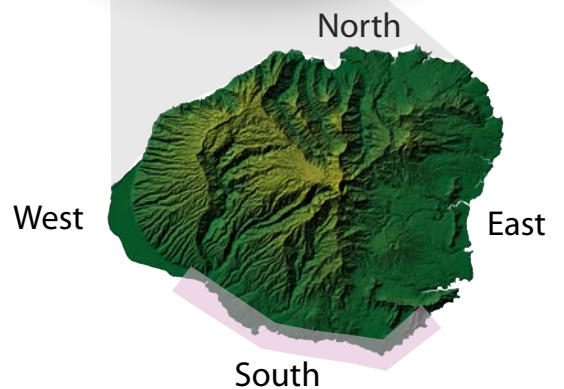
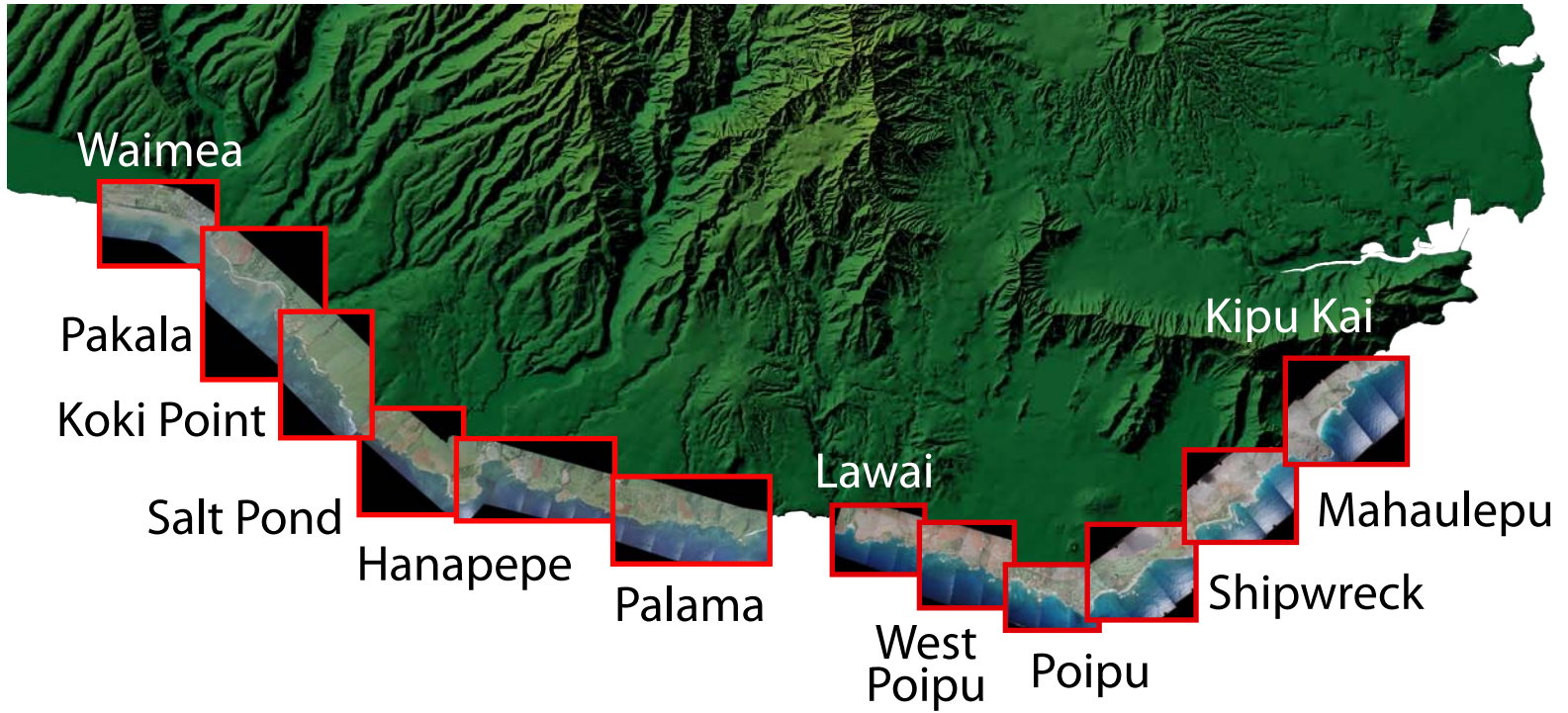
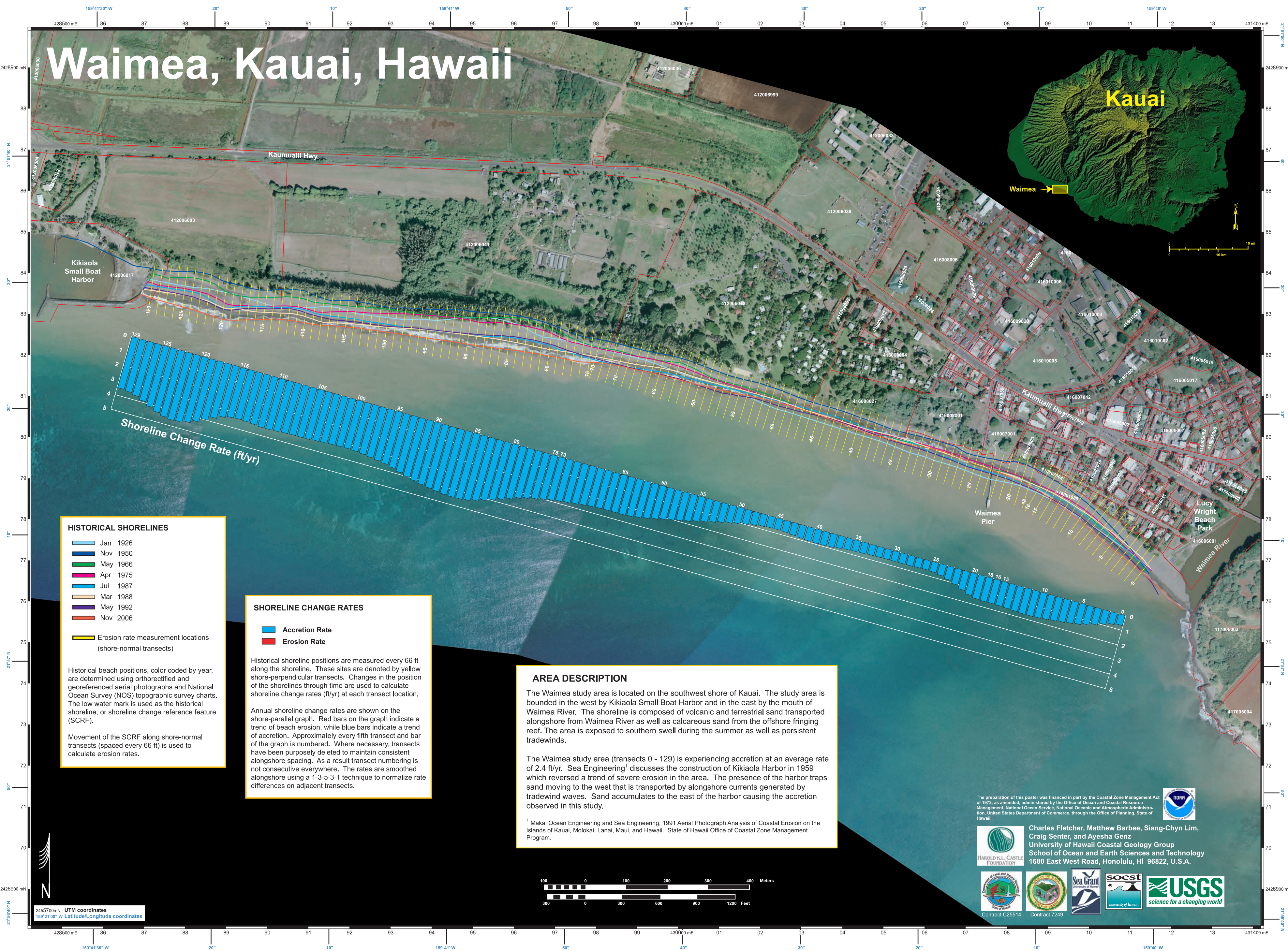
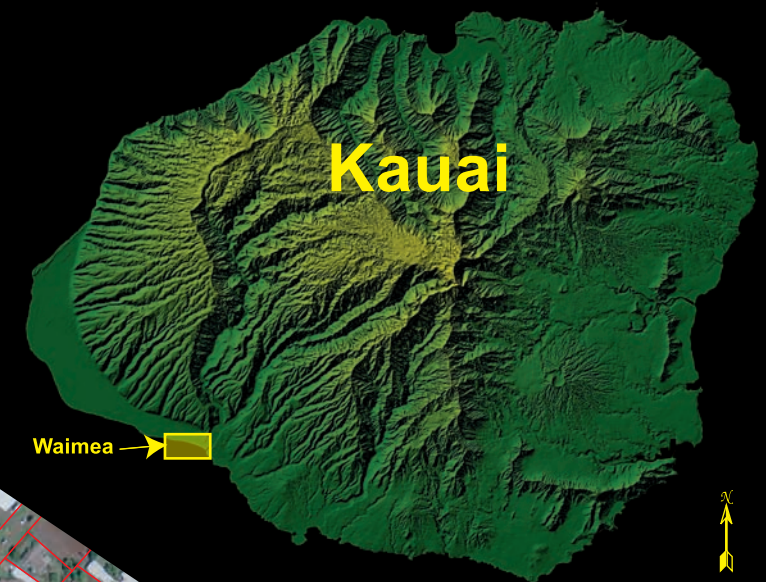


South Coast, Kauai, Hawaii



Waimea, Kauai, Hawaii



HISTORICAL SHORELINES

- Jan 1926
- Nov 1950
- May 1966
- Apr 1975
- Jul 1987
- Mar 1988
- 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.

AREA DESCRIPTION

The Waimea study area is located on the southwest shore of Kauai. The study area is bounded in the west by Kikiaola Small Boat Harbor and in the east by the mouth of Waimea River. The shoreline is composed of volcanic and terrestrial sand transported alongshore from Waimea River as well as calcareous sand from the offshore fringing reef. The area is exposed to southern swell during the summer as well as persistent tradewinds.

