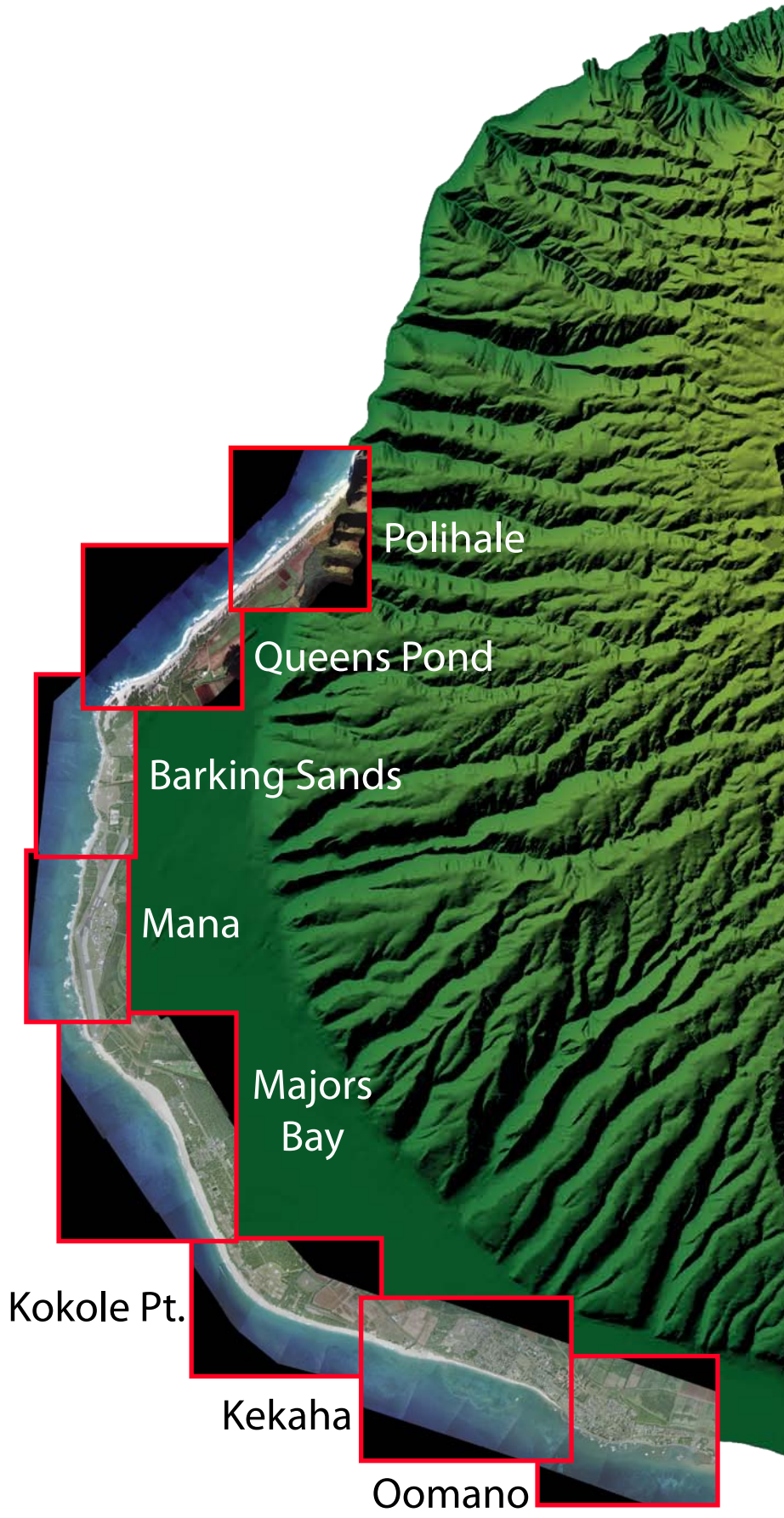
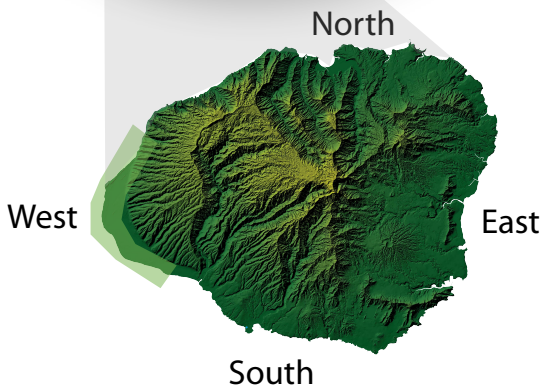


West Coast, Kauai, Hawaii



Polihale, Kauai, Hawaii

HISTORICAL SHORELINES

- 1927 T-sheet
- May 1962
- May 1966
- Apr 1975
- Jul 1987
- Mar 1988
- Sep 1999
- Nov 2006

- Erosion rate measurement locations (shore-normal transects)

Historical beach positions, color coded by year, are determined using orthorectified and georeferenced aerial photographs and National Ocean Survey (NOS) topographic survey charts. The low water mark is used as the historical shoreline, or shoreline change reference feature (SCRF).

Movement of the SCRF along shore-normal transects (spaced every 66 ft) is used to calculate erosion rates.

SHORELINE CHANGE RATES

- Accretion Rate
- Erosion Rate

Historical shoreline positions are measured every 66 ft along the shoreline. These sites are denoted by yellow shore-perpendicular transects. Changes in the position of the shorelines through time are used to calculate shoreline change rates (ft/yr) at each transect location.

Annual shoreline change rates are shown on the shore-parallel graph. Red bars on the graph indicate a trend of beach erosion, while blue bars indicate a trend of accretion. Approximately every fifth transect and bar of the graph is numbered. Where necessary, transects have been purposely deleted to maintain consistent alongshore spacing. As a result transect numbering is not consecutive everywhere. The rates are smoothed alongshore using a 1-3-5-3-1 technique to normalize rate differences on adjacent transects.

Shoreline Change Rate (ft/yr)

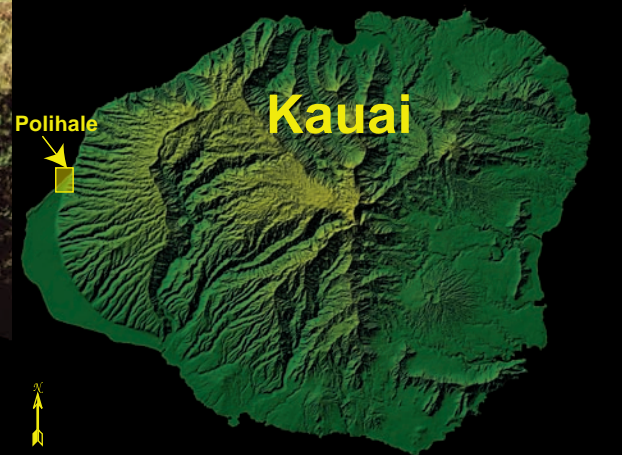
AREA DESCRIPTION

Polihale study area (transects 140 - 272) lies on the northwest exposure of the Mana Plain where it intersects the steep ridges and valleys of the Na Pali coast. The shoreline in the majority of the study area is composed of white carbonate sand backed by vegetated dunes. The northernmost section of the area is interspersed with basalt boulders and backed by basalt ridges. The study area is exposed to swell from the north and northwest during winter and spring months. As a result, the area experiences large seasonal fluctuations of the shoreline evidenced by an average difference in summer (1987) and winter (1988) shoreline positions of approximately 90 ft.

This area is a continuation of Polihale Beach which extends through the Queen's Pond area to the south. The average shoreline change for this study area is erosional at a rate of -0.6 ft/yr. The northern portion of the study area (transects 207 - 272) is eroding at an average rate of -1.0 ft/yr while the southern portion (transects 140 - 206) is eroding at an average rate of -0.1 ft/yr.

Polihale State Park (transects 80 through 272) extends through Polihale into Queen's Pond study areas. The average shoreline change for Polihale State Park is erosional at an average rate of -0.4 ft/yr. Previous studies¹ do not analyze Polihale Beach.

¹ Makai Ocean Engineering and Sea Engineering, 1991 Aerial Photograph Analysis of Coastal Erosion on the Islands of Kauai, Molokai, Lanai, Maui, and Hawaii. State of Hawaii Office of Coastal Zone Management Program.



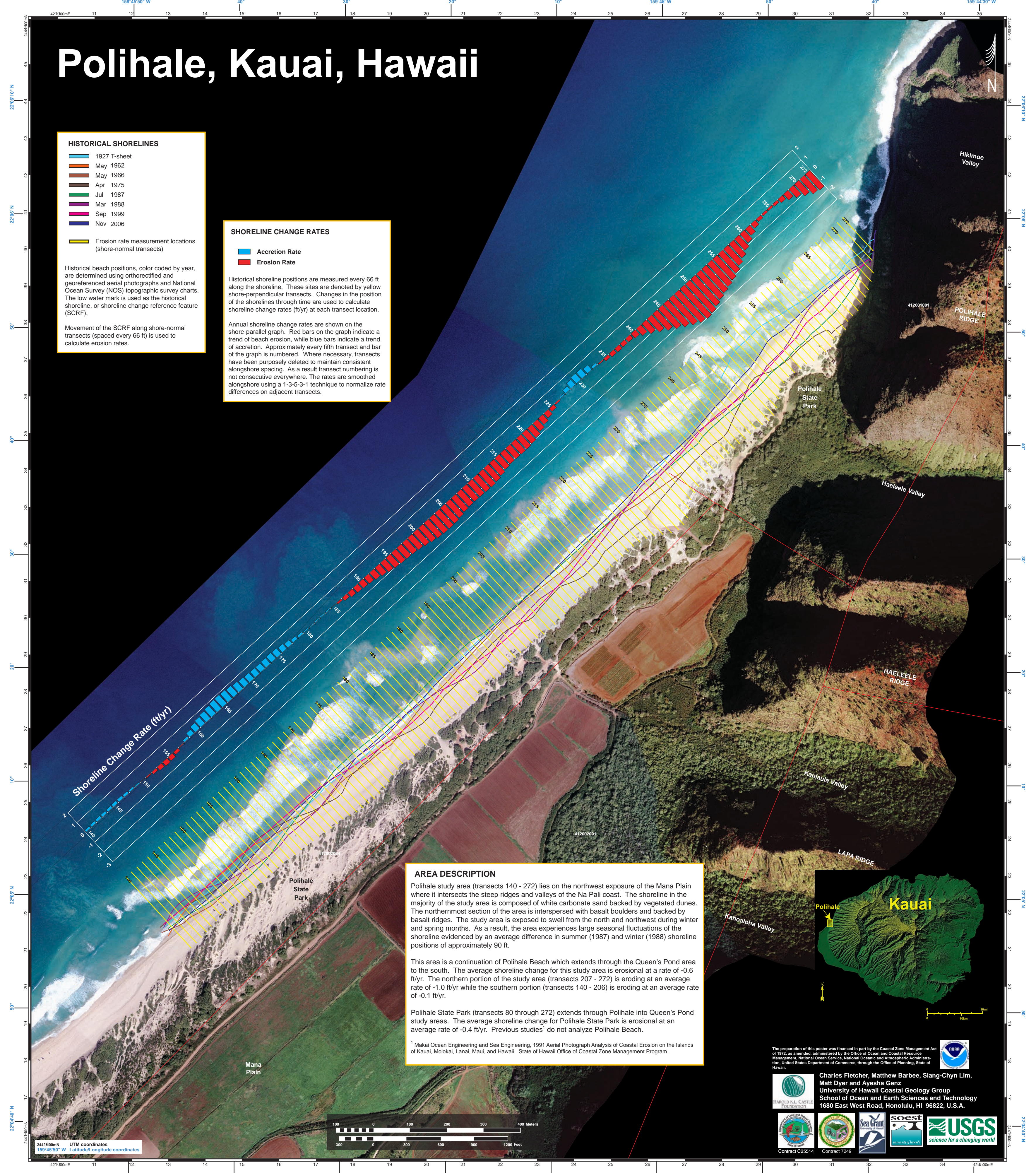
The preparation of this poster was financed in part by the Coastal Zone Management Act of 1972, as amended, administered by the Office of Ocean and Coastal Resource Management, National Ocean Service, National Oceanic and Atmospheric Administration, United States Department of Commerce, through the Office of Planning, State of Hawaii.

Charles Fletcher, Matthew Barbee, Siang-Chyn Lim, Matt Dyer and Ayesha Genz
 University of Hawaii Coastal Geology Group
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 1680 East West Road, Honolulu, HI 96822, U.S.A.

Contract C25514 Contract 7249



2441600mN UTM coordinates
 159°45'50" W Latitude/Longitude coordinates



Polihale - Smoothed Rates

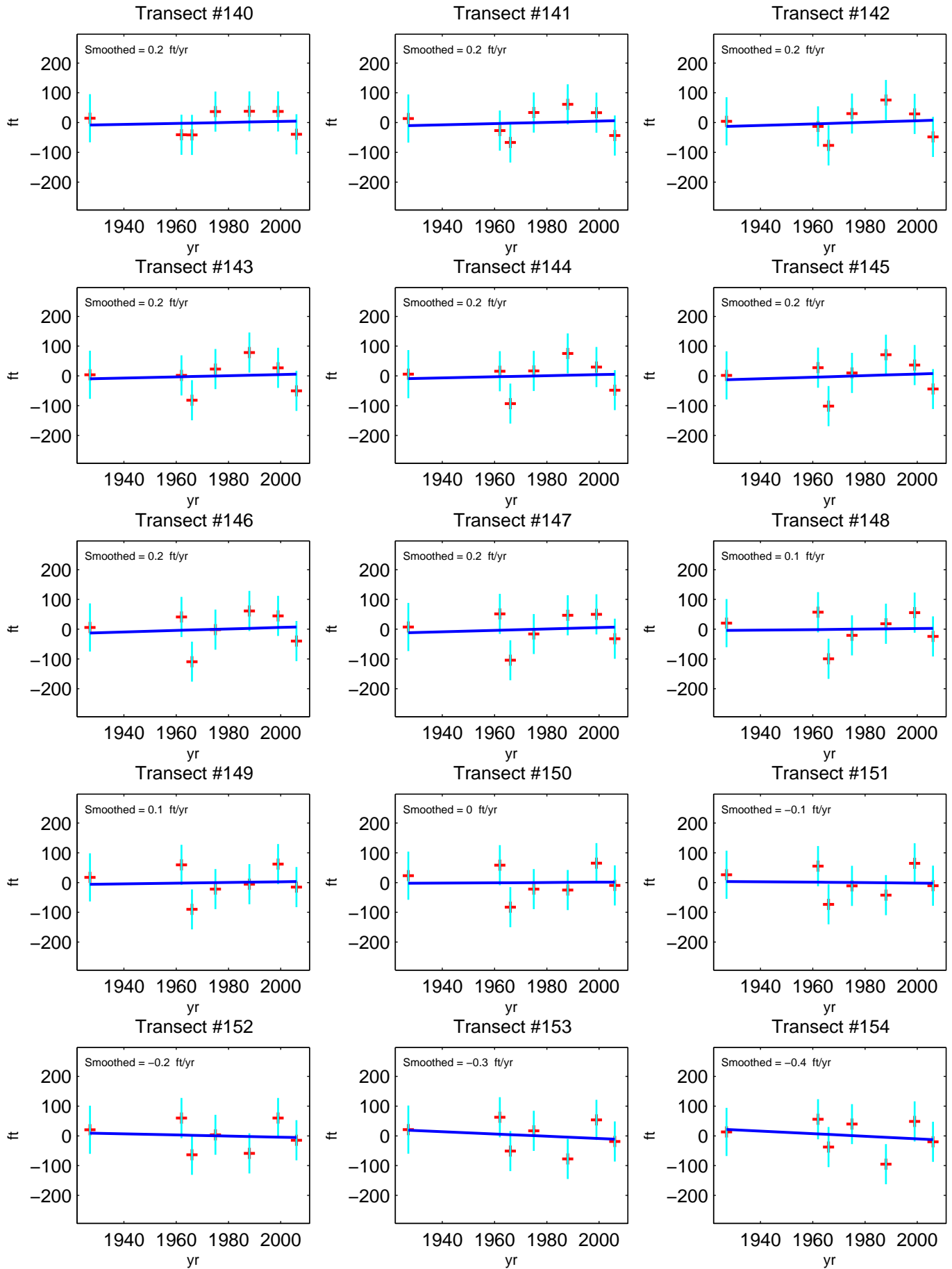
Positive Rate = Accretion
Negative Rate = Erosion

Transect	Smoothed Rate (ft/yr)	Transect	Smoothed Rate (ft/yr)	Transect	Smoothed Rate (ft/yr)
140	0.2	186	-0.1	232	0.5
141	0.2	187	-0.3	233	0.2
142	0.2	188	-0.4	234	-0.1
143	0.2	189	-0.5	235	-0.2
144	0.2	190	-0.5	236	-0.3
145	0.2	191	-0.6	237	-0.4
146	0.2	192	-0.7	238	-0.3
147	0.2	193	-0.8	239	-0.3
148	0.1	194	-0.9	240	-0.5
149	0.1	195	-1.0	241	-0.7
150	0.0	196	-1.1	242	-1.0
151	-0.1	197	-1.1	243	-1.4
152	-0.2	198	-1.1	244	-1.7
153	-0.3	199	-1.2	245	-2.1
154	-0.4	200	-1.3	246	-2.4
155	-0.4	201	-1.4	247	-2.7
156	-0.2	202	-1.5	248	-2.9
157	-0.1	203	-1.6	249	-3.0
158	0.2	204	-1.6	250	-3.0
159	0.4	205	-1.6	251	-2.8
160	0.6	206	-1.5	252	-2.6
161	0.7	207	-1.4	253	-2.4
162	0.7	208	-1.4	254	-2.3
163	0.8	209	-1.4	255	-2.2
164	0.9	210	-1.4	256	-2.0
165	0.9	211	-1.4	257	-1.7
166	0.9	212	-1.4	258	-1.4
167	0.8	213	-1.4	259	-1.2
168	0.7	214	-1.3	260	-0.9
169	0.6	215	-1.1	261	-0.6
170	0.6	216	-1.1	262	-0.4
171	0.6	217	-1.1	263	-0.3
172	0.6	218	-1.1	264	-0.2
173	0.6	219	-1.1	265	-0.2
174	0.6	220	-1.1	266	-0.2
175	0.6	221	-0.9	267	-0.4
176	0.5	222	-0.8	268	-0.6
177	0.4	223	-0.6	269	-0.9
178	0.3	224	-0.5	270	-1.2
179	0.2	225	-0.3	271*	-1.5
180	0.1	226	-0.1	272*	-1.6
181	0.1	227	0.1		
182	0.1	228	0.3		
183	0.1	229	0.5		
184	0.1	230	0.6		
185	0.0	231	0.6		

*Imagery indicates beachwidth of zero during period of analysis. Rate calculation reflects data with beach existence.

Poli Hale - Smoothed Shoreline Change Rates

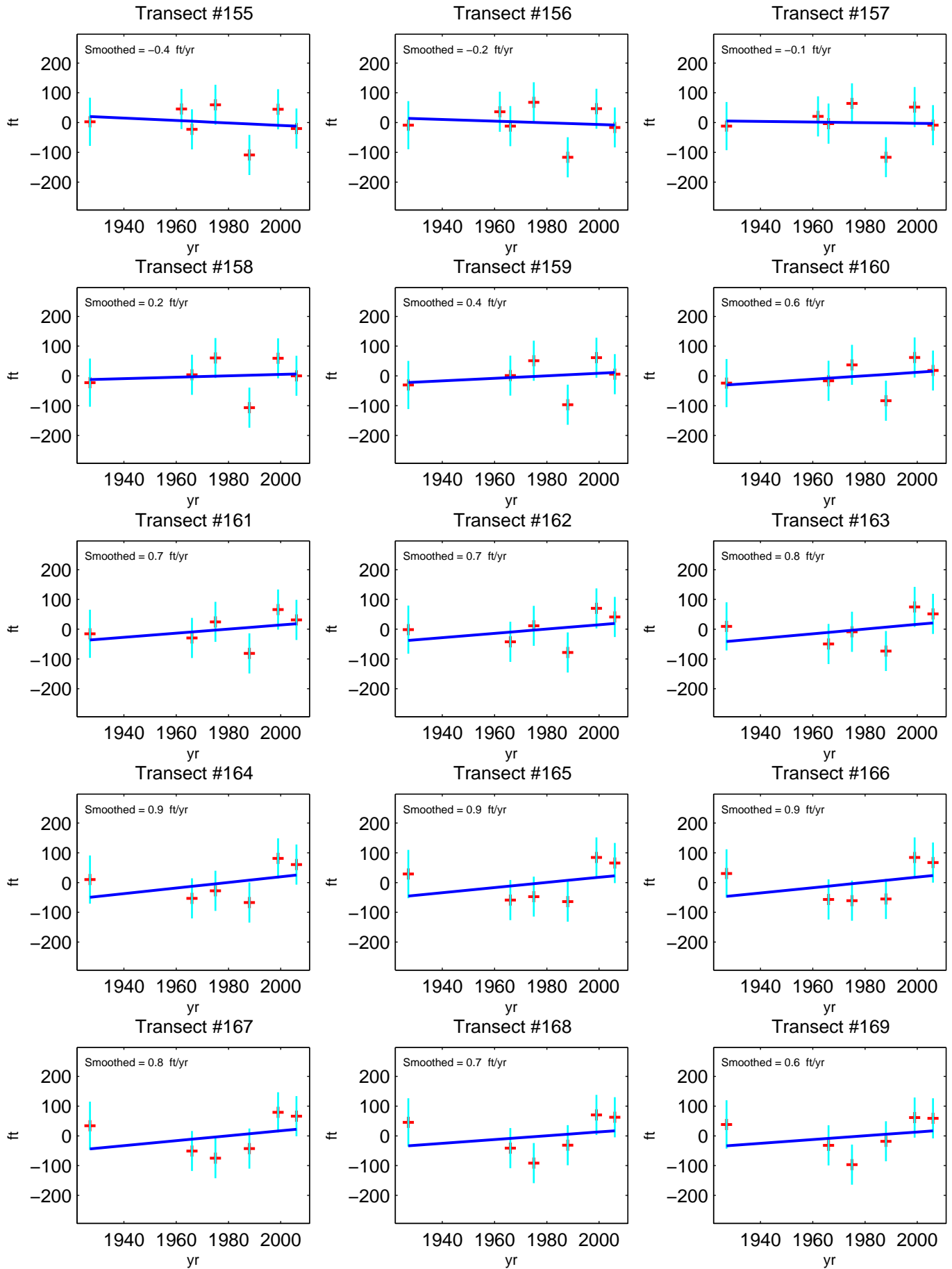
Positive Rate = Accretion
Negative Rate = Erosion



*Hardened Shorelines with no beach are shown with a blue square. The analysis stops at the first hardened shoreline.

Polihaie - Smoothed Shoreline Change Rates

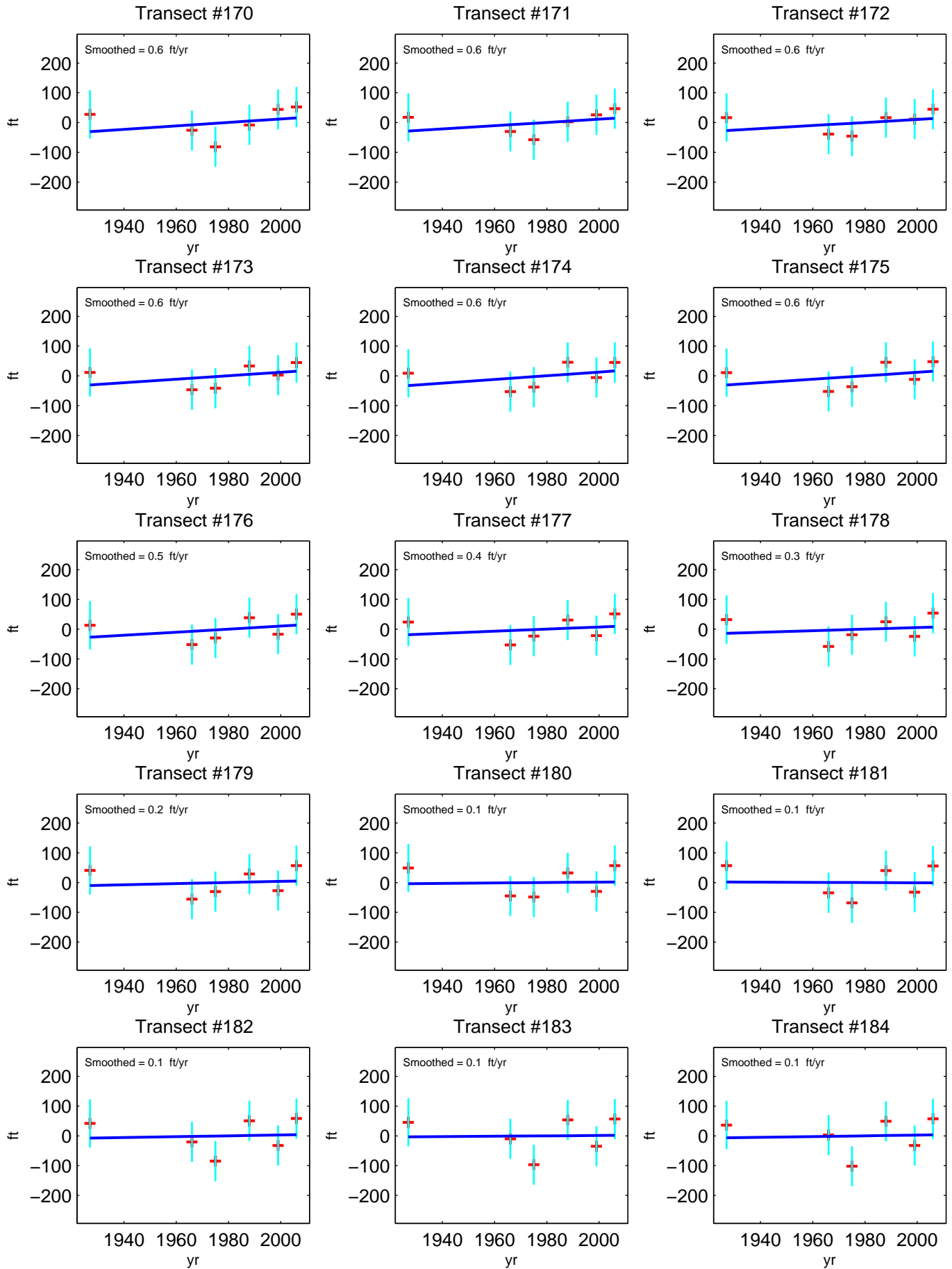
Positive Rate = Accretion
Negative Rate = Erosion



*Hardened Shorelines with no beach are shown with a blue square. The analysis stops at the first hardened shoreline.

Polihaie - Smoothed Shoreline Change Rates

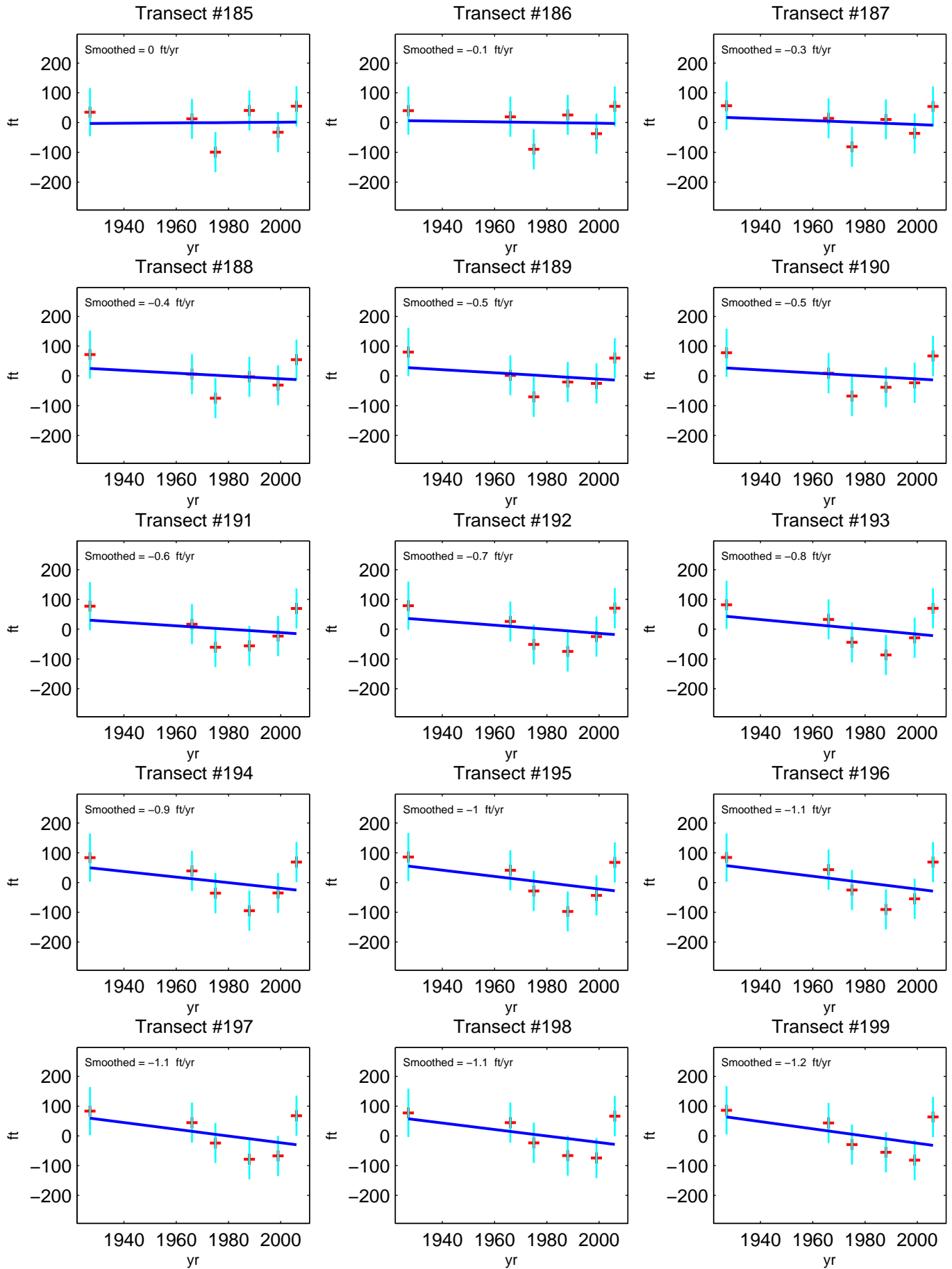
Positive Rate = Accretion
Negative Rate = Erosion



*Hardened Shorelines with no beach are shown with a blue square. The analysis stops at the first hardened shoreline.

Polihale - Smoothed Shoreline Change Rates

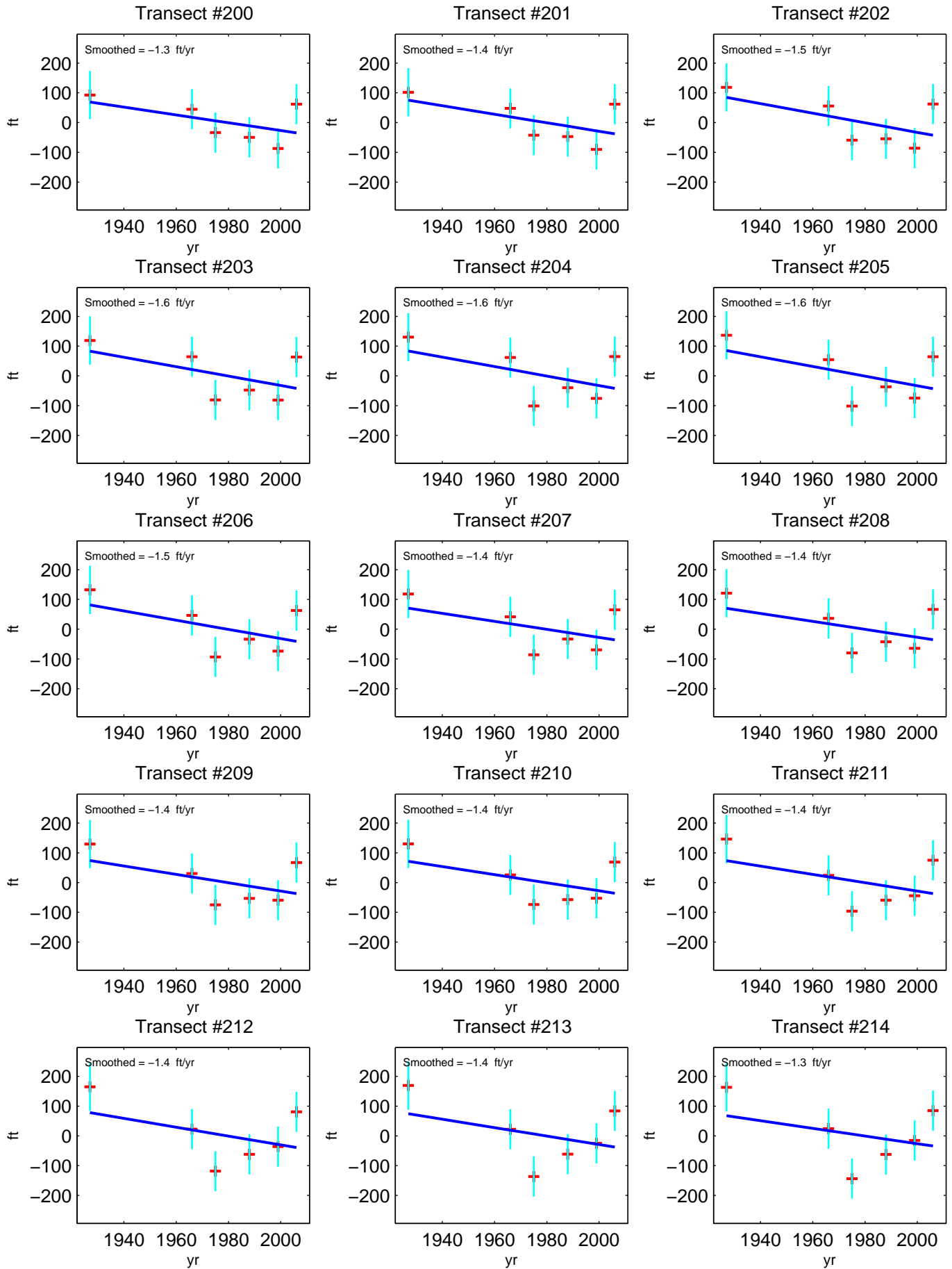
Positive Rate = Accretion
Negative Rate = Erosion



*Hardened Shorelines with no beach are shown with a blue square. The analysis stops at the first hardened shoreline.

Poli Hale - Smoothed Shoreline Change Rates

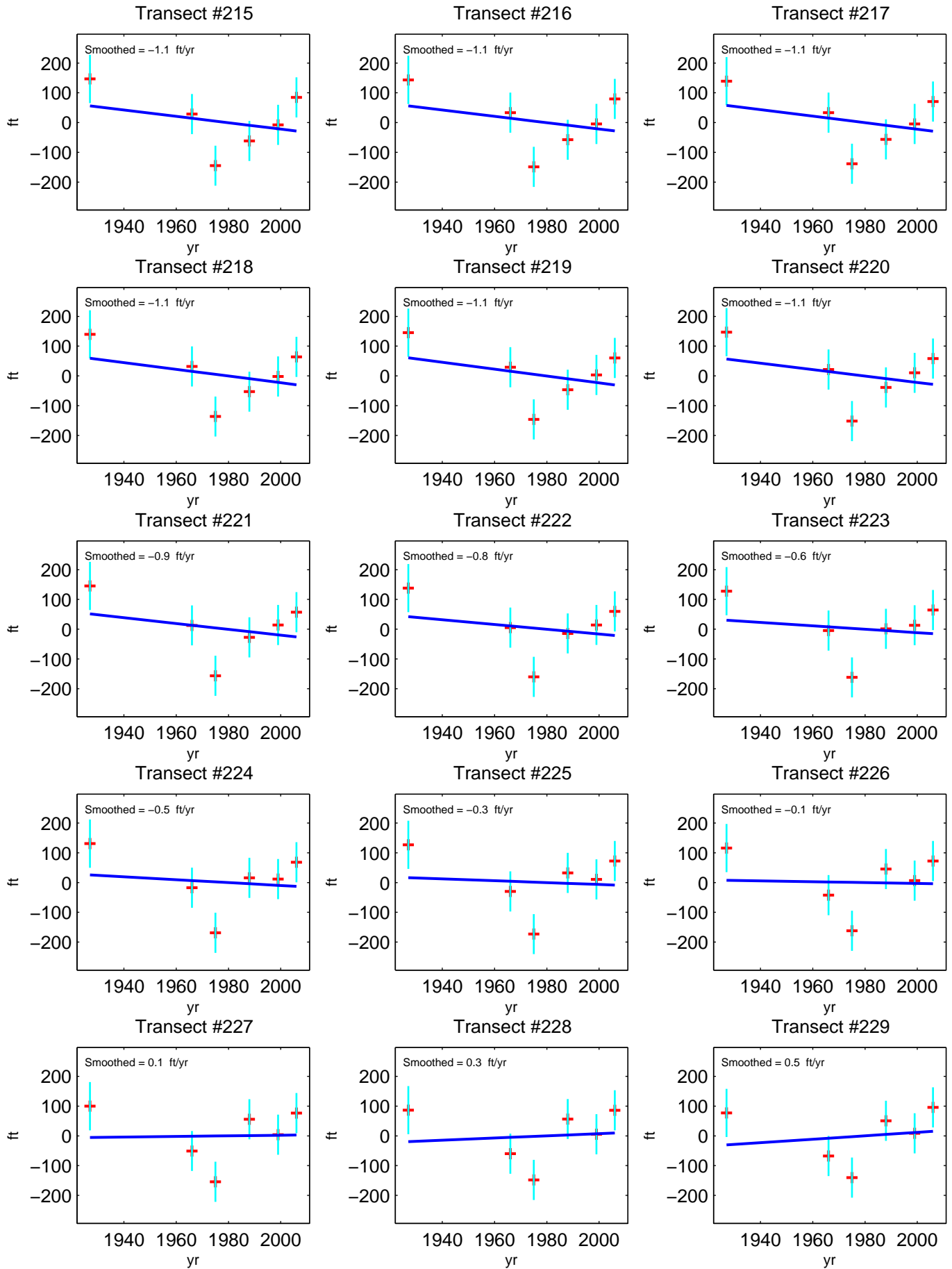
Positive Rate = Accretion
Negative Rate = Erosion



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Polihale - Smoothed Shoreline Change Rates

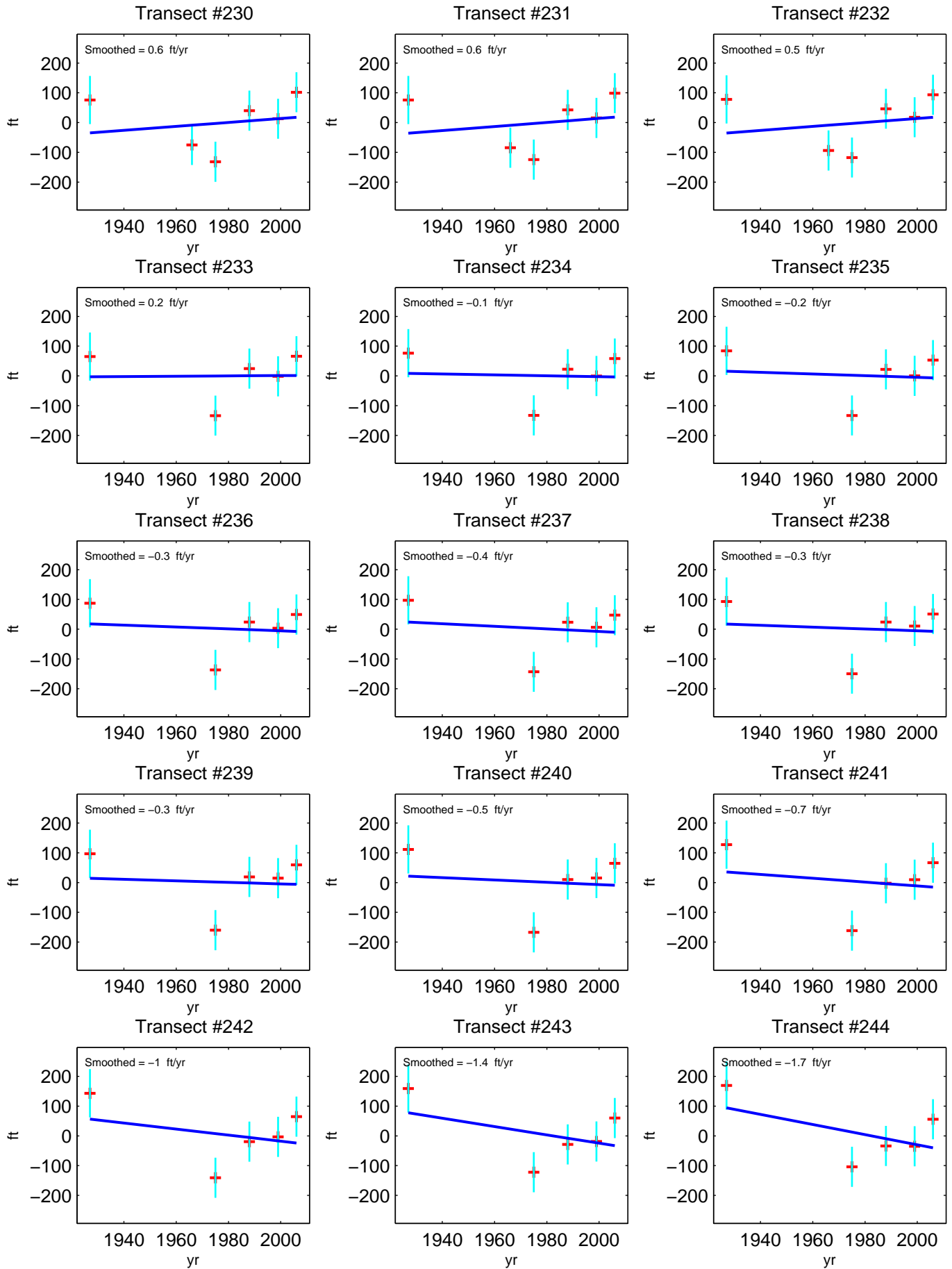
Positive Rate = Accretion
Negative Rate = Erosion



*Hardened Shorelines with no beach are shown with a blue square. The analysis stops at the first hardened shoreline.

