	69146	1351262	47797	4509443	186375	6164023	73.2
Developed	61270	454146	70835	938883	3750745	5275879	71.1
Ground truth	23494966	8250141	788501	5952290	4267513	*42753411*	
Producer's accuracy (%)	93.8	65.8	49.5	75.8	87.9		

Table S2. Confusion matrix showing comparison between Coastal Change Analysis Program (C-CAP) and Designing Sustainable Landscapes (DSL) land cover datasets with user's error (accuracy) and producer's error (reliability). The overall accuracy rate in this comparison is 85%, where CCAP data are considered as ground truth.

	Predicted							
Actual	**Water**	**Marsh**	**Beach**	**Rocky**	**Forest**	**Developed**	**Total**	**User's accuracy (%)**
Water	**22047162**	1544679	0	0	406731	0	23998572	91.9
Marsh	1329913	**2993110**	0	0	1928163	0	6251186	21.3
Beach	1053405	453200	**0**	0	174135	0	1680740	62.7
Rocky	62204	22706	0	**0**	15235	0	100145	62.1
Forest	146486	1394100	0	0	**3921786**	0	5462372	2.7
Developed	140500	948210	0	0	3450330	**0**	4539040	3.1
Ground truth	24779670	7356005	0	0	9896380	0	**42032055**	
Producer's accuracy(%)	89.5	24.1			6.3			

Table S3a. Confusion matrix showing comparison between predicted land cover and measured (observed) land cover when elevation data are used as inputs with original distributions, with user's error (accuracy) and producer's error (reliability). The overall accuracy rate for this comparison is 77%.

	Predicted							
Actual	**Water**	**Marsh**	**Beach**	**Rocky**	**Forest**	**Developed**	**Total**	**User's accuracy (%)**
Water	**16528310**	1544679	5518852	0	0	406731	23998572	68.9
Marsh	61994	**2993110**	1267919	0	0	1928163	6251186	1
Beach	218448	453200	**834957**	0	0	174135	1680740	13
Rocky	35931	22706	26273	**0**	0	15235	100145	35.9
Forest	11238	1394100	135248	0	**0**	3921786	5462372	0.2
Developed	25627	948210	114873	0	0	**3450330**	4539040	0.6
Ground truth	16881548	7356005	7898122	0	0	9896380	**42032055**	
Producer's accuracy (%)	98.1	24.1	70.9			6.3		

Table S3b. Confusion matrix showing comparison between predicted land cover and measured (observed) land cover when elevation data are used as inputs with uniform distributions, with user's error (accuracy) and producer's error (reliability). The overall accuracy rate for this comparison is 65.5%

	Predicted						
Actual	**-10 to -1**	**-1 to 0**	**0 to 1**	**1 to 5**	**5 to 10**	**Total**	**User's accuracy (%)**
-10 to -1	**16564241**	218448	61994	36865	0	16881548	98.1
-1 to 0	5545125	**834957**	1267919	250121	0	7898122	10.6
0 to 1	1567383	453200	**2966182**	2342297	0	7329062	40.5
1 to 5	421966	174135	1928163	**7372116**	0	9896380	74.5
5 to 10	2	0	26928	13	**0**	26943	0
Ground truth	24098717	1680740	6251186	10001412	0	**42032055**	
Producer's accuracy (%)	68.7	49.7	47.4	73.7			

Table S4a. Confusion matrix showing comparison between predicted elevations and measured (observed) elevations when land cover data are used as inputs with original distributions, with user's error (accuracy) and producer's error (reliability). The overall accuracy rate for this comparison is 66%.

	Predicted						
Actual	**-10 to -1**	**-1 to 0**	**0 to 1**	**1 to 5**	**5 to 10**	**Total**	**User's accuracy (%)**
-10 to -1	**16528310**	254379	0	36865	61994	16881548	97.9
-1 to 0	5518852	**861230**	0	250121	1267919	7898122	10.9
0 to 1	1544677	475906	**0**	2342297	2966182	7329062	0
1 to 5	406731	189370	0	**7372116**	1928163	9896380	74.5
5 to 10	2	0	0	13	**26928**	26943	99.9
Ground truth	23998572	1780885	0	10001412	6251186	**42032055**	
Producer's accuracy (%)	68.9	48.4		73.7	30.8		

Table S4b. Confusion matrix showing comparison between predicted elevations and measured (observed) elevations when land cover data are used as inputs with uniform distributions, with user's error (accuracy) and producer's error (reliability). The overall accuracy rate for this comparison is 59%.