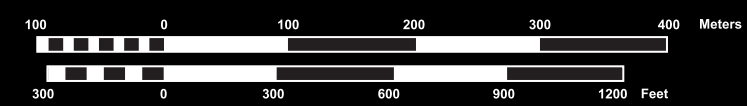
The Waimea study area (transects 0 - 129) is experiencing accretion at an average rate of 2.4 ft/yr. Sea Engineering¹ discusses the construction of Kikiaola Harbor in 1959 which reversed a trend of severe erosion in the area. The presence of the harbor traps sand moving to the west that is transported by alongshore currents generated by tradewind waves. Sand accumulates to the east of the harbor causing the accretion observed in this study.

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.

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Contract C25514 Contract 7249



2455700mN UTM coordinates
 159°21'00" W Latitude/Longitude coordinates

Waimea - Smoothed Rates

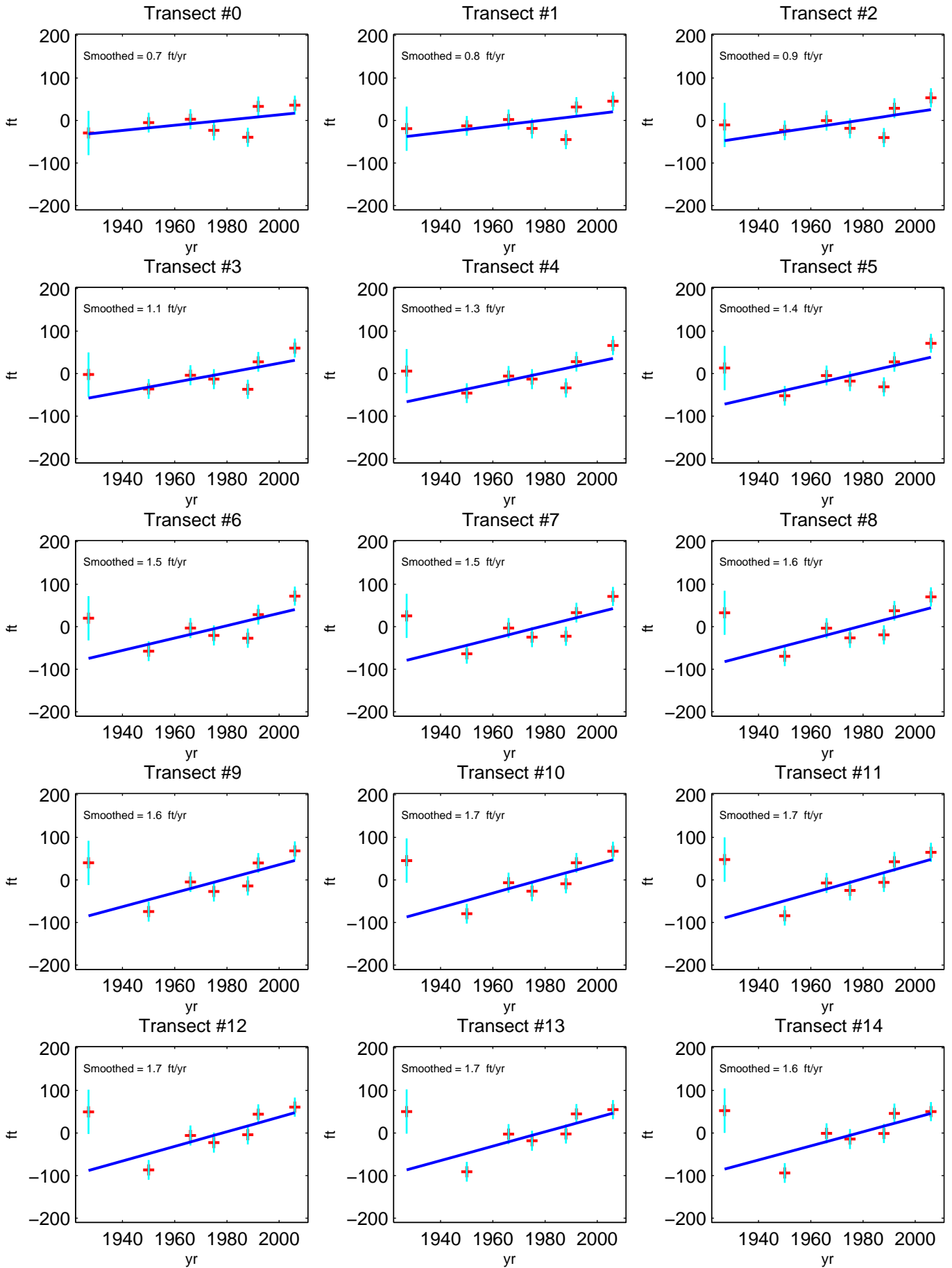
Positive Rate = Accretion
Negative Rate = Erosion

Transect	Smoothed Rate (ft/yr)	Transect	Smoothed Rate (ft/yr)	Transect	Smoothed Rate (ft/yr)
0	0.7	47	0.8	94	3.7
1	0.8	48	0.9	95	3.6
2	0.9	49	1.0	96	3.5
3	1.1	50	1.1	97	3.4
4	1.3	51	1.2	98	3.3
5	1.4	52	1.3	99	3.3
6	1.5	53	1.4	100	3.3
7	1.5	54	1.5	101	3.3
8	1.6	55	1.7	102	3.3
9	1.6	56	1.8	103	3.3
10	1.7	57	1.9	104	3.3
11	1.7	58	2.0	105	3.4
12	1.7	59	2.1	106	3.4
13	1.7	60	2.2	107	3.4
14	1.6	61	2.4	108	3.4
15	1.6	62	2.5	109	3.4
16	1.6	63	2.5	110	3.5
18	1.6	64	2.5	111	3.5
19	1.6	65	2.5	112	3.4
20	1.5	66	2.5	113	3.4
21	1.3	67	2.6	114	3.3
22	1.1	68	2.6	115	3.4
23	0.9	69	2.6	116	3.5
24	0.7	70	2.7	117	3.7
25	0.7	71	2.8	118	4.0
26	0.6	72	2.8	119	4.3
27	0.6	73	2.9	120	4.5
28	0.7	75	3.0	121	4.6
29	0.7	76	3.1	122	4.6
30	0.7	77	3.2	123	4.5
31	0.7	78	3.4	124	4.4
32	0.7	79	3.6	125	4.1
33	0.7	80	3.8	126	3.9
34	0.7	81	3.9	127	3.7
35	0.7	82	4.1	128	3.6
36	0.8	83	4.3	129	3.5
37	0.8	84	4.4		
38	0.9	85	4.5		
39	0.9	86	4.5		
40	0.9	87	4.5		
41	0.9	88	4.4		
42	0.9	89	4.3		
43	0.8	90	4.2		
44	0.8	91	4.1		
45	0.7	92	4.0		
46	0.7	93	3.8		

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

Waimea - Smoothed Shoreline Change Rates

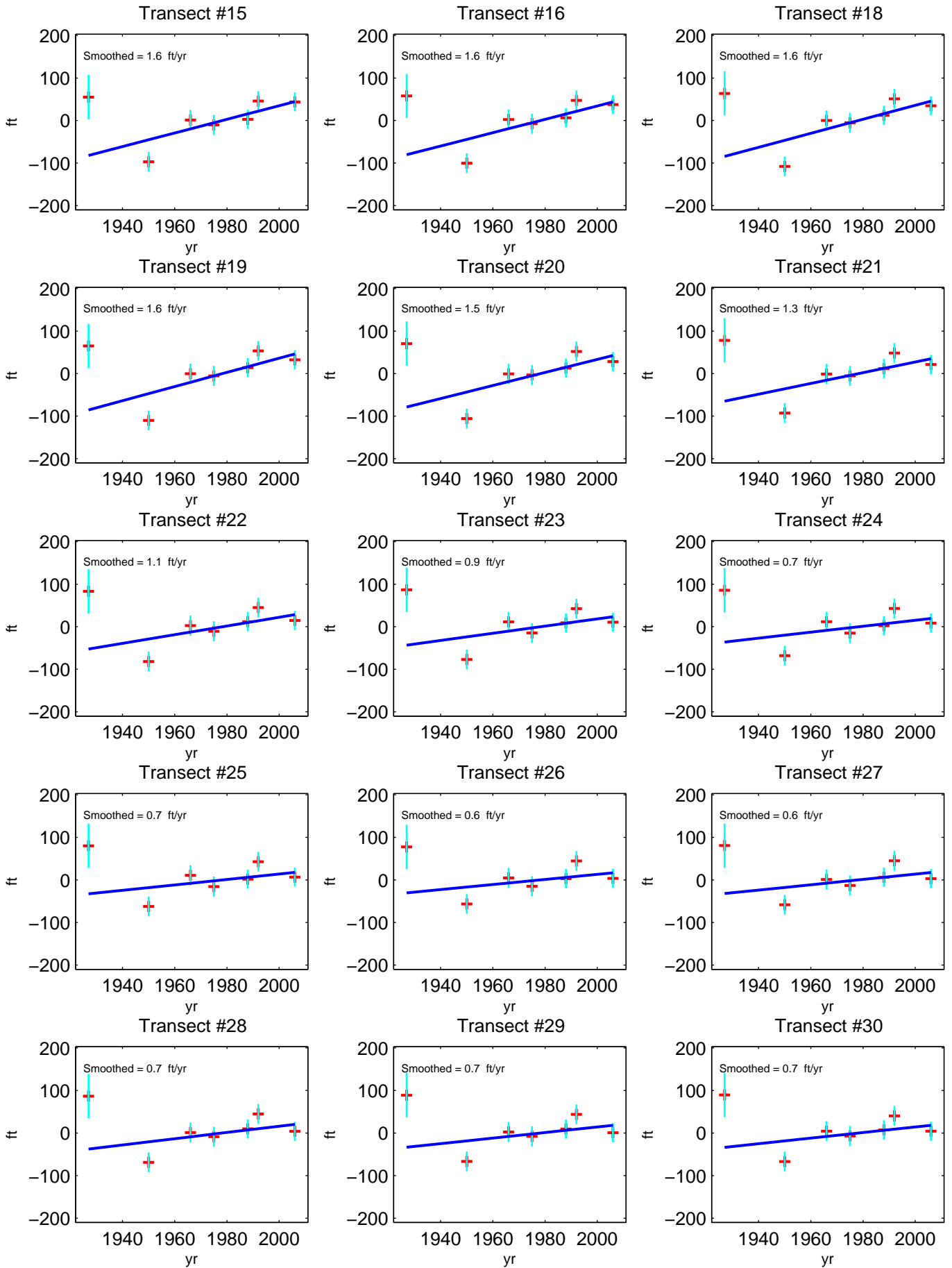
Positive Rate = Accretion
Negative Rate = Erosion