Polihi Hale - Smoothed Shoreline Change Rates

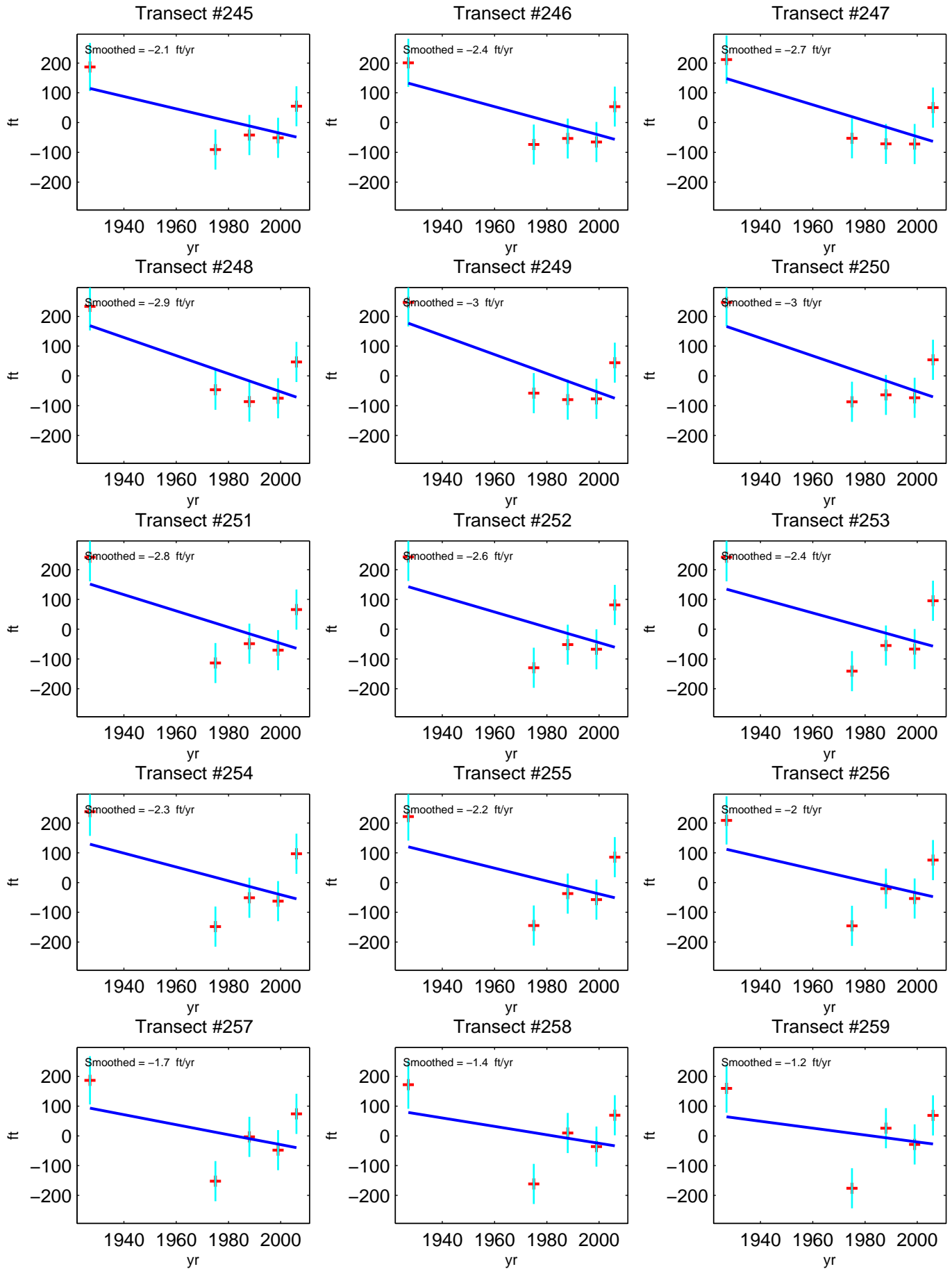
Positive Rate = Accretion
Negative Rate = Erosion



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Poli Hale - Smoothed Shoreline Change Rates

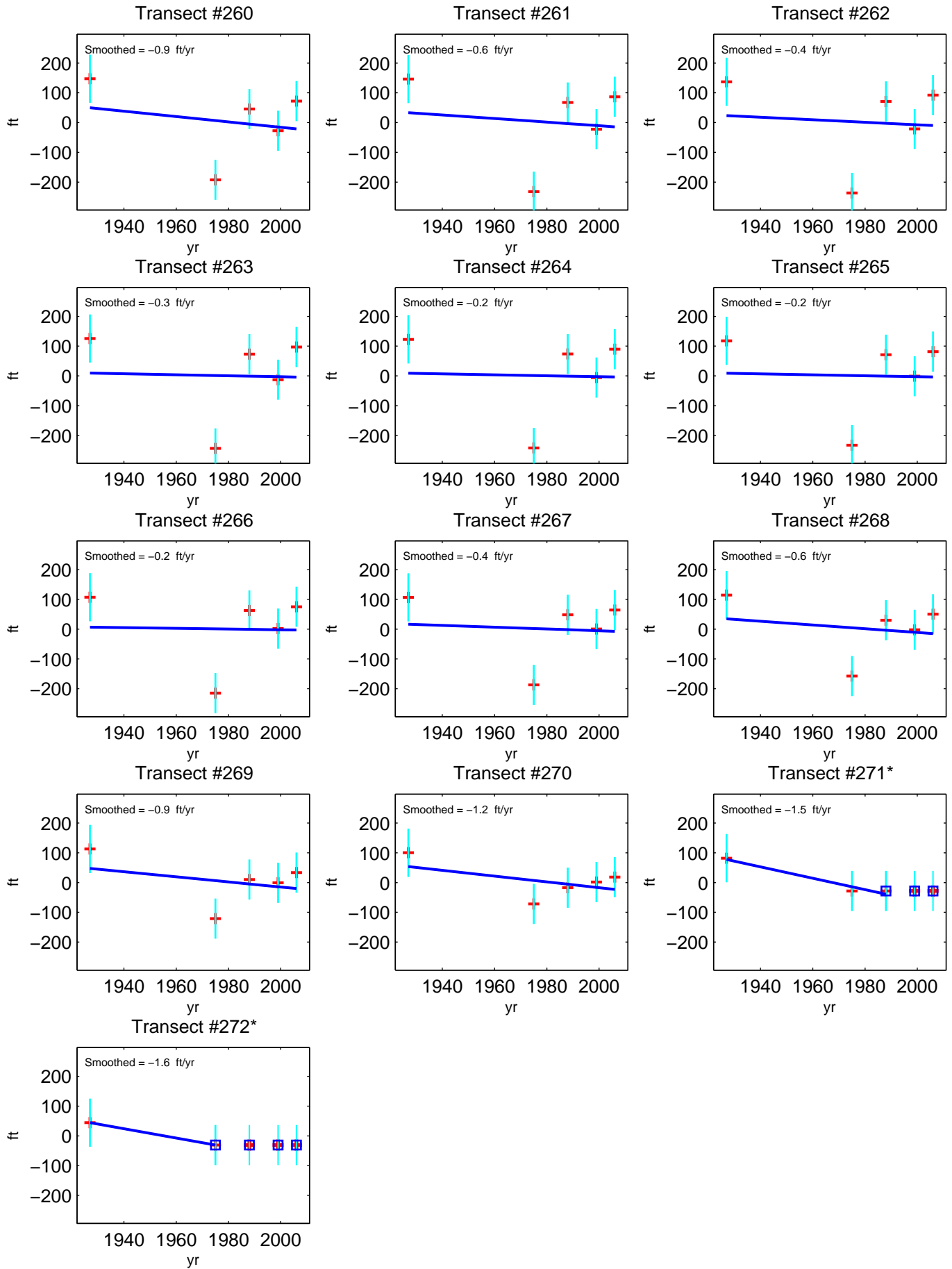
Positive Rate = Accretion
Negative Rate = Erosion



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Polihi Hale - Smoothed Shoreline Change Rates

Positive Rate = Accretion
Negative Rate = Erosion



*Hardened Shorelines with no beach are shown with a blue square. The analysis stops at the first hardened shoreline.

Queen's Pond, Kauai, Hawaii

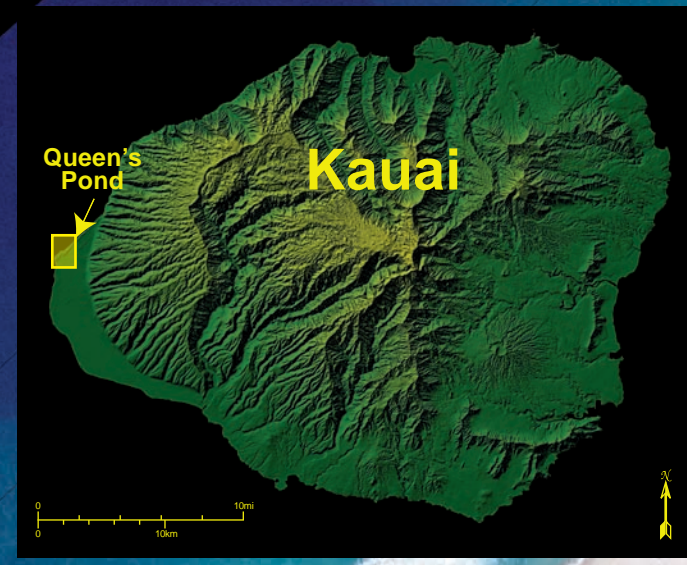
AREA DESCRIPTION

Queen's Pond study area (transects 1 – 139) covers the southern section of Polihale Beach. The beach at Queen's Pond is composed of carbonate sand backed by vegetated dunes and sugarcane fields. The study area is exposed to swell from the north and northwest during winter and spring months. As a result, the area experiences large seasonal fluctuations of the shoreline evidenced by an average difference in summer (1987) and winter (1988) shoreline positions of approximately 100 ft. Previous studies¹ do not analyze Queen's Pond study area.

Queen's Pond (transects 95 – 106) is a small basin along the shoreline in the northern section of the area. The area is bounded to the south by a complex of emerged shore-parallel beachrock. The average shoreline change for this study area is erosional at an average rate of -0.4 ft/yr. The northern portion of the study area (transects 70 – 139) is experiencing erosion at an average rate of -0.2 ft/yr while the southern portion (transects 1 – 69) is eroding at an average rate of -0.6 ft/yr.

Polihale State Park (transects 80 - 272) includes the northern half of Queen's Pond study area. The average shoreline change for Polihale State Park is experiencing erosion at an average rate of -0.4 ft/yr.

¹ Makai Ocean Engineering and Sea Engineering, 1991 Aerial Photograph Analysis of Coastal Erosion on the Islands of Kauai, Molokai, Lanai, Maui, and Hawaii. State of Hawaii Office of Coastal Zone Management Program.



HISTORICAL SHORELINES

- 1927 T-sheet
- Nov 1950
- May 1962
- May 1966
- Apr 1975
- Jul 1987
- Mar 1988
- Oct 1991
- Sep 1992
- Sep 1999
- Nov 2006

Yellow lines indicate erosion rate measurement locations (shore-normal transects).

Historical beach positions, color coded by year, are determined using orthorectified and georeferenced aerial photographs and National Ocean Survey (NOS) topographic survey charts. The low water mark is used as the historical shoreline, or shoreline change reference feature (SCRF).

Movement of the SCRF along shore-normal transects (spaced every 66 ft) is used to calculate erosion rates.

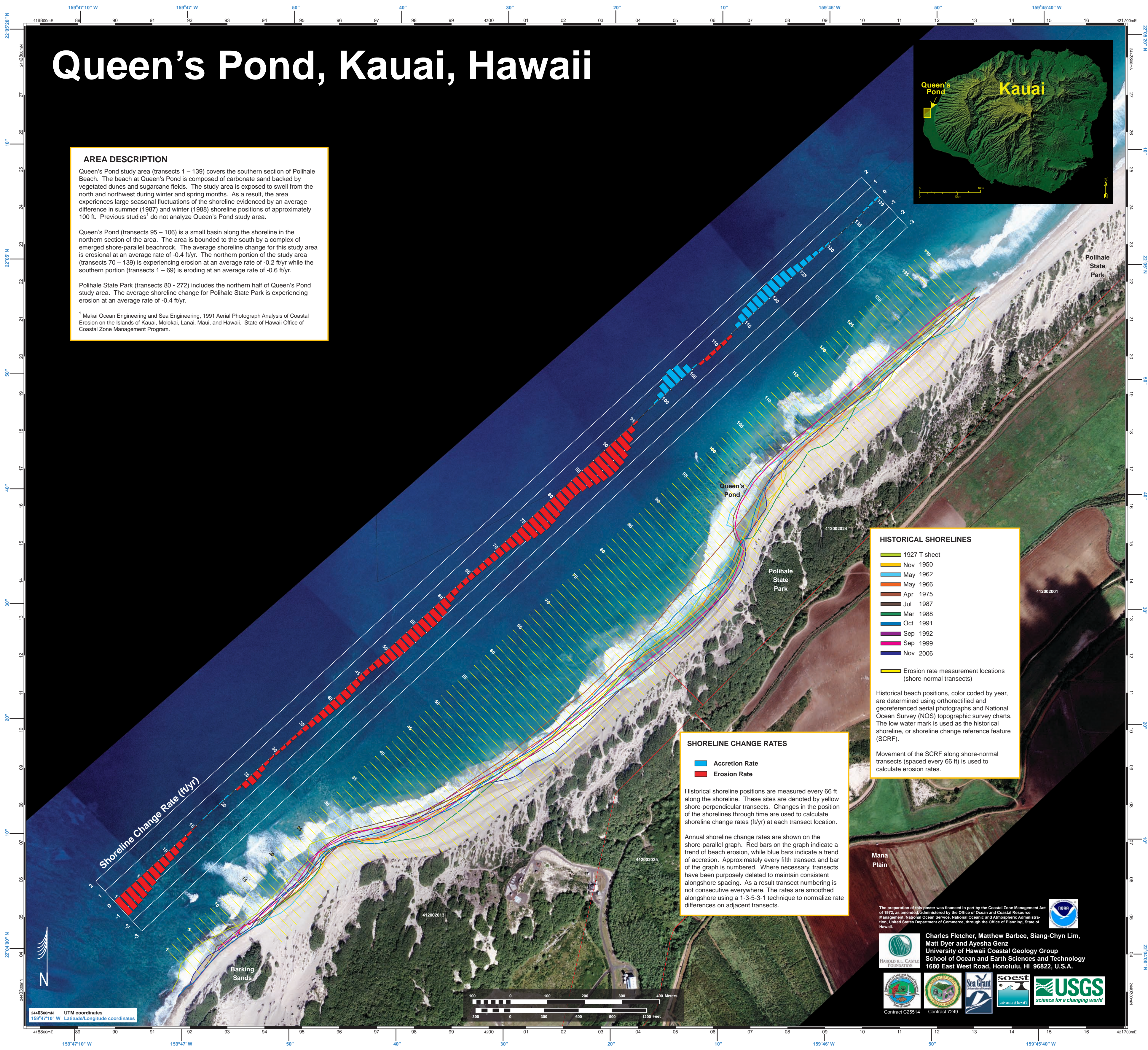
SHORELINE CHANGE RATES

- Blue bars: Accretion Rate
- Red bars: Erosion Rate

Historical shoreline positions are measured every 66 ft along the shoreline. These sites are denoted by yellow shore-perpendicular transects. Changes in the position of the shorelines through time are used to calculate shoreline change rates (ft/yr) at each transect location.

Annual shoreline change rates are shown on the shore-parallel graph. Red bars on the graph indicate a trend of beach erosion, while blue bars indicate a trend of accretion. Approximately every fifth transect and bar of the graph is numbered. Where necessary, transects have been purposely deleted to maintain consistent alongshore spacing. As a result transect numbering is not consecutive everywhere. The rates are smoothed alongshore using a 1-3-5-3-1 technique to normalize rate differences on adjacent transects.

Shoreline Change Rate (ft/yr)



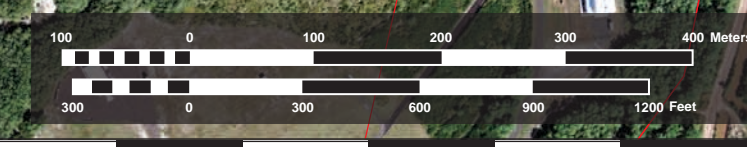
The preparation of this poster was financed in part by the Coastal Zone Management Act of 1972, as amended, administered by the Office of Ocean and Coastal Resource Management, National Ocean Service, National Oceanic and Atmospheric Administration, United States Department of Commerce, through the Office of Planning, State of Hawaii.

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 School of Ocean and Earth Sciences and Technology
 1680 East West Road, Honolulu, HI 96822, U.S.A.

Logos for NOAA, Harold K. Castle Foundation, Sea Grant, University of Hawaii, and USGS.

Contract C25514 Contract 7249

2440300mN UTM coordinates
 159°47'10" W Latitude/Longitude coordinates



Queens Pond - Smoothed Rates

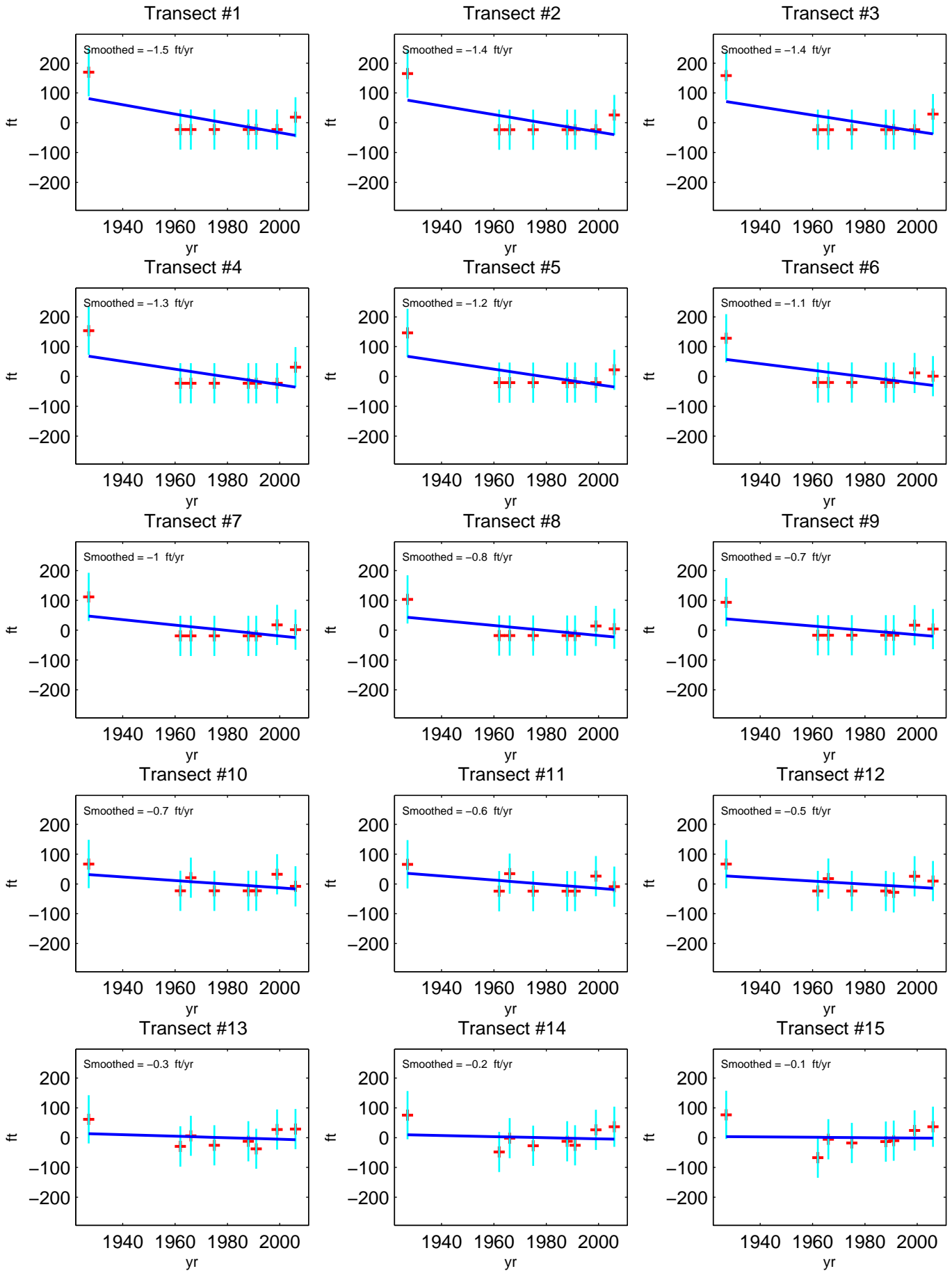
Positive Rate = Accretion
Negative Rate = Erosion

Transect	Smoothed Rate (ft/yr)	Transect	Smoothed Rate (ft/yr)	Transect	Smoothed Rate (ft/yr)
1	-1.5	47	-0.4	93	-0.8
2	-1.4	48	-0.5	94	-0.4
3	-1.4	49	-0.7	95	-0.1
4	-1.3	50	-0.9	96	0.0
5	-1.2	51	-1.0	97	0.0
6	-1.1	52	-1.0	98	0.0
7	-1.0	53	-1.0	99	0.2
8	-0.8	54	-1.0	100	0.4
9	-0.7	55	-1.0	101	0.8
10	-0.7	56	-1.0	102	1.1
11	-0.6	57	-1.1	103	1.2
12	-0.5	58	-1.0	104	1.0
13	-0.3	59	-0.9	105	0.6
14	-0.2	60	-0.8	106	0.1
15	-0.1	61	-0.6	107	-0.2
16	0.0	62	-0.4	108	-0.3
17	0.1	63	-0.4	109	-0.3
18	0.1	64	-0.4	110	-0.3
19	0.1	65	-0.4	111	-0.3
20	0.1	66	-0.4	112	-0.2
21	0.1	67	-0.5	113	0.0
22	0.0	68	-0.5	114	0.3
23	-0.2	69	-0.6	115	0.6
24	-0.5	70	-0.6	116	0.8
25	-0.6	71	-0.7	117	0.8
26	-0.6	72	-0.8	118	0.9
27	-0.4	73	-0.9	119	0.9
28	-0.2	74	-1.1	120	1.0
29	-0.2	75	-1.3	121	1.0
30	-0.2	76	-1.4	122	1.0
31	-0.2	77	-1.4	123	0.8
32	-0.2	78	-1.4	124	0.7
33	-0.2	79	-1.3	125	0.6
34	-0.3	80	-1.2	126	0.5
35	-0.4	81	-1.1	127	0.4
36	-0.4	82	-1.0	128	0.3
37	-0.5	83	-1.0	129	0.2
38	-0.6	84	-1.1	130	0.1
39	-0.7	85	-1.3	131	0.1
40	-0.7	86	-1.5	132	0.0
41	-0.7	87	-1.6	133	0.0
42	-0.7	88	-1.7	134	0.0
43	-0.6	89	-1.7	135	0.0
44	-0.5	90	-1.6	136	0.0
45	-0.4	91	-1.4	137	0.1
46	-0.4	92	-1.2	138	0.2

*Imagery indicates beachwidth of zero during period of analysis. Rate calculation reflects data with beach existence.

Queen's Pond - Smoothed Shoreline Change Rates

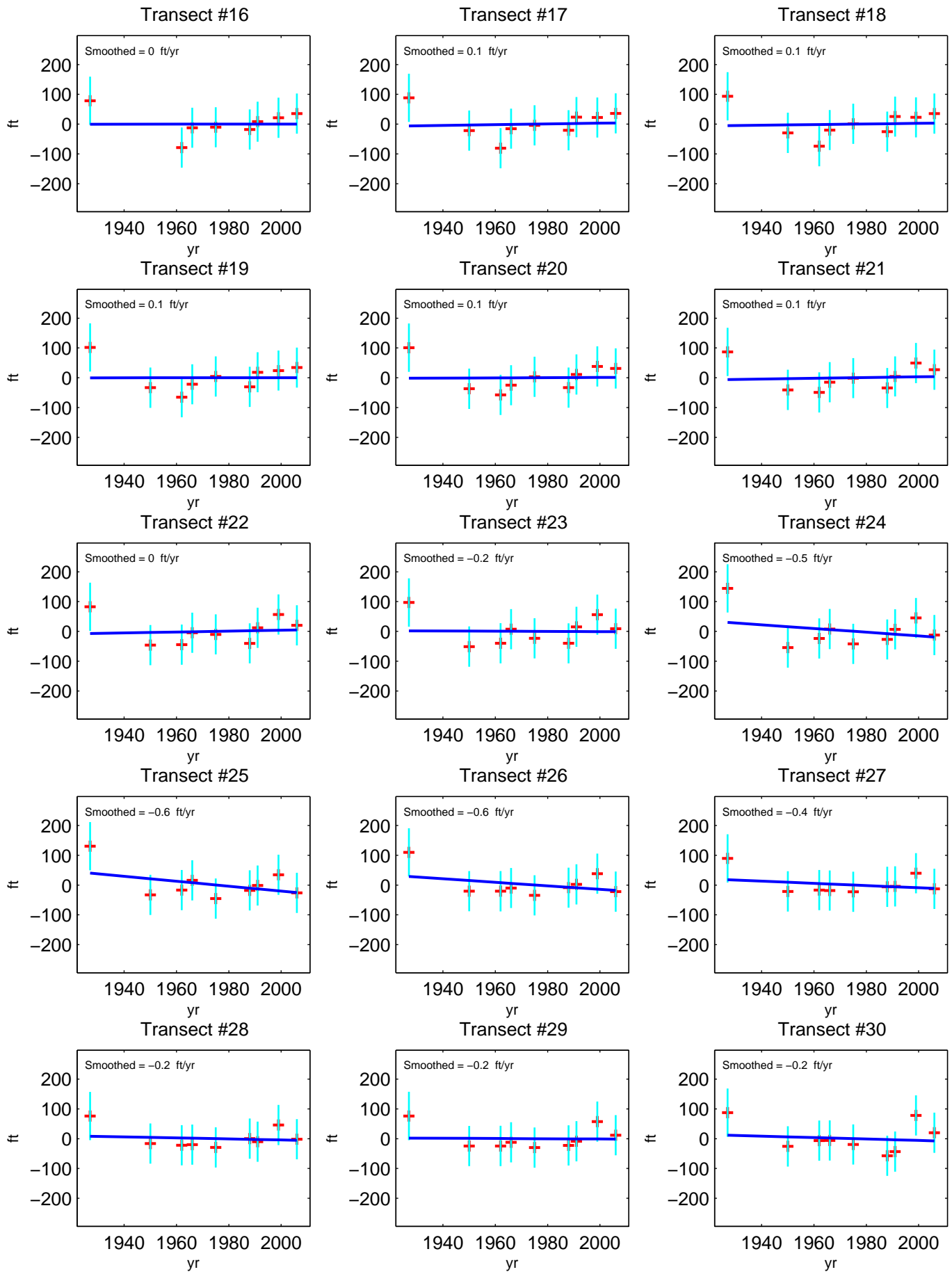
Positive Rate = Accretion
Negative Rate = Erosion



*Hardened Shorelines with no beach are shown with a blue square. The analysis stops at the first hardened shoreline.

Queen's Pond - Smoothed Shoreline Change Rates

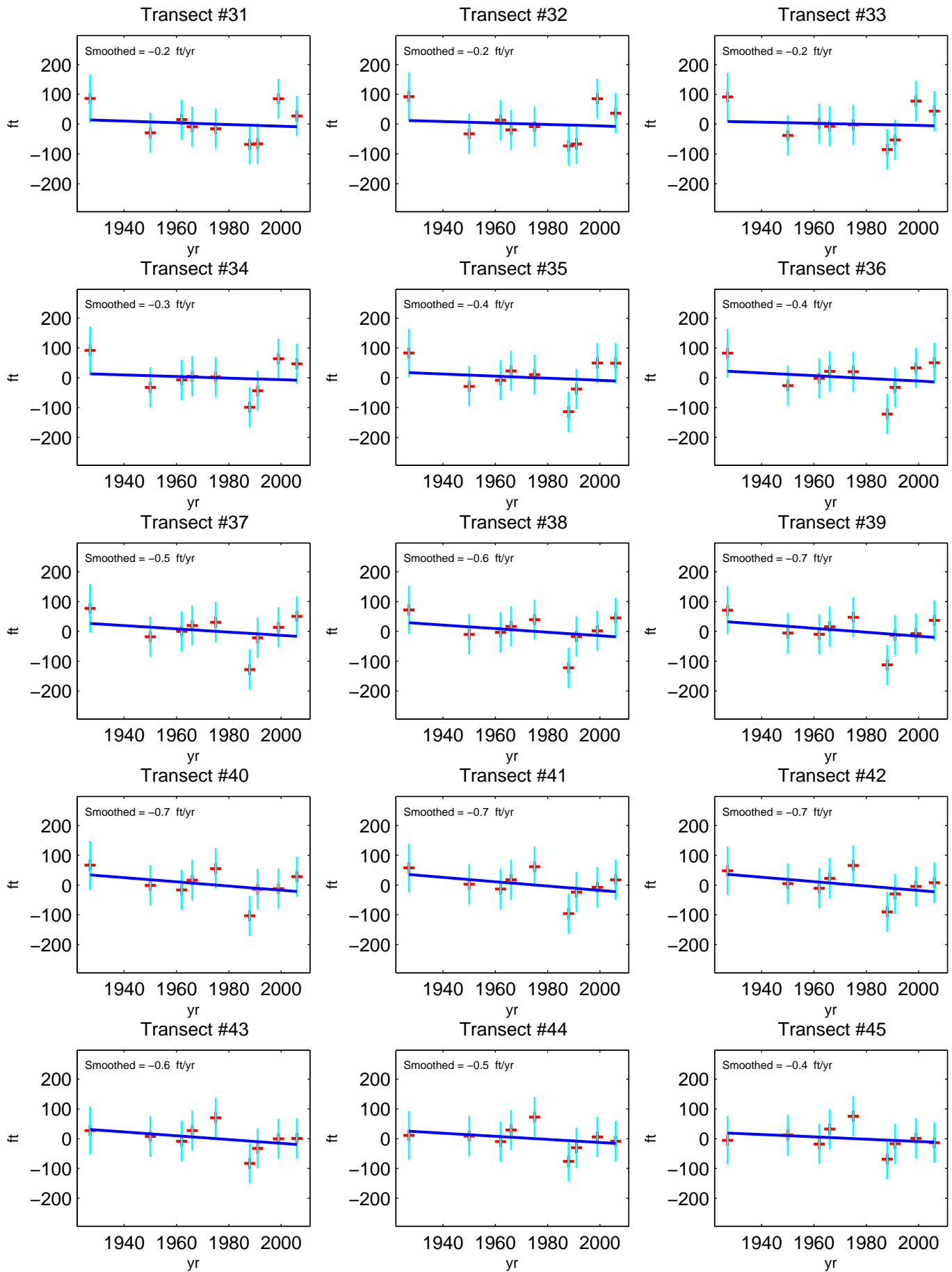
Positive Rate = Accretion
Negative Rate = Erosion



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Queen's Pond - Smoothed Shoreline Change Rates

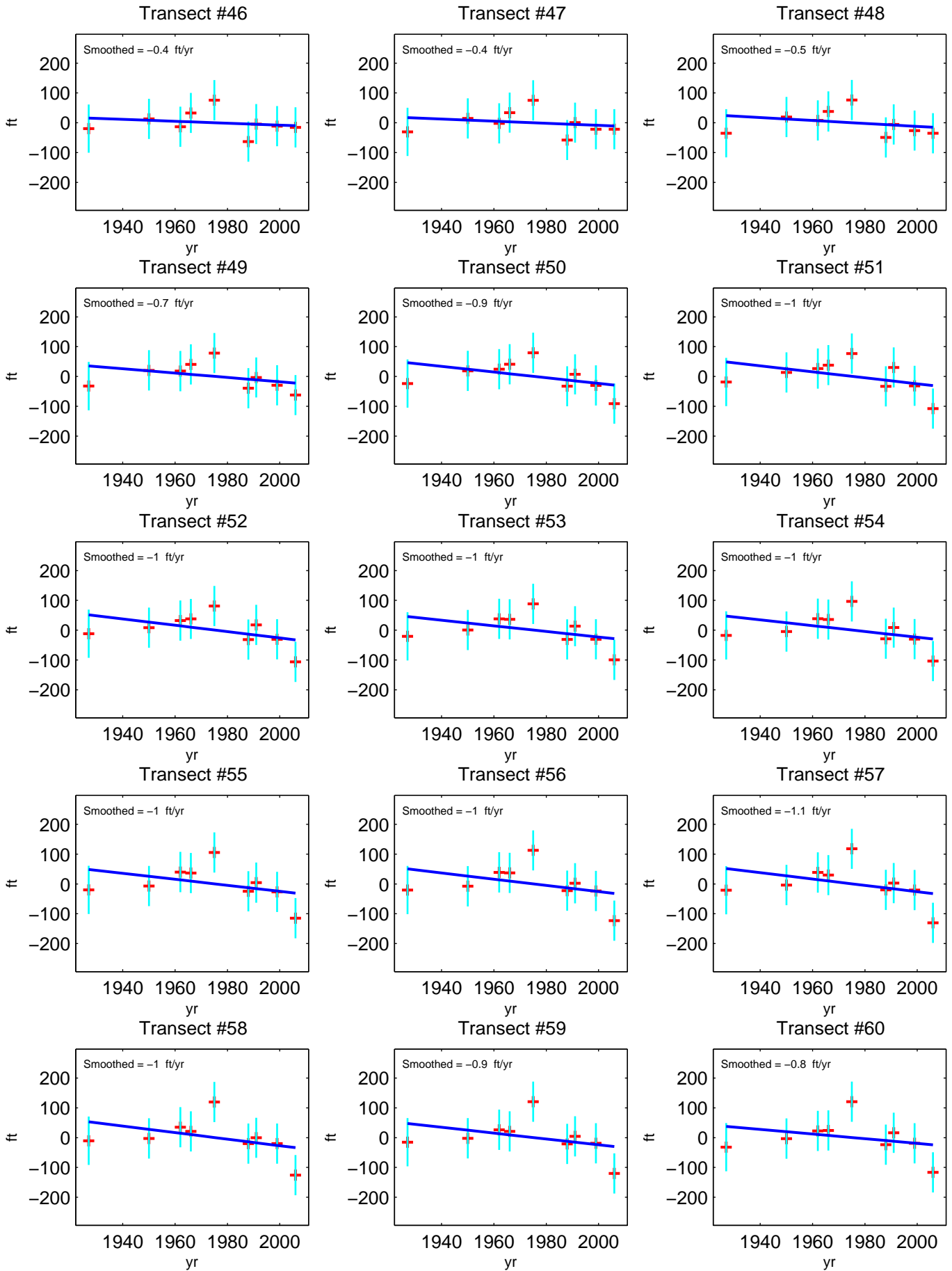
Positive Rate = Accretion
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Queen's Pond - Smoothed Shoreline Change Rates

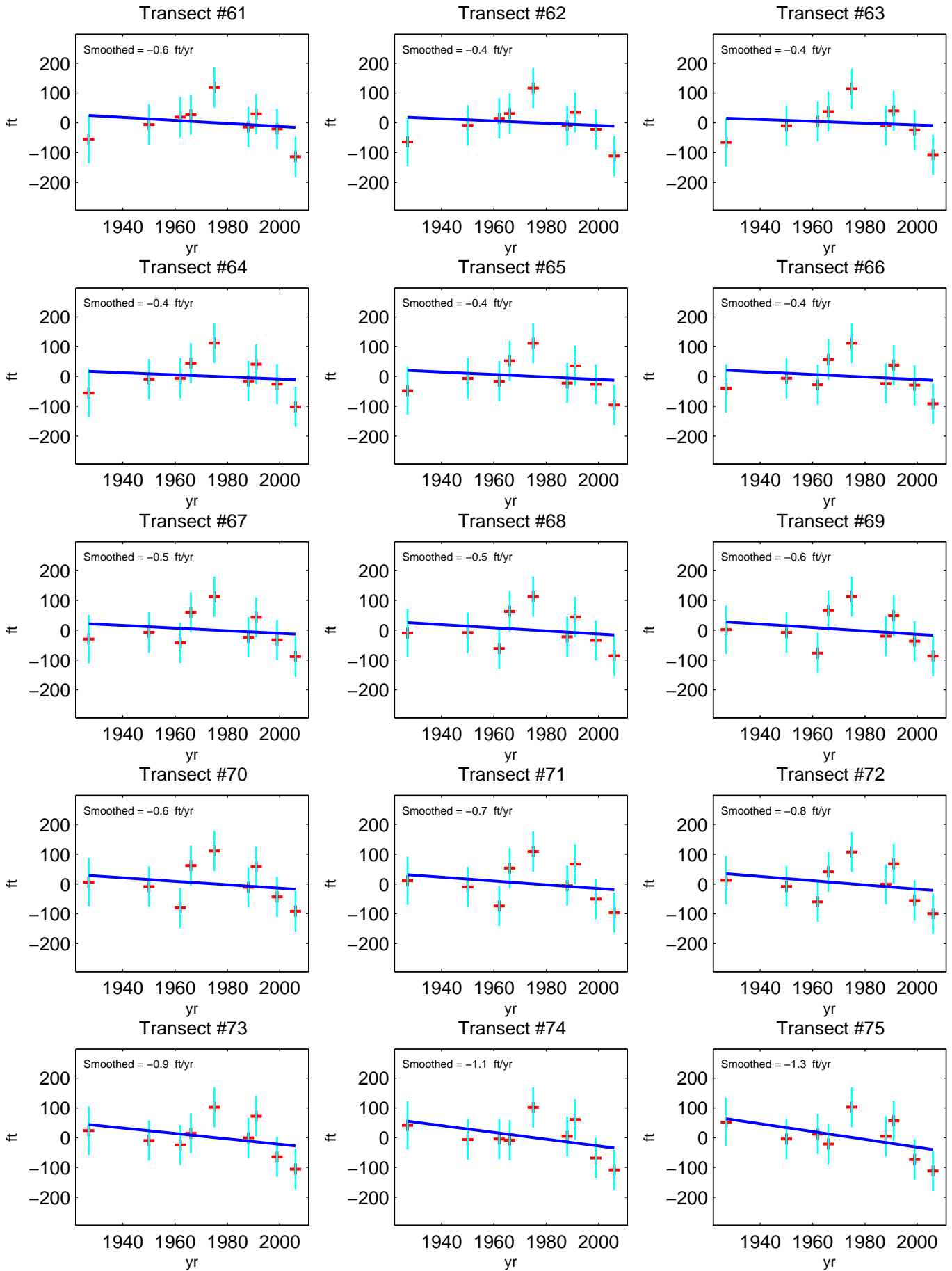
Positive Rate = Accretion
Negative Rate = Erosion



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Queen's Pond - Smoothed Shoreline Change Rates

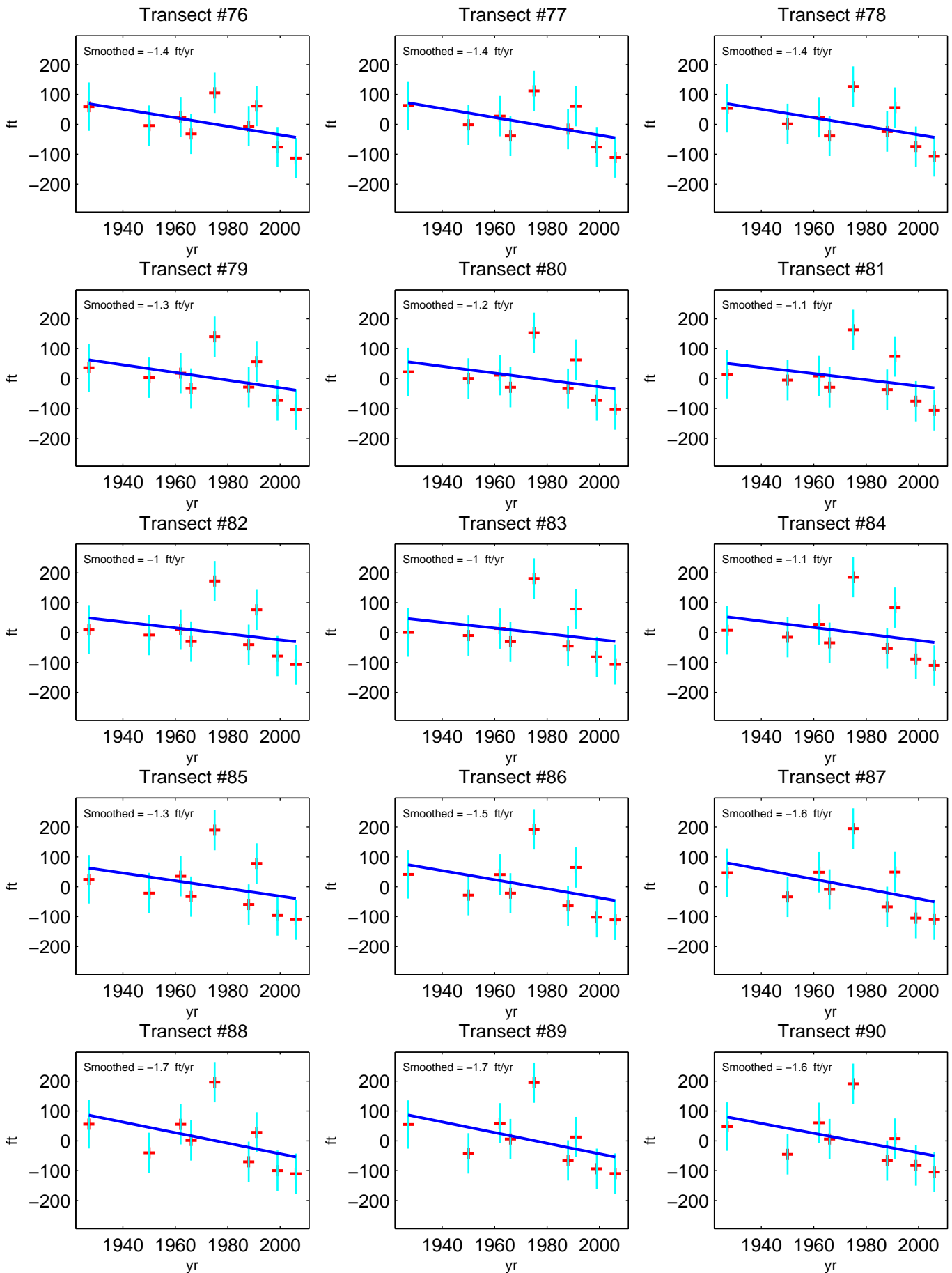
Positive Rate = Accretion
Negative Rate = Erosion