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

Waimea - Smoothed Shoreline Change Rates

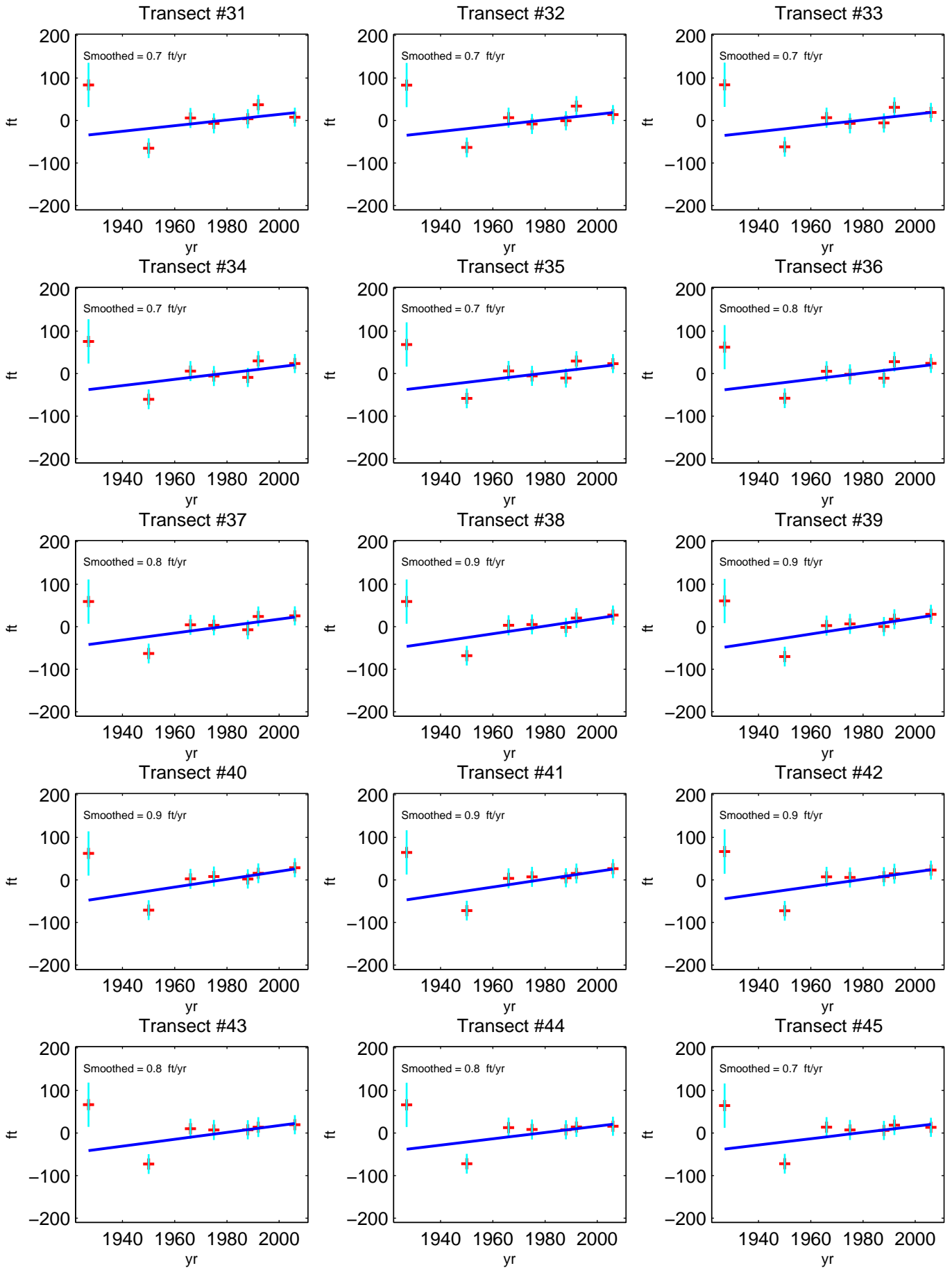
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Waimea - Smoothed Shoreline Change Rates

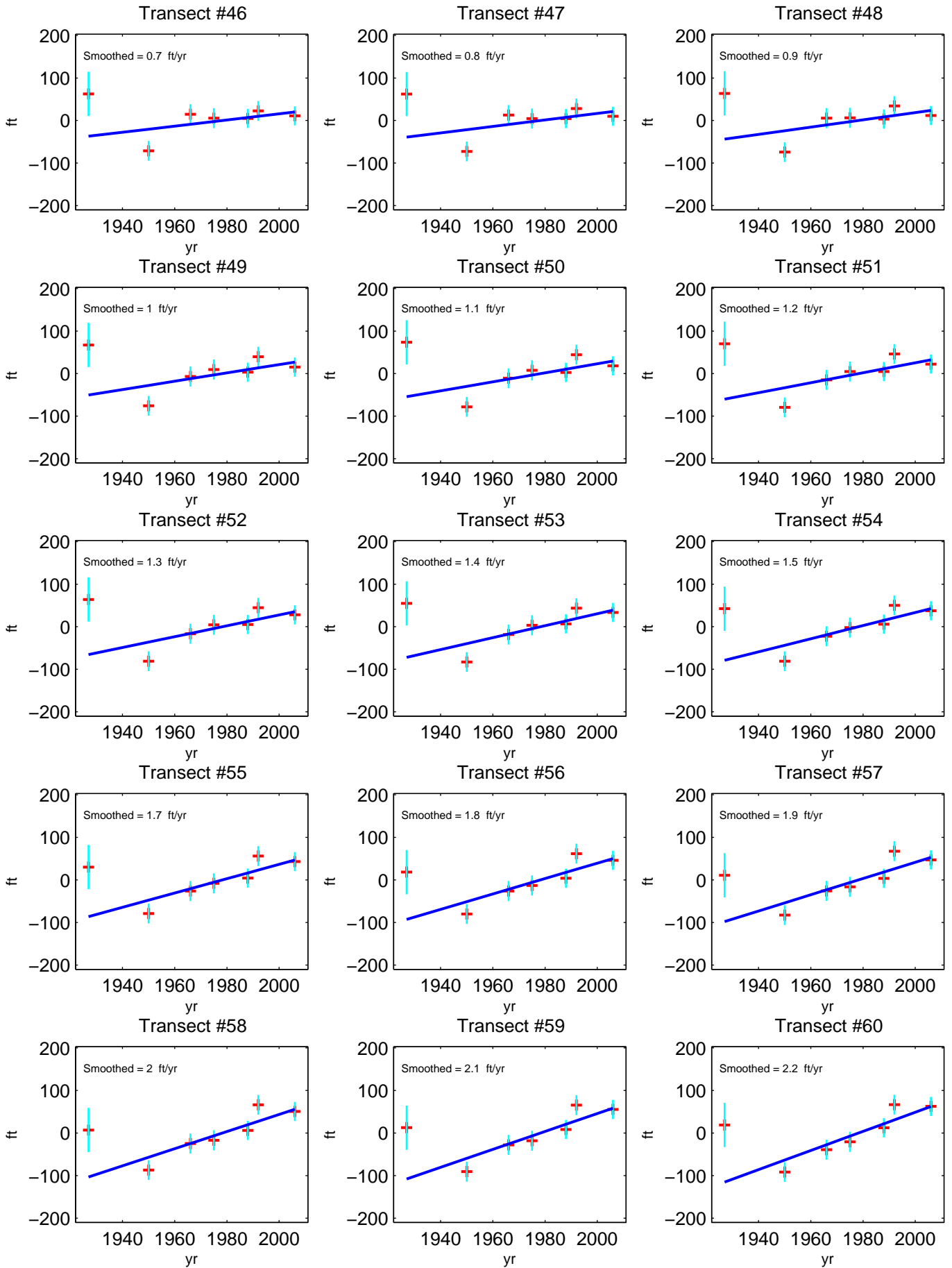
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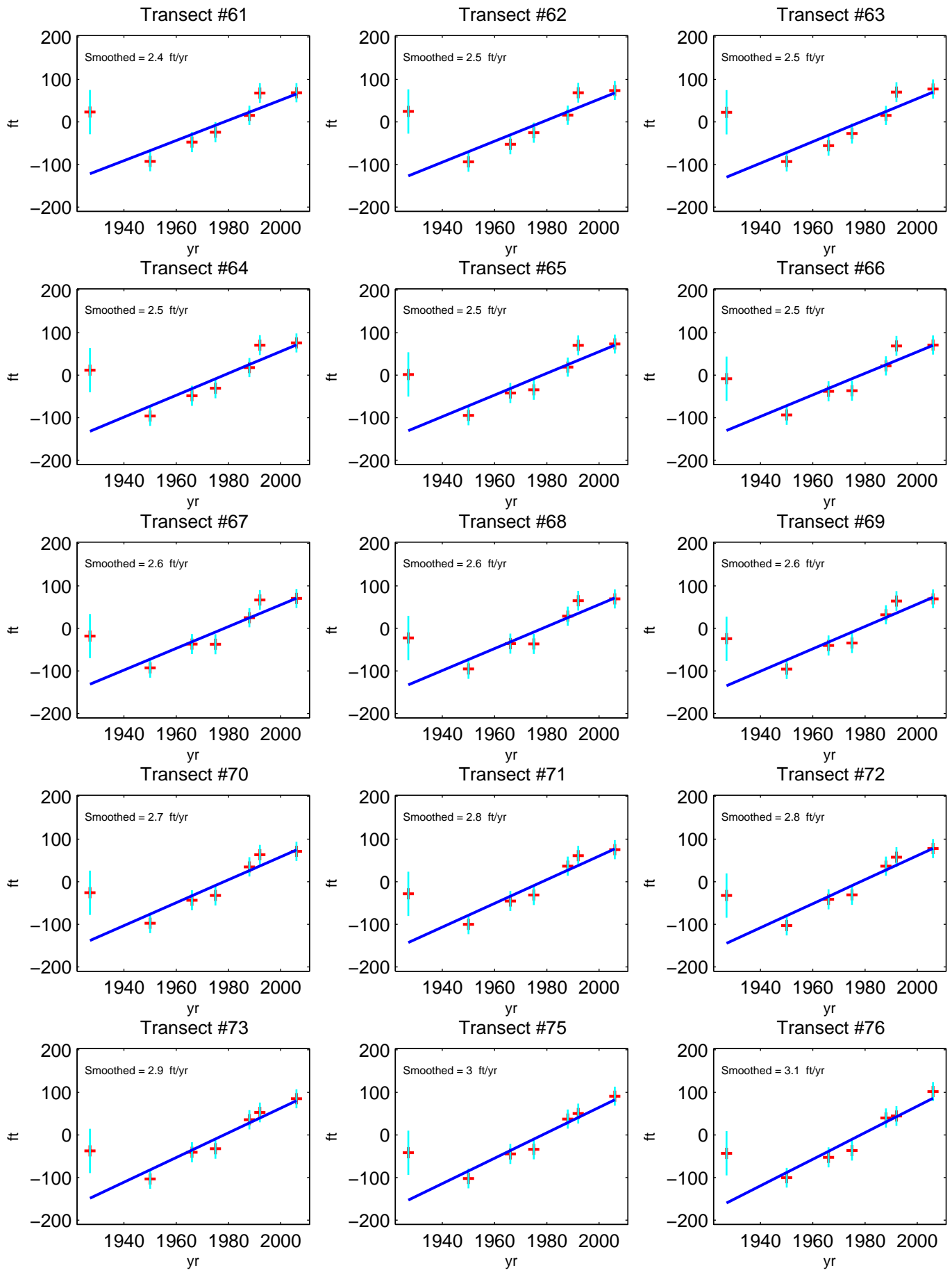
Positive Rate = Accretion
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Waimea - Smoothed Shoreline Change Rates

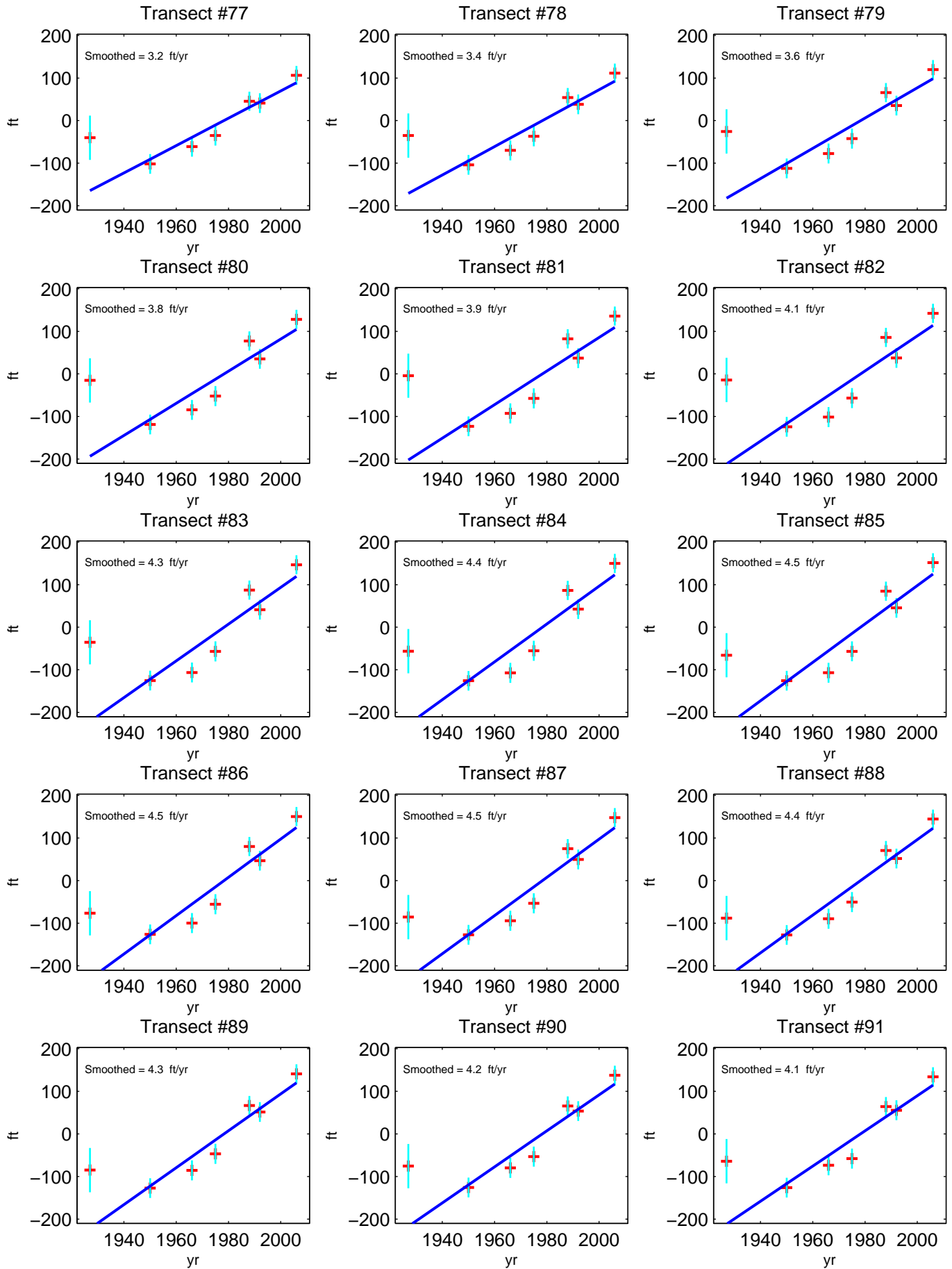
Positive Rate = Accretion
Negative Rate = Erosion



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Waimea - Smoothed Shoreline Change Rates

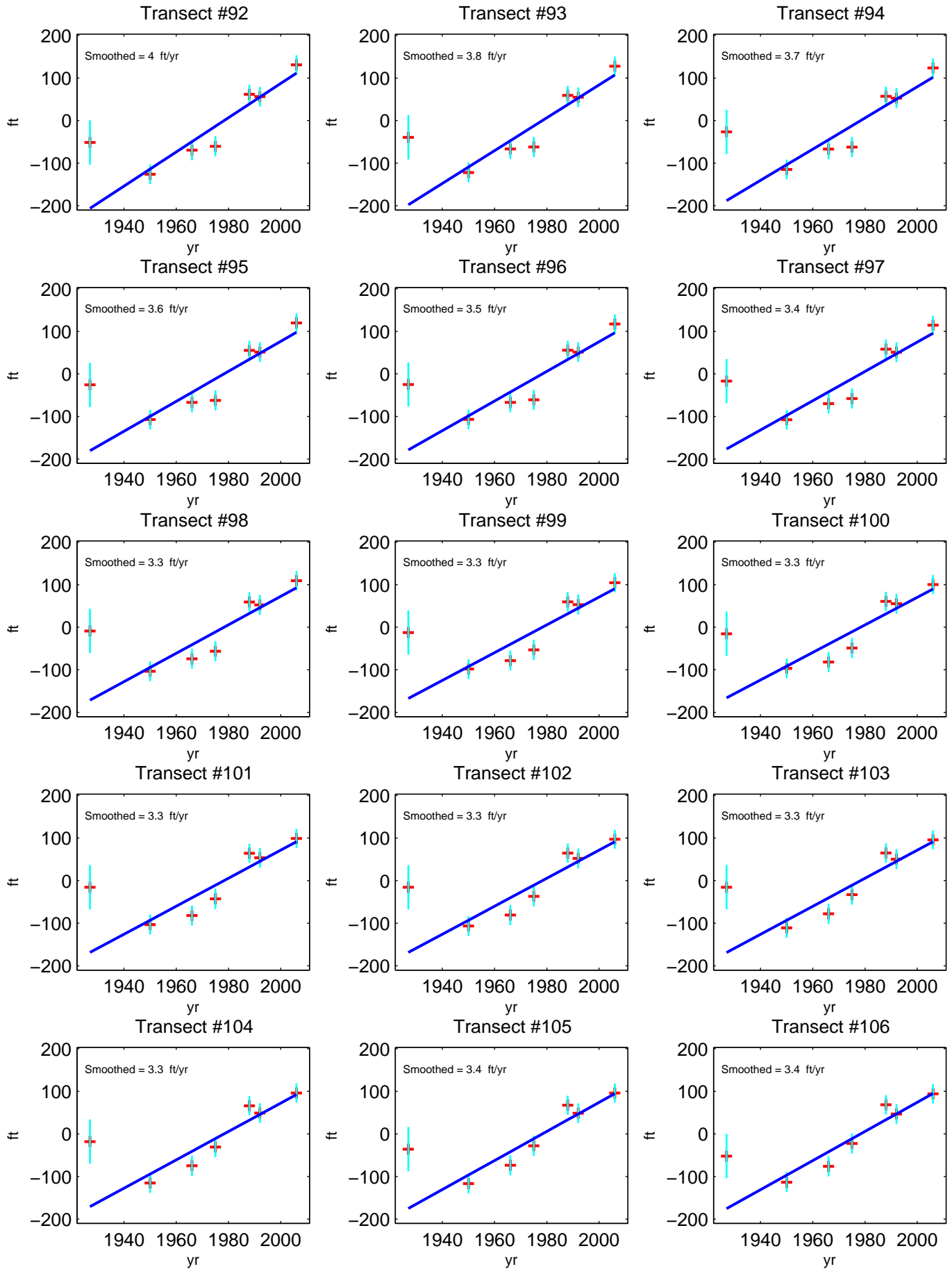
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Waimea - Smoothed Shoreline Change Rates