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Queen's Pond - Smoothed Shoreline Change Rates

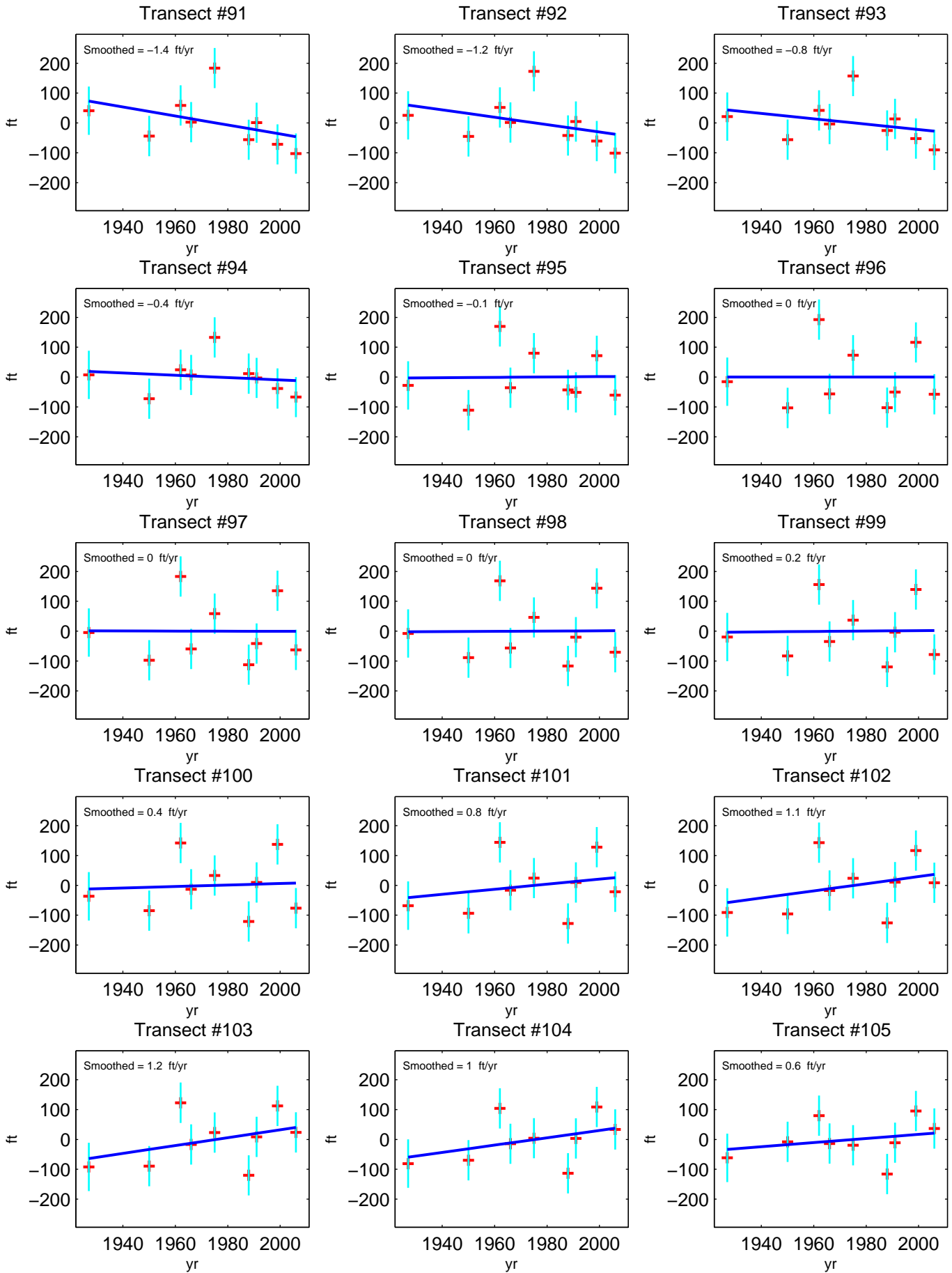
Positive Rate = Accretion
Negative Rate = Erosion



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Queen's Pond - Smoothed Shoreline Change Rates

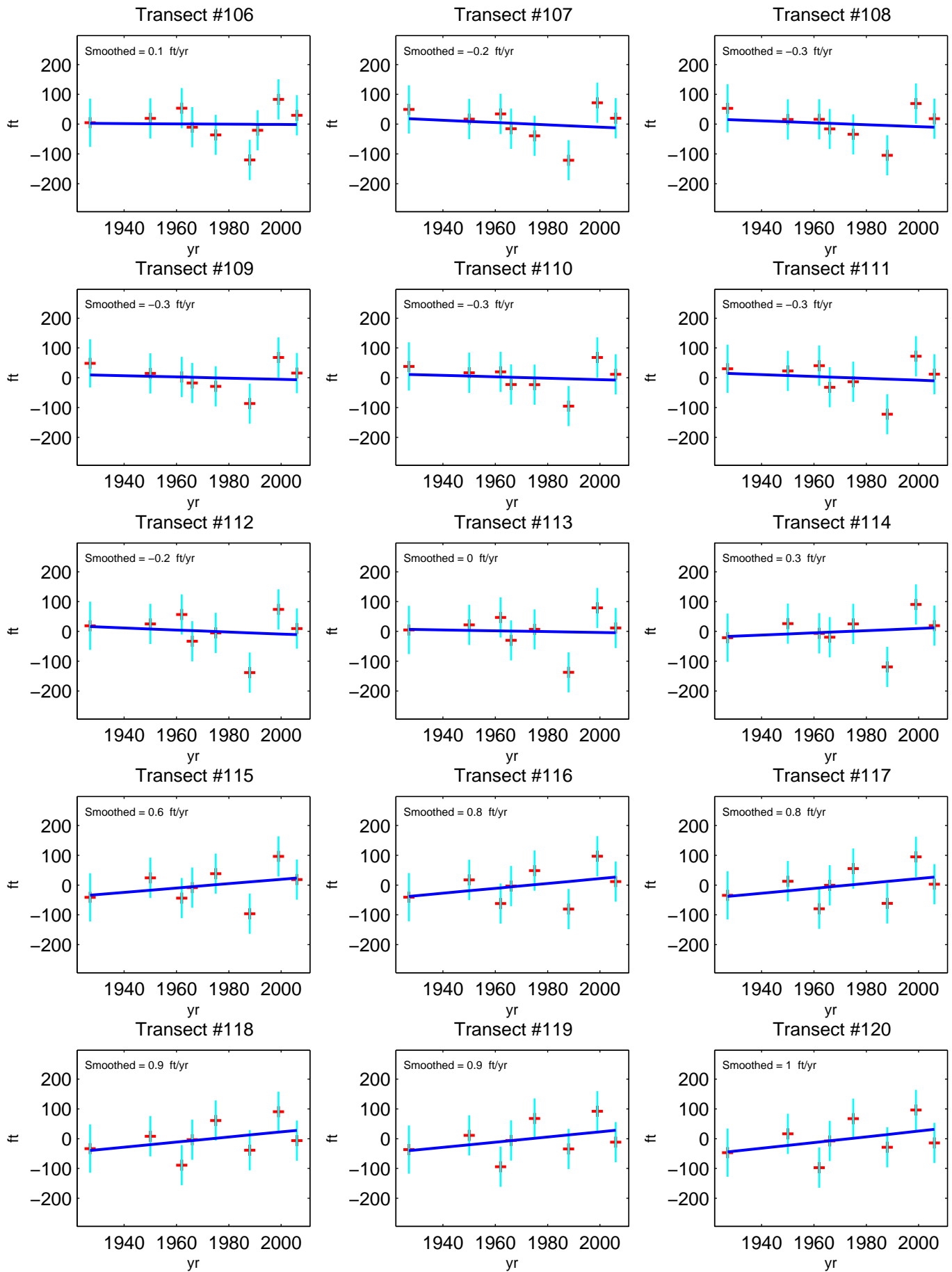
Positive Rate = Accretion
Negative Rate = Erosion



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Queen's Pond - Smoothed Shoreline Change Rates

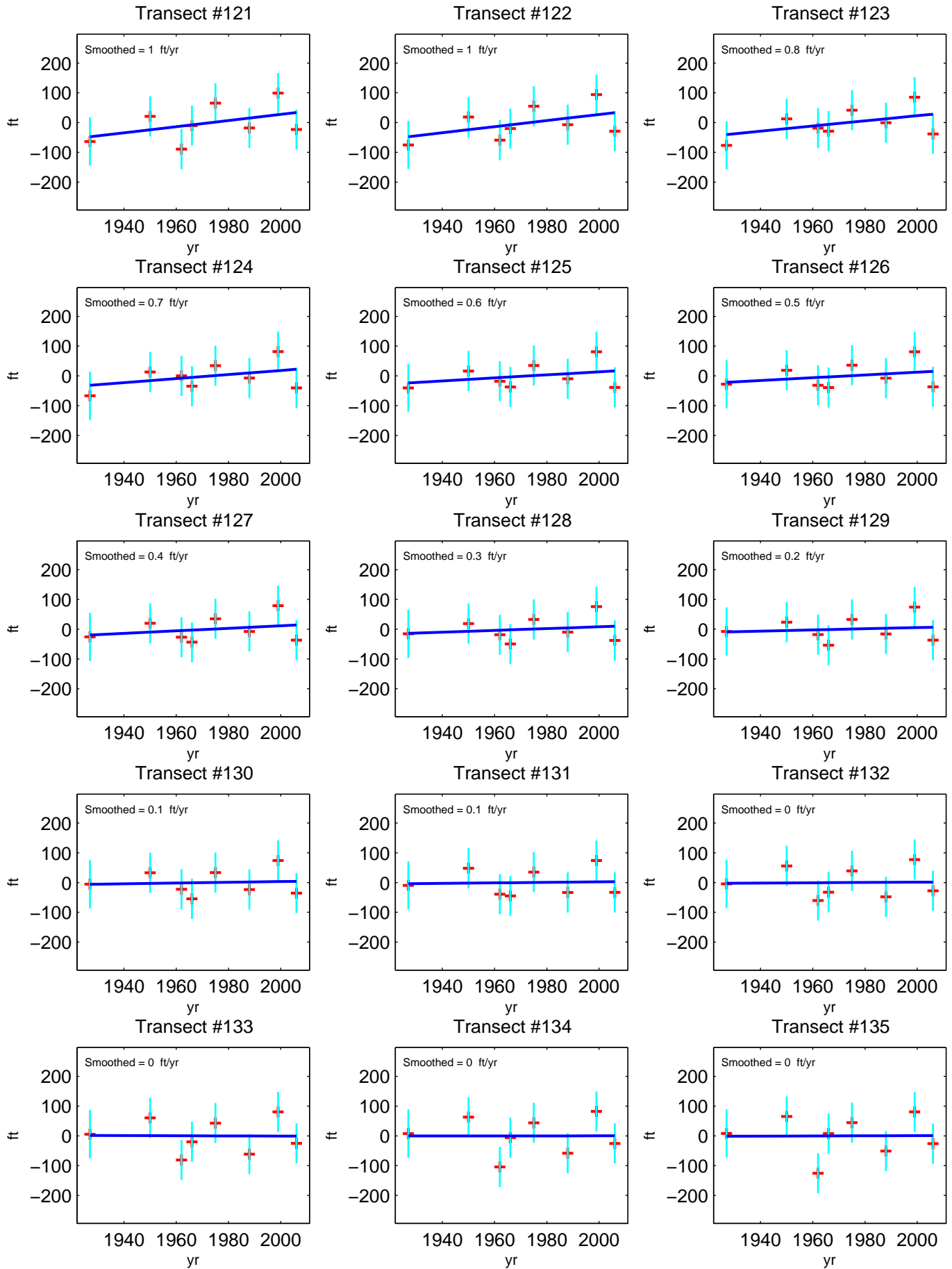
Positive Rate = Accretion
Negative Rate = Erosion



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Queen's Pond - Smoothed Shoreline Change Rates

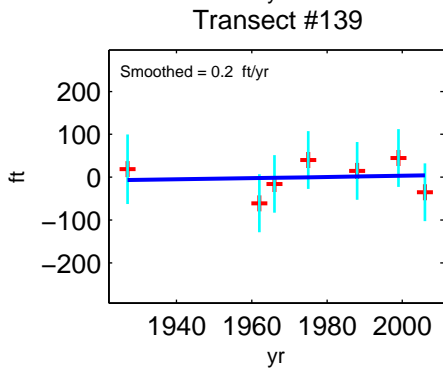
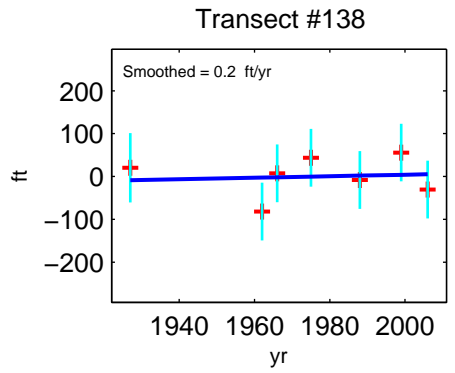
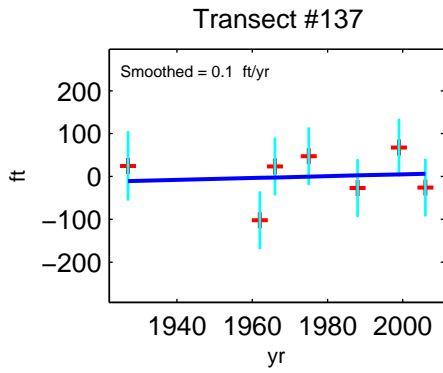
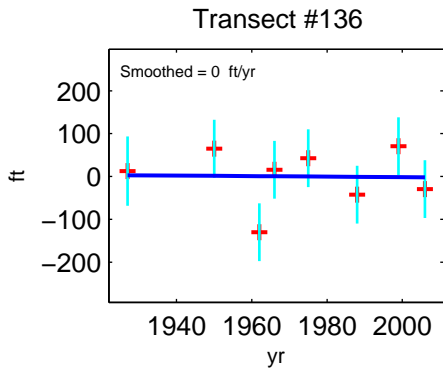
Positive Rate = Accretion
Negative Rate = Erosion



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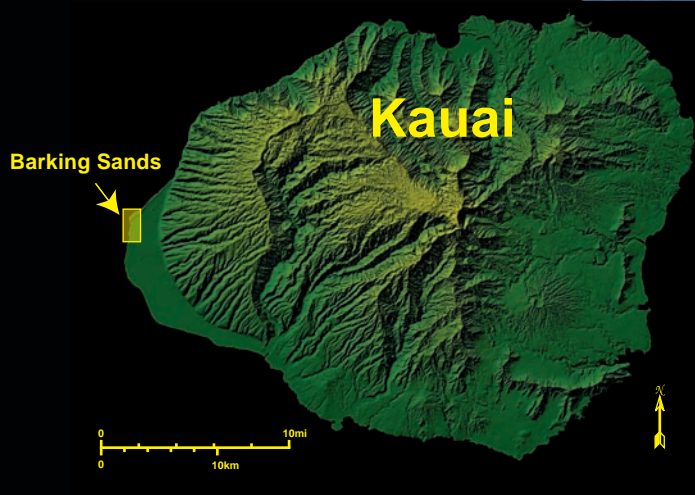
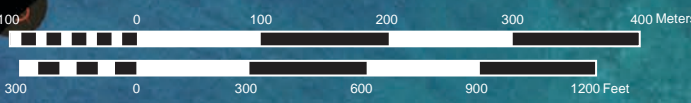
Queen's Pond - Smoothed Shoreline Change Rates

Positive Rate = Accretion
Negative Rate = Erosion



*Hardened Shorelines with no beach are shown with a blue square. The analysis stops at the first hardened shoreline.

Barking Sands, Kauai, Hawaii



HISTORICAL SHORELINES

- May 1927
 - Nov 1950
 - May 1962
 - May 1966
 - Apr 1975
 - Jul 1987
 - Mar 1988
 - Oct 1991
 - Sept 1992
 - Nov 2006
- Erosion rate measurement locations (shore-normal transects)

Historical beach positions, color coded by year, are determined using orthorectified and georeferenced aerial photographs and National Ocean Survey (NOS) topographic survey charts. The low water mark is used as the historical shoreline, or shoreline change reference feature (SCRF).

Movement of the SCRF along shore-normal transects (spaced every 66 ft) is used to calculate erosion rates.

SHORELINE CHANGE RATES

- █ Accretion Rate
- █ Erosion Rate

Historical shoreline positions are measured every 66 ft along the shoreline. These sites are denoted by yellow shore-perpendicular transects. Changes in the position of the shorelines through time are used to calculate shoreline change rates (ft/yr) at each transect location.

Annual shoreline change rates are shown on the shore-parallel graph. Red bars on the graph indicate a trend of beach erosion, while blue bars indicate a trend of accretion. Approximately every fifth transect and bar of the graph is numbered. Where necessary, transects have been purposely deleted to maintain consistent alongshore spacing. As a result transect numbering is not consecutive everywhere. The rates are smoothed alongshore using a 1-3-5-3-1 technique to normalize rate differences on adjacent transects.

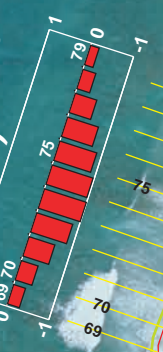
AREA DESCRIPTION

The Barking Sands study area is located on the west coast of Kauai on the Mana Plain. The area is bounded by Nohili Point to the north and the Pacific Missile Range air strip in the south. The shoreline is characterized by extensive beach rock backed by vegetated sand dunes and broken by carbonate sand beach. The study area is exposed to swell from the northwest and west during winter and spring months, swell from the west and southwest in the summer, as well as persistent tradewinds.

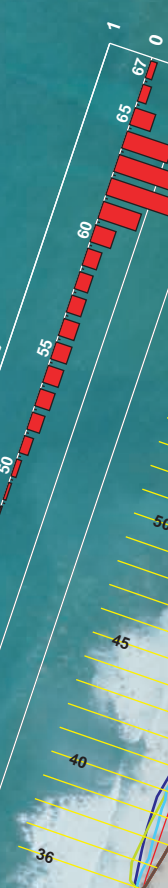
The area is divided into two discrete sections for analysis and description purposes. The southern section (transects 36 – 67) is experiencing erosion at an average rate of -0.3 ft/yr. The northern section (transects 69 – 79) is comprised of a small pocket of sand that has been eroding at an average rate of -0.6 ft/yr. Previous studies¹ did not analyze the Barking Sands study area shoreline.

¹ Makai Ocean Engineering and Sea Engineering, 1991 Aerial Photograph Analysis of Coastal Erosion on the Islands of Kauai, Molokai, Lanai, Maui, and Hawaii. State of Hawaii Office of Coastal Zone Management Program.

Shoreline Change Rate (ft/yr)



Shoreline Change Rate (ft/yr)



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 1680 East West Road, Honolulu, HI 96822, U.S.A.



2327800mN UTM coordinates
 159°47'30" W Latitude/Longitude coordinates

Barking Sands - Smoothed Rates

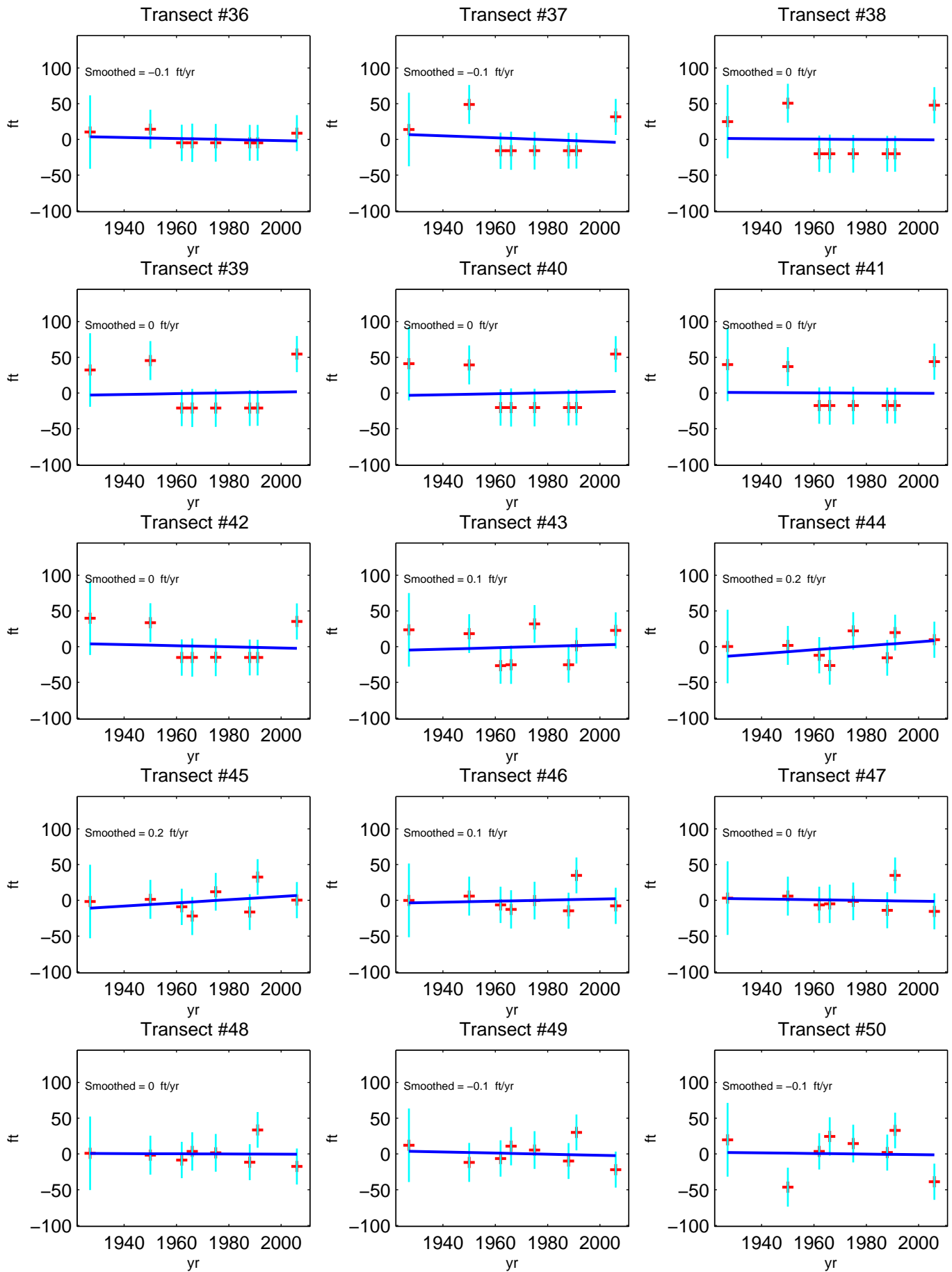
Positive Rate = Accretion
Negative Rate = Erosion

Transect	Smoothed Rate (ft/yr)
36	-0.1
37	-0.1
38	0.0
39	0.0
40	0.0
41	0.0
42	0.0
43	0.1
44	0.2
45	0.2
46	0.1
47	0.0
48	0.0
49	-0.1
50	-0.1
51	-0.2
52	-0.3
53	-0.3
54	-0.4
55	-0.4
56	-0.4
57	-0.3
58	-0.3
59	-0.3
60	-0.5
61*	-0.9
62*	-1.5
63*	-1.8
64	-1.1
65	-0.5
66	-0.2
67	-0.1
69*	-0.3
70*	-0.4
71*	-0.6
72*	-0.9
73*	-1.0
74*	-1.0
75*	-0.9
76*	-0.7
77*	-0.5
78*	-0.3
79*	-0.2

*Imagery indicates beachwidth of zero during period of analysis. Rate calculation reflects data with beach existence.

Barking Sands - Smoothed Shoreline Change Rates

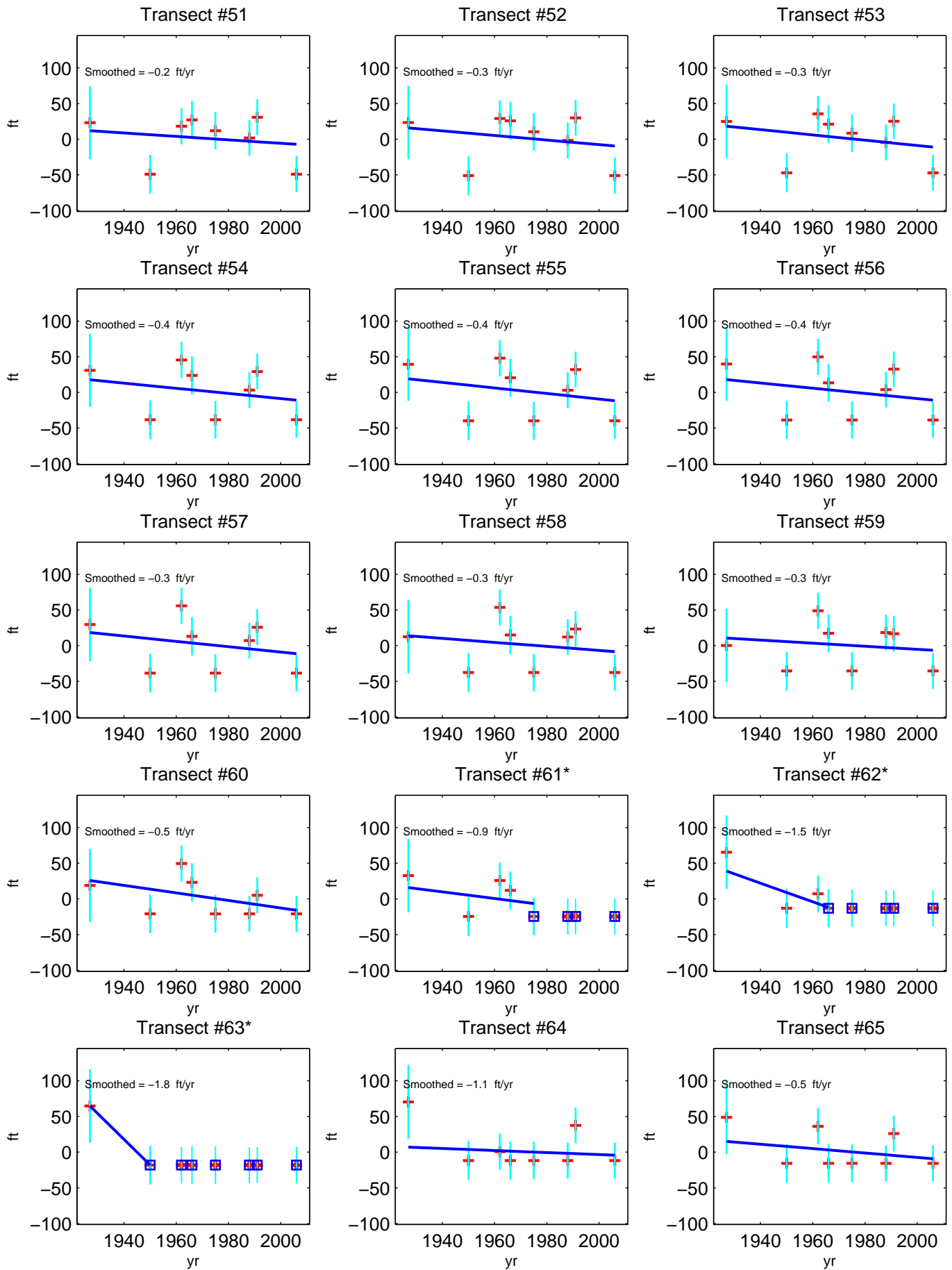
Positive Rate = Accretion
Negative Rate = Erosion



*Hardened Shorelines with no beach are shown with a blue square. The analysis stops at the first hardened shoreline.

Barking Sands - Smoothed Shoreline Change Rates

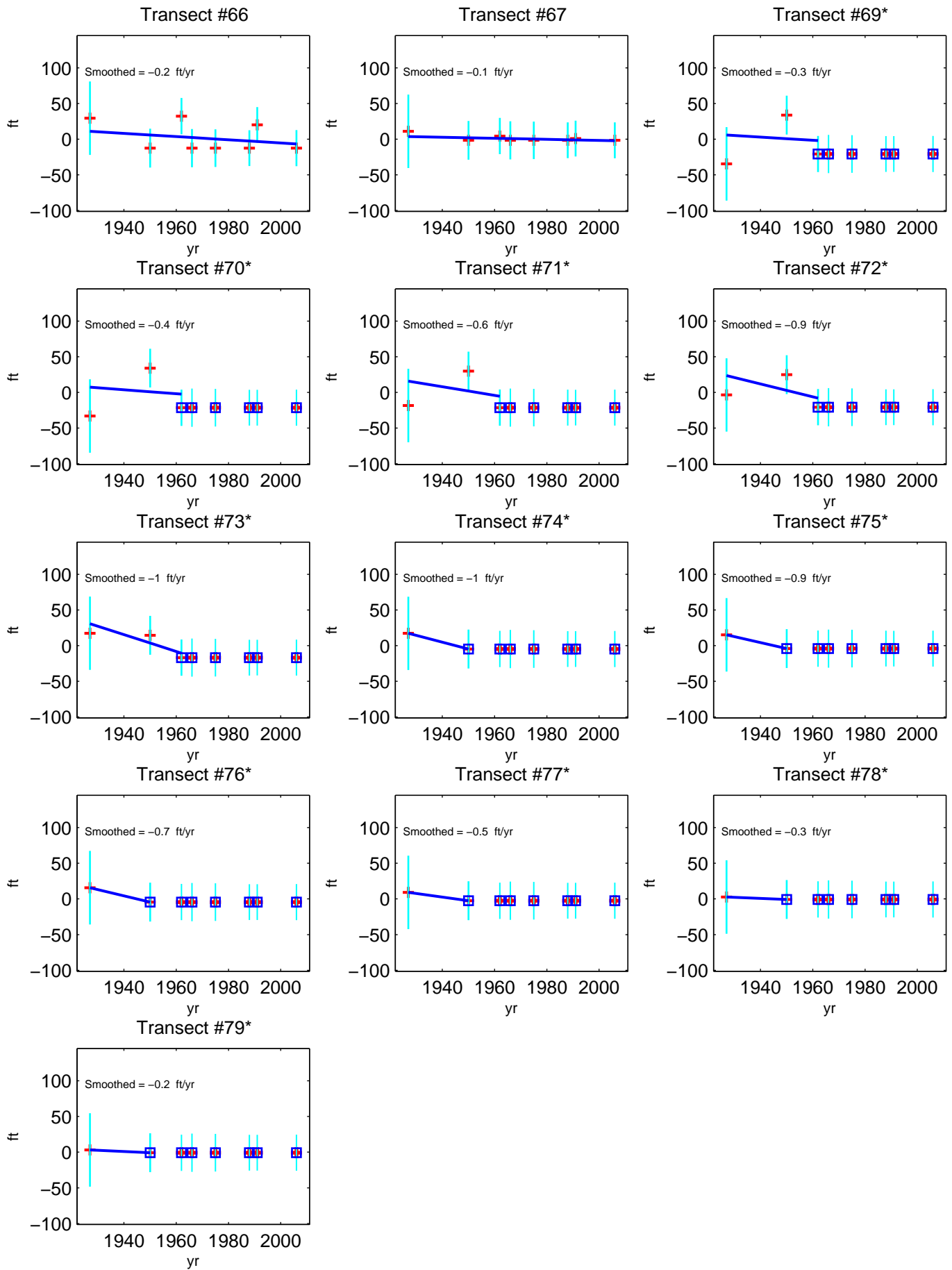
Positive Rate = Accretion
Negative Rate = Erosion



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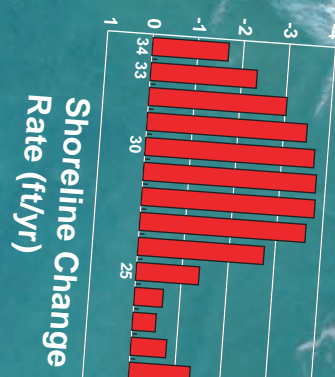
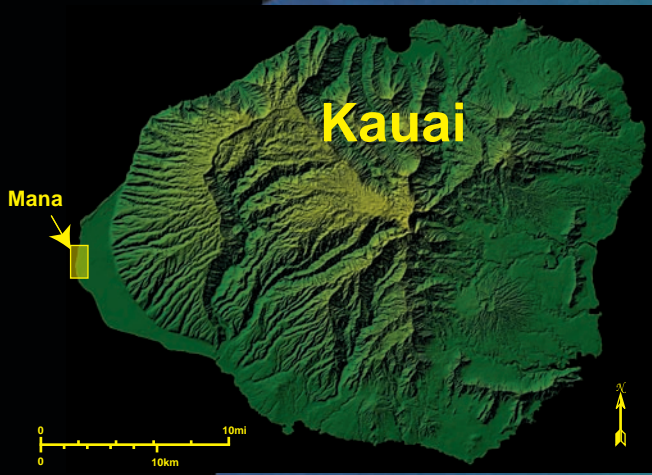
Barking Sands - Smoothed Shoreline Change Rates

Positive Rate = Accretion
Negative Rate = Erosion



*Hardened Shorelines with no beach are shown with a blue square. The analysis stops at the first hardened shoreline.

Mana, Kauai, Hawaii



AREA DESCRIPTION

The Mana study area is located on the west coast of Kauai on the Mana Plain. The area includes the air strips of the Pacific Missile Range with Mana Point at the center of the area. The shoreline is characterized by extensive beach rock backed by vegetated sand dunes and broken by carbonate sand beach. The study area is exposed to swell from the northwest and west during winter and spring months, swell from the west and southwest in the summer as well as persistent tradewinds.

The area is divided into three discrete sections for analysis and description purposes. The southernmost section (transects 0 – 15) is experiencing erosion at an average rate of -0.5 ft/yr. The next section to the north (transect 17) is eroding at a rate of -0.1 ft/yr. The northernmost section (transects 20 – 33) is eroding at an average rate of -2.4 ft/yr. Previous studies¹ did not analyze the Mana study area shoreline.

¹ Makai Ocean Engineering and Sea Engineering, 1991 Aerial Photograph Analysis of Coastal Erosion on the Islands of Kauai, Molokai, Lanai, Maui, and Hawaii. State of Hawaii Office of Coastal Zone Management Program.

HISTORICAL SHORELINES

- May 1927
 - Nov 1950
 - May 1962
 - May 1966
 - Apr 1975
 - Sept 1984
 - Jul 1987
 - Mar 1988
 - Oct 1991
 - Sept 1992
 - Nov 2006
- Erosion rate measurement locations (shore-normal transects)

Historical beach positions, color coded by year, are determined using orthorectified and georeferenced aerial photographs and National Ocean Survey (NOS) topographic survey charts. The low water mark is used as the historical shoreline, or shoreline change reference feature (SCRF).

Movement of the SCRF along shore-normal transects (spaced every 66 ft) is used to calculate erosion rates.

SHORELINE CHANGE RATES

- █ Accretion Rate
- █ Erosion Rate

Historical shoreline positions are measured every 66 ft along the shoreline. These sites are denoted by yellow shore-perpendicular transects. Changes in the position of the shorelines through time are used to calculate shoreline change rates (ft/yr) at each transect location.

Annual shoreline change rates are shown on the shore-parallel graph. Red bars on the graph indicate a trend of beach erosion, while blue bars indicate a trend of accretion. Approximately every fifth transect and bar of the graph is numbered. Where necessary, transects have been purposely deleted to maintain consistent alongshore spacing. As a result transect numbering is not consecutive everywhere. The rates are smoothed alongshore using a 1-3-5-3-1 technique to normalize rate differences on adjacent transects.

Shoreline Change Rate (ft/yr)



2434800mN UTM coordinates
159°47'20" W Latitude/Longitude coordinates



The preparation of this poster was financed in part by the Coastal Zone Management Act of 1972, as amended, administered by the Office of Ocean and Coastal Resource Management, National Ocean Service, National Oceanic and Atmospheric Administration, United States Department of Commerce, through the Office of Planning, State of Hawaii.

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Mana - Smoothed Rates

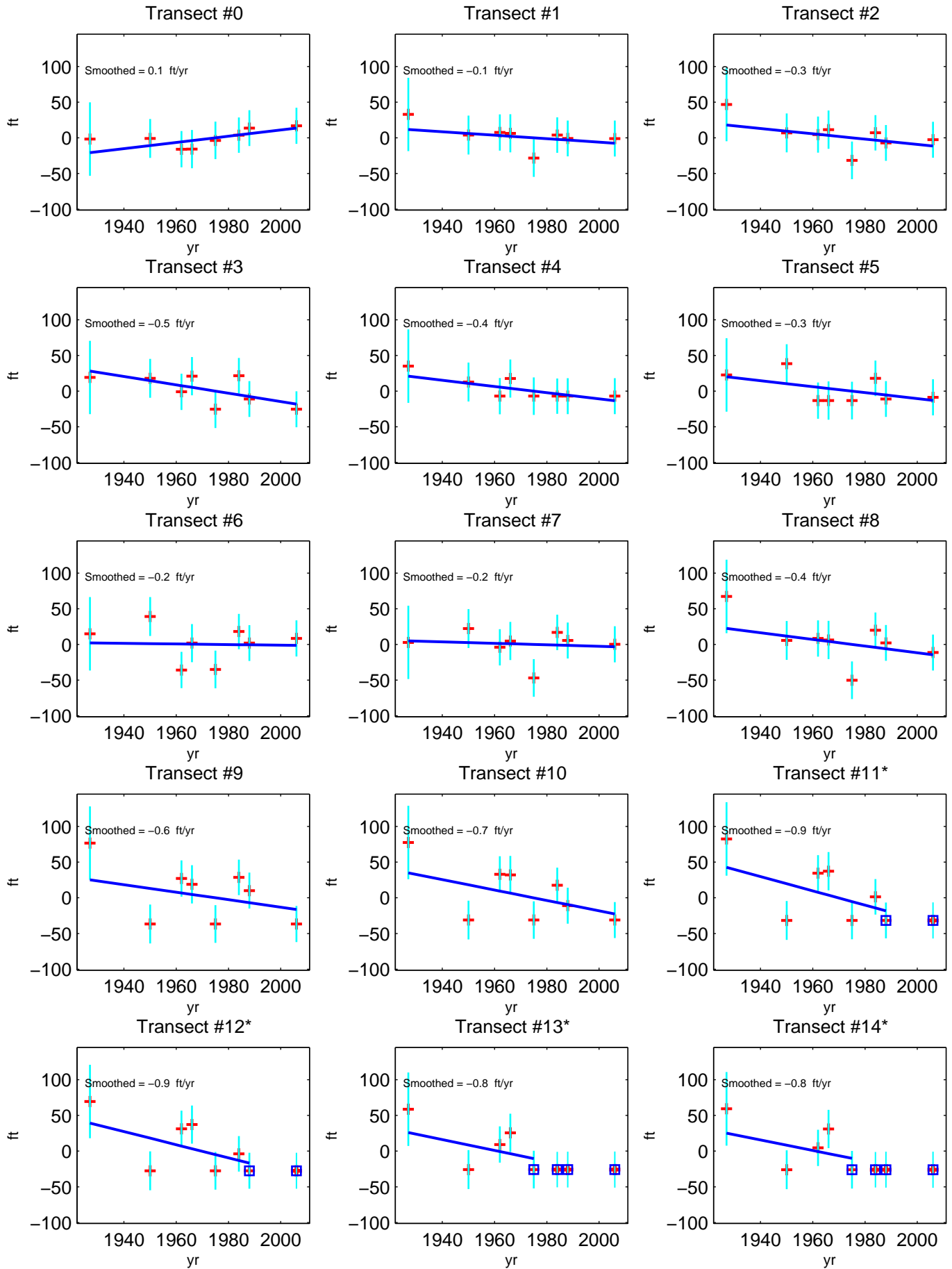
Positive Rate = Accretion
Negative Rate = Erosion

Transect	Smoothed Rate (ft/yr)
0	0.1
1	-0.1
2	-0.3
3	-0.5
4	-0.4
5	-0.3
6	-0.2
7	-0.2
8	-0.4
9	-0.6
10	-0.7
11*	-0.9
12*	-0.9
13*	-0.8
14*	-0.8
15*	-0.9
17*	-0.1
19*	-2.7
20*	-2.1
21*	-1.3
22*	-0.8
23*	-0.5
24*	-0.6
25*	-1.4
26*	-2.8
27*	-3.6
28*	-3.8
29*	-3.8
30*	-3.7
31*	-3.5
32*	-3.0
33*	-2.3
34*	-1.7

*Imagery indicates beachwidth of zero during period of analysis. Rate calculation reflects data with beach existence.