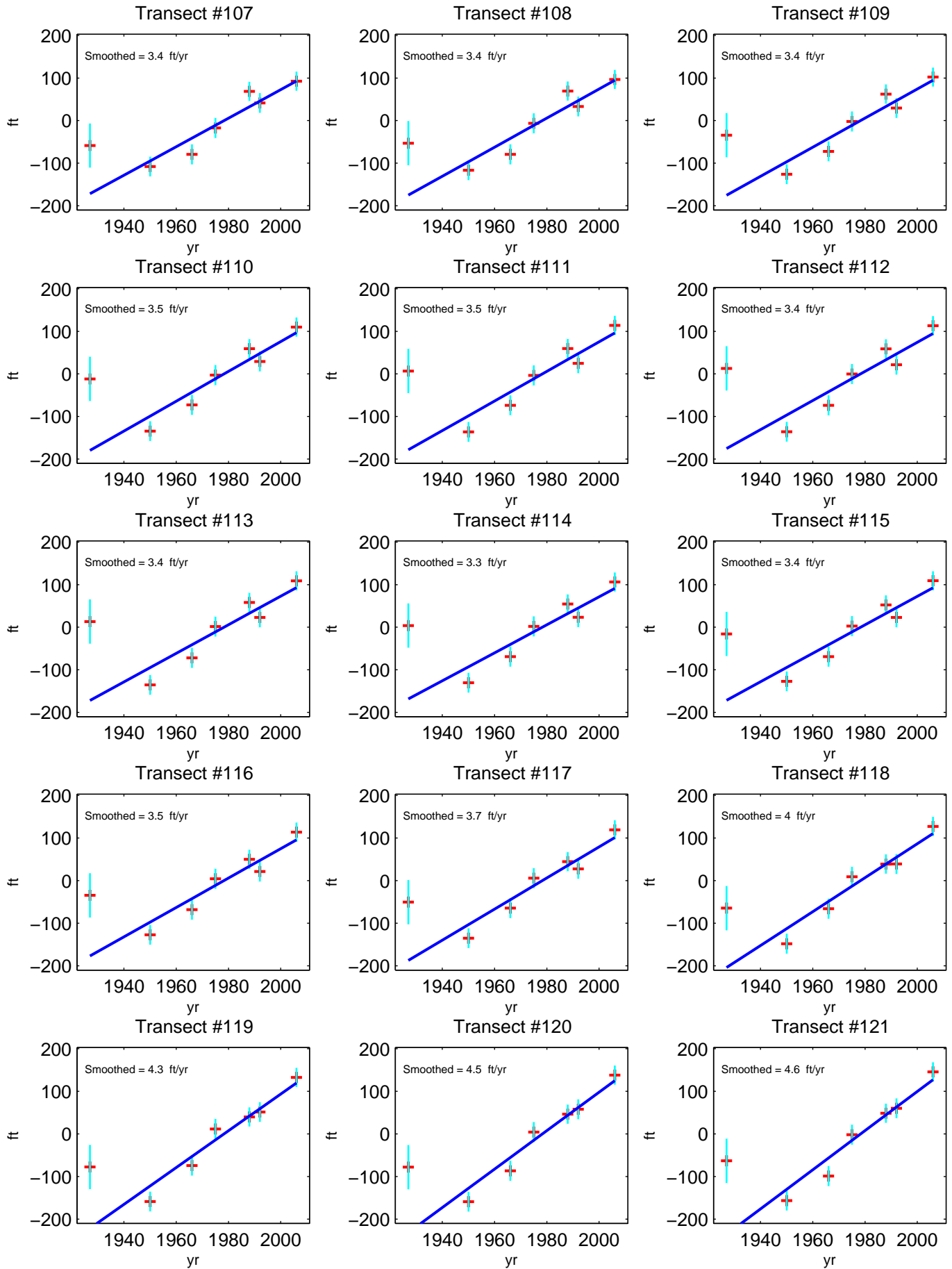
Positive Rate = Accretion
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Waimea - Smoothed Shoreline Change Rates

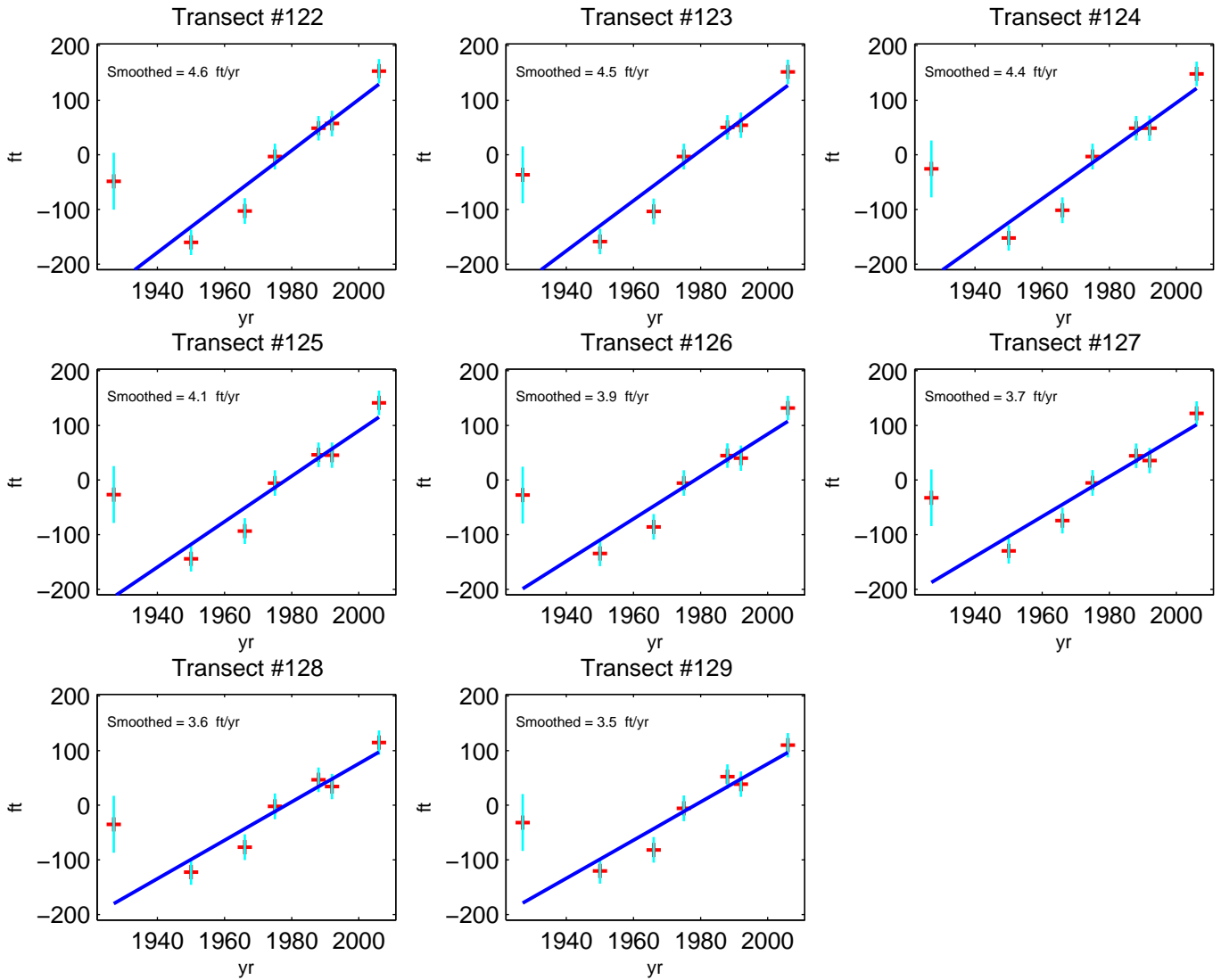
Positive Rate = Accretion
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Waimea - Smoothed Shoreline Change Rates

Positive Rate = Accretion
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Pakala, Kauai, Hawaii

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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Contract C25514 Contract 7249

HISTORICAL SHORELINES

- Jan 1926
- Nov 1950
- Apr 1975
- Jul 1987
- Mar 1988
- May 26 1992
- May 27 1992
- Sept 1992
- Nov 1999
- 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.

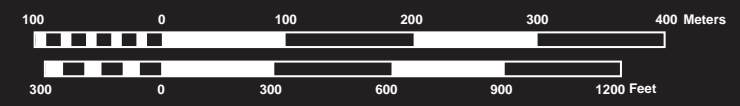
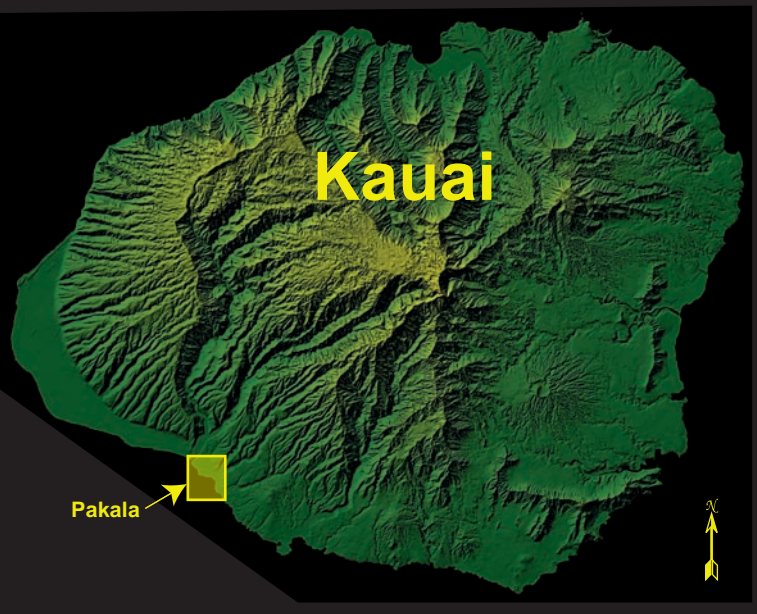
AREA DESCRIPTION

The Pakala study area is located on the south west shore of Kauai. The area extends to the south from the Waimea River to include Pakala Point. The shoreline is composed of terrestrial and carbonate sand beaches, rocky shoreline, and basalt headlands. The area is exposed to swell from the south and southwest during the summer as well as persistent tradewinds.

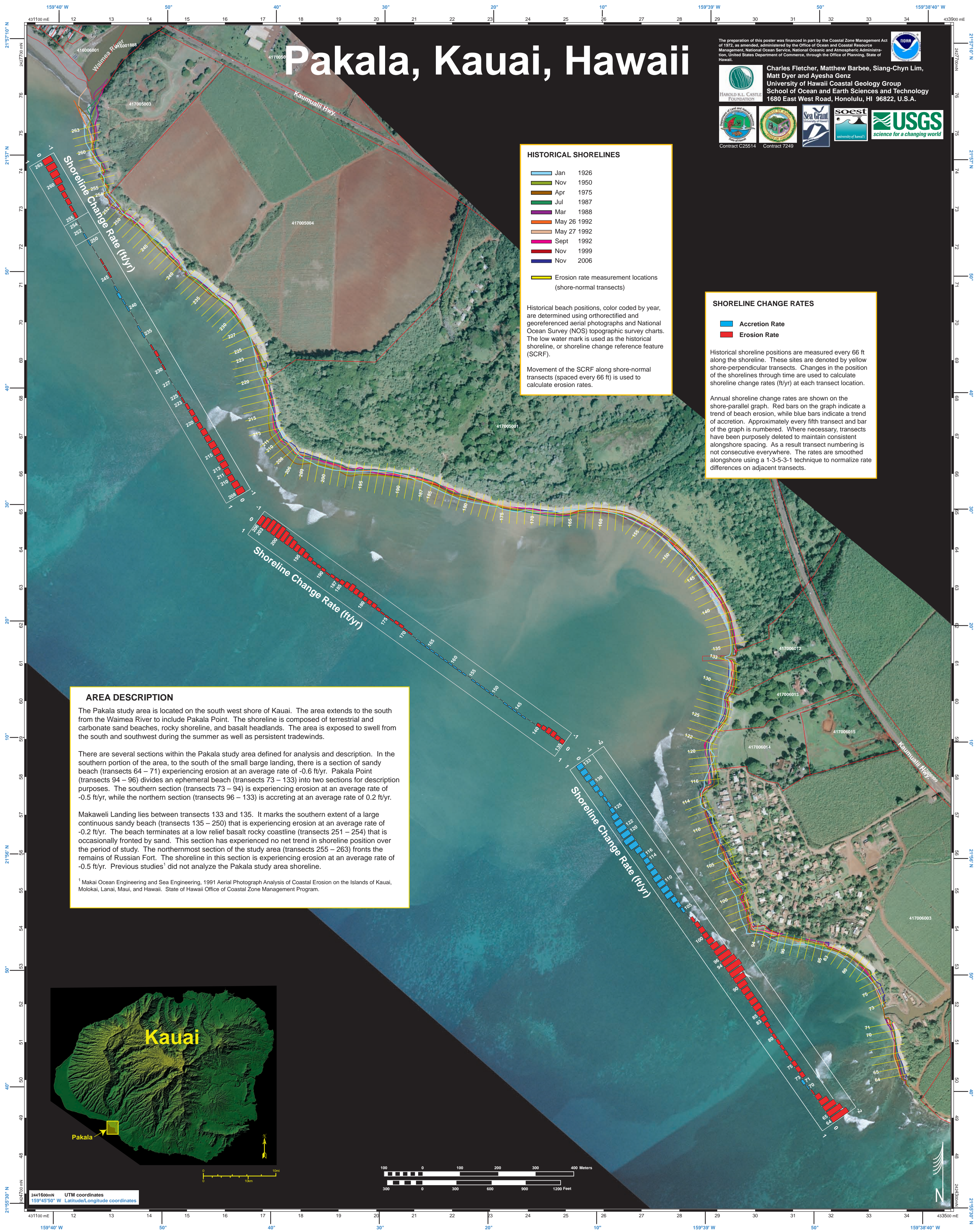
There are several sections within the Pakala study area defined for analysis and description. In the southern portion of the area, to the south of the small barge landing, there is a section of sandy beach (transects 64 – 71) experiencing erosion at an average rate of -0.6 ft/yr. Pakala Point (transects 94 – 96) divides an ephemeral beach (transects 73 – 133) into two sections for description purposes. The southern section (transects 73 – 94) is experiencing erosion at an average rate of -0.5 ft/yr, while the northern section (transects 96 – 133) is accreting at an average rate of 0.2 ft/yr.

Makaweli Landing lies between transects 133 and 135. It marks the southern extent of a large continuous sandy beach (transects 135 – 250) that is experiencing erosion at an average rate of -0.2 ft/yr. The beach terminates at a low relief basalt rocky coastline (transects 251 – 254) that is occasionally fronted by sand. This section has experienced no net trend in shoreline position over the period of study. The northernmost section of the study area (transects 255 – 263) fronts the remains of Russian Fort. The shoreline in this section is experiencing erosion at an average rate of -0.5 ft/yr. Previous studies¹ did not analyze the Pakala 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.



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



Pakala - Smoothed Rates

Positive Rate = Accretion
Negative Rate = Erosion

Transect	Smoothed Rate (ft/yr)	Transect	Smoothed Rate (ft/yr)	Transect	Smoothed Rate (ft/yr)
64	-1.4	113	0.5	163	0.1
65	-1.2	114	0.4	164	0.1
66	-1.0	116	0.4	165	0.1
67	-0.7	117	0.5	166	0.1
68	-0.4	118	0.7	167	0.1
69	-0.1	119	0.8	168	0.0
70	0.1	120	0.7	169	-0.1
71	0.2	122	0.7	170	-0.1
73	-0.3	123	0.6	171	-0.2
74	-0.3	124	0.5	172	-0.2
75	-0.3	125	0.3	173	-0.1
76	-0.2	126	0.2	174	-0.1
77	-0.2	127	0.2	176	-0.1
78	-0.2	128	0.3	177	-0.2
79	-0.2	129	0.4	178	-0.3
80	-0.2	130	0.4	179	-0.3
81	-0.2	131	0.5	180	-0.3
82	-0.3	132	0.5	181	-0.4
83	-0.4	133	0.5	182	-0.4
85	-0.5	135	-0.3	183	-0.4
86	-0.6	136	-0.3	184	-0.4
87	-0.6	137	-0.4	185	-0.3
88	-0.6	138	-0.4	187	-0.2
89	-0.6	139	-0.3	188	-0.1
90	-0.7	140	-0.2	189	-0.1
91	-0.9	141	-0.1	190	-0.1
92	-1.1	142	0.0	191	-0.2
93	-1.2	143	0.1	192	-0.2
94	-1.1	144	0.1	193	-0.3
96	-1.0	145	0.1	194	-0.4
97	-0.9	146	0.1	195	-0.5
98	-0.6	147	0.0	196	-0.5
99	-0.5	148	0.0	197	-0.6
100	-0.4	149	0.0	198	-0.7
101	-0.4	150	0.0	199	-0.8
102	-0.3	151	0.1	200	-0.9
103	-0.2	152	0.1	201	-0.9
104	0.0	153	0.1	202	-0.9
105	0.2	154	0.0	203	-0.8
106	0.3	155	0.0	206	-0.7
107	0.4	156	0.0	208	-0.6
108	0.6	158	0.1	209	-0.5
109	0.6	159	0.1	210	-0.4
110	0.6	160	0.1	211	-0.4
111	0.6	161	0.1	213	-0.5
112	0.5	162	0.1	214	-0.5

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

Pakala - Smoothed Rates

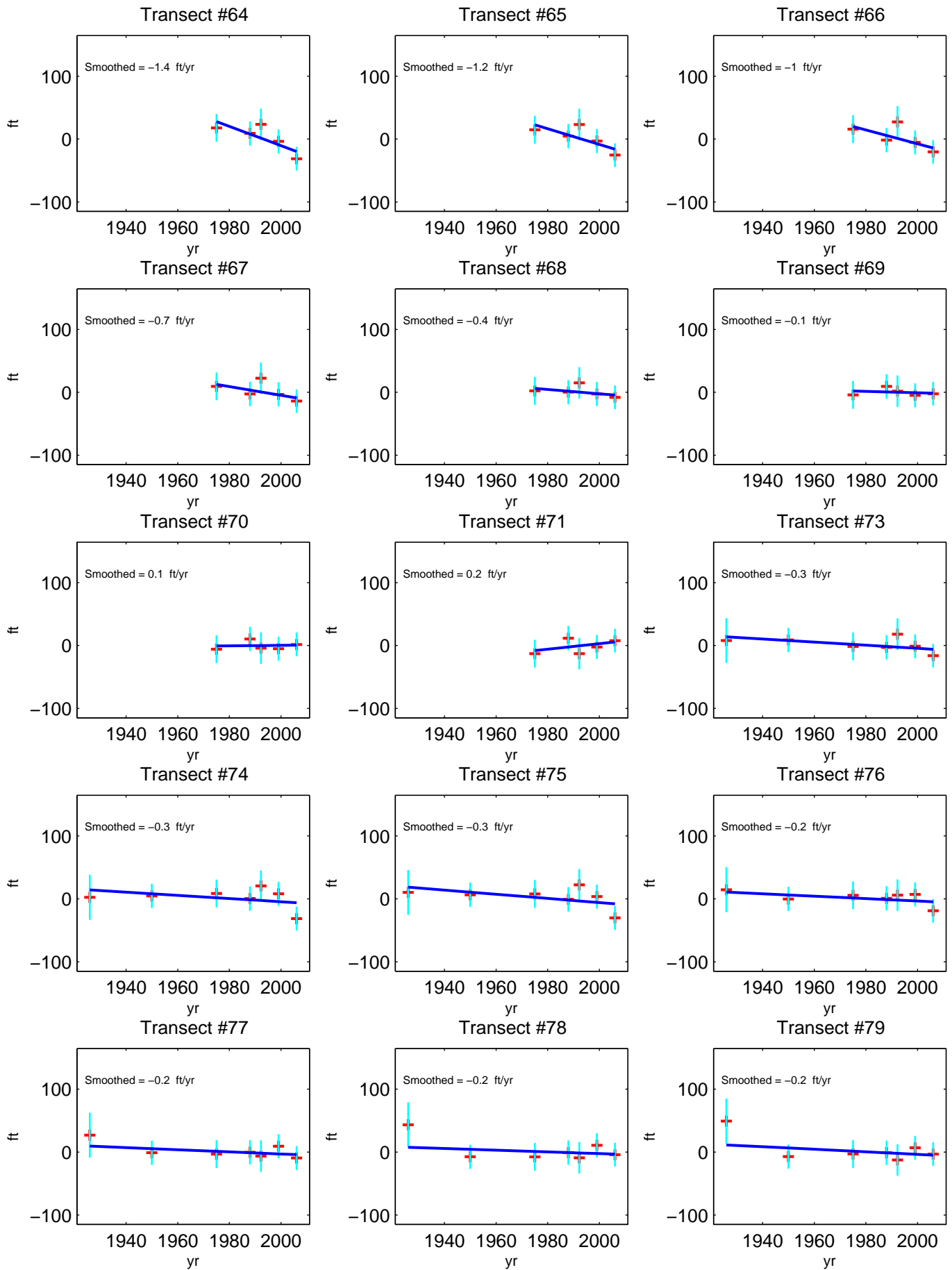
Positive Rate = Accretion
Negative Rate = Erosion