Mana - Smoothed Shoreline Change Rates

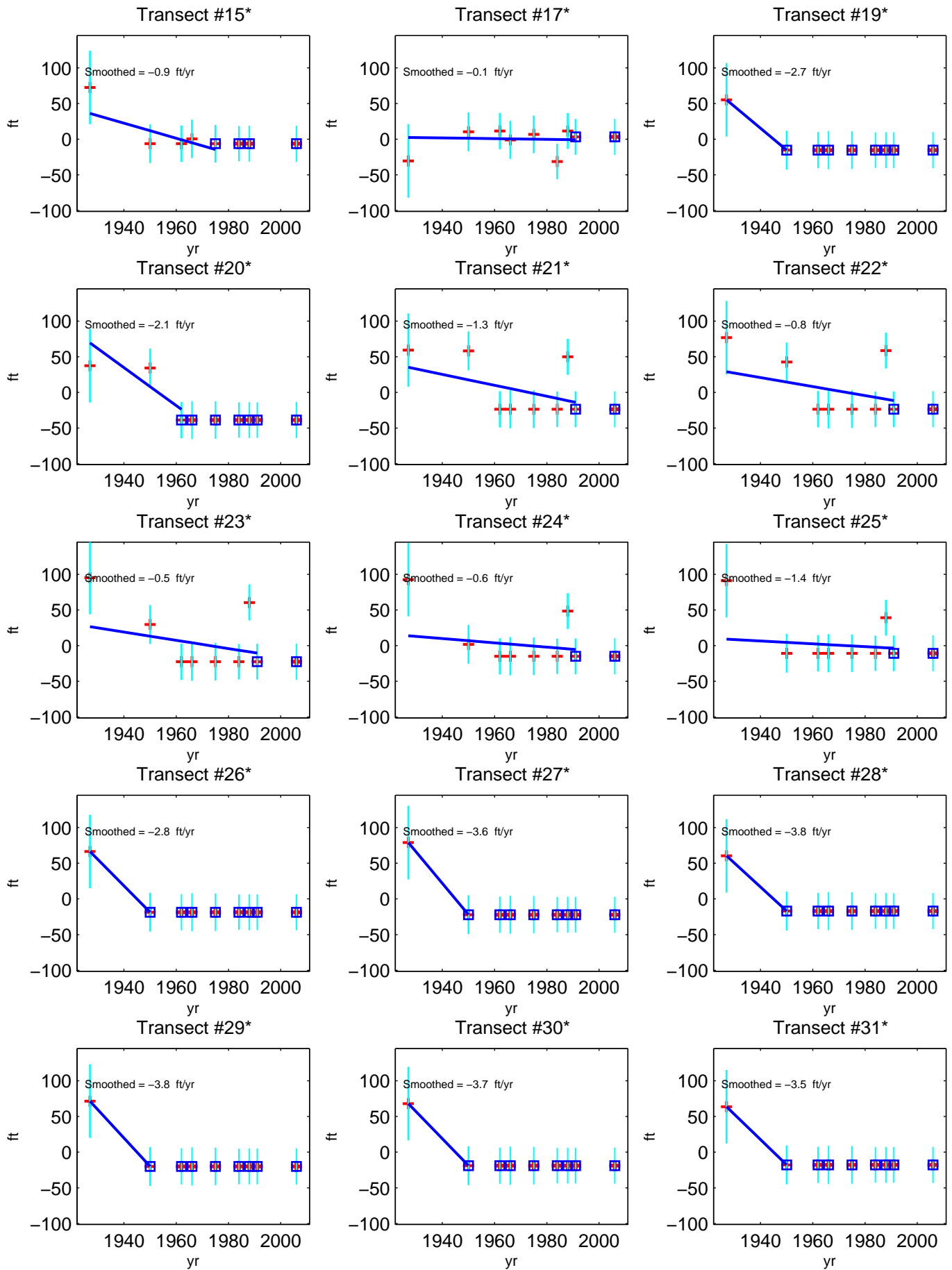
Positive Rate = Accretion
Negative Rate = Erosion



*Hardened Shorelines with no beach are shown with a blue square. The analysis stops at the first hardened shoreline.

Mana - Smoothed Shoreline Change Rates

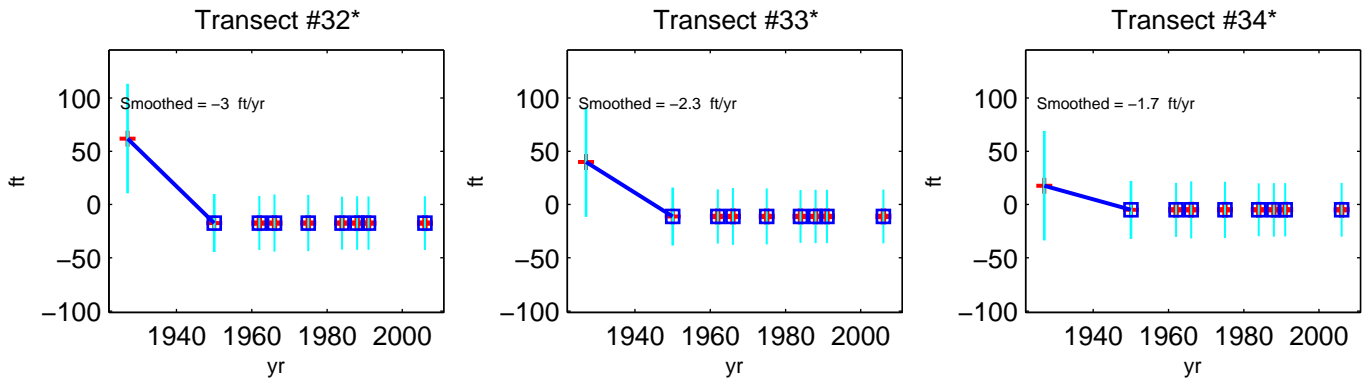
Positive Rate = Accretion
Negative Rate = Erosion



*Hardened Shorelines with no beach are shown with a blue square. The analysis stops at the first hardened shoreline.

Mana - Smoothed Shoreline Change Rates

Positive Rate = Accretion
Negative Rate = Erosion



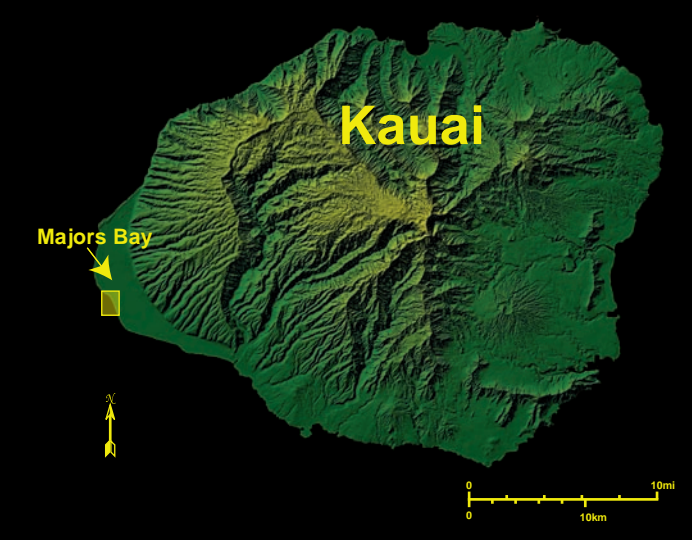
*Hardened Shorelines with no beach are shown with a blue square. The analysis stops at the first hardened shoreline.

Majors Bay, Kauai, Hawaii

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Contract C25514 Contract 7249



AREA DESCRIPTION

Majors Bay study area (transects 442 - 636) is located on the southwest shore of Kauai on the west exposure of the Mana Plain. The study area is bounded to the north by hard shoreline fronting the Pacific Missile Range airstrip (transects 613 - 636) and to the south by Kokole Point. The shoreline is composed of white carbonate sand and vegetated dunes. The study area is exposed to swell from the northwest and west during winter and spring months, swell from the west and southwest in the summer as well as persistent tradewinds. The central portion of the area (transects 522 - 562) experiences large seasonal fluctuations of the shoreline up to approximately 100 ft.

This study area is a section of a continuous sandy beach which runs from Kikiaola Small Boat Harbor through Kekaha and Majors Bay. Overall, the Majors Bay study area is experiencing accretion at an average rate of 0.9 ft/yr. The northern portion of the study area (transects 522 - 636) is experiencing accretion at an average rate of 1.1 ft/yr while the southern portion (transects 442 - 520) is accreting at an average rate of 0.6 ft/yr. Previous studies¹ did not analyze the Majors Bay study area shoreline.

¹ Makai Ocean Engineering and Sea Engineering, 1991 Aerial Photograph Analysis of Coastal Erosion on the Islands of Kauai, Molokai, Lanai, Maui, and Hawaii. State of Hawaii Office of Coastal Zone Management Program.

HISTORICAL SHORELINES

- May 1927
- Nov 1950
- May 1962
- May 1966
- Apr 1975
- Jul 1987
- Mar 1988
- Oct 1991
- Sept 1992
- May 1992
- Nov 2006

Erosion rate measurement locations (shore-normal transects)

Historical beach positions, color coded by year, are determined using orthorectified and georeferenced aerial photographs and National Ocean Survey (NOS) topographic survey charts. The low water mark is used as the historical shoreline, or shoreline change reference feature (SCRF).

Movement of the SCRF along shore-normal transects (spaced every 66 ft) is used to calculate erosion rates.

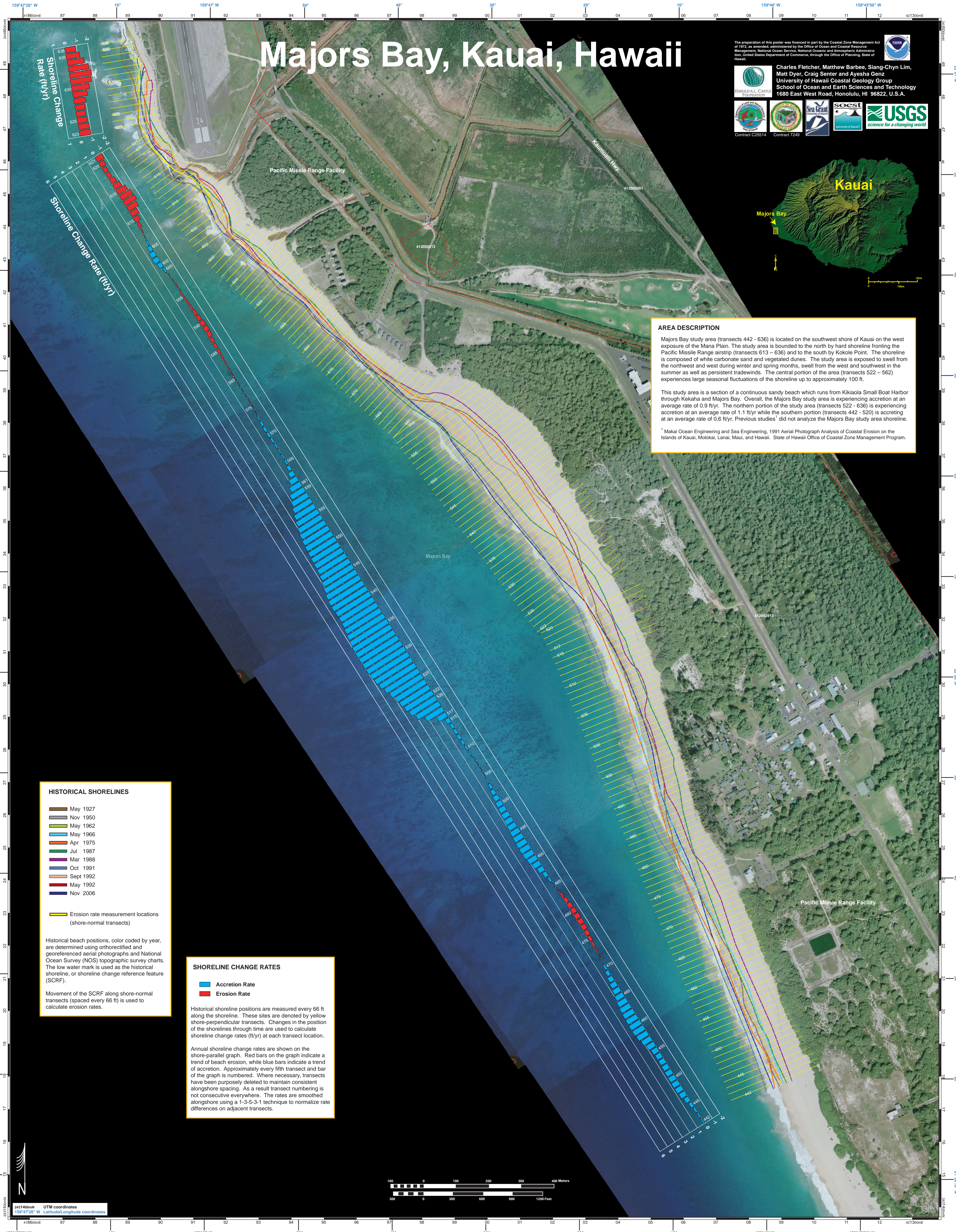
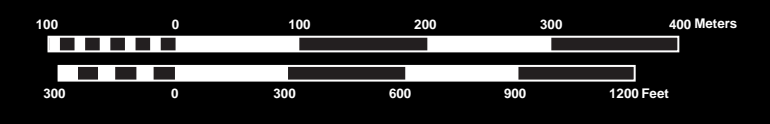
SHORELINE CHANGE RATES

- Blue bar: Accretion Rate
- Red bar: Erosion Rate

Historical shoreline positions are measured every 66 ft along the shoreline. These sites are denoted by yellow shore-perpendicular transects. Changes in the position of the shorelines through time are used to calculate shoreline change rates (ft/yr) at each transect location.

Annual shoreline change rates are shown on the shore-parallel graph. Red bars on the graph indicate a trend of beach erosion, while blue bars indicate a trend of accretion. Approximately every fifth transect and bar of the graph is numbered. Where necessary, transects have been purposely deleted to maintain consistent alongshore spacing. As a result transect numbering is not consecutive everywhere. The rates are smoothed alongshore using a 1-3-5-3-1 technique to normalize rate differences on adjacent transects.

2431460mN UTM coordinates
 159°47'20" W Latitude/Longitude coordinates



Majors Bay - Smoothed Rates

Positive Rate = Accretion
Negative Rate = Erosion

Transect	Smoothed Rate (ft/yr)	Transect	Smoothed Rate (ft/yr)	Transect	Smoothed Rate (ft/yr)
442	0.2	488	0.7	536	4.8
443	0.2	489	0.9	537	4.7
444	0.2	490	1.1	538	4.6
445	0.4	491	1.2	539	4.5
446	0.6	492	1.3	540	4.5
447	0.7	493	1.2	541	4.5
448	0.8	494	1.2	542	4.5
449	0.8	495	1.1	543	4.4
450	0.8	496	1.0	544	4.2
451	0.8	497	1.0	545	4.0
452	0.7	498	0.9	546	3.8
453	0.7	499	0.8	547	3.7
454	0.7	500	0.7	548	3.6
455	0.8	501	0.6	549	3.6
456	0.9	502	0.5	550	3.5
457	1.2	503	0.3	551	3.5
458	1.3	504	0.2	552	3.4
459	1.4	505	0.1	553	3.2
460	1.4	506	0.0	554	3.1
461	1.4	507	0.0	555	2.9
462	1.3	508	0.1	556	2.6
463	1.3	509	0.2	557	2.4
464	1.2	510	0.2	558	2.1
465	1.0	511	0.3	559	1.8
466	0.9	512	0.3	561	1.4
467	0.7	513	0.4	562	1.0
468	0.6	514	0.3	563	0.6
469	0.4	515	0.5	564	0.4
470	0.2	517	1.2	565	0.2
471	0.1	518	2.3	566	0.2
472	0.0	519	3.0	567	0.2
473	-0.1	520	3.4	568	0.2
474	-0.2	522	3.6	569	0.2
475	-0.4	523	3.8	570	0.3
476	-0.5	524	4.0	571	0.3
477	-0.6	525	4.2	572	0.3
478	-0.6	526	4.5	573	0.2
479	-0.6	527	4.7	574	0.0
480	-0.6	528	4.9	575	0.0
481	-0.5	529	5.0	576	-0.1
482	-0.4	530	5.0	577	-0.1
483	-0.2	531	5.0	578	0.0
484	-0.1	532	5.1	579	0.0
485	0.1	533	5.1	580	-0.1
486	0.2	534	5.0	581	-0.1
487	0.5	535	4.9	582	-0.1

*Imagery indicates beachwidth of zero during period of analysis. Rate calculation reflects data with beach existence.

Majors Bay - Smoothed Rates

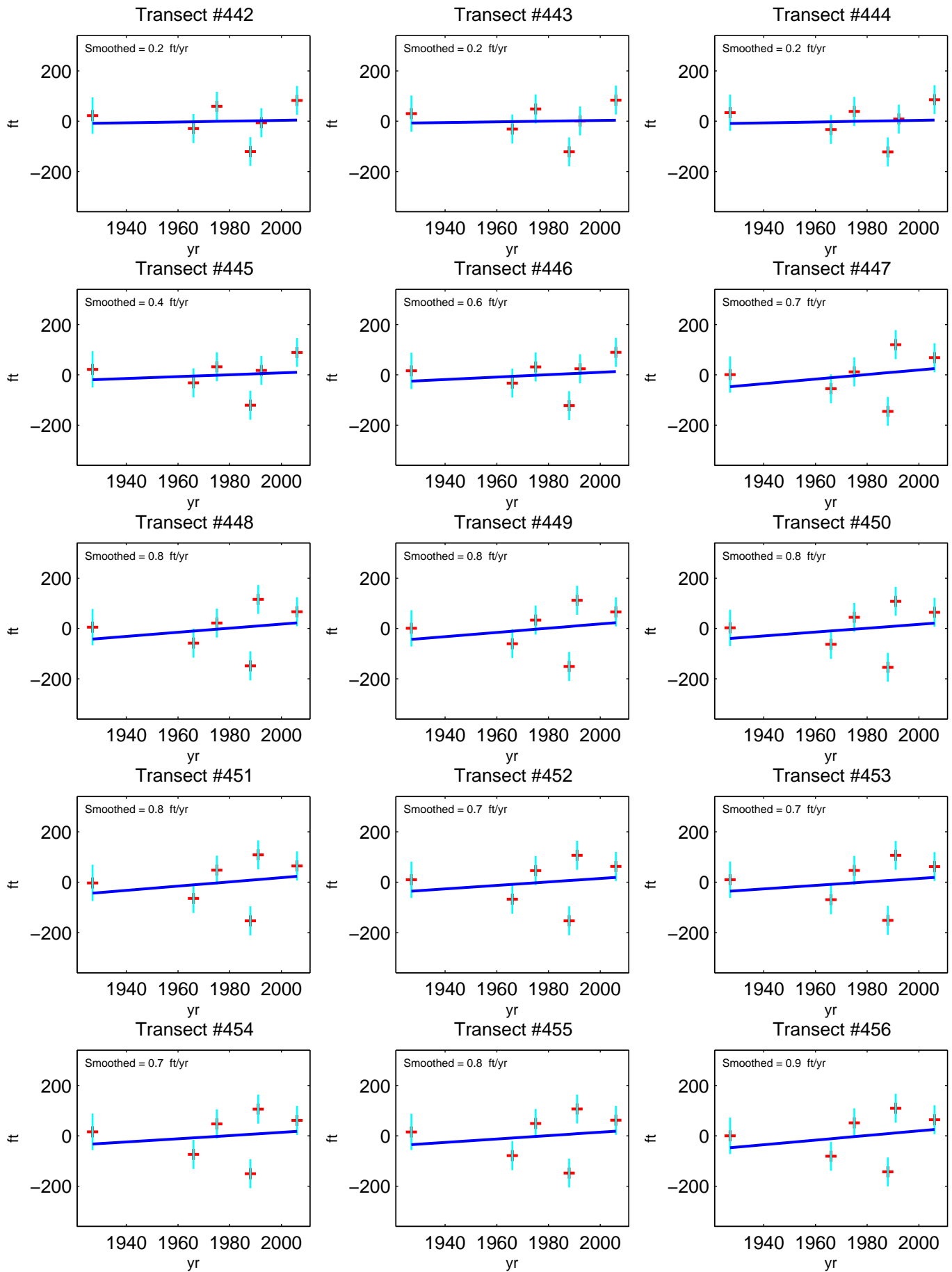
Positive Rate = Accretion
 Negative Rate = Erosion

Transect	Smoothed Rate (ft/yr)	Transect	Smoothed Rate (ft/yr)
583	-0.1	631	-2.2
584	-0.2	632*	-2.8
585	-0.3	633*	-3.0
586	-0.3	634*	-2.7
587	-0.4	635*	-2.3
588	-0.5	636*	-1.7
589	-0.6		
590	-0.6		
591	-0.5		
592	-0.3		
593	-0.3		
594	-0.2		
595	-0.2		
596	-0.1		
597	-0.1		
598	-0.1		
599	0.0		
600	0.2		
602	0.5		
603	0.7		
604	0.7		
605	0.5		
606	0.2		
607	0.0		
608	-0.1		
609	-0.3		
610	-0.6		
611	-0.9		
612	-1.3		
613	-1.5		
614	-1.4		
615	-1.2		
616	-0.9		
617	-0.7		
618	-0.5		
619	-0.5		
620	-0.6		
621	-0.9		
623	-1.0		
624	-0.9		
625	-0.8		
626	-0.8		
627	-0.9		
628	-1.0		
629	-1.2		
630	-1.6		

*Imagery indicates beachwidth of zero during period of analysis. Rate calculation reflects data with beach existence.

Majors Bay - Smoothed Shoreline Change Rates

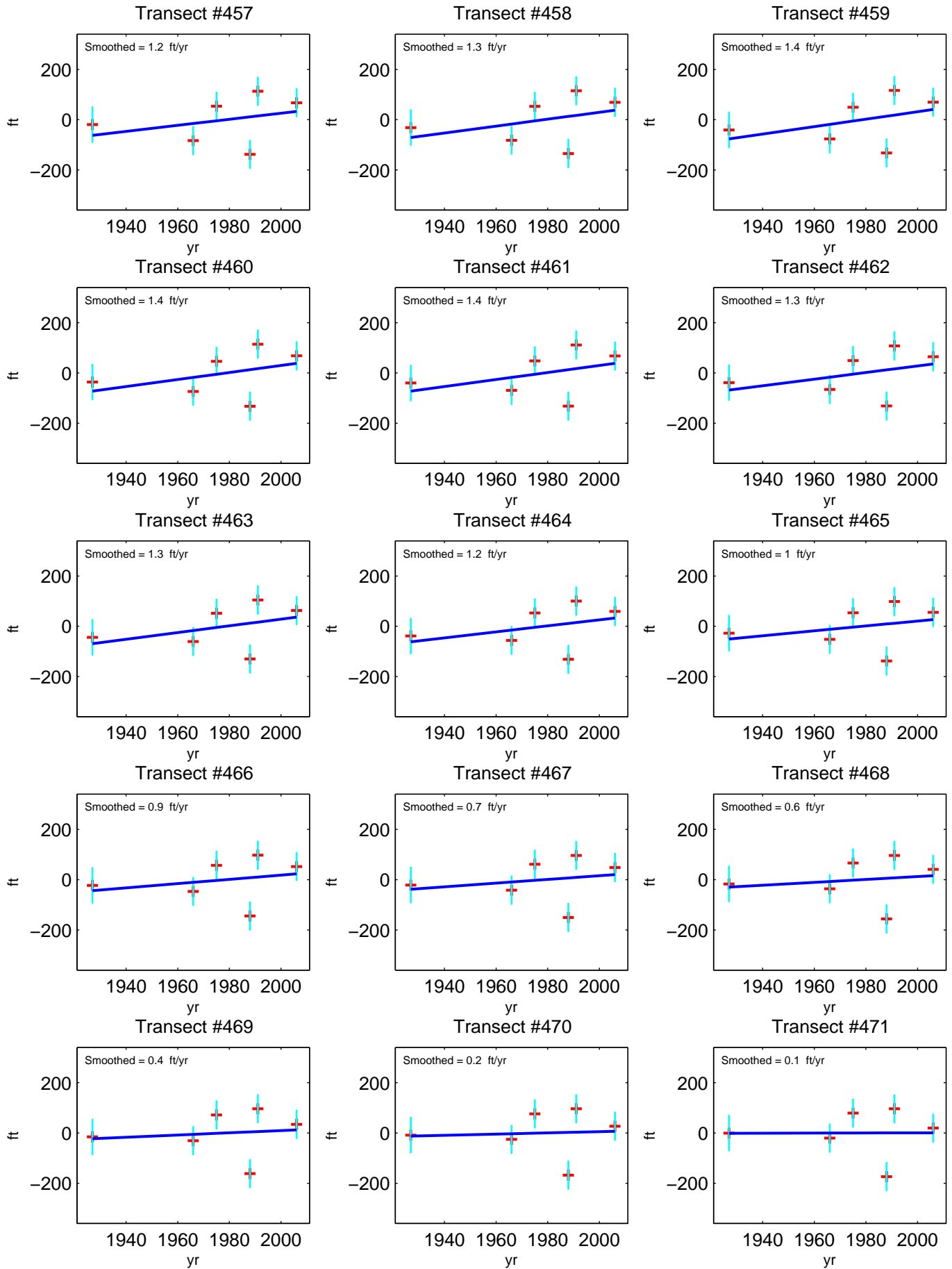
Positive Rate = Accretion
Negative Rate = Erosion



*Hardened Shorelines with no beach are shown with a blue square. The analysis stops at the first hardened shoreline.

Majors Bay - Smoothed Shoreline Change Rates

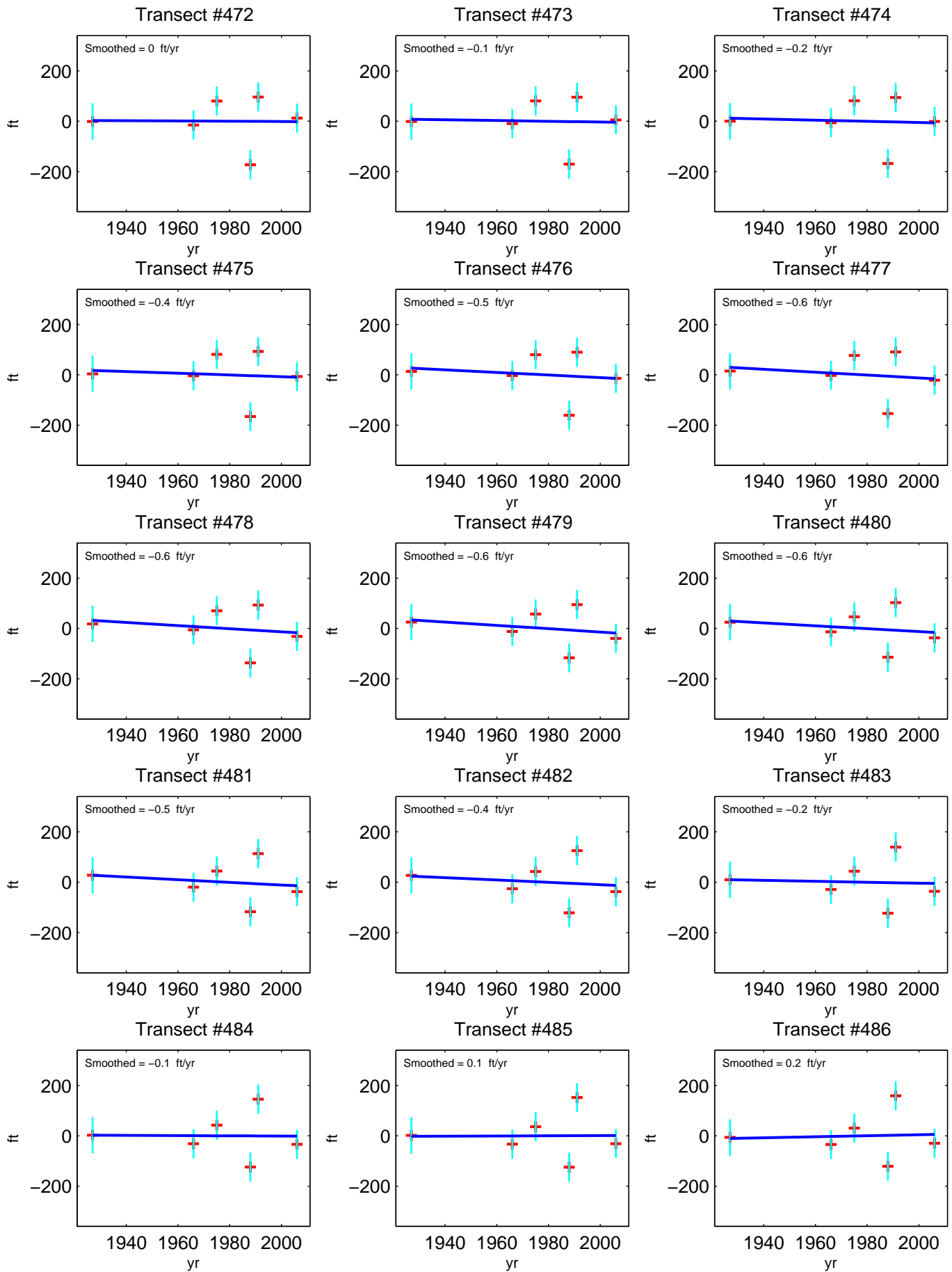
Positive Rate = Accretion
Negative Rate = Erosion



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Majors Bay - Smoothed Shoreline Change Rates

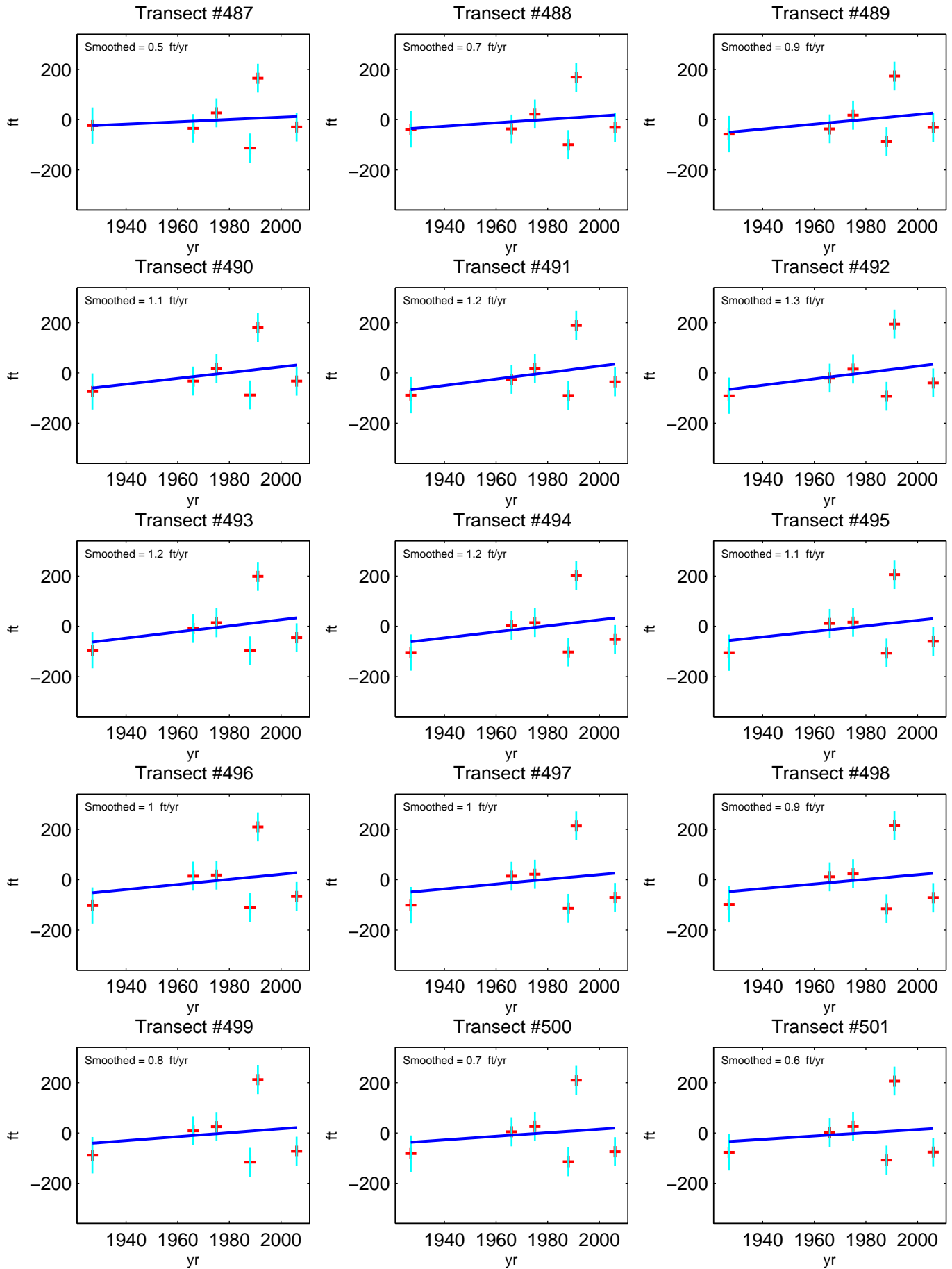
Positive Rate = Accretion
Negative Rate = Erosion



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Majors Bay - Smoothed Shoreline Change Rates

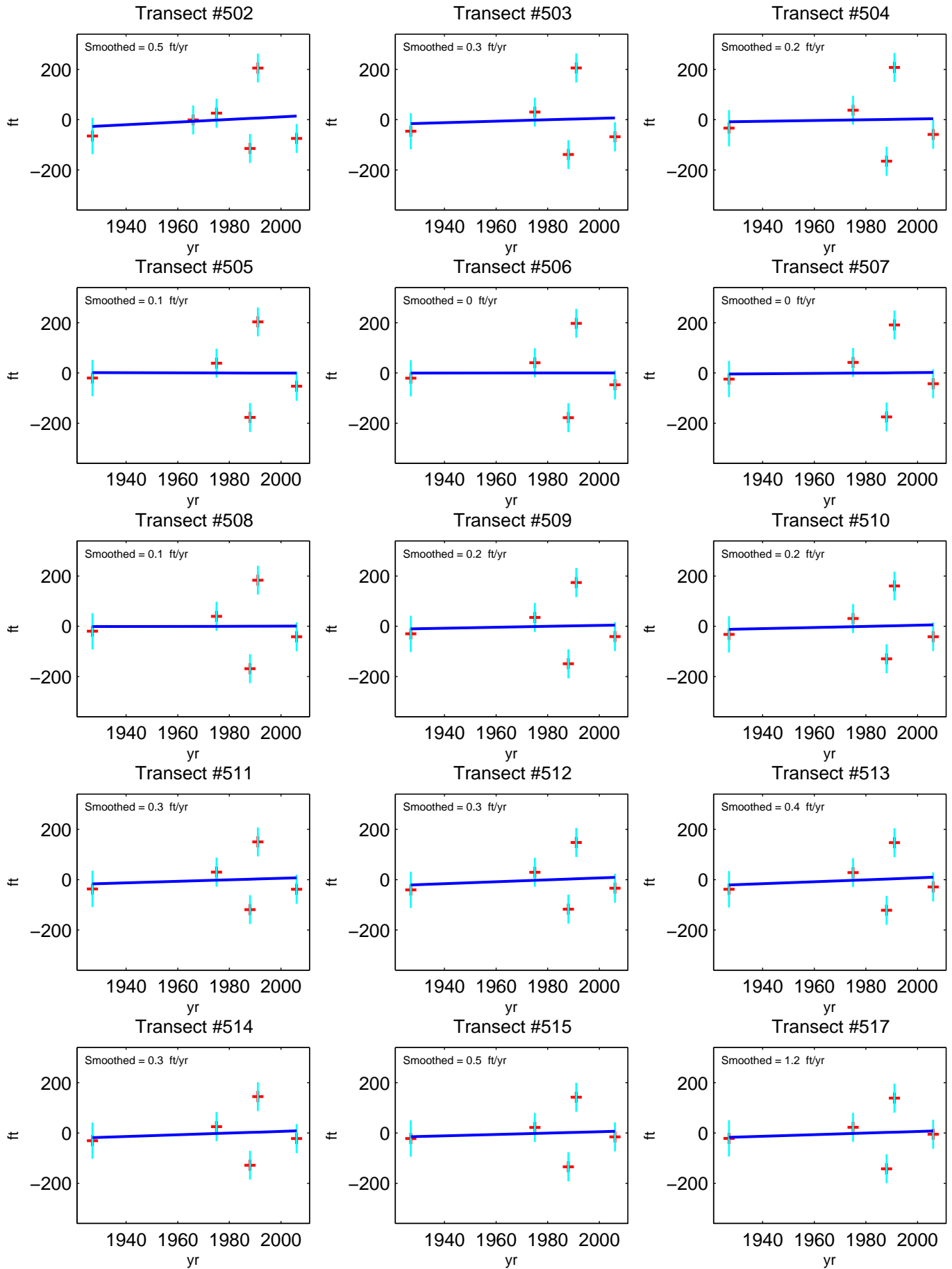
Positive Rate = Accretion
Negative Rate = Erosion



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Majors Bay - Smoothed Shoreline Change Rates

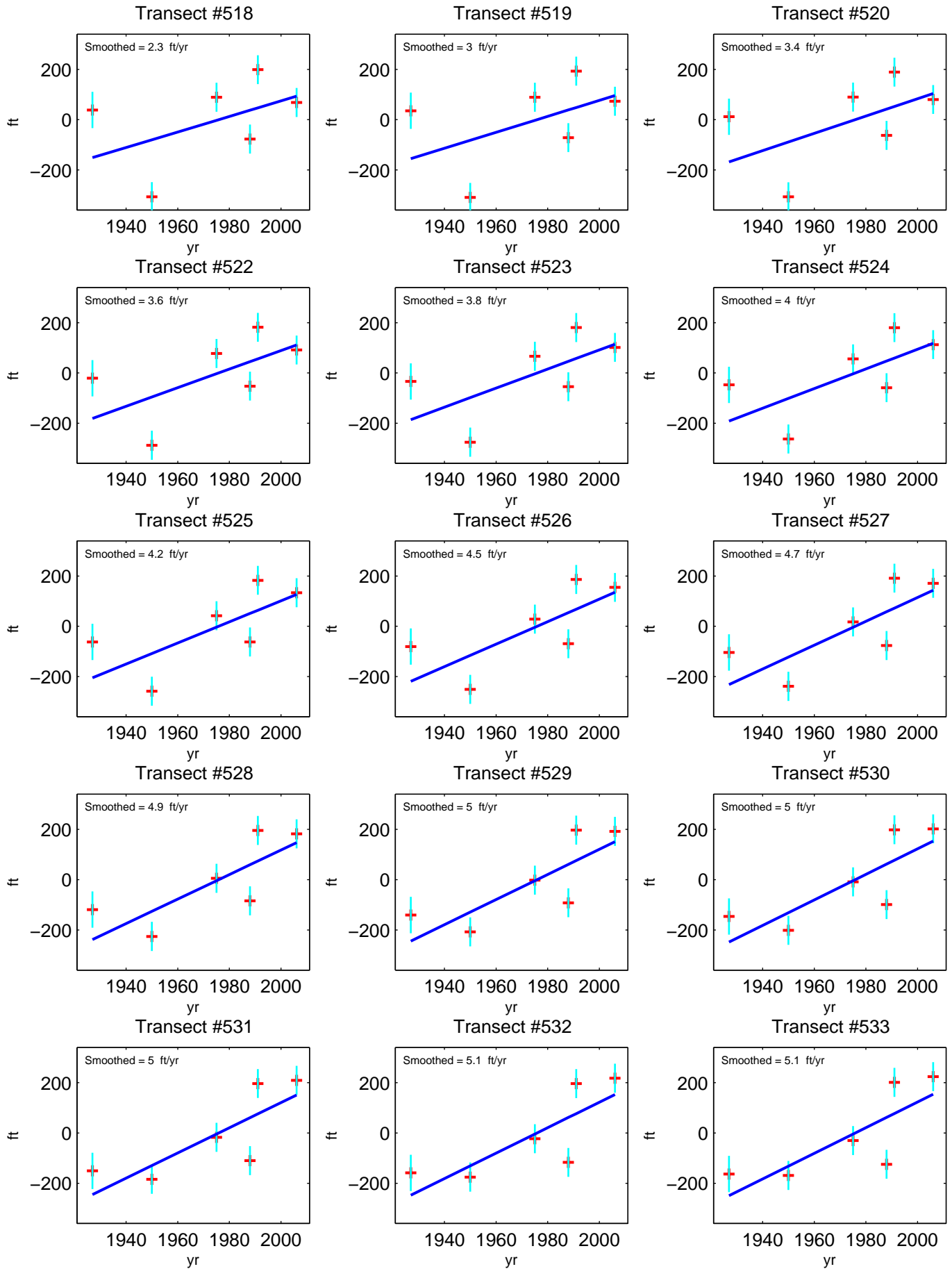
Positive Rate = Accretion
Negative Rate = Erosion



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Majors Bay - Smoothed Shoreline Change Rates

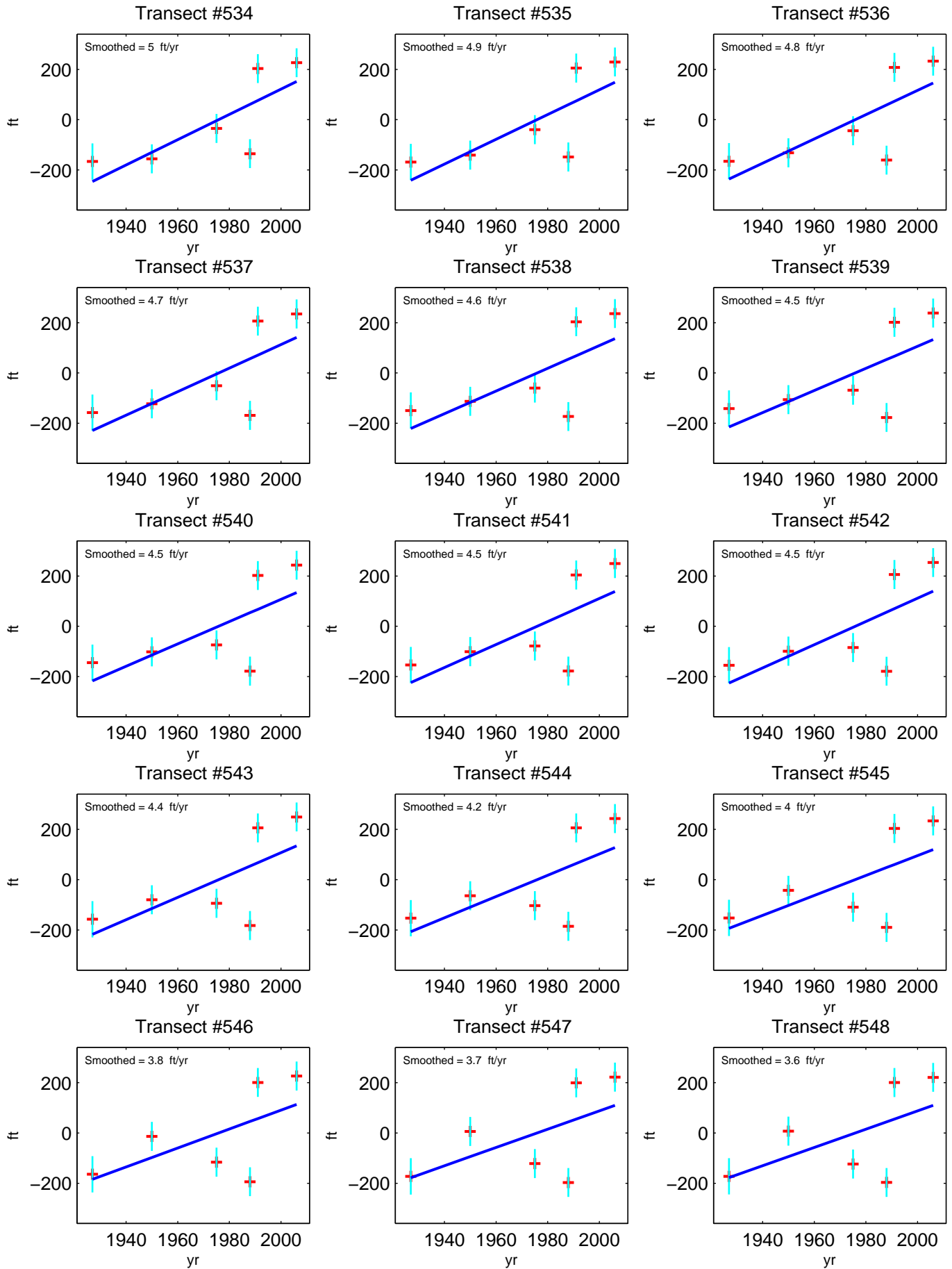
Positive Rate = Accretion
Negative Rate = Erosion