Transect	Smoothed Rate (ft/yr)
215	-0.5
216	-0.5
217	-0.4
218	-0.4
219	-0.3
220	-0.3
221	-0.3
222	-0.2
223	-0.1
225	-0.1
226	0.0
227	0.0
229	0.0
230	-0.1
231	-0.1
232	-0.2
233	-0.1
234	0.0
235	0.1
236	0.1
237	0.0
238	0.0
240	0.1
241	0.1
242	0.2
243	0.1
244	0.0
245	-0.1
246	-0.1
247	-0.1
248	0.0
249	0.0
250	0.1
251	0.1
252	0.0
254	0.0
255	-0.2
256	-0.2
257	-0.3
258	-0.3
259	-0.4
260	-0.5
261	-0.6
262	-0.7
263	-0.7

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

Pakala - Smoothed Shoreline Change Rates

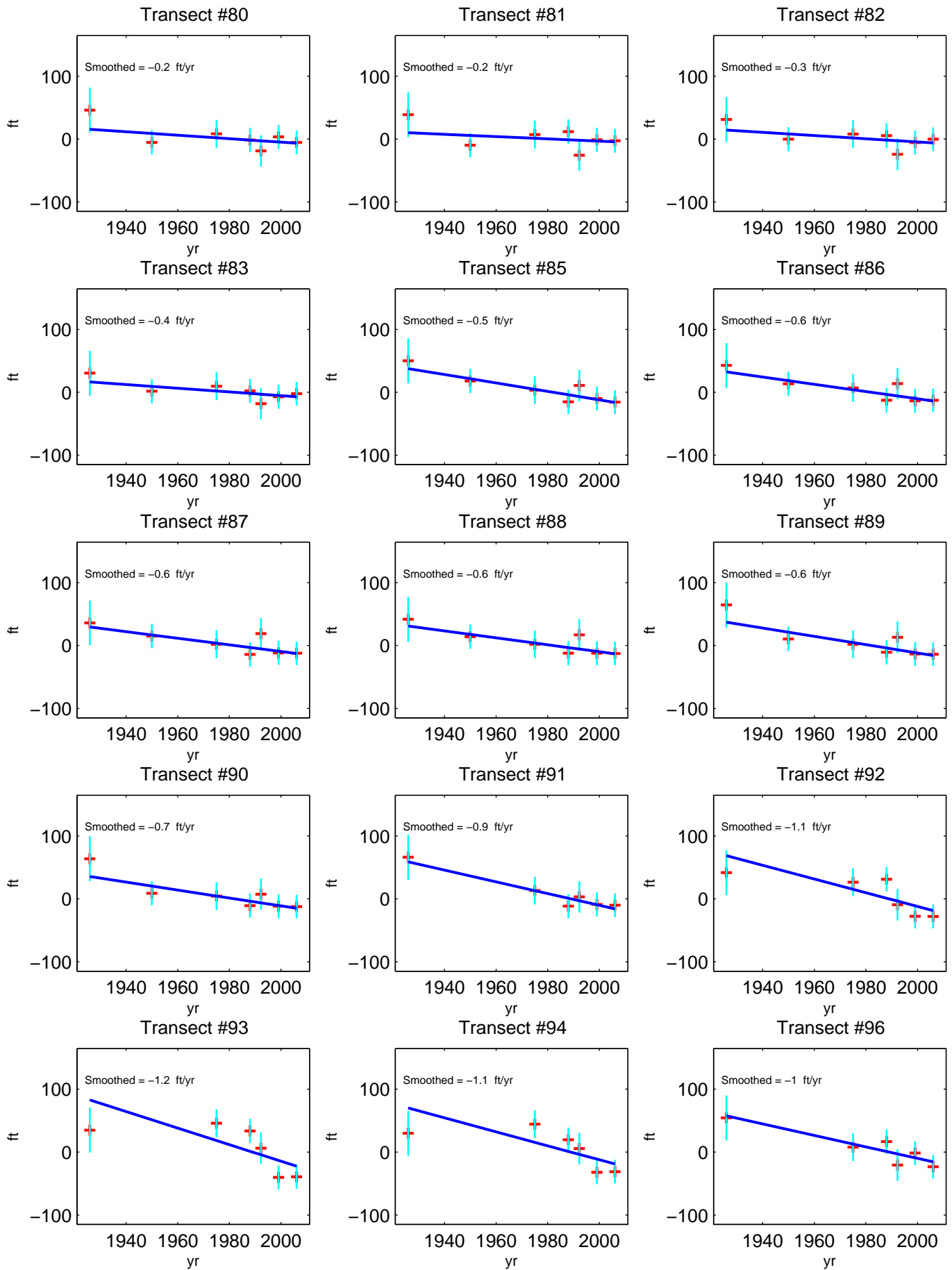
Positive Rate = Accretion
Negative Rate = Erosion



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

Pakala - Smoothed Shoreline Change Rates

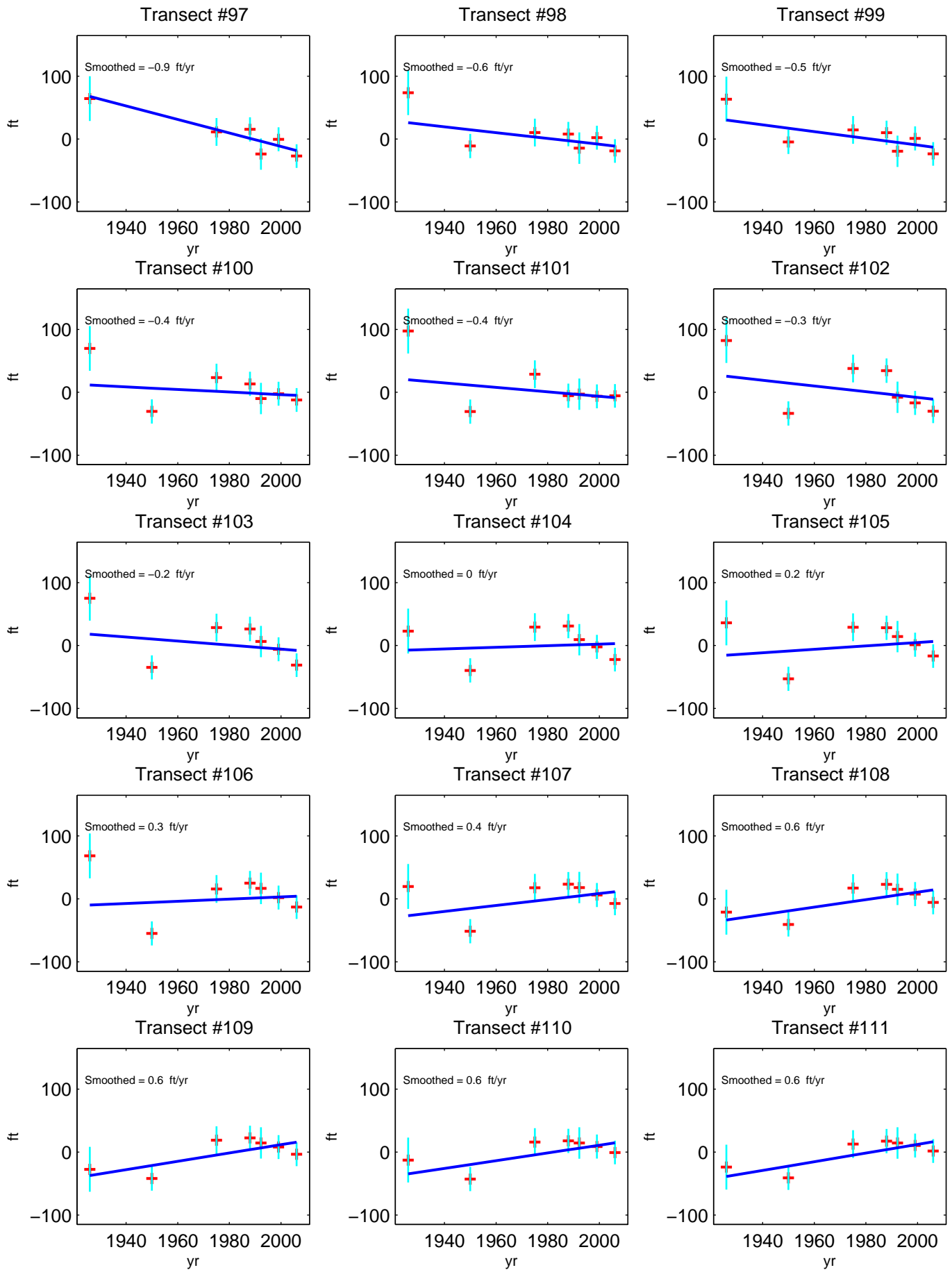
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Pakala - Smoothed Shoreline Change Rates