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Majors Bay - Smoothed Shoreline Change Rates

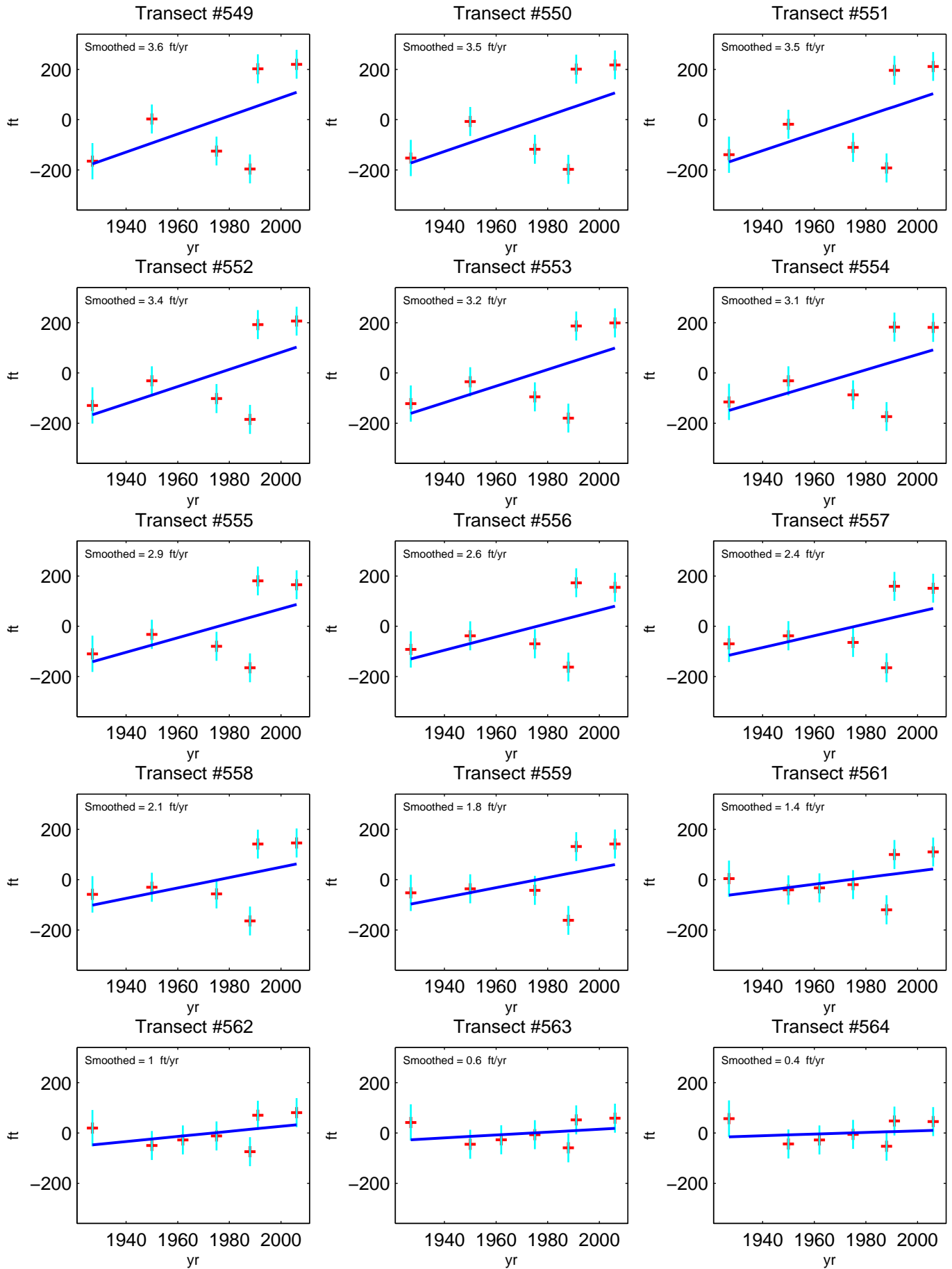
Positive Rate = Accretion
Negative Rate = Erosion



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Majors Bay - Smoothed Shoreline Change Rates

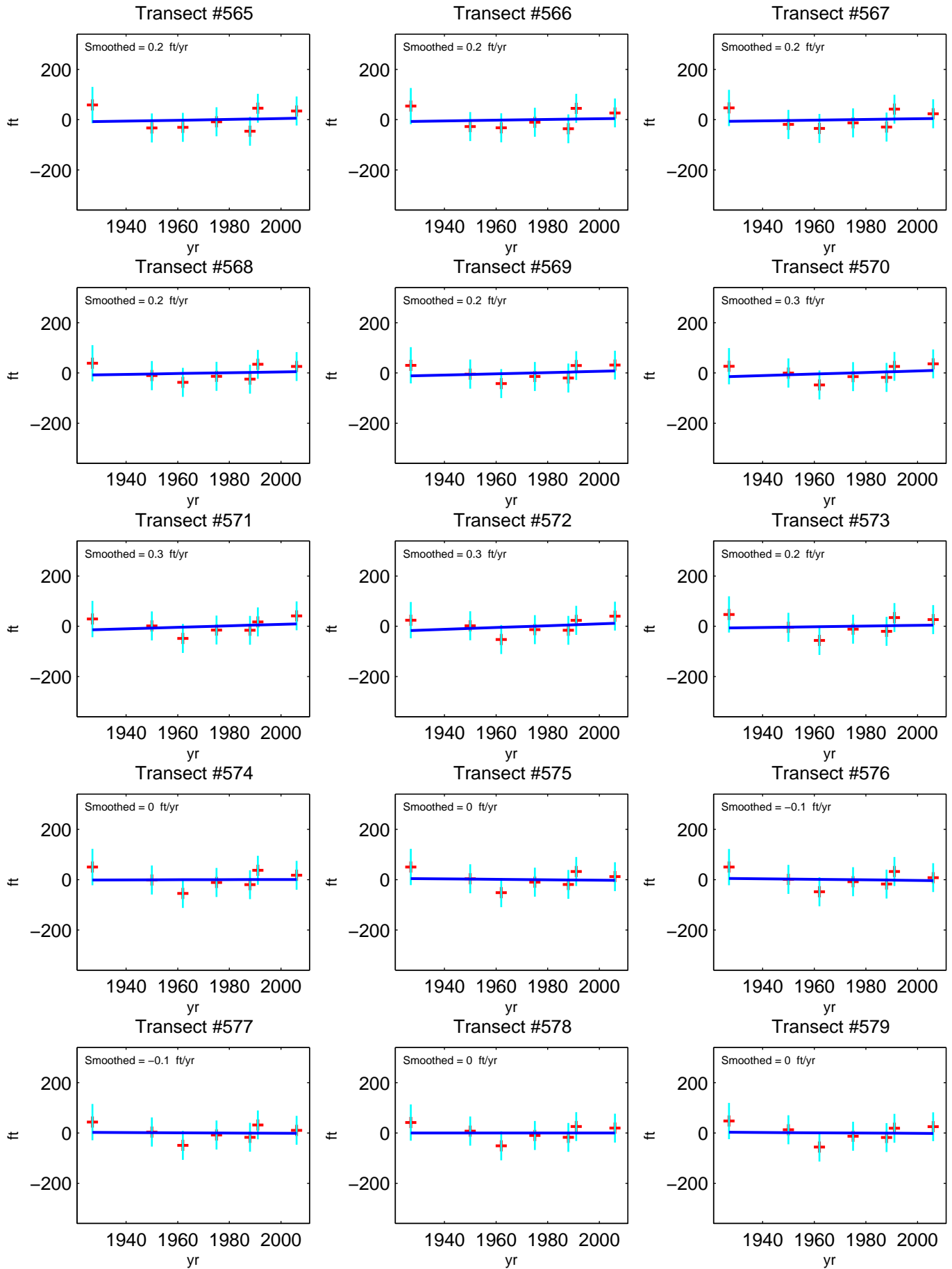
Positive Rate = Accretion
Negative Rate = Erosion



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Majors Bay - Smoothed Shoreline Change Rates

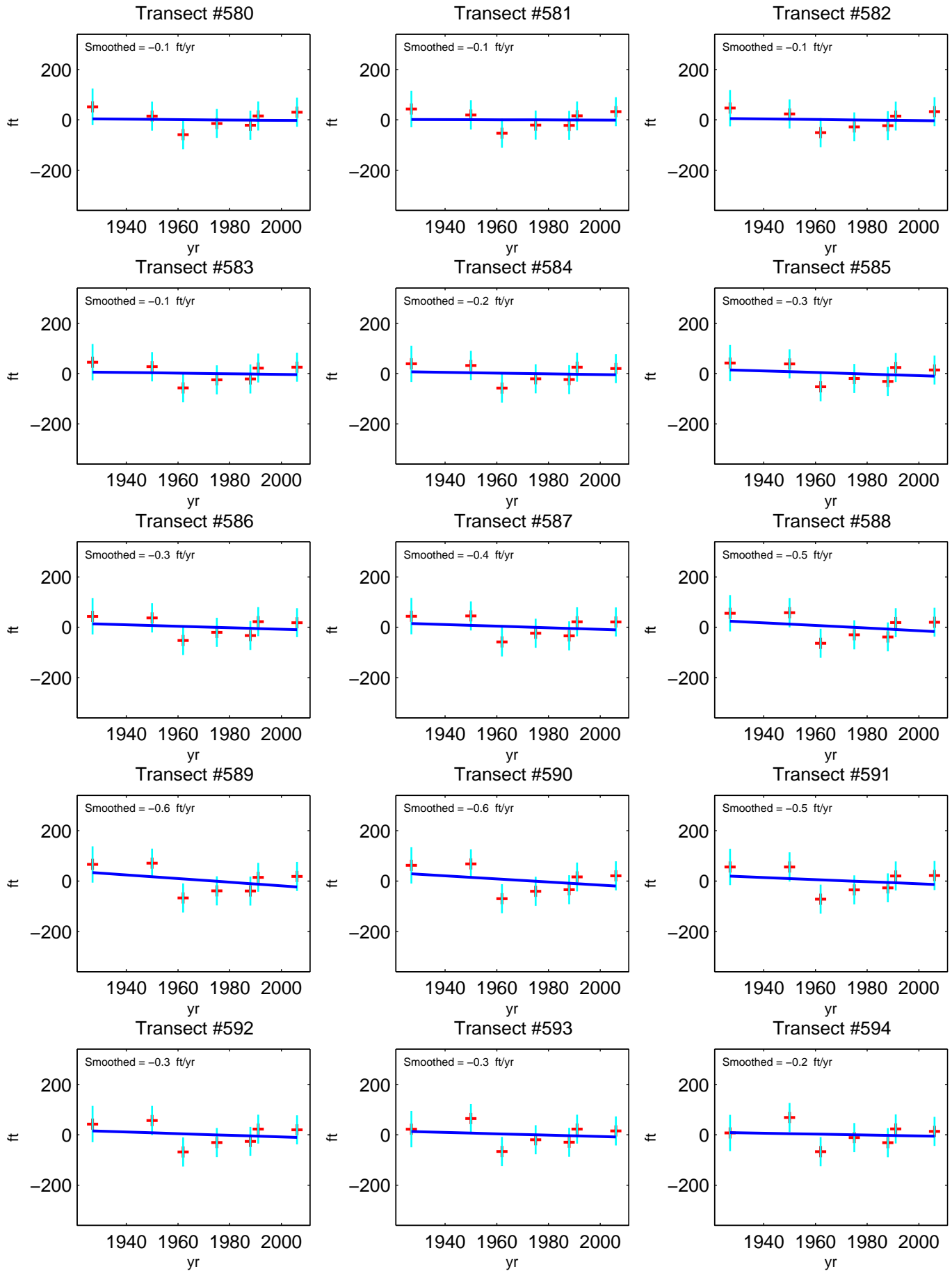
Positive Rate = Accretion
Negative Rate = Erosion



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Majors Bay - Smoothed Shoreline Change Rates

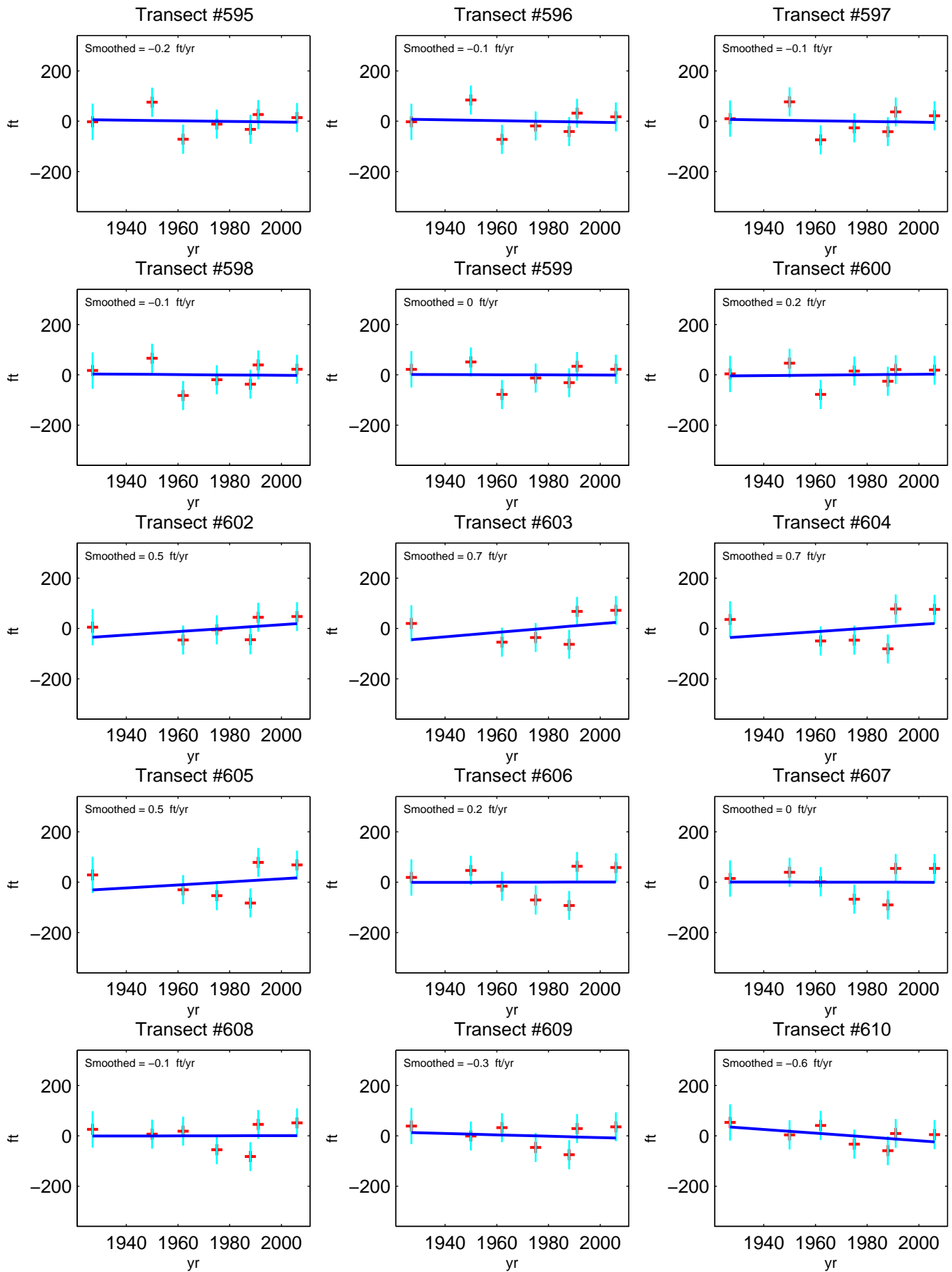
Positive Rate = Accretion
Negative Rate = Erosion



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Majors Bay - Smoothed Shoreline Change Rates

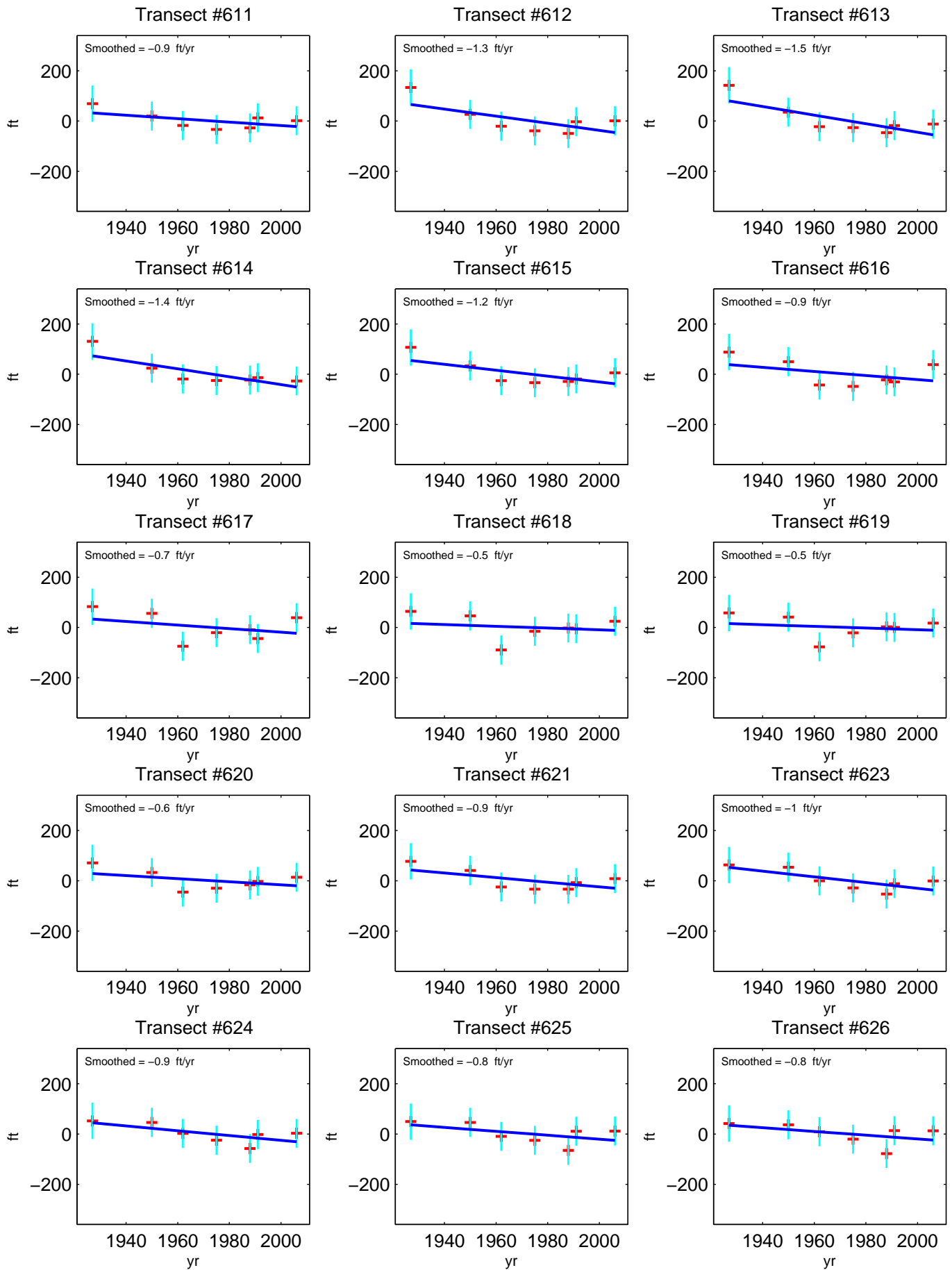
Positive Rate = Accretion
Negative Rate = Erosion



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Majors Bay - Smoothed Shoreline Change Rates

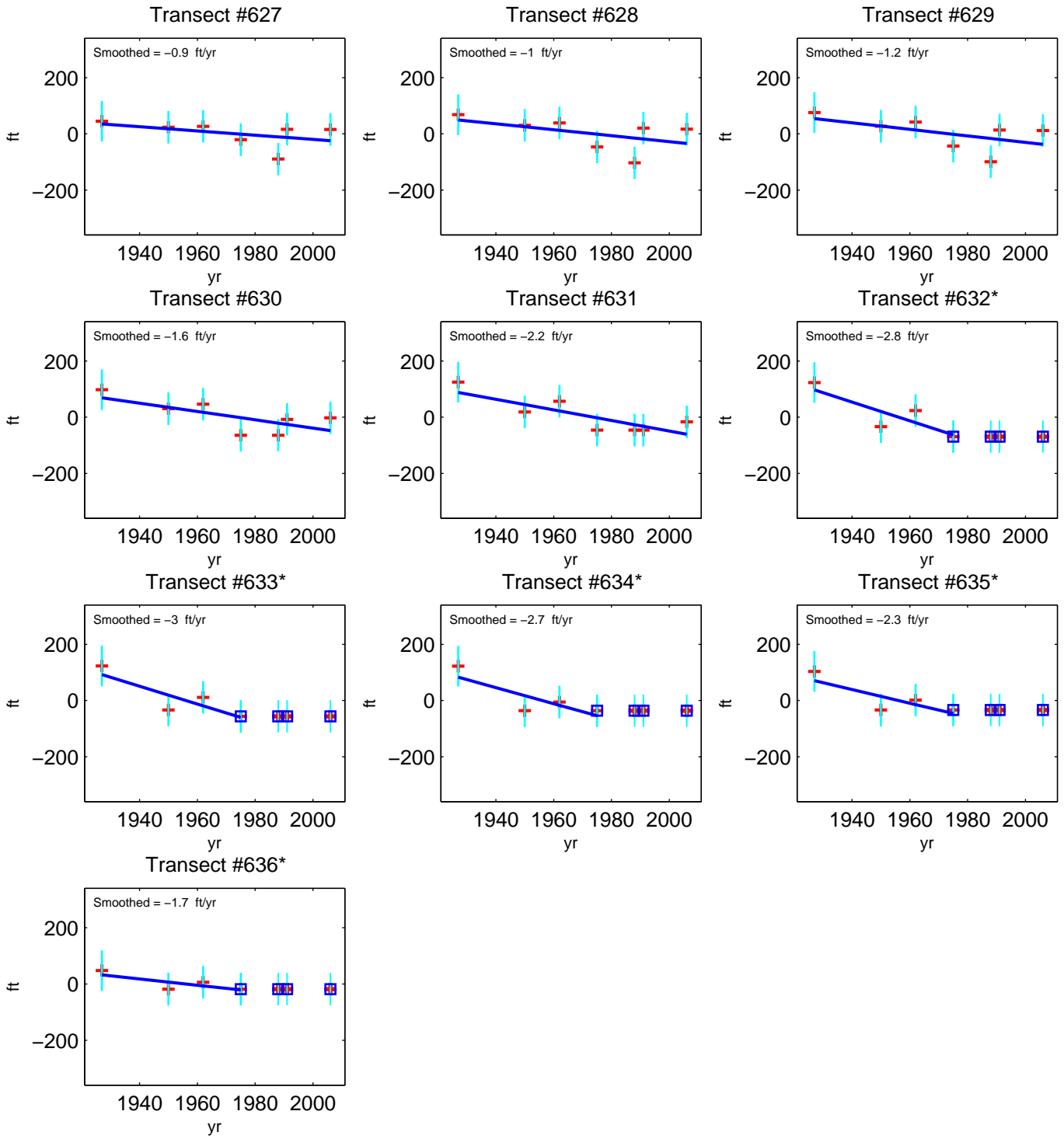
Positive Rate = Accretion
Negative Rate = Erosion



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Majors Bay - Smoothed Shoreline Change Rates

Positive Rate = Accretion
Negative Rate = Erosion



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Kokole Point, Kauai, Hawaii

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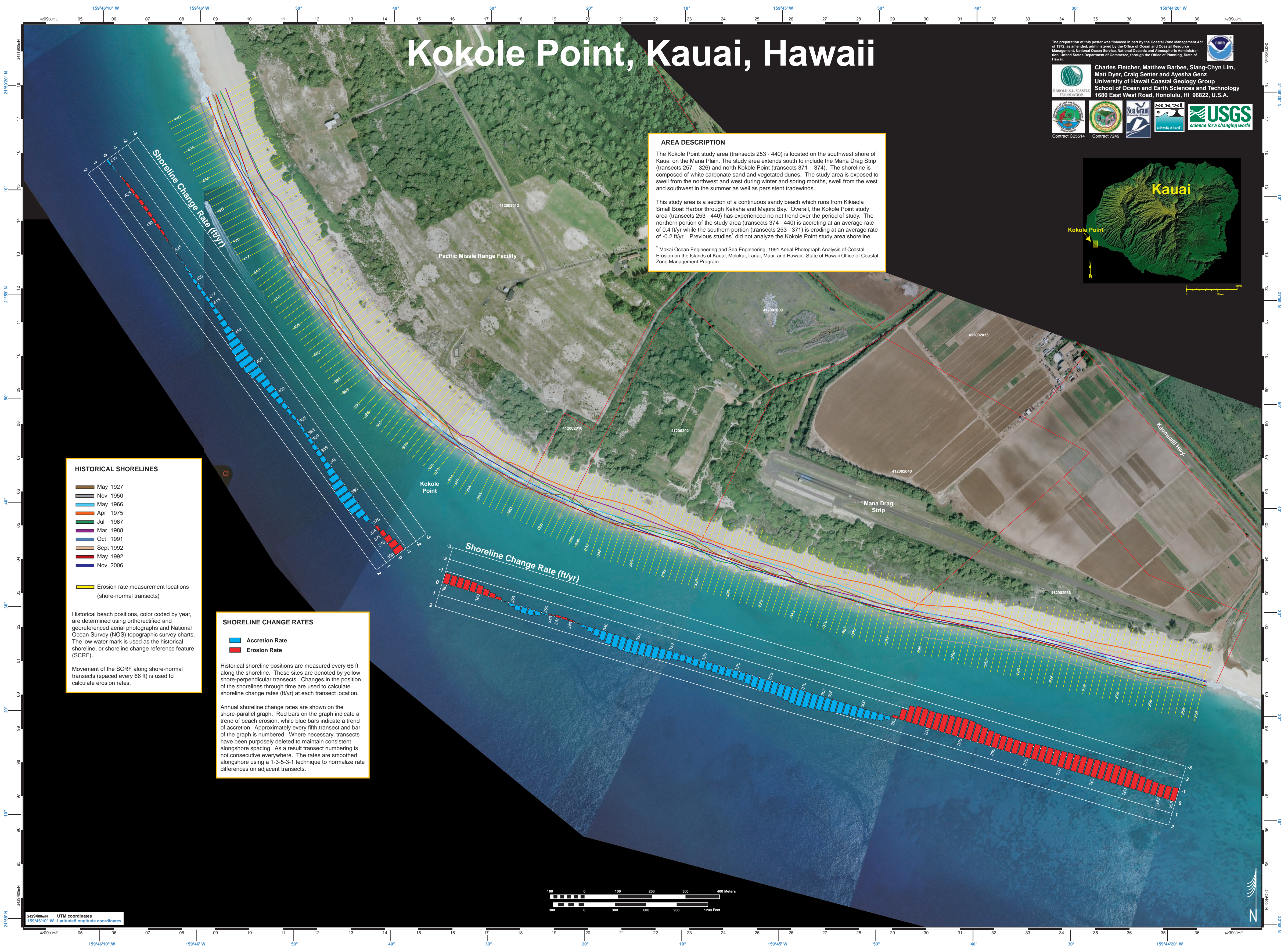
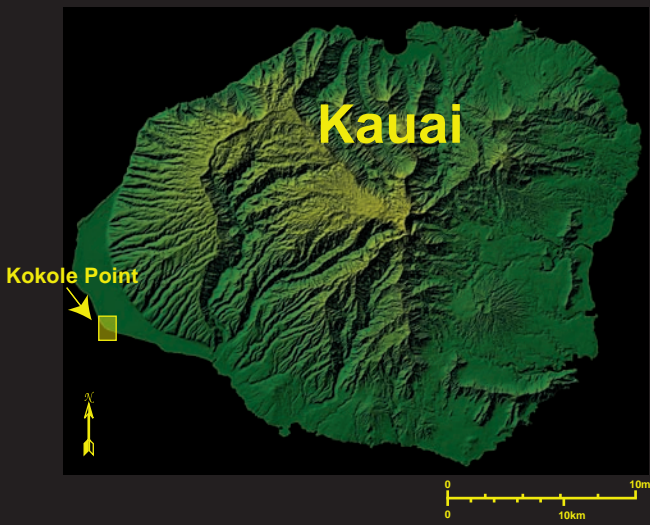
USGS science for a changing world

AREA DESCRIPTION

The Kokole Point study area (transects 253 - 440) is located on the southwest shore of Kauai on the Mana Plain. The study area extends south to include the Mana Drag Strip (transects 257 - 326) and north Kokole Point (transects 371 - 374). The shoreline is composed of white carbonate sand and vegetated dunes. The study area is exposed to swell from the northwest and west during winter and spring months, swell from the west and southwest in the summer as well as persistent tradewinds.

This study area is a section of a continuous sandy beach which runs from Kikiaola Small Boat Harbor through Kekaha and Majors Bay. Overall, the Kokole Point study area (transects 253 - 440) has experienced no net trend over the period of study. The northern portion of the study area (transects 374 - 440) is accreting at an average rate of 0.4 ft/yr while the southern portion (transects 253 - 371) is eroding at an average rate of -0.2 ft/yr. Previous studies¹ did not analyze the Kokole Point study area shoreline.

¹ Makai Ocean Engineering and Sea Engineering, 1991 Aerial Photograph Analysis of Coastal Erosion on the Islands of Kauai, Molokai, Lanai, Maui, and Hawaii. State of Hawaii Office of Coastal Zone Management Program.



HISTORICAL SHORELINES

- May 1927
- Nov 1950
- May 1966
- Apr 1975
- Jul 1987
- Mar 1988
- Oct 1991
- Sept 1992
- May 1992
- Nov 2006

Yellow line: Erosion rate measurement locations (shore-normal transects)

Historical beach positions, color coded by year, are determined using orthorectified and georeferenced aerial photographs and National Ocean Survey (NOS) topographic survey charts. The low water mark is used as the historical shoreline, or shoreline change reference feature (SCRF).

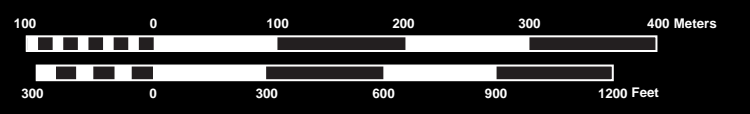
Movement of the SCRF along shore-normal transects (spaced every 66 ft) is used to calculate erosion rates.

SHORELINE CHANGE RATES

- Blue bar: Accretion Rate
- Red bar: Erosion Rate

Historical shoreline positions are measured every 66 ft along the shoreline. These sites are denoted by yellow shore-perpendicular transects. Changes in the position of the shorelines through time are used to calculate shoreline change rates (ft/yr) at each transect location.

Annual shoreline change rates are shown on the shore-parallel graph. Red bars on the graph indicate a trend of beach erosion, while blue bars indicate a trend of accretion. Approximately every fifth transect and bar of the graph is numbered. Where necessary, transects have been purposely deleted to maintain consistent alongshore spacing. As a result transect numbering is not consecutive everywhere. The rates are smoothed alongshore using a 1-3-5-3-1 technique to normalize rate differences on adjacent transects.



242946mN UTM coordinates
 159°46'10" W Latitude/Longitude coordinates

Kokole Point - Smoothed Rates

Positive Rate = Accretion
Negative Rate = Erosion

Transect	Smoothed Rate (ft/yr)	Transect	Smoothed Rate (ft/yr)	Transect	Smoothed Rate (ft/yr)
253	-1.1	299	0.7	346	-0.2
254	-1.1	300	0.8	347	-0.1
255	-1.0	301	0.9	349	-0.1
256	-1.1	302	0.9	350	0.1
257	-1.1	303	1.0	351	0.3
258	-1.2	304	1.0	352	0.5
259	-1.3	305	1.1	353	0.5
260	-1.4	307	1.1	354	0.4
261	-1.4	308	1.2	355	0.2
262	-1.5	309	1.3	356	0.0
263	-1.5	310	1.3	357	-0.2
264	-1.5	311	1.3	358	-0.4
265	-1.4	312	1.2	359	-0.5
266	-1.4	313	1.0	360	-0.7
267	-1.4	314	1.0	361	-0.8
268	-1.4	315	1.0	362	-0.8
269	-1.3	316	1.0	363	-0.8
270	-1.3	317	0.9	364	-0.8
271	-1.3	318	0.8	365	-0.8
272	-1.3	319	0.7	368	-0.8
273	-1.3	320	0.6	369	-0.7
274	-1.2	321	0.7	370	-0.6
275	-1.2	322	0.7	371	-0.4
276	-1.1	323	0.7	374	-0.2
277	-1.1	324	0.6	375	0.1
278	-1.1	325	0.6	376	0.4
279	-1.1	326	0.6	377	0.7
280	-1.2	327	0.6	378	1.0
281	-1.2	328	0.5	379	1.1
282	-1.3	329	0.6	380	1.1
283	-1.5	330	0.7	381	1.1
284	-1.5	331	0.9	382	1.0
285	-1.6	332	1.0	383	0.8
286	-1.6	333	1.0	384	0.6
287	-1.5	334	1.0	385	0.5
288	-1.4	335	1.1	386	0.4
289	-1.4	336	1.1	388	0.4
290	-1.4	337	1.1	389	0.4
291	-1.4	338	1.0	390	0.3
292	-1.5	339	0.9	393	0.2
293	-1.3	340	0.7	394	0.2
294	-0.9	341	0.6	395	0.2
295	-0.2	342	0.4	396	0.2
296	0.3	343	0.2	397	0.3
297	0.5	344	0.0	398	0.4
298	0.6	345	-0.1	399	0.5

*Imagery indicates beachwidth of zero during period of analysis. Rate calculation reflects data with beach existence.

Kokole Point - Smoothed Rates

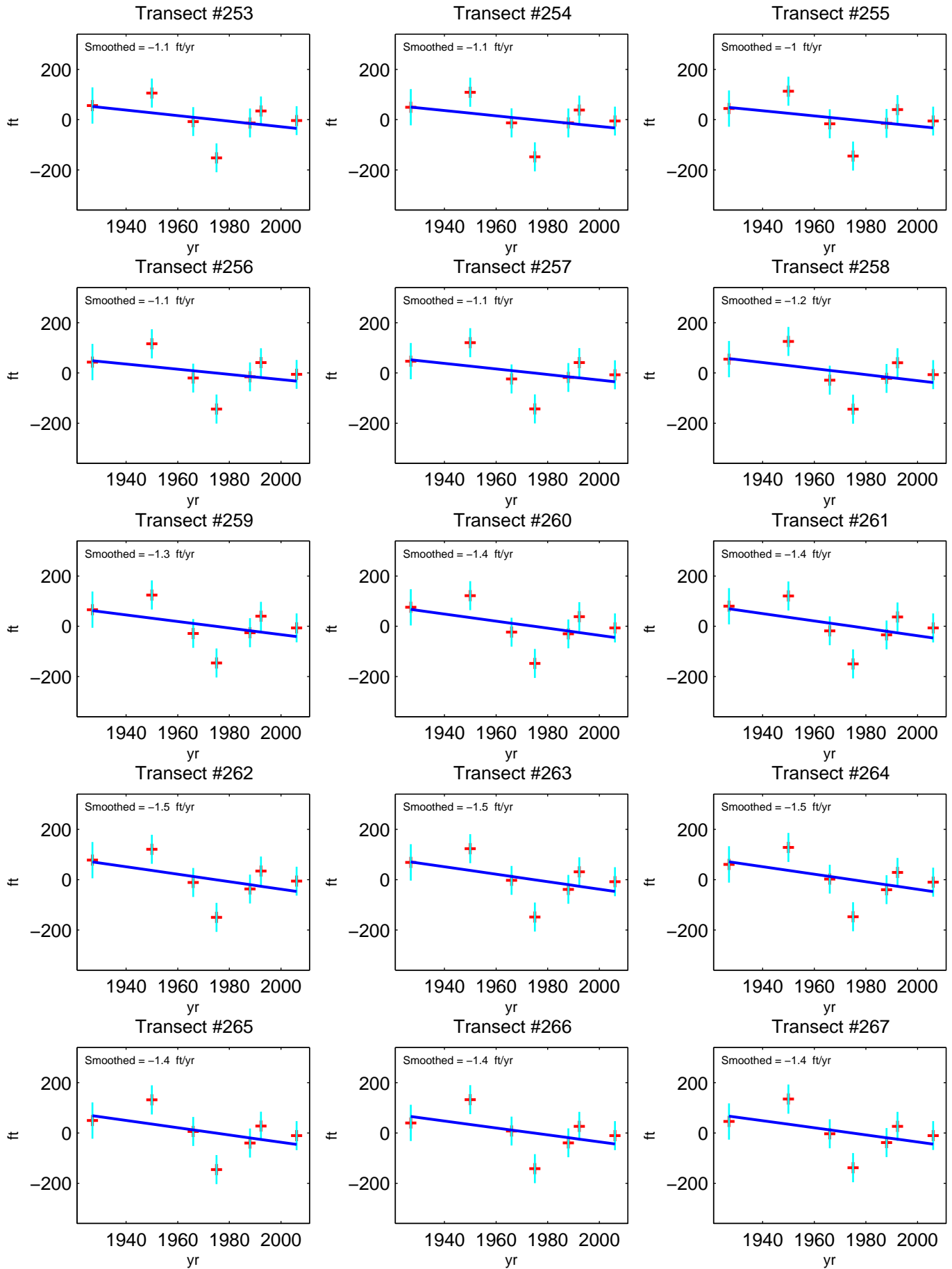
Positive Rate = Accretion
Negative Rate = Erosion

Transect	Smoothed Rate (ft/yr)
400	0.6
401	0.6
402	0.7
403	0.8
404	1.0
405	1.1
406	1.2
407	1.2
408	1.1
409	0.9
410	0.7
411	0.6
412	0.5
413	0.4
414	0.3
415	0.3
417	0.3
418	0.3
419	0.3
420	0.2
421	0.2
422	0.1
423	0.1
424	0.0
425	0.0
426	0.0
427	-0.1
428	-0.2
429	-0.2
430	-0.2
431	-0.2
432	-0.3
433	-0.3
434	-0.2
435	-0.2
436	-0.2
437	-0.1
438	0.0
439	0.1
440	0.2

*Imagery indicates beachwidth of zero during period of analysis. Rate calculation reflects data with beach existence.

Kokole Point - Smoothed Shoreline Change Rates

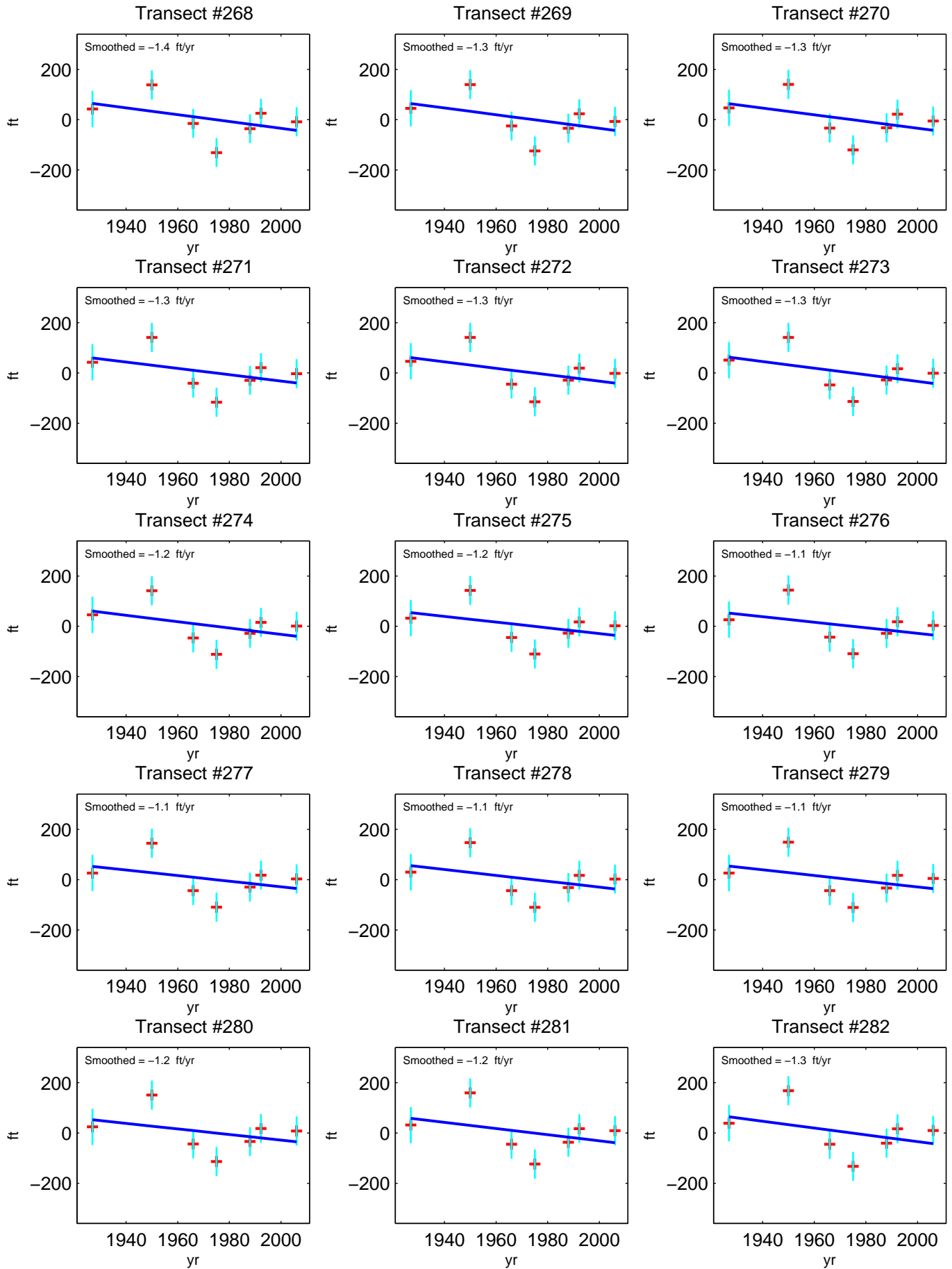
Positive Rate = Accretion
Negative Rate = Erosion



*Hardened Shorelines with no beach are shown with a blue square. The analysis stops at the first hardened shoreline.

Kokole Point - Smoothed Shoreline Change Rates

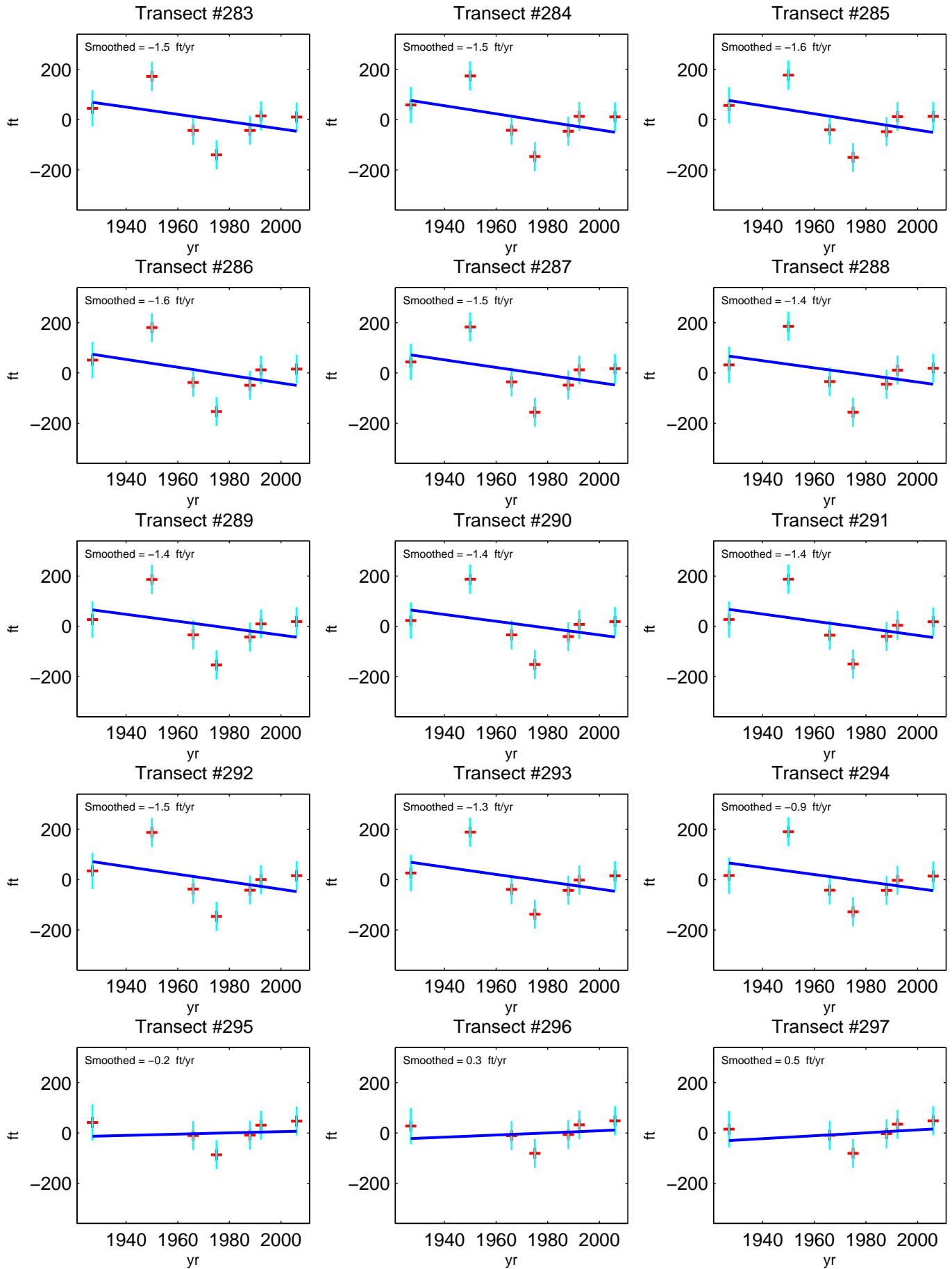
Positive Rate = Accretion
Negative Rate = Erosion



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Kokole Point - Smoothed Shoreline Change Rates

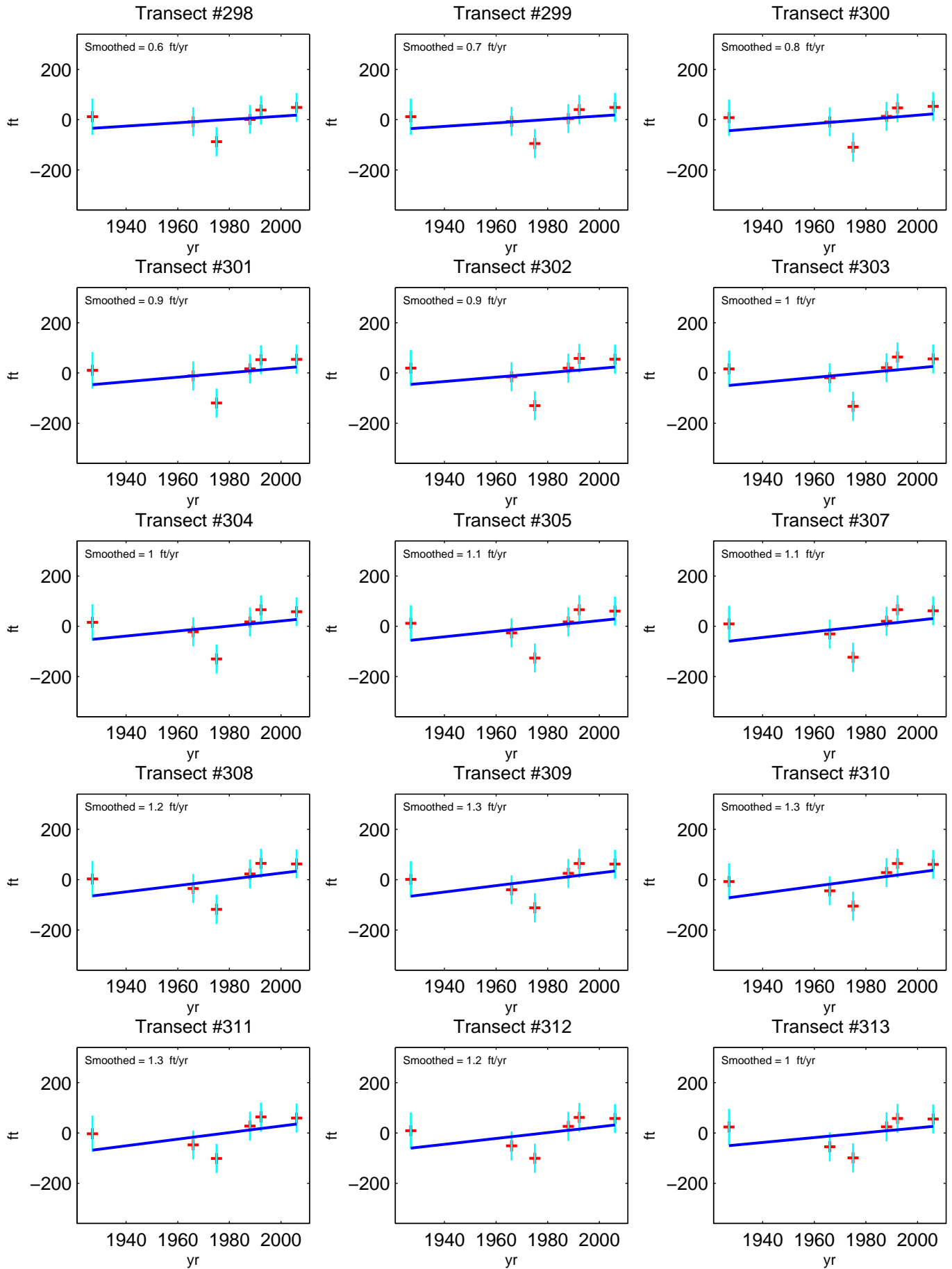
Positive Rate = Accretion
Negative Rate = Erosion



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Kokole Point - Smoothed Shoreline Change Rates

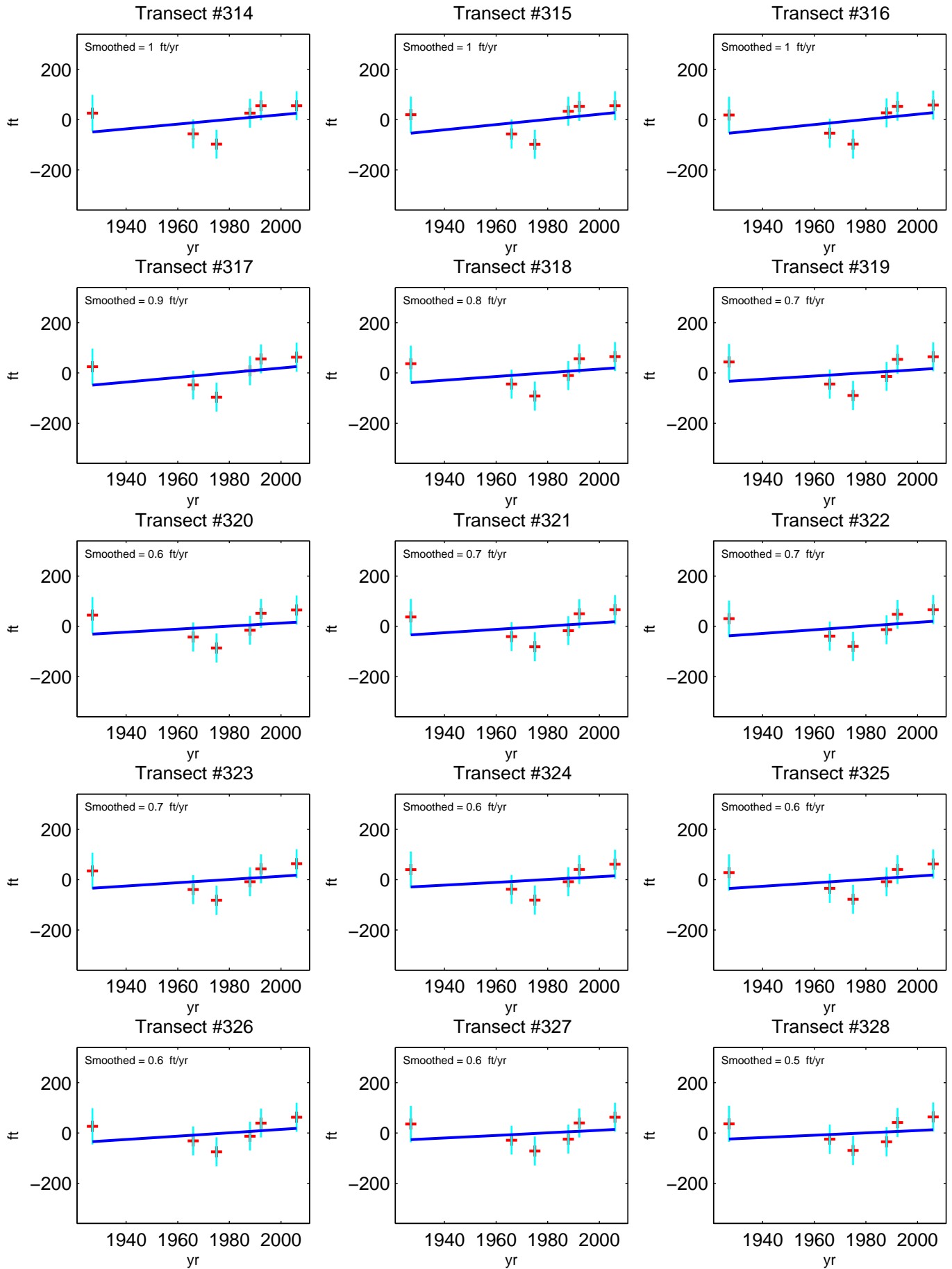
Positive Rate = Accretion
Negative Rate = Erosion



*Hardened Shorelines with no beach are shown with a blue square. The analysis stops at the first hardened shoreline.

Kokole Point - Smoothed Shoreline Change Rates

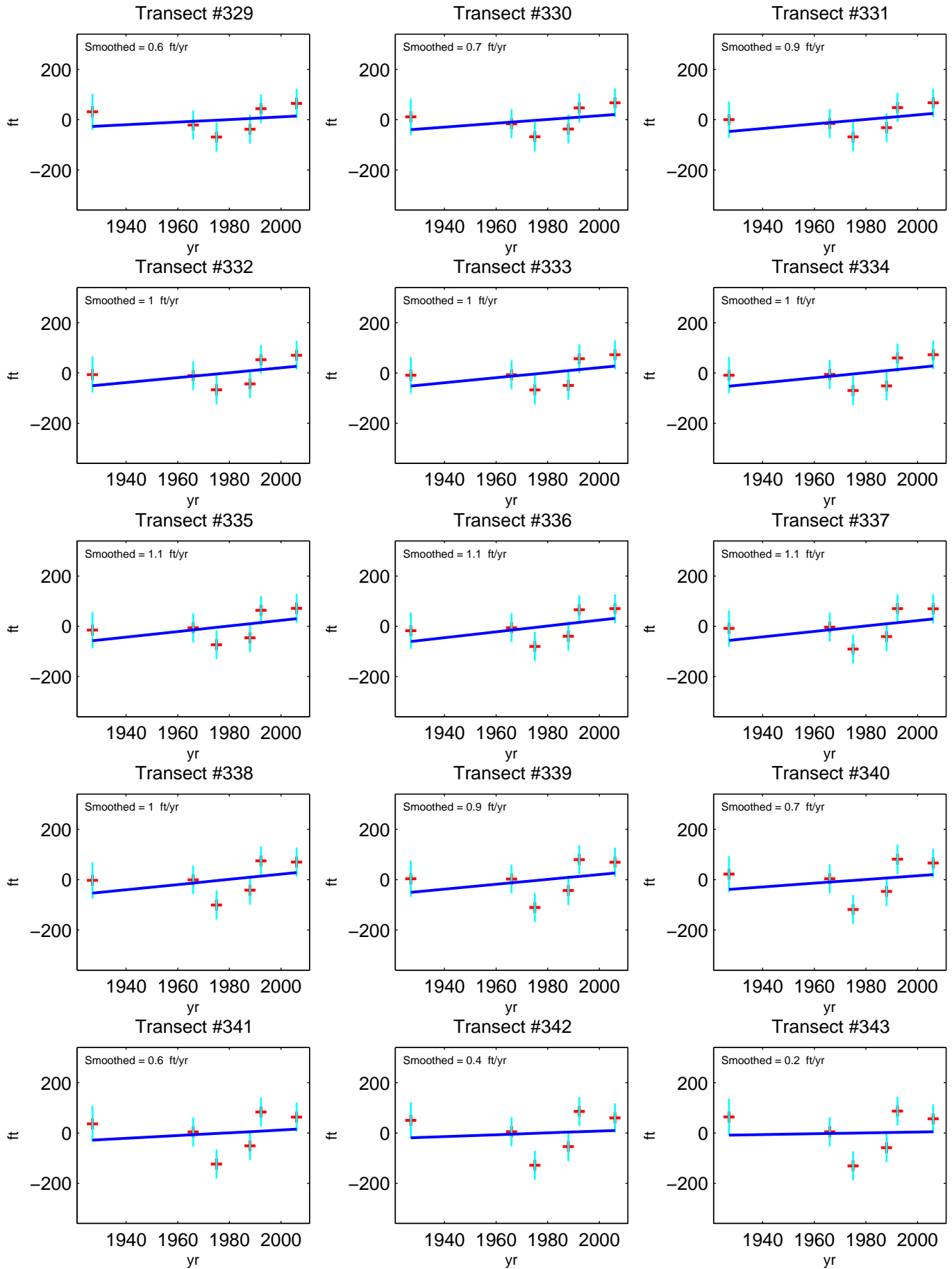
Positive Rate = Accretion
Negative Rate = Erosion



*Hardened Shorelines with no beach are shown with a blue square. The analysis stops at the first hardened shoreline.

Kokole Point - Smoothed Shoreline Change Rates

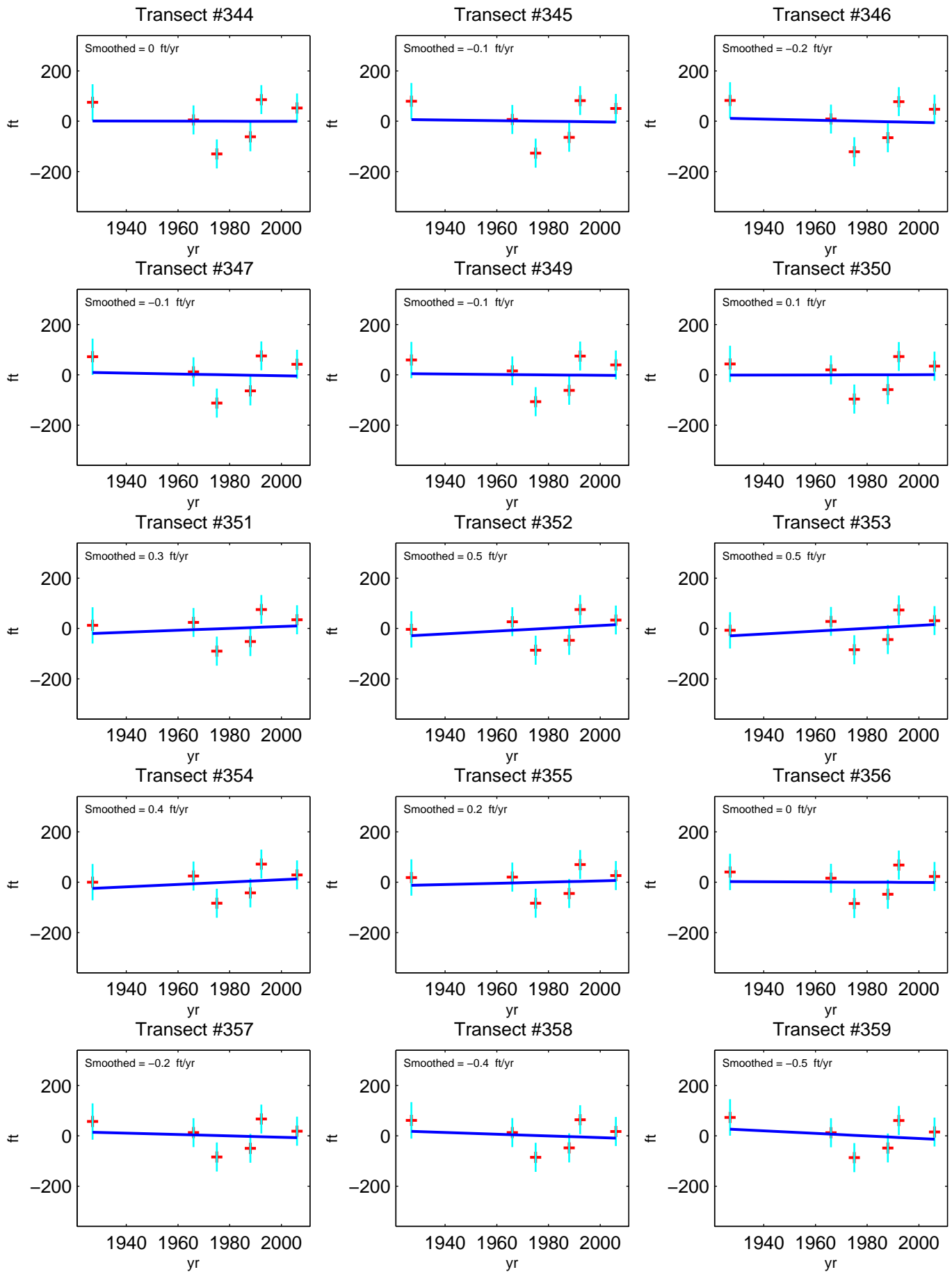
Positive Rate = Accretion
Negative Rate = Erosion



*Hardened Shorelines with no beach are shown with a blue square. The analysis stops at the first hardened shoreline.

Kokole Point - Smoothed Shoreline Change Rates

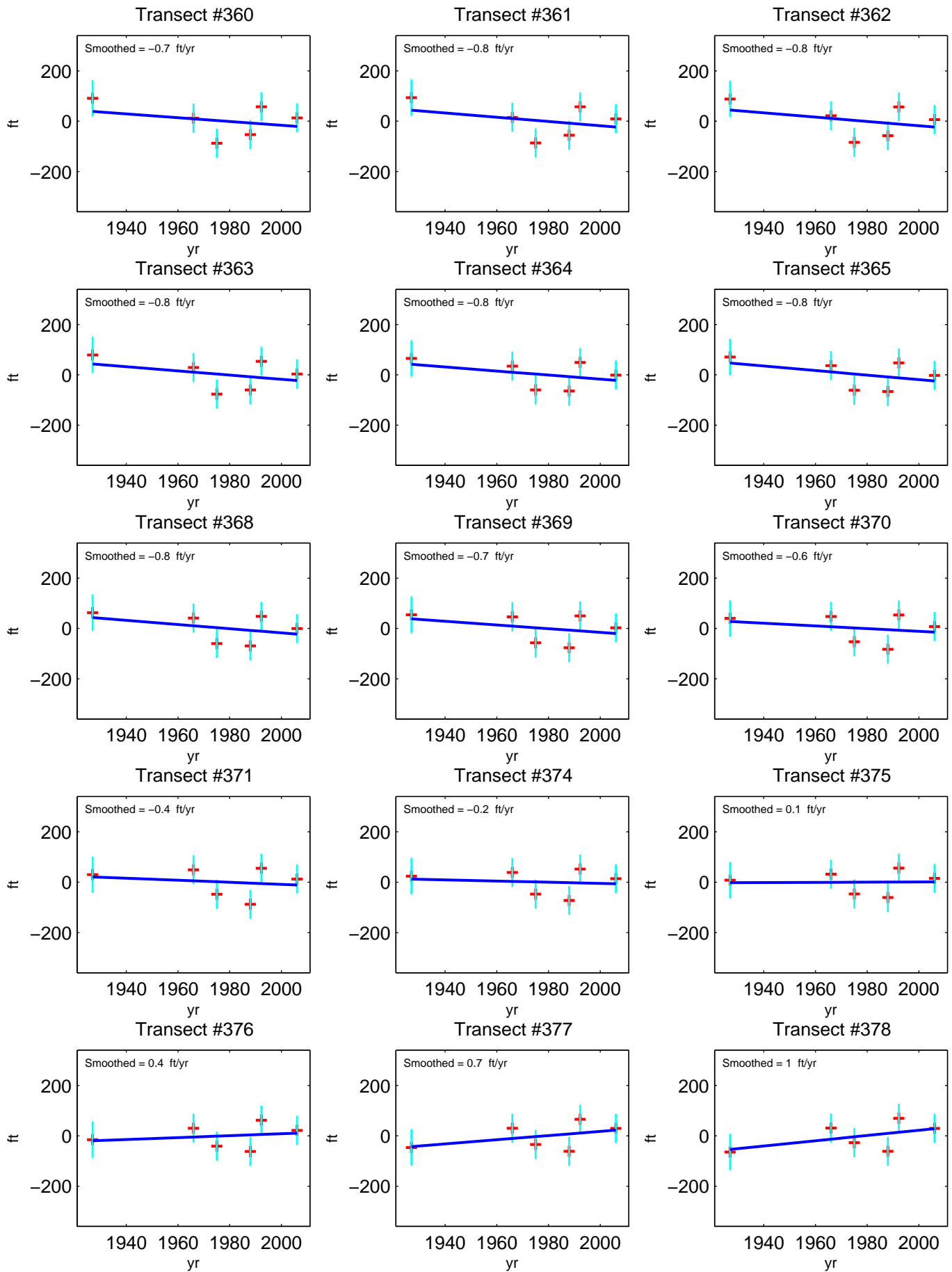
Positive Rate = Accretion
Negative Rate = Erosion



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Kokole Point - Smoothed Shoreline Change Rates

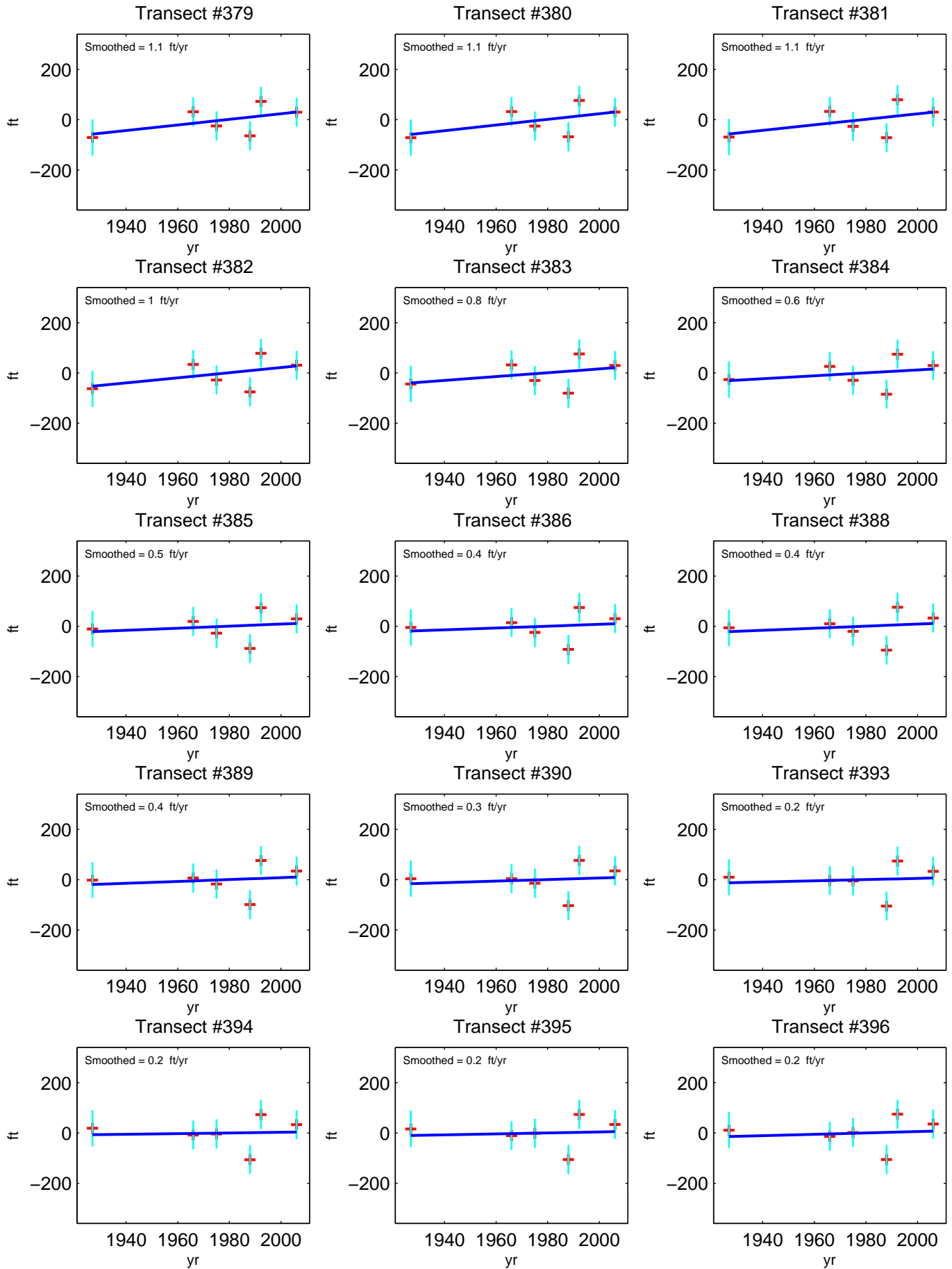
Positive Rate = Accretion
Negative Rate = Erosion



*Hardened Shorelines with no beach are shown with a blue square. The analysis stops at the first hardened shoreline.

Kokole Point - Smoothed Shoreline Change Rates

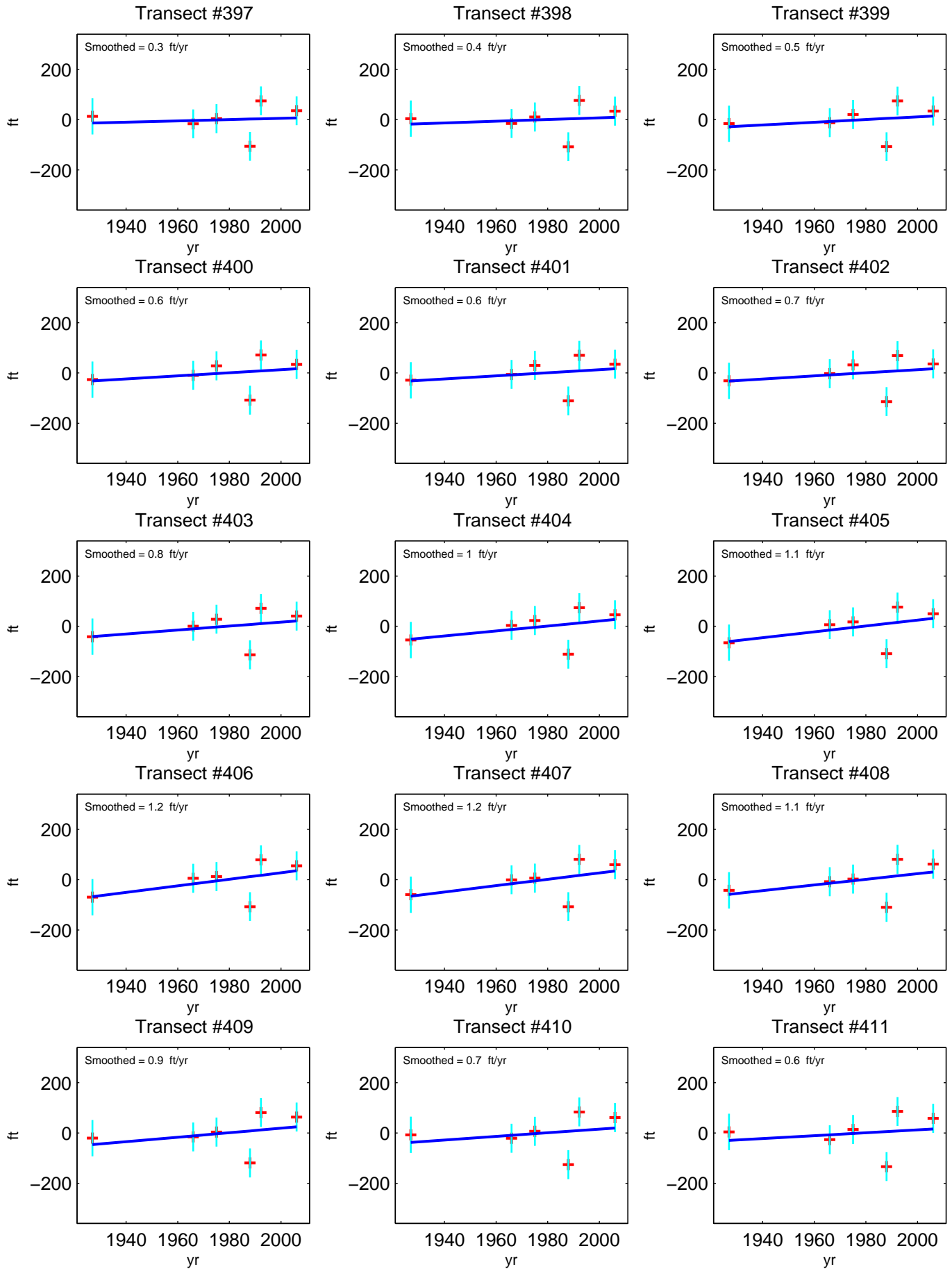
Positive Rate = Accretion
Negative Rate = Erosion



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Kokole Point - Smoothed Shoreline Change Rates

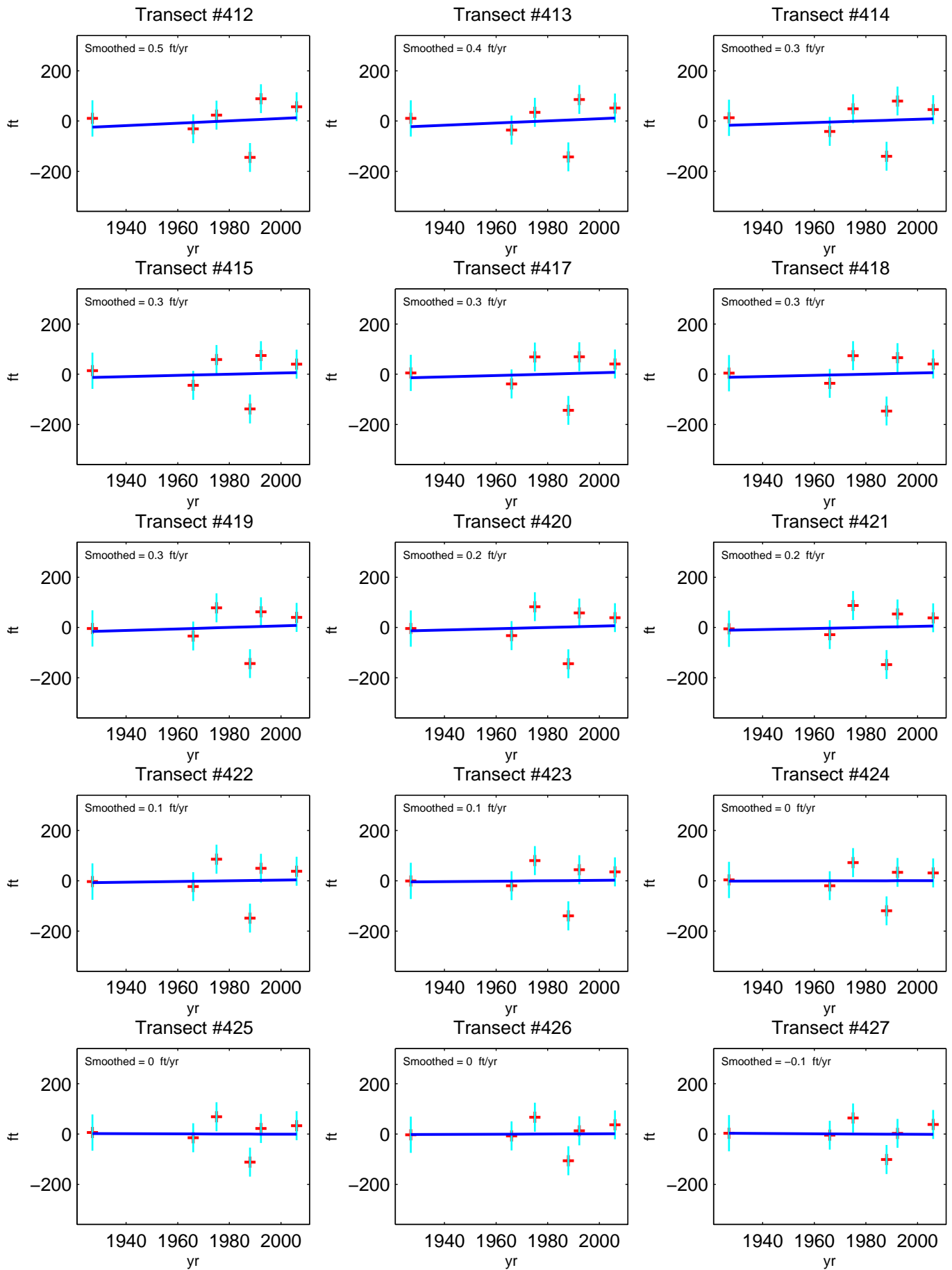
Positive Rate = Accretion
Negative Rate = Erosion



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Kokole Point - Smoothed Shoreline Change Rates

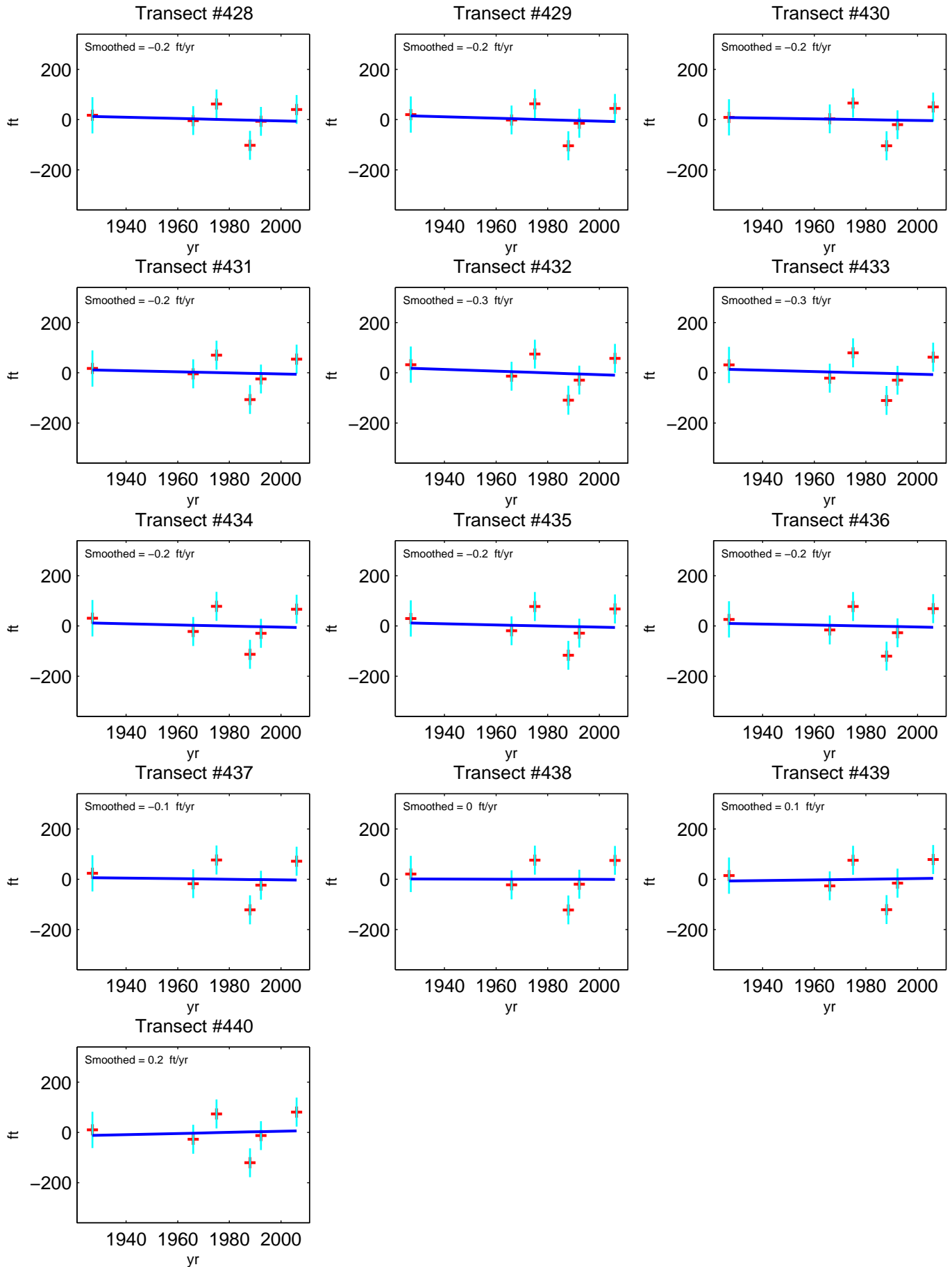
Positive Rate = Accretion
Negative Rate = Erosion



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Kokole Point - Smoothed Shoreline Change Rates

Positive Rate = Accretion
Negative Rate = Erosion



*Hardened Shorelines with no beach are shown with a blue square. The analysis stops at the first hardened shoreline.