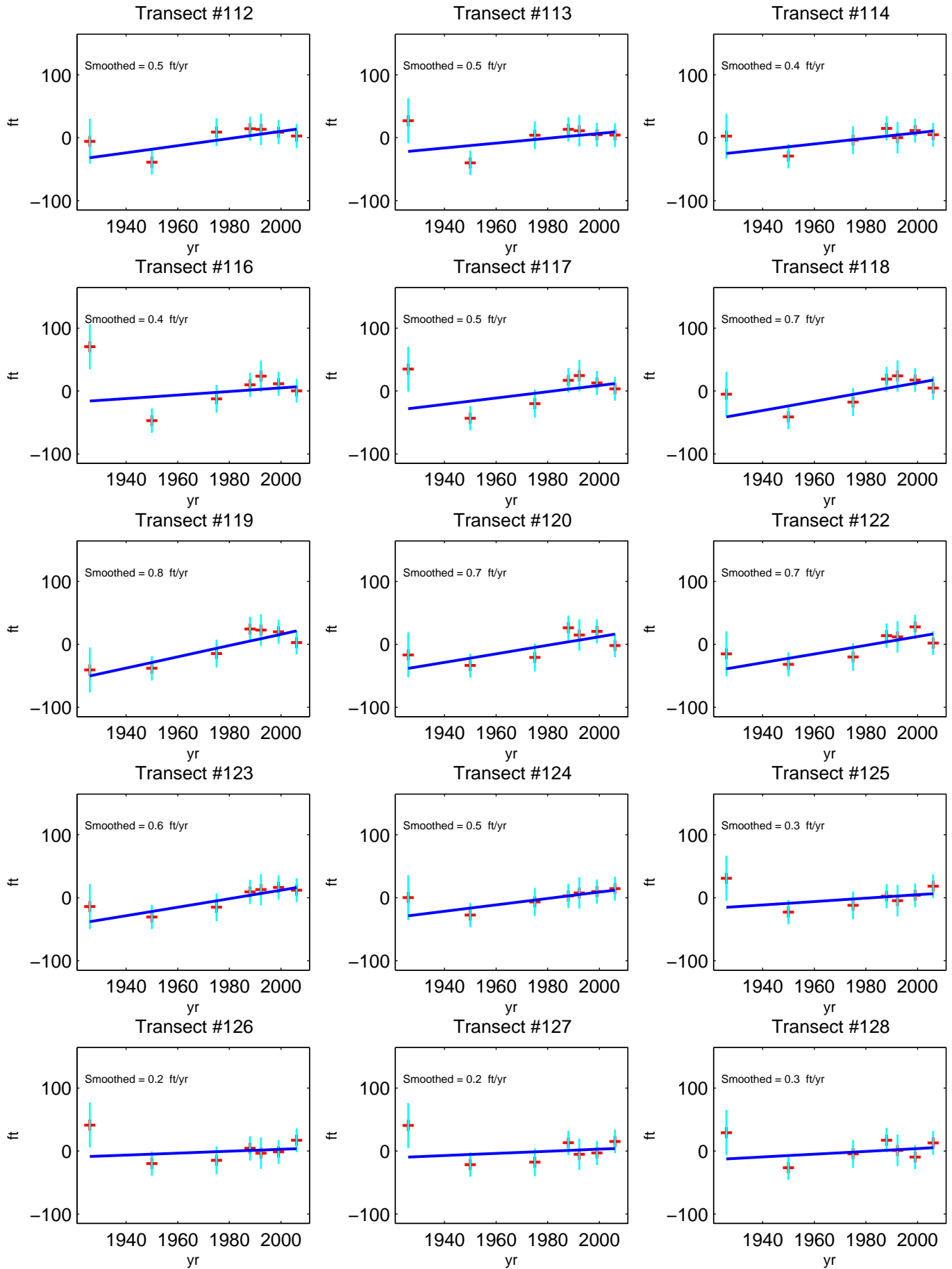
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Pakala - Smoothed Shoreline Change Rates

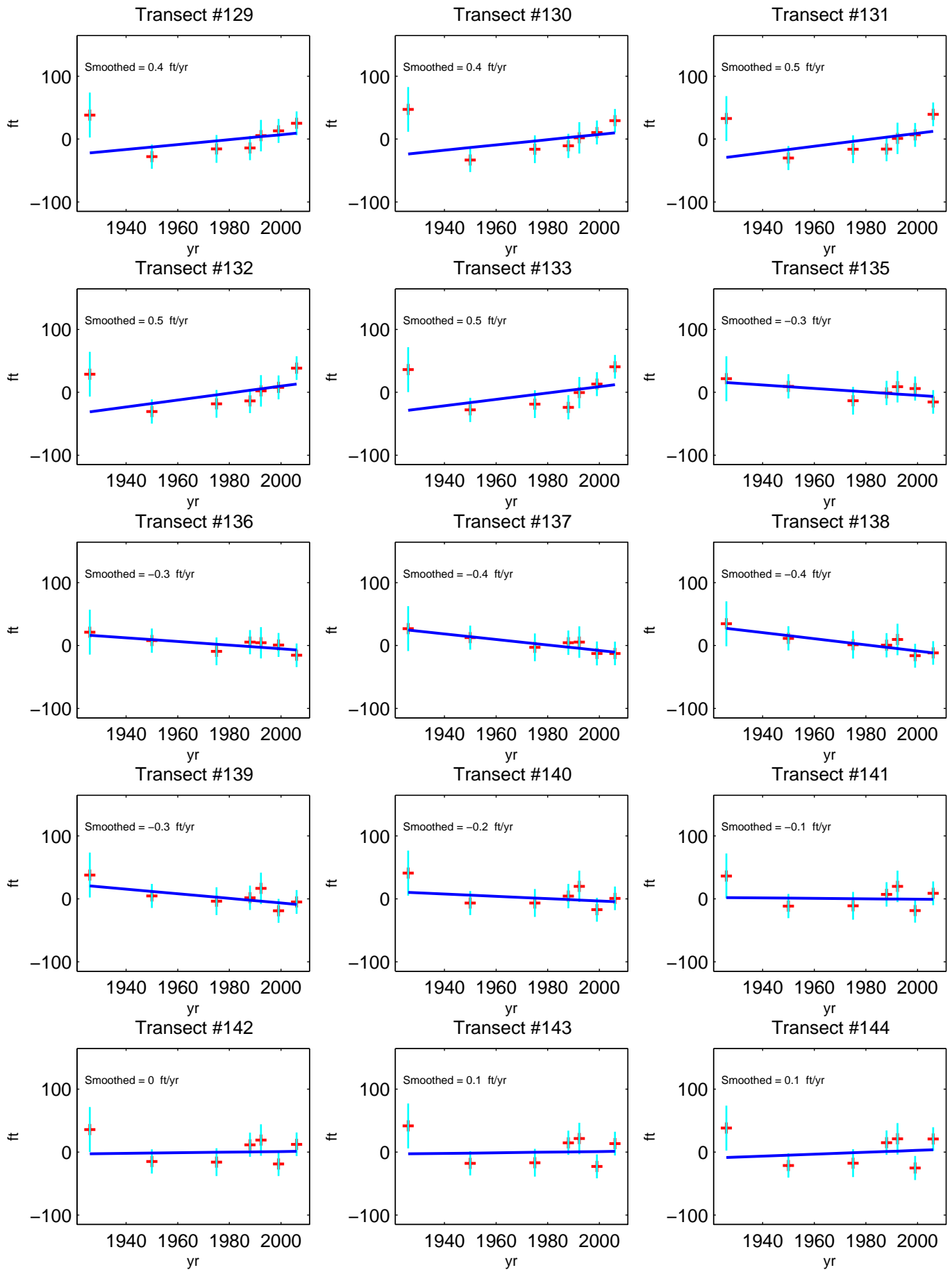
Positive Rate = Accretion
Negative Rate = Erosion



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Pakala - Smoothed Shoreline Change Rates

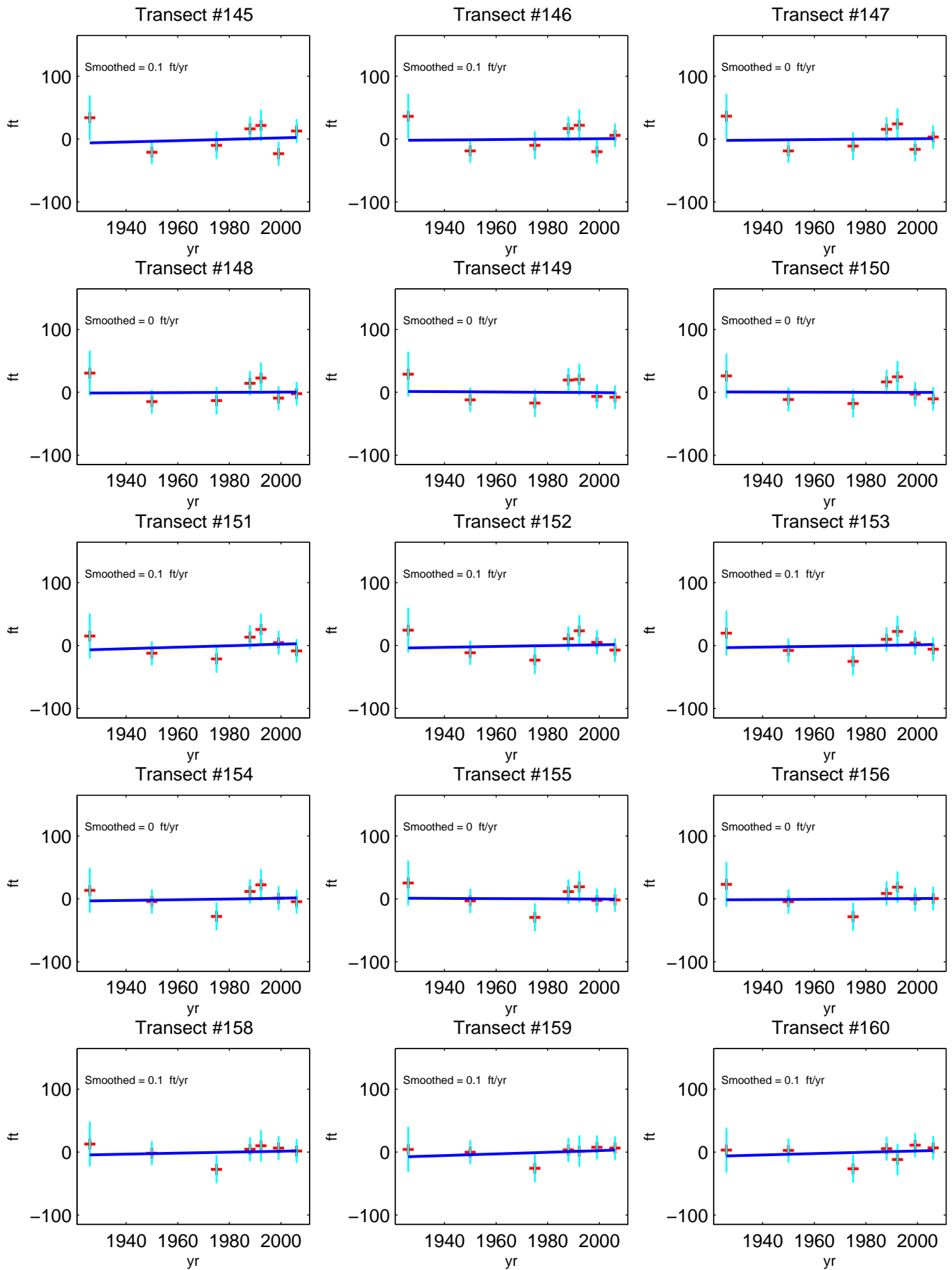
Positive Rate = Accretion
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Pakala - Smoothed Shoreline Change Rates