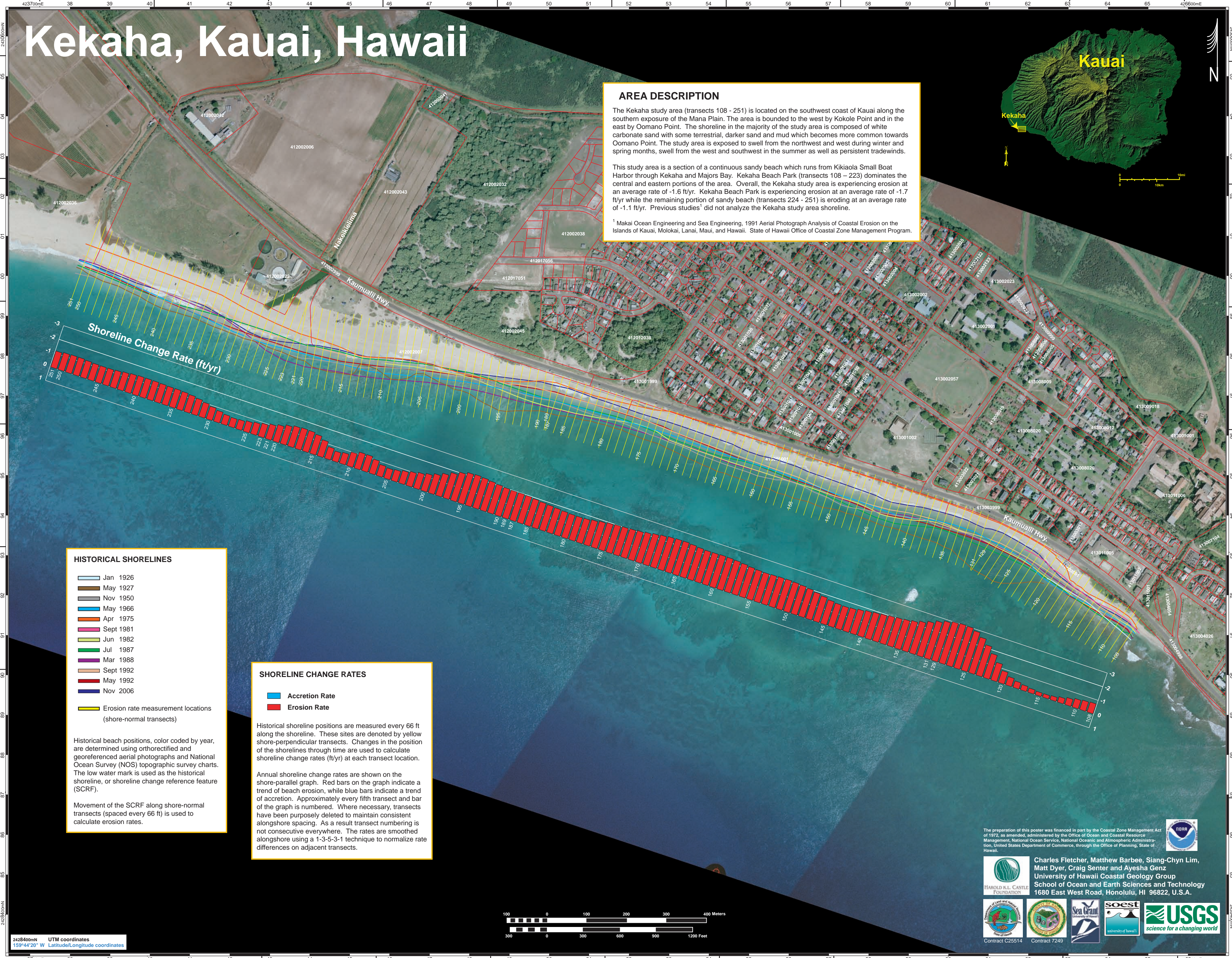
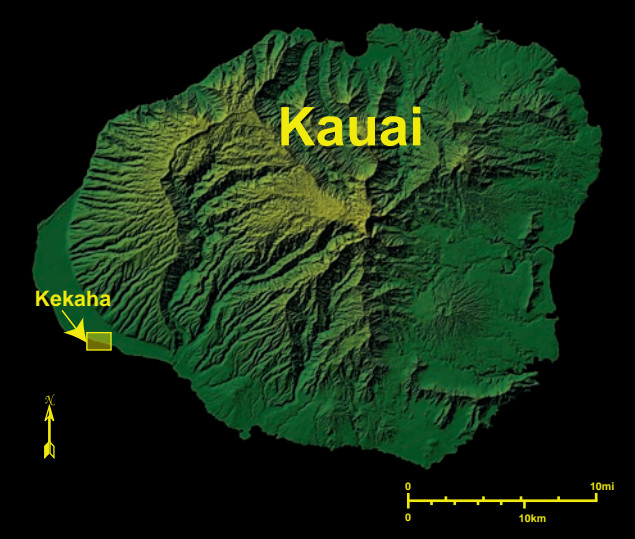
Kekaha, Kauai, Hawaii

AREA DESCRIPTION

The Kekaha study area (transects 108 - 251) is located on the southwest coast of Kauai along the southern exposure of the Mana Plain. The area is bounded to the west by Kokole Point and in the east by Omano Point. The shoreline in the majority of the study area is composed of white carbonate sand with some terrestrial, darker sand and mud which becomes more common towards Omano Point. The study area is exposed to swell from the northwest and west during winter and spring months, swell from the west and southwest in the summer as well as persistent tradewinds.

This study area is a section of a continuous sandy beach which runs from Kikiola Small Boat Harbor through Kekaha and Majors Bay. Kekaha Beach Park (transects 108 - 223) dominates the central and eastern portions of the area. Overall, the Kekaha study area is experiencing erosion at an average rate of -1.6 ft/yr. Kekaha Beach Park is experiencing erosion at an average rate of -1.7 ft/yr while the remaining portion of sandy beach (transects 224 - 251) is eroding at an average rate of -1.1 ft/yr. Previous studies¹ did not analyze the Kekaha study area shoreline.

¹ Makai Ocean Engineering and Sea Engineering, 1991 Aerial Photograph Analysis of Coastal Erosion on the Islands of Kauai, Molokai, Lanai, Maui, and Hawaii. State of Hawaii Office of Coastal Zone Management Program.



HISTORICAL SHORELINES

- Jan 1926
- May 1927
- Nov 1950
- May 1966
- Apr 1975
- Sept 1981
- Jun 1982
- Jul 1987
- Mar 1988
- Sept 1992
- May 1992
- Nov 2006

Erosion rate measurement locations (shore-normal transects)

Historical beach positions, color coded by year, are determined using orthorectified and georeferenced aerial photographs and National Ocean Survey (NOS) topographic survey charts. The low water mark is used as the historical shoreline, or shoreline change reference feature (SCRF).

Movement of the SCRF along shore-normal transects (spaced every 66 ft) is used to calculate erosion rates.

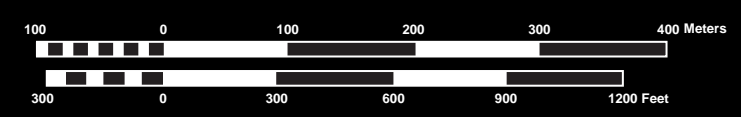
SHORELINE CHANGE RATES

- Accretion Rate
- Erosion Rate

Historical shoreline positions are measured every 66 ft along the shoreline. These sites are denoted by yellow shore-perpendicular transects. Changes in the position of the shorelines through time are used to calculate shoreline change rates (ft/yr) at each transect location.

Annual shoreline change rates are shown on the shore-parallel graph. Red bars on the graph indicate a trend of beach erosion, while blue bars indicate a trend of accretion. Approximately every fifth transect and bar of the graph is numbered. Where necessary, transects have been purposely deleted to maintain consistent alongshore spacing. As a result transect numbering is not consecutive everywhere. The rates are smoothed alongshore using a 1-3-5-3-1 technique to normalize rate differences on adjacent transects.

2428400mN UTM coordinates
159°44'20" W Latitude/Longitude coordinates



The preparation of this poster was financed in part by the Coastal Zone Management Act of 1972, as amended, administered by the Office of Ocean and Coastal Resource Management, National Ocean Service, National Oceanic and Atmospheric Administration, United States Department of Commerce, through the Office of Planning, State of Hawaii.

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School of Ocean and Earth Sciences and Technology
1680 East West Road, Honolulu, HI 96822, U.S.A.

Contract C25514 Contract 7249

Kekaha - Smoothed Rates

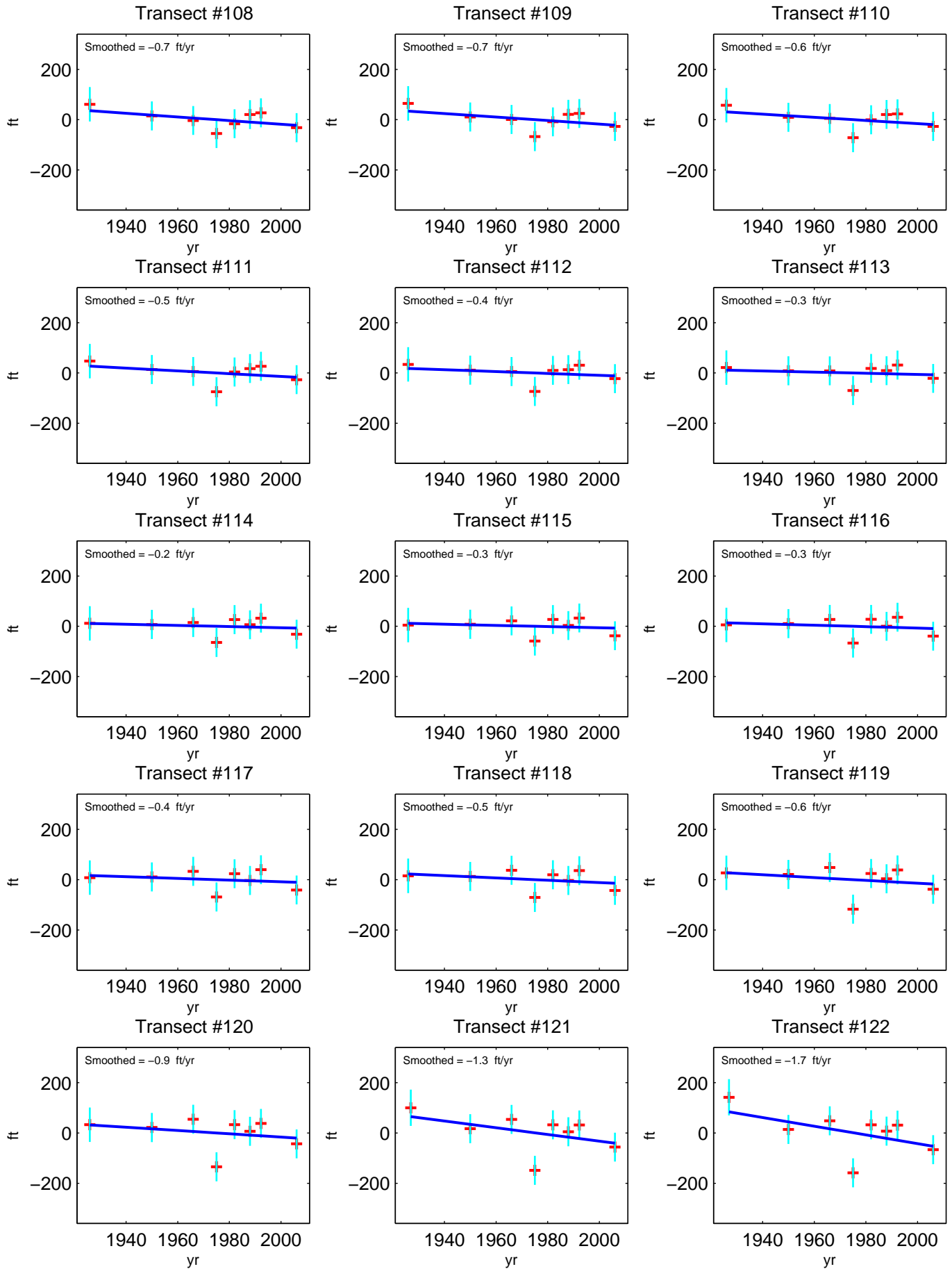
Positive Rate = Accretion
Negative Rate = Erosion

Transect	Smoothed Rate (ft/yr)	Transect	Smoothed Rate (ft/yr)	Transect	Smoothed Rate (ft/yr)
108	-0.7	155	-2.1	202	-1.0
109	-0.7	156	-2.2	203	-0.9
110	-0.6	157	-2.2	204	-0.8
111	-0.5	158	-2.3	205	-0.7
112	-0.4	159	-2.3	206	-0.8
113	-0.3	160	-2.3	207	-1.0
114	-0.2	161	-2.3	208	-1.2
115	-0.3	162	-2.3	209	-1.2
116	-0.3	163	-2.3	210	-1.0
117	-0.4	164	-2.4	211	-0.8
118	-0.5	165	-2.4	212	-0.7
119	-0.6	166	-2.4	213	-0.8
120	-0.9	167	-2.4	214	-1.2
121	-1.3	168	-2.3	215	-1.4
122	-1.7	169	-2.2	216	-1.5
123	-2.2	170	-2.2	217	-1.5
124	-2.6	171	-2.1	218	-1.5
125	-2.9	172	-2.0	219	-1.4
126	-3.0	173	-2.0	220	-1.2
127	-3.0	174	-2.0	221	-1.1
128	-3.0	175	-1.9	223	-0.9
129	-2.9	176	-1.9	224	-0.8
131	-2.7	177	-1.8	225	-0.8
132	-2.5	178	-1.7	226	-0.7
133	-2.3	179	-1.7	227	-0.6
134	-2.2	180	-1.7	228	-0.7
135	-2.1	181	-1.7	229	-0.8
136	-2.0	182	-1.8	230	-0.9
137	-2.0	183	-1.8	231	-1.0
138	-1.9	184	-1.9	232	-1.1
139	-1.9	185	-1.9	233	-1.2
140	-1.8	186	-2.0	234	-1.3
141	-1.7	187	-2.0	235	-1.3
142	-1.7	189	-2.0	236	-1.3
143	-1.6	190	-2.0	237	-1.3
144	-1.6	191	-2.1	238	-1.3
145	-1.7	192	-2.1	239	-1.4
146	-1.8	193	-2.2	240	-1.4
147	-1.9	194	-2.2	241	-1.3
148	-2.0	195	-2.2	242	-1.3
149	-2.1	196	-2.0	243	-1.2
150	-2.1	197	-1.8	244	-1.2
151	-2.1	198	-1.6	245	-1.2
152	-2.1	199	-1.4	246	-1.2
153	-2.1	200	-1.2	247	-1.2
154	-2.1	201	-1.1	248	-1.2

*Imagery indicates beachwidth of zero during period of analysis. Rate calculation reflects data with beach existence.

Kekaha - Smoothed Shoreline Change Rates

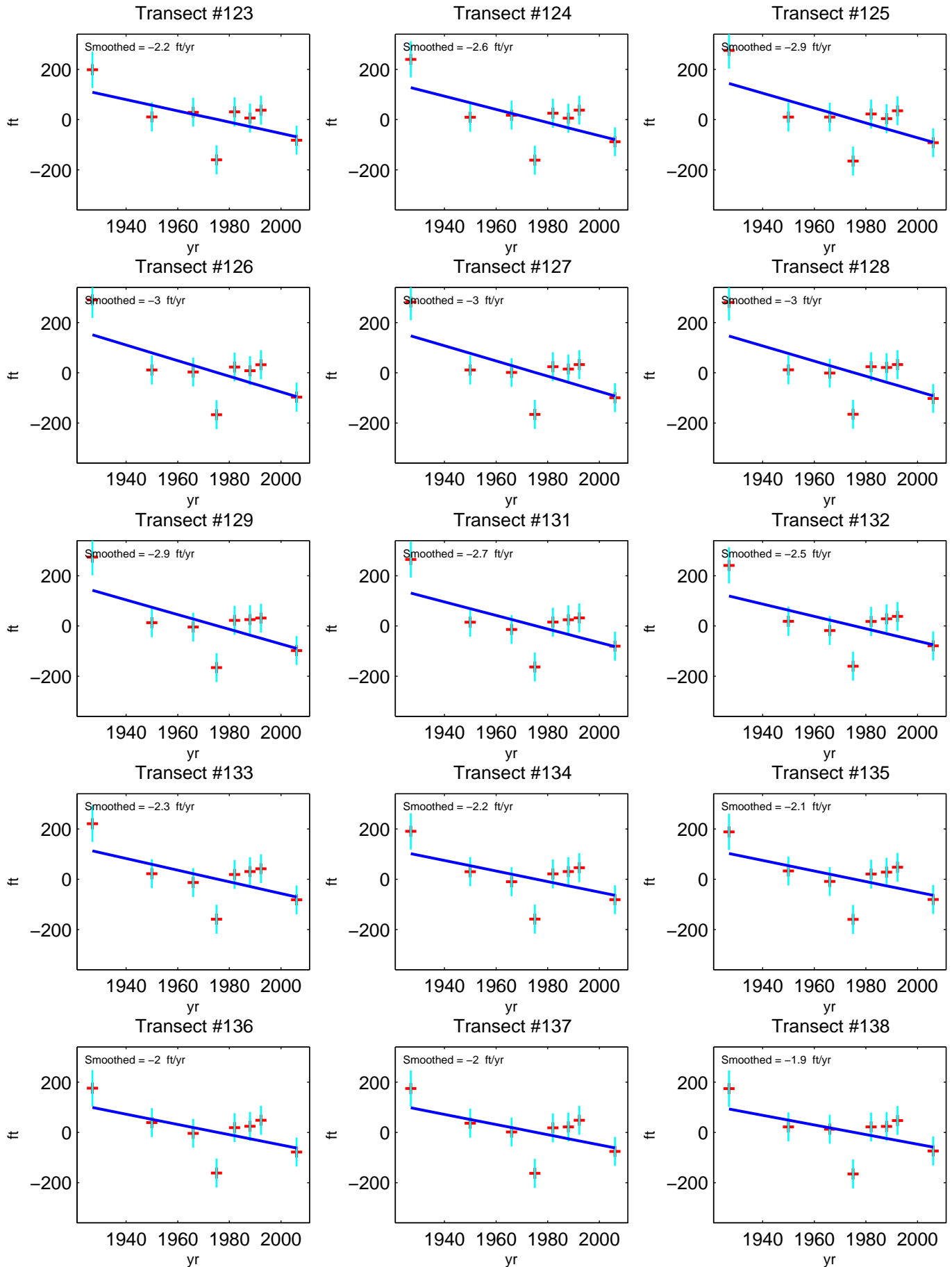
Positive Rate = Accretion
Negative Rate = Erosion



*Hardened Shorelines with no beach are shown with a blue square. The analysis stops at the first hardened shoreline.

Kekaha - Smoothed Shoreline Change Rates

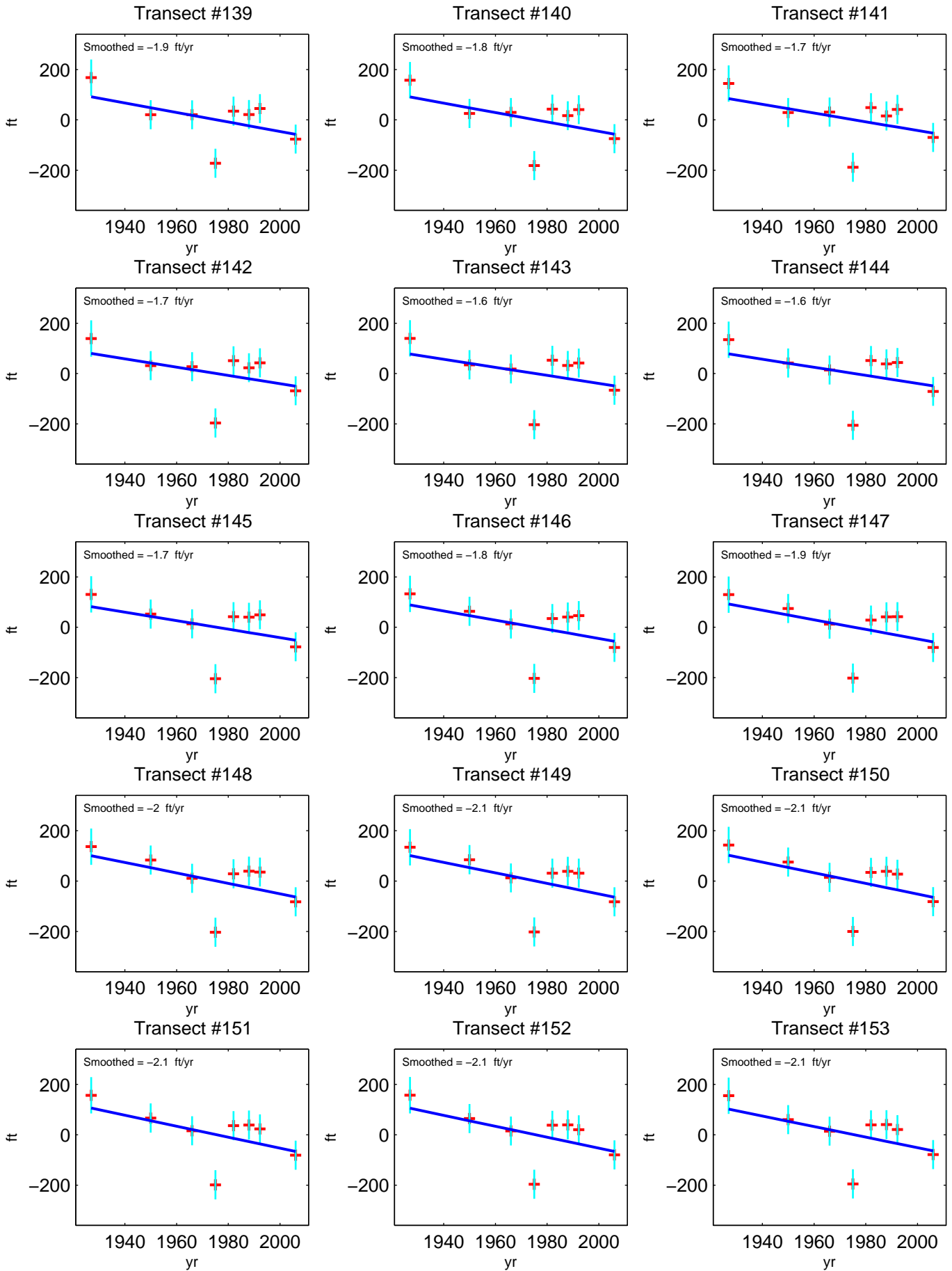
Positive Rate = Accretion
Negative Rate = Erosion



*Hardened Shorelines with no beach are shown with a blue square. The analysis stops at the first hardened shoreline.

Kekaha - Smoothed Shoreline Change Rates

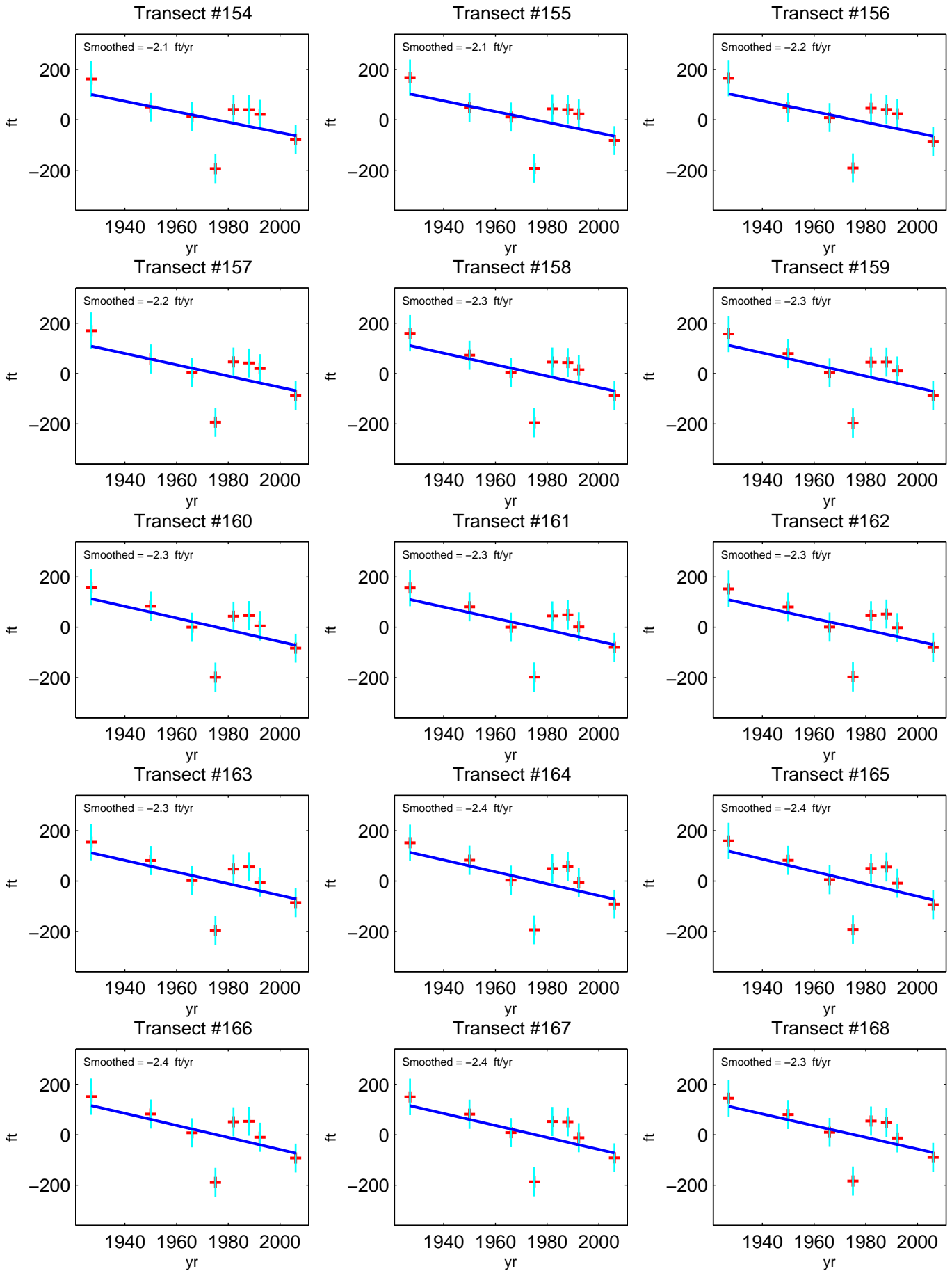
Positive Rate = Accretion
Negative Rate = Erosion



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Kekaha - Smoothed Shoreline Change Rates

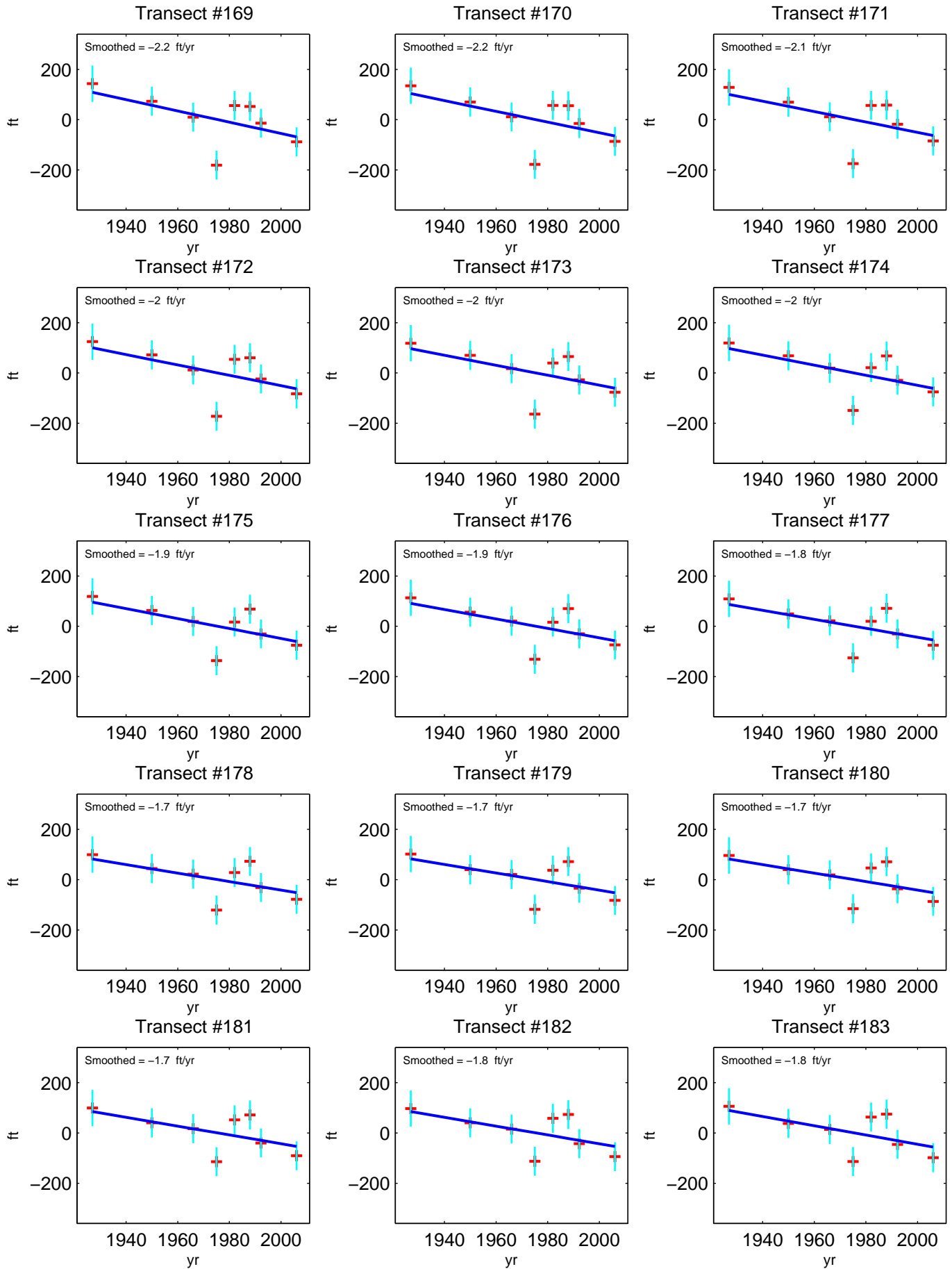
Positive Rate = Accretion
Negative Rate = Erosion



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Kekaha - Smoothed Shoreline Change Rates

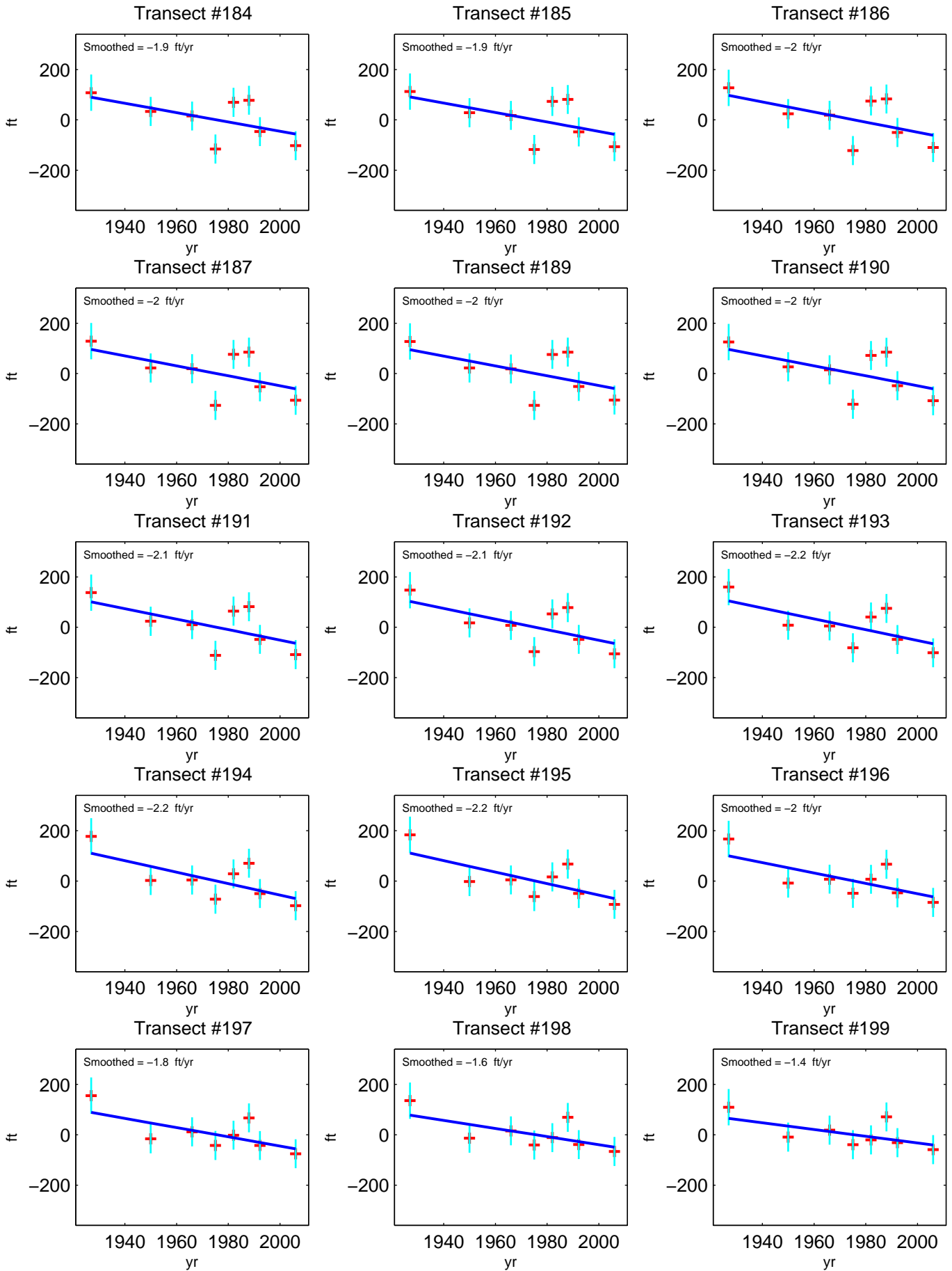
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Negative Rate = Erosion



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Kekaha - Smoothed Shoreline Change Rates

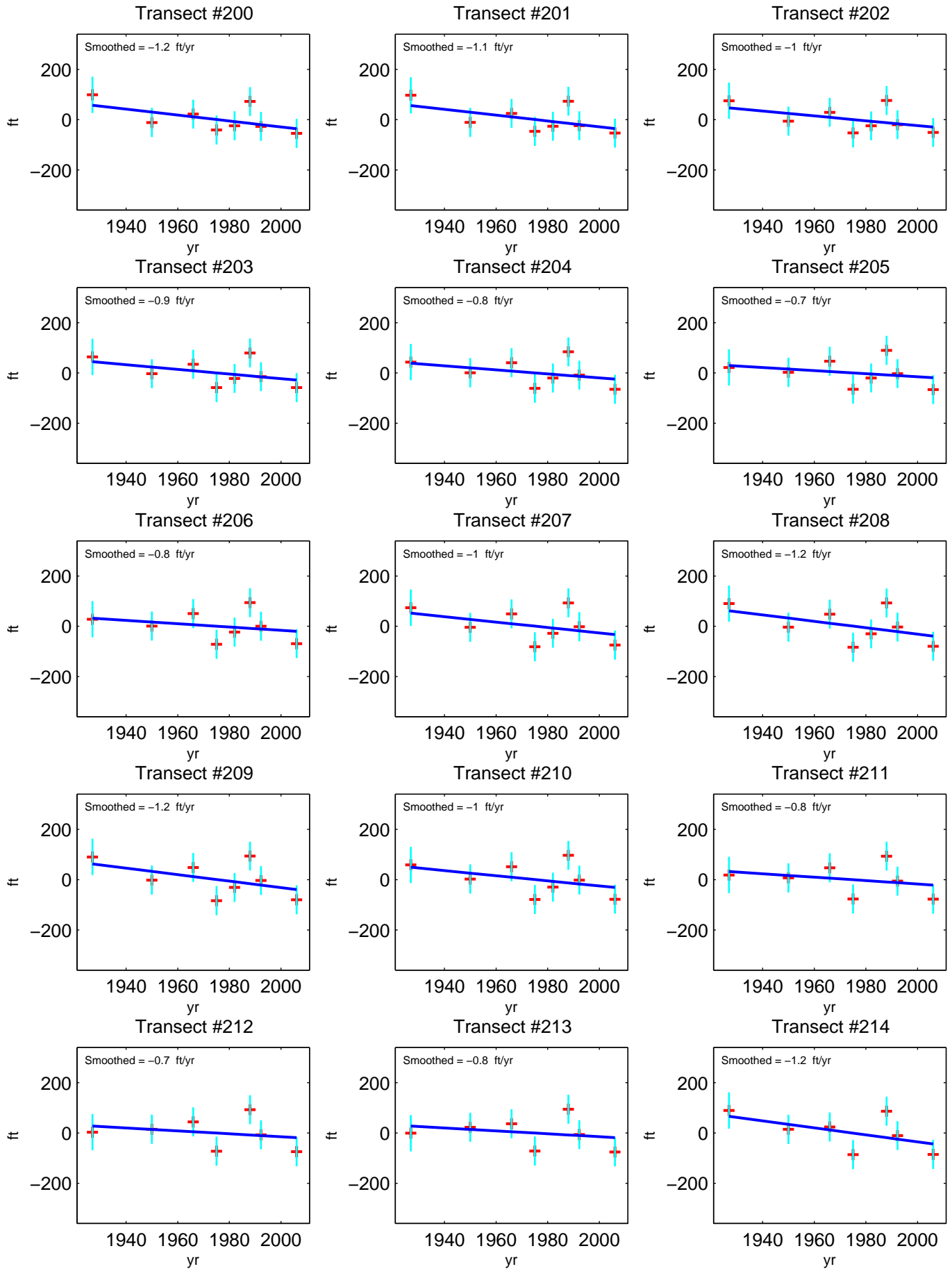
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Negative Rate = Erosion



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Kekaha - Smoothed Shoreline Change Rates

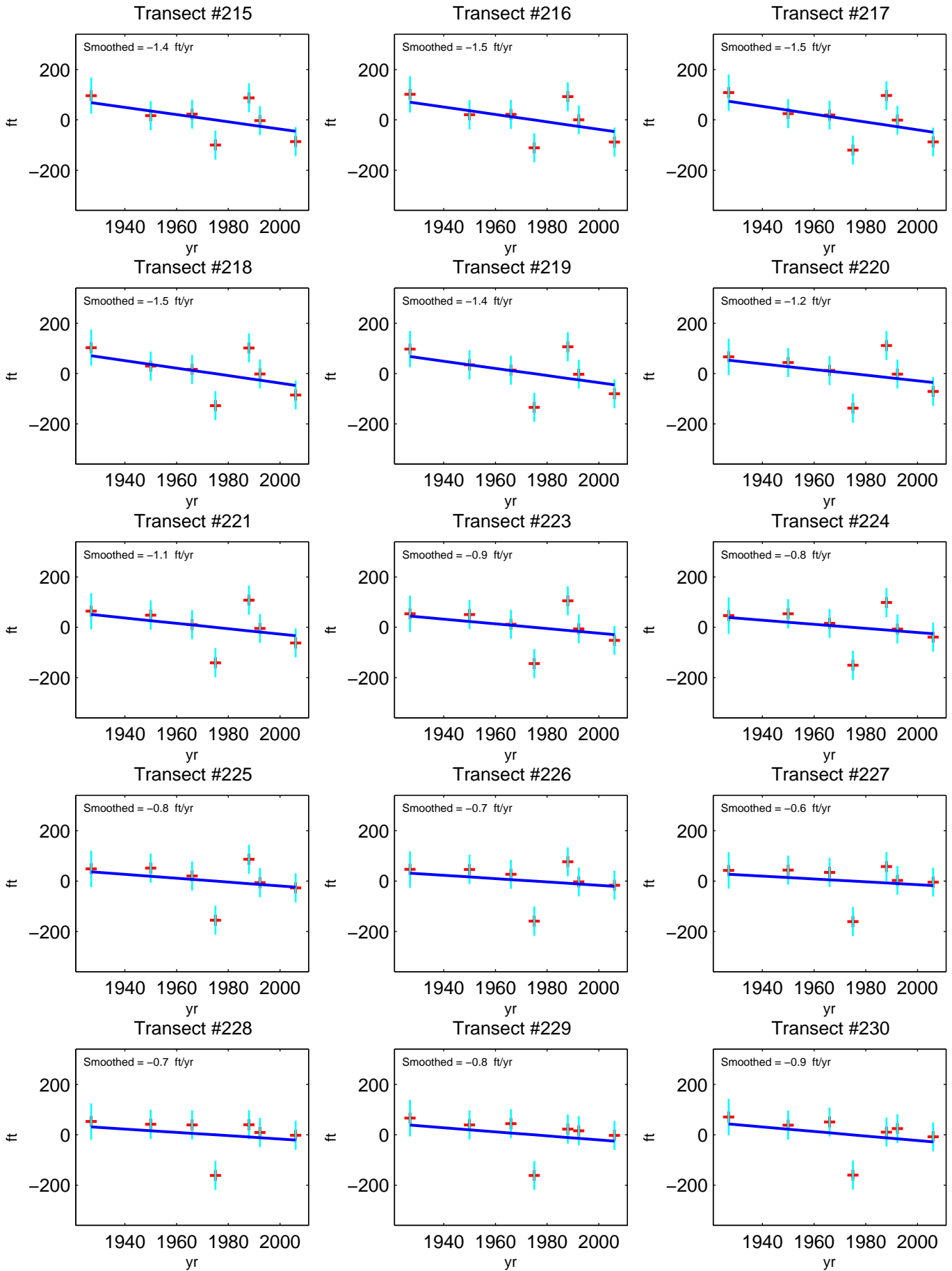
Positive Rate = Accretion
Negative Rate = Erosion



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Kekaha - Smoothed Shoreline Change Rates

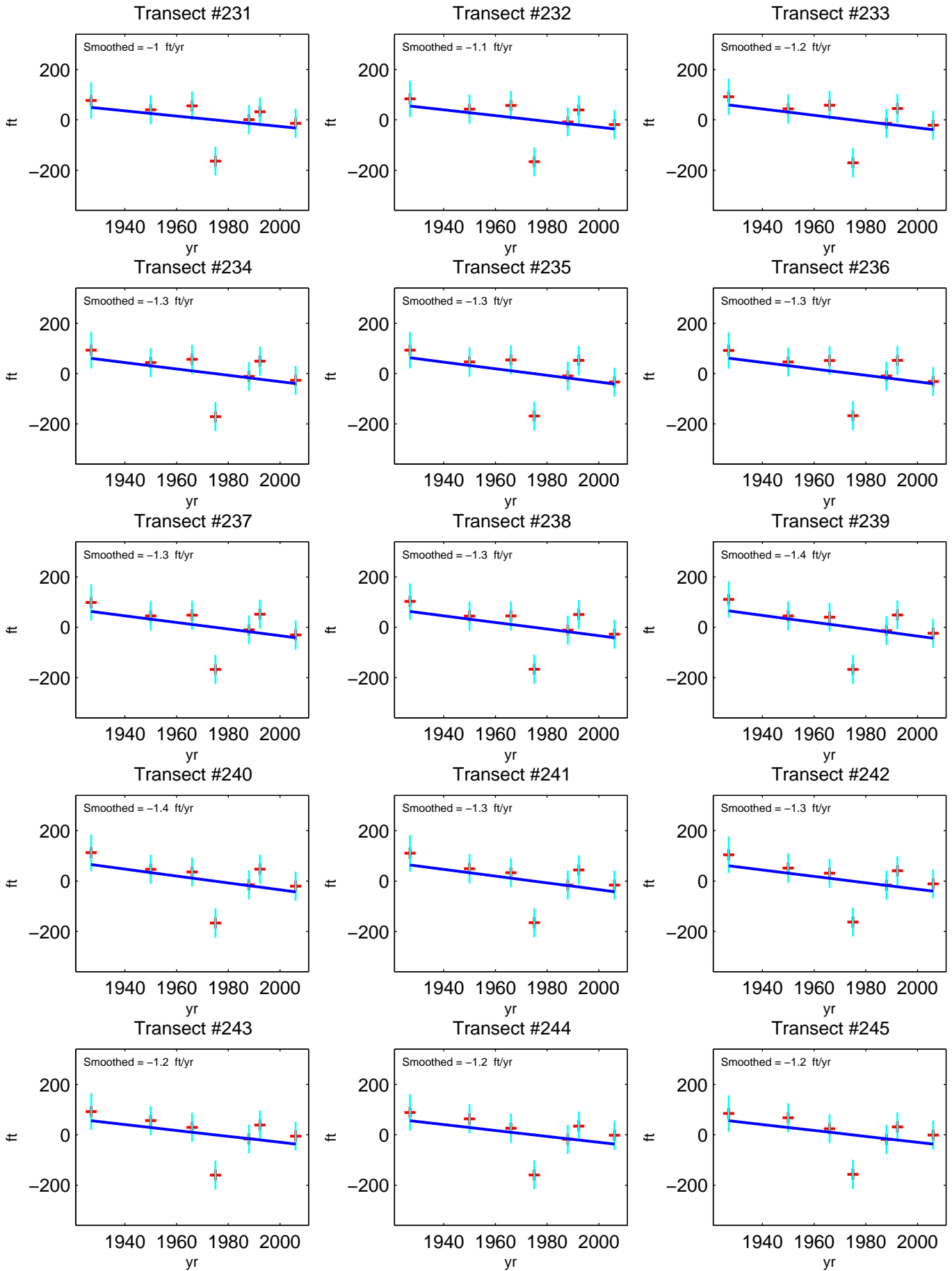
Positive Rate = Accretion
Negative Rate = Erosion



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Kekaha - Smoothed Shoreline Change Rates

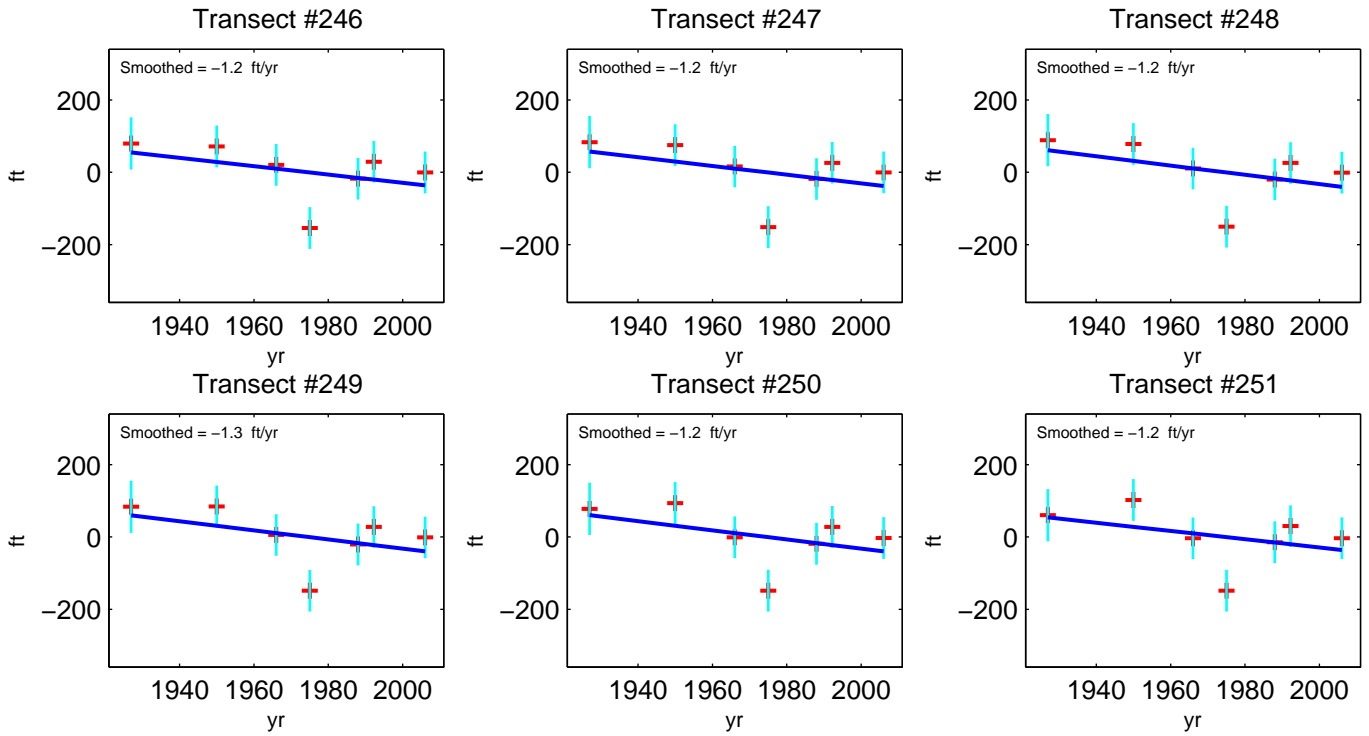
Positive Rate = Accretion
Negative Rate = Erosion



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Kekaha - Smoothed Shoreline Change Rates

Positive Rate = Accretion
Negative Rate = Erosion



*Hardened Shorelines with no beach are shown with a blue square. The analysis stops at the first hardened shoreline.

Oomano Point, Kauai, Hawaii

AREA DESCRIPTION

Oomano Point study area is characterized by a narrow sand beach and hardened shoreline. The area is bounded by Kekaha Beach to the west and Kikiaoloa Small Boat Harbor to the east. The beach is composed of black volcanic sand, mud, and calcareous sand. Terrestrial material is primarily delivered by the Waimea River which is located to the east.

The shoreline is exposed to south wave swell during the summer and occasional wrapping of northwest waves during the winter as well as persistent tradewinds. Oomano Point (*aka* Davidson's Point, transects 59 - 61) lies central to the area and effectively divides the area into two sections for description purposes. Previous studies¹ discuss the impact of Kikiaoloa Small Boat Harbor, built in 1959, which interrupts alongshore sediment transport from the east. The resulting erosion at and near Oomano Point has threatened Kaunualii Hwy, and led to the construction of an extensive revetment by the U.S. Army Corps of Engineers to mitigate further erosion.

Overall, the Oomano study area (transects 0 - 106) is experiencing erosion at an average rate of -2.1 ft/yr. The eastern section of the area (transects 0 - 59) is experiencing erosion at an average rate of -2.7 ft/yr while the western section (transects 61 - 106) is eroding at an average rate of -1.3 ft/yr.

¹ Makai Ocean Engineering and Sea Engineering, 1991 Aerial Photograph Analysis of Coastal Erosion on the Islands of Kauai, Molokai, Lanai, Maui, and Hawaii. State of Hawaii Office of Coastal Zone Management Program.

SHORELINE CHANGE RATES

- █ Accretion Rate
- █ Erosion Rate

Historical shoreline positions are measured every 66 ft along the shoreline. These sites are denoted by yellow shore-perpendicular transects. Changes in the position of the shorelines through time are used to calculate shoreline change rates (ft/yr) at each transect location.

Annual shoreline change rates are shown on the shore-parallel graph. Red bars on the graph indicate a trend of beach erosion, while blue bars indicate a trend of accretion. Approximately every fifth transect and bar of the graph is numbered. Where necessary, transects have been purposely deleted to maintain consistent alongshore spacing. As a result transect numbering is not consecutive everywhere. The rates are smoothed alongshore using a 1-3-5-3-1 technique to normalize rate differences on adjacent transects.

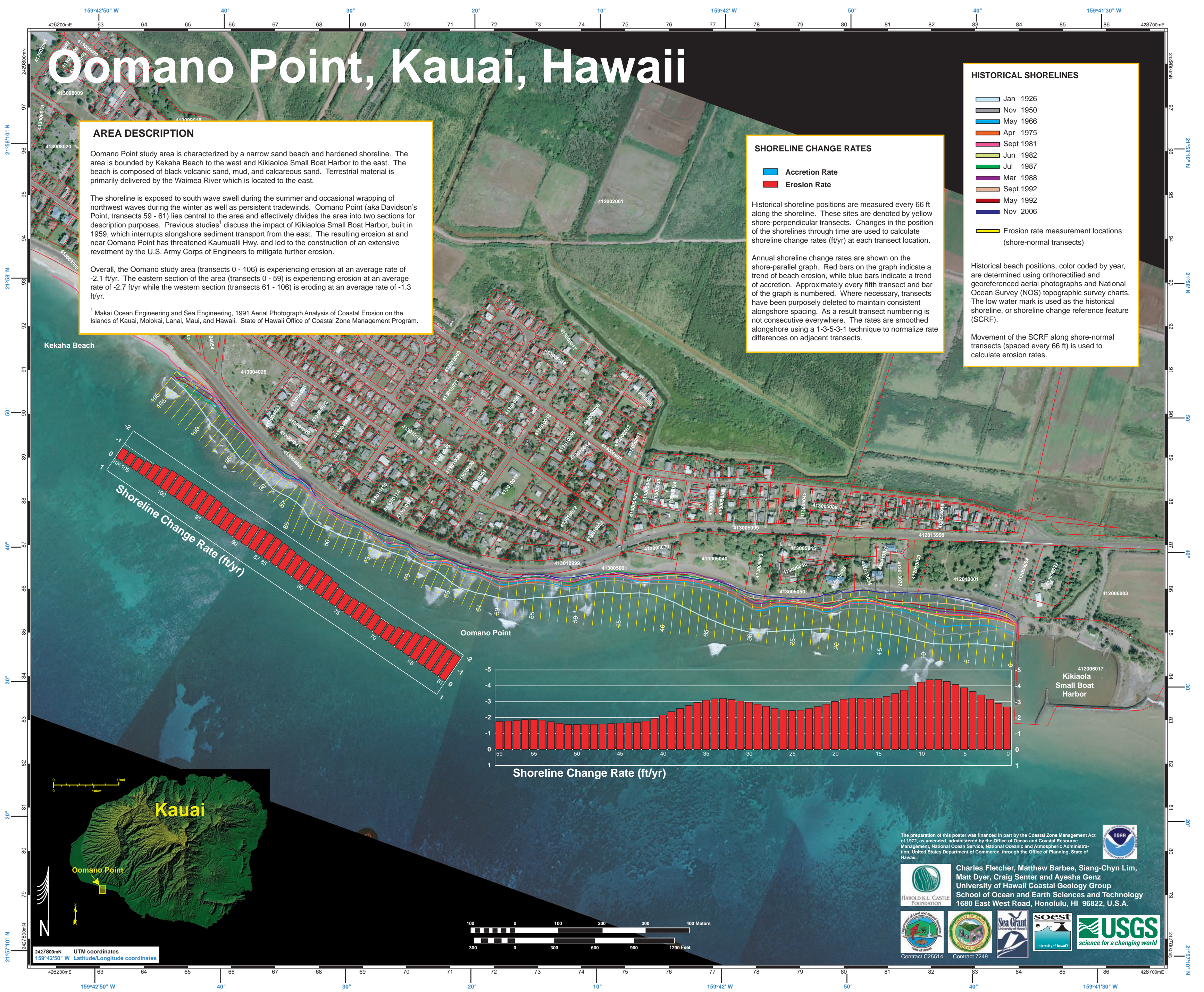
HISTORICAL SHORELINES

- Jan 1926
- Nov 1950
- May 1966
- Apr 1975
- Sept 1981
- Jun 1982
- Jul 1987
- Mar 1988
- Sept 1992
- May 1992
- Nov 2006

Erosion rate measurement locations (shore-normal transects)

Historical beach positions, color coded by year, are determined using orthorectified and georeferenced aerial photographs and National Ocean Survey (NOS) topographic survey charts. The low water mark is used as the historical shoreline, or shoreline change reference feature (SCRF).

Movement of the SCRF along shore-normal transects (spaced every 66 ft) is used to calculate erosion rates.



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 School of Ocean and Earth Sciences and Technology
 1680 East West Road, Honolulu, HI 96822, U.S.A.

Contract C25514 Contract 7249

2427800mN UTM coordinates
 159°42'50" W Latitude/Longitude coordinates

Oomano Point - Smoothed Rates

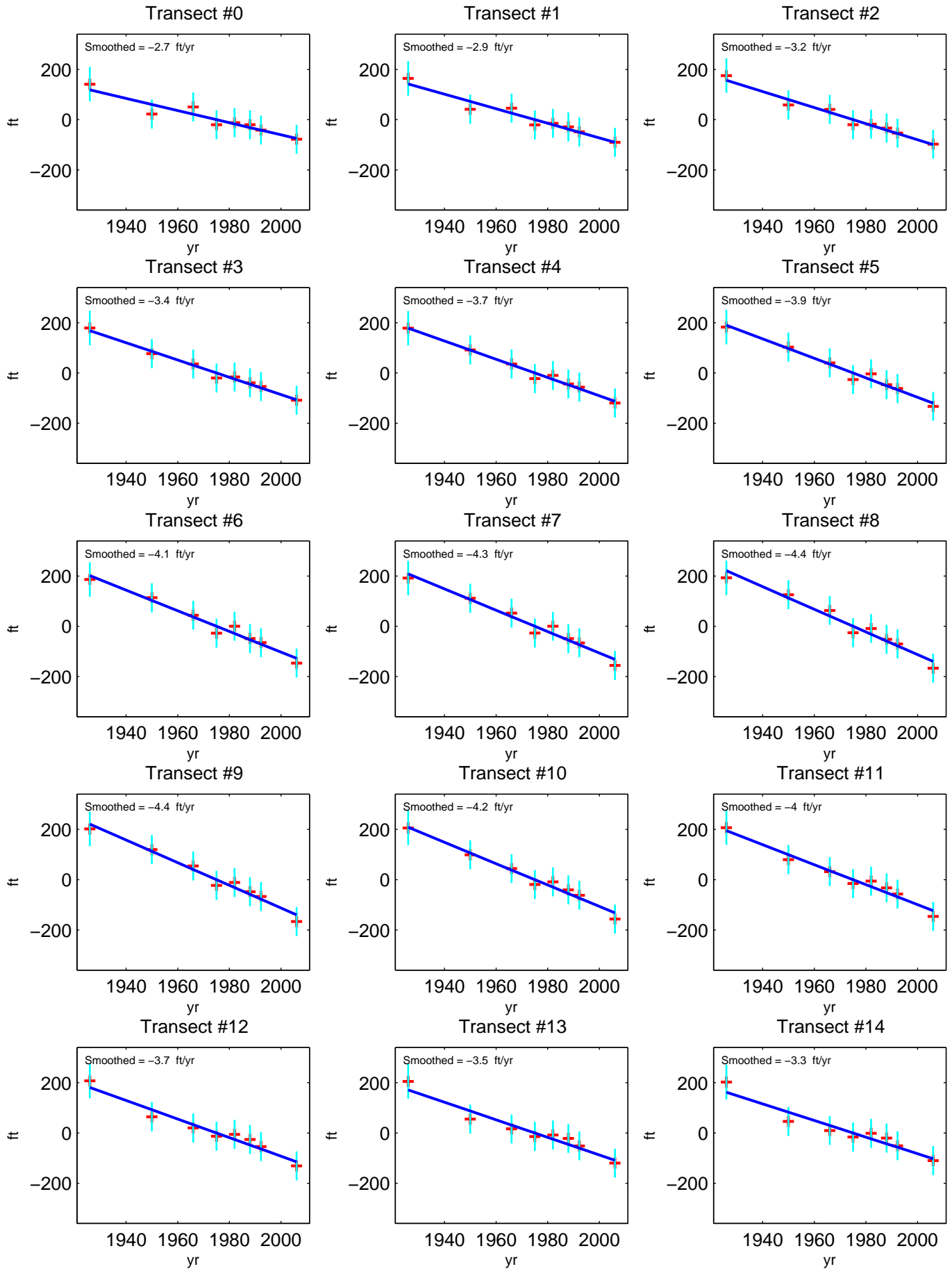
Positive Rate = Accretion
Negative Rate = Erosion

Transect	Smoothed Rate (ft/yr)	Transect	Smoothed Rate (ft/yr)	Transect	Smoothed Rate (ft/yr)
0	-2.7	46	-1.6	94	-1.4
1	-2.9	47	-1.6	95	-1.4
2	-3.2	48	-1.6	96	-1.4
3	-3.4	49	-1.6	97	-1.4
4	-3.7	50	-1.6	98	-1.3
5	-3.9	51	-1.6	99	-1.4
6	-4.1	52	-1.6	100	-1.3
7	-4.3	53	-1.8	101	-1.2
8	-4.4	54	-1.9	102	-1.1
9	-4.4	55	-1.9	103	-0.9
10	-4.2	56	-1.9	104	-0.8
11	-4.0	57	-1.8	105	-0.8
12	-3.7	58	-1.8	106	-0.7
13	-3.5	59	-1.8		
14	-3.3	61	-1.8		
15	-3.2	62	-1.8		
16	-3.2	63	-1.8		
17	-3.2	64	-1.8		
18	-3.2	65	-1.6		
19	-3.2	66	-1.5		
20	-3.0	67	-1.3		
21	-2.8	68	-1.2		
22	-2.7	69	-1.0		
23	-2.6	70	-1.0		
24	-2.5	71	-1.0		
25	-2.4	72	-1.1		
26	-2.5	73	-1.1		
27	-2.6	74	-1.1		
28	-2.7	75	-1.0		
29	-2.9	76	-1.1		
30	-3.0	77	-1.3		
31	-3.1	78	-1.4		
32	-3.1	79	-1.4		
33	-3.2	80	-1.3		
34	-3.2	81	-1.3		
35	-3.1	82	-1.4		
36	-2.9	83	-1.4		
37	-2.8	84	-1.5		
38	-2.6	85	-1.5		
39	-2.4	87	-1.5		
40	-2.2	88	-1.5		
41	-2.0	89	-1.4		
42	-1.8	90	-1.3		
43	-1.7	91	-1.2		
44	-1.7	92	-1.2		
45	-1.7	93	-1.3		

*Imagery indicates beachwidth of zero during period of analysis. Rate calculation reflects data with beach existence.

Oomano Point - Smoothed Shoreline Change Rates

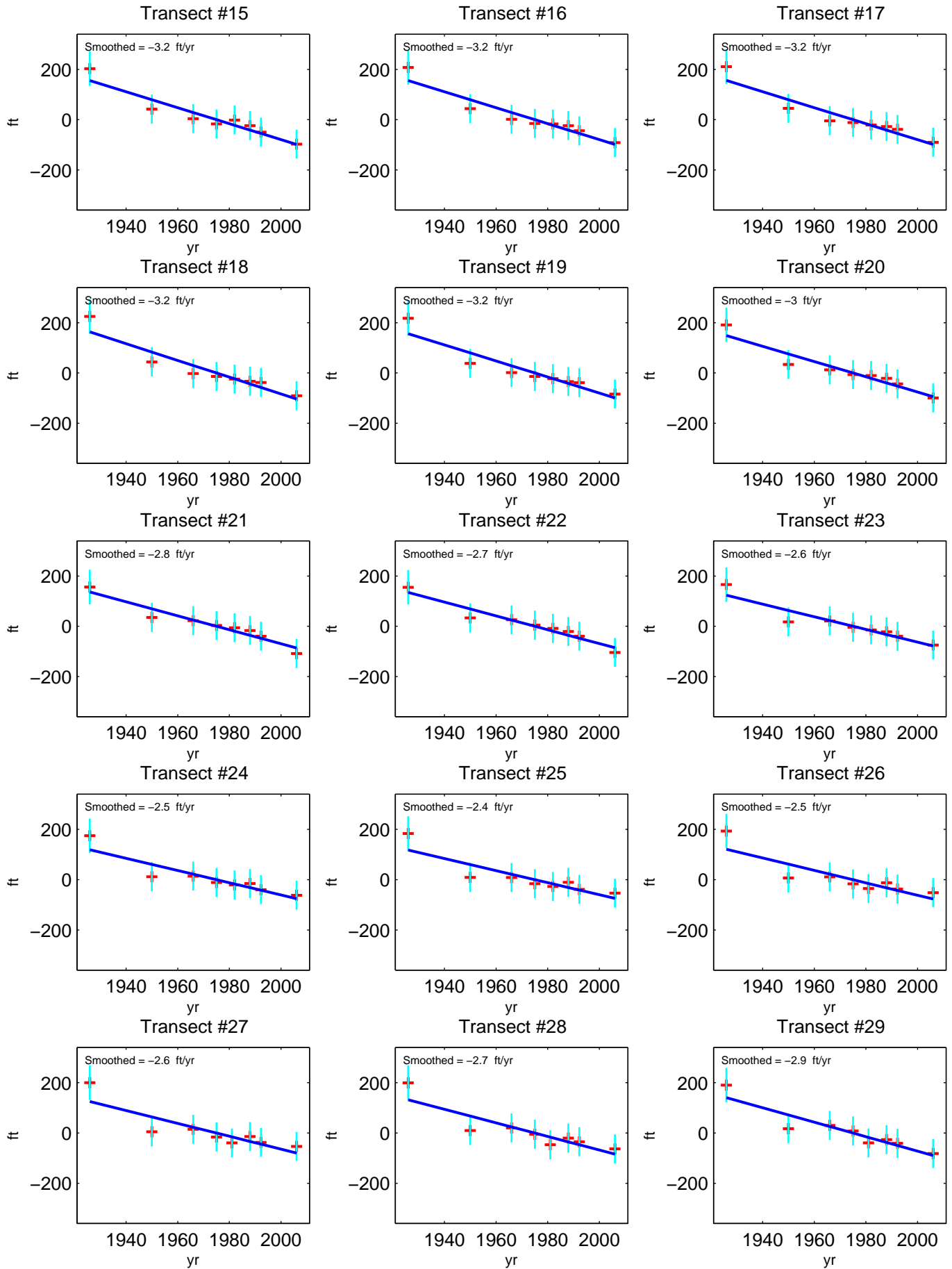
Positive Rate = Accretion
Negative Rate = Erosion



*Hardened Shorelines with no beach are shown with a blue square. The analysis stops at the first hardened shoreline.

Oomano Point - Smoothed Shoreline Change Rates

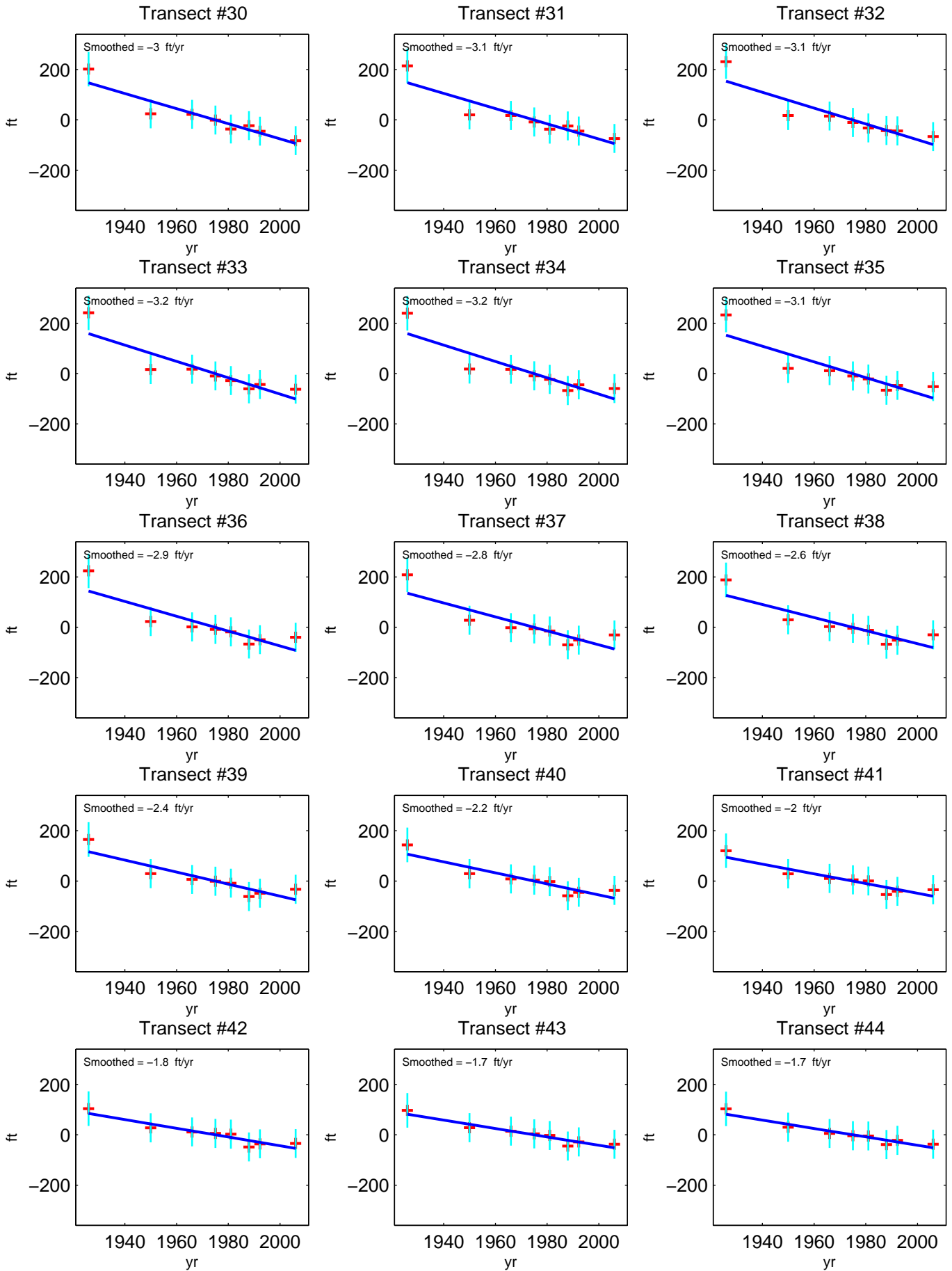
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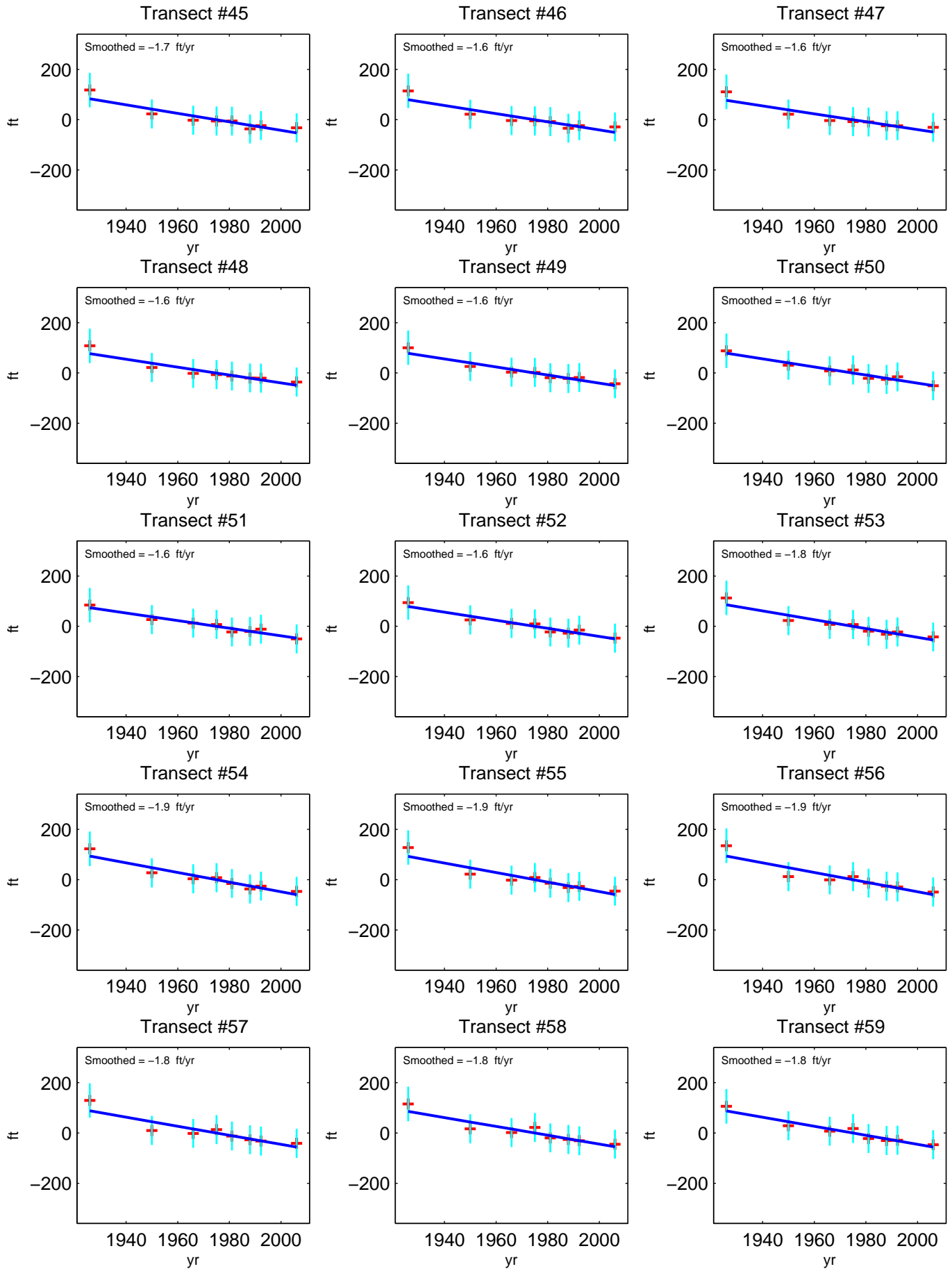
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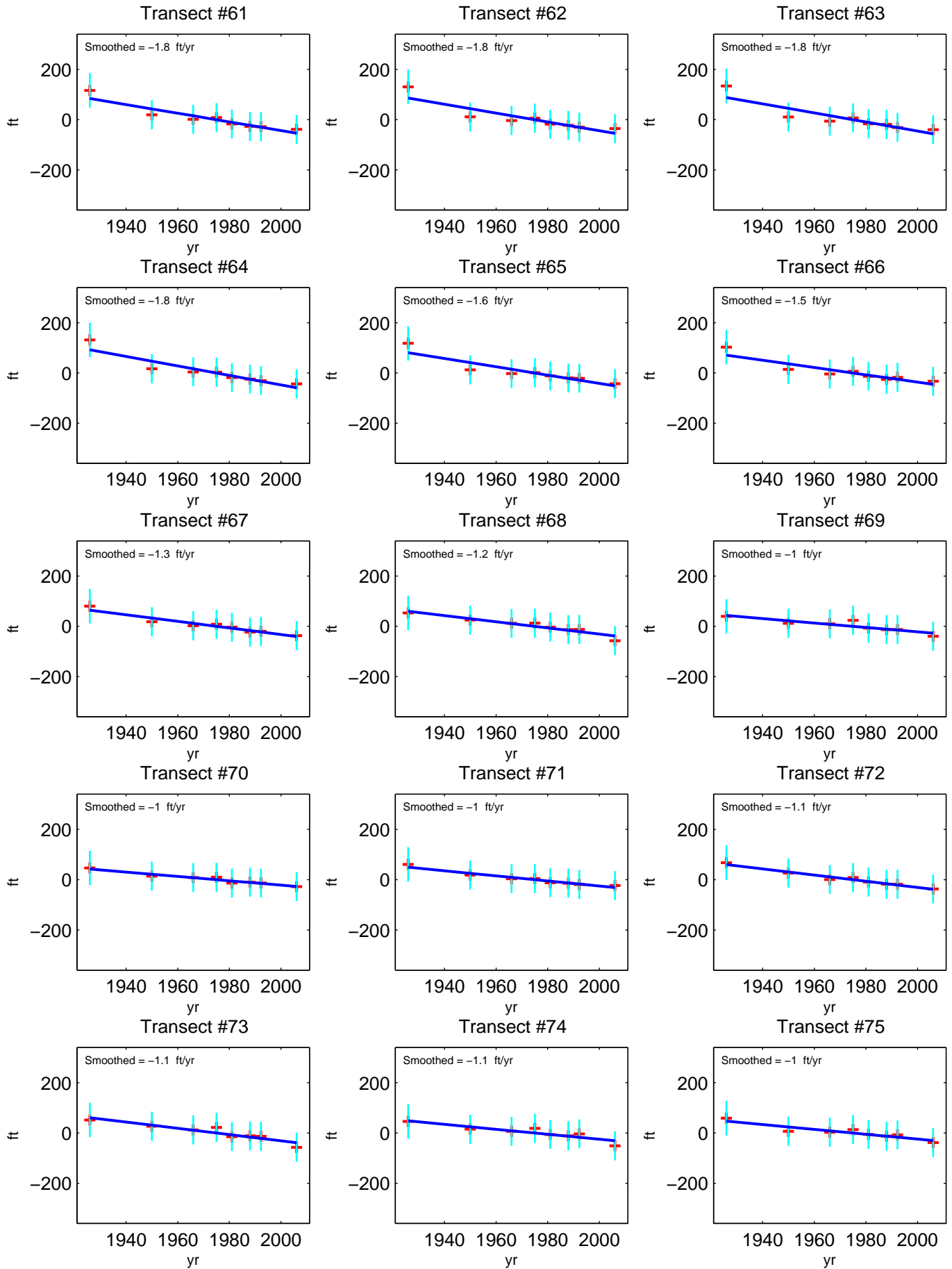
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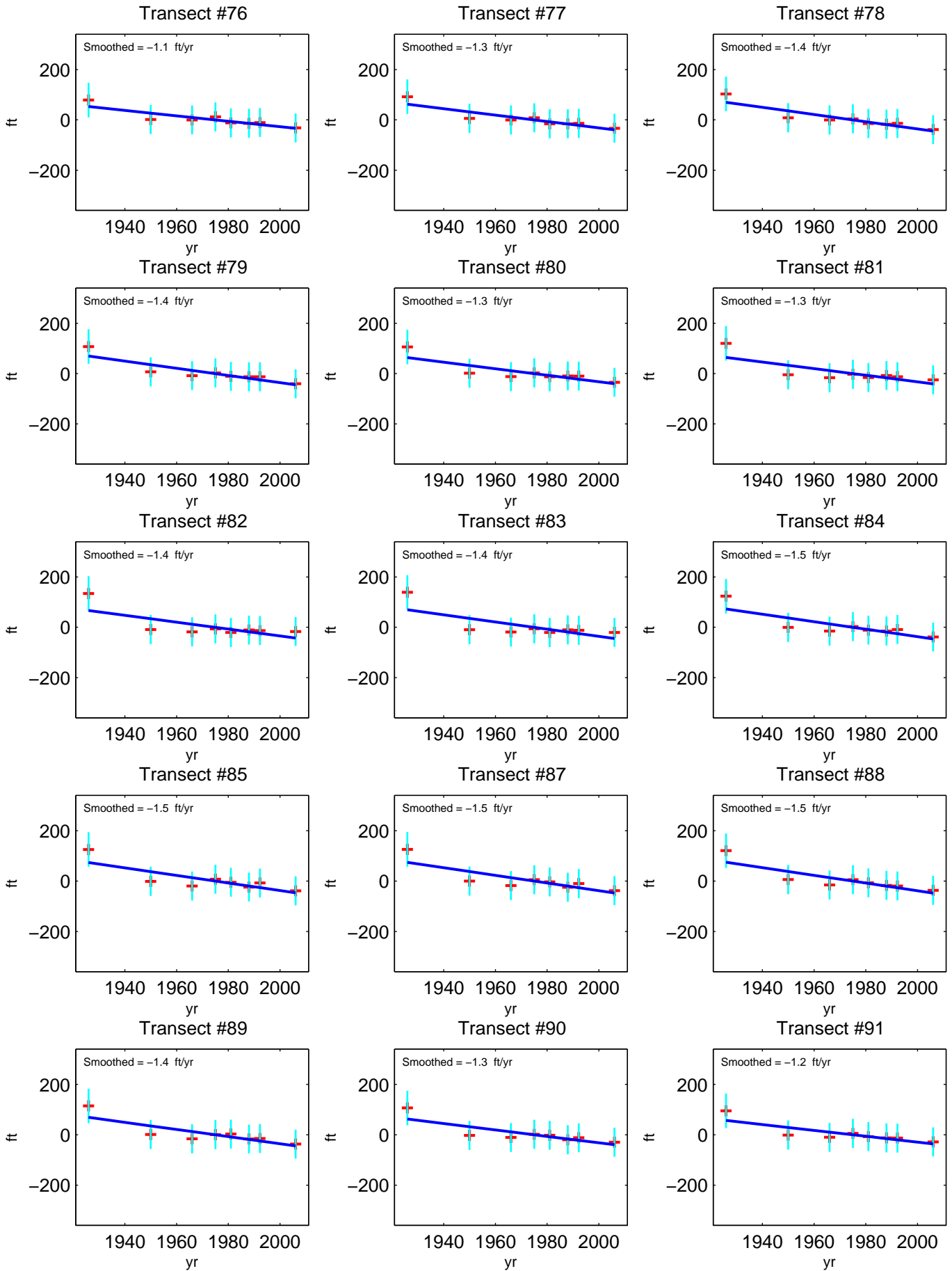
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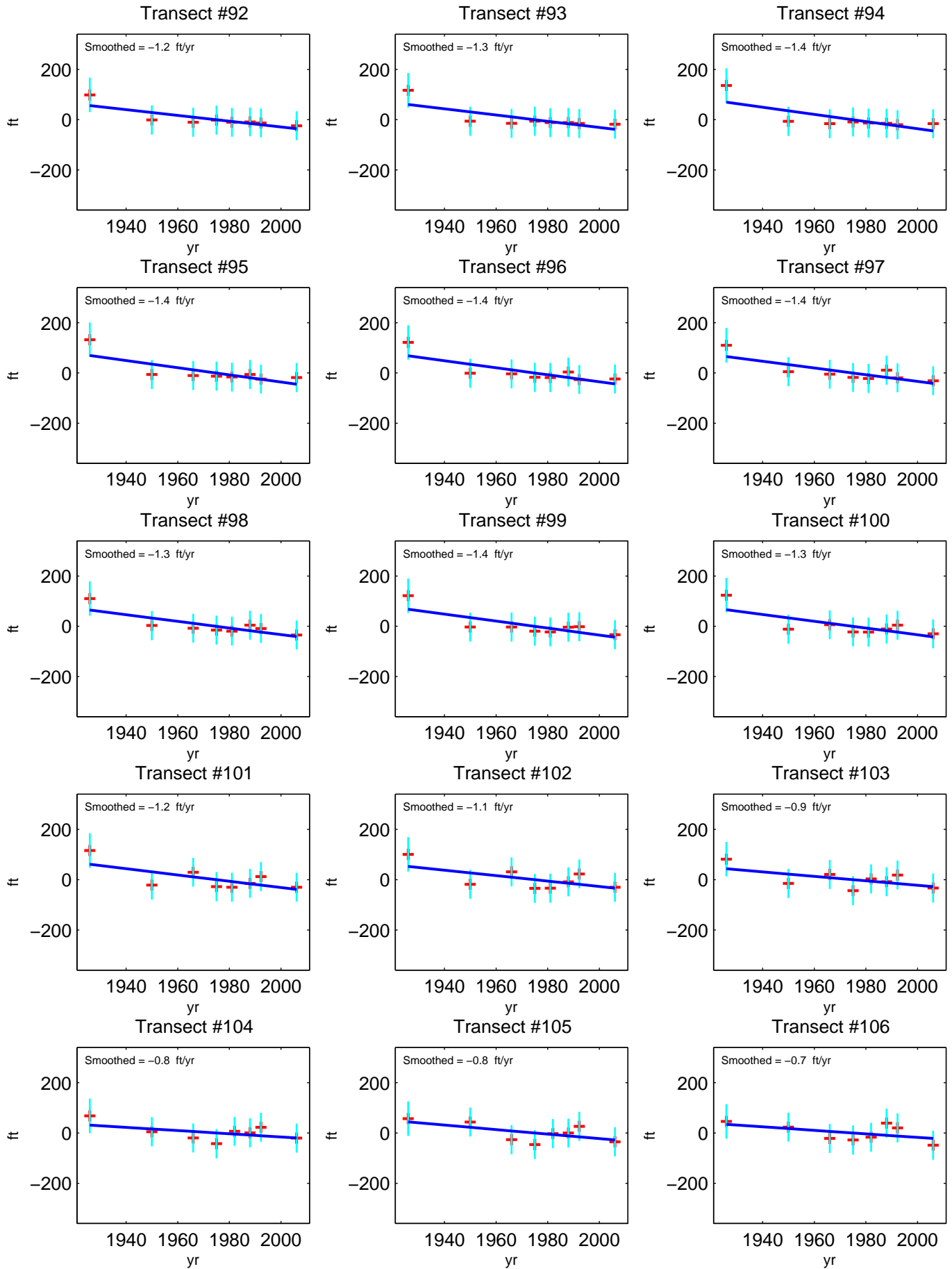
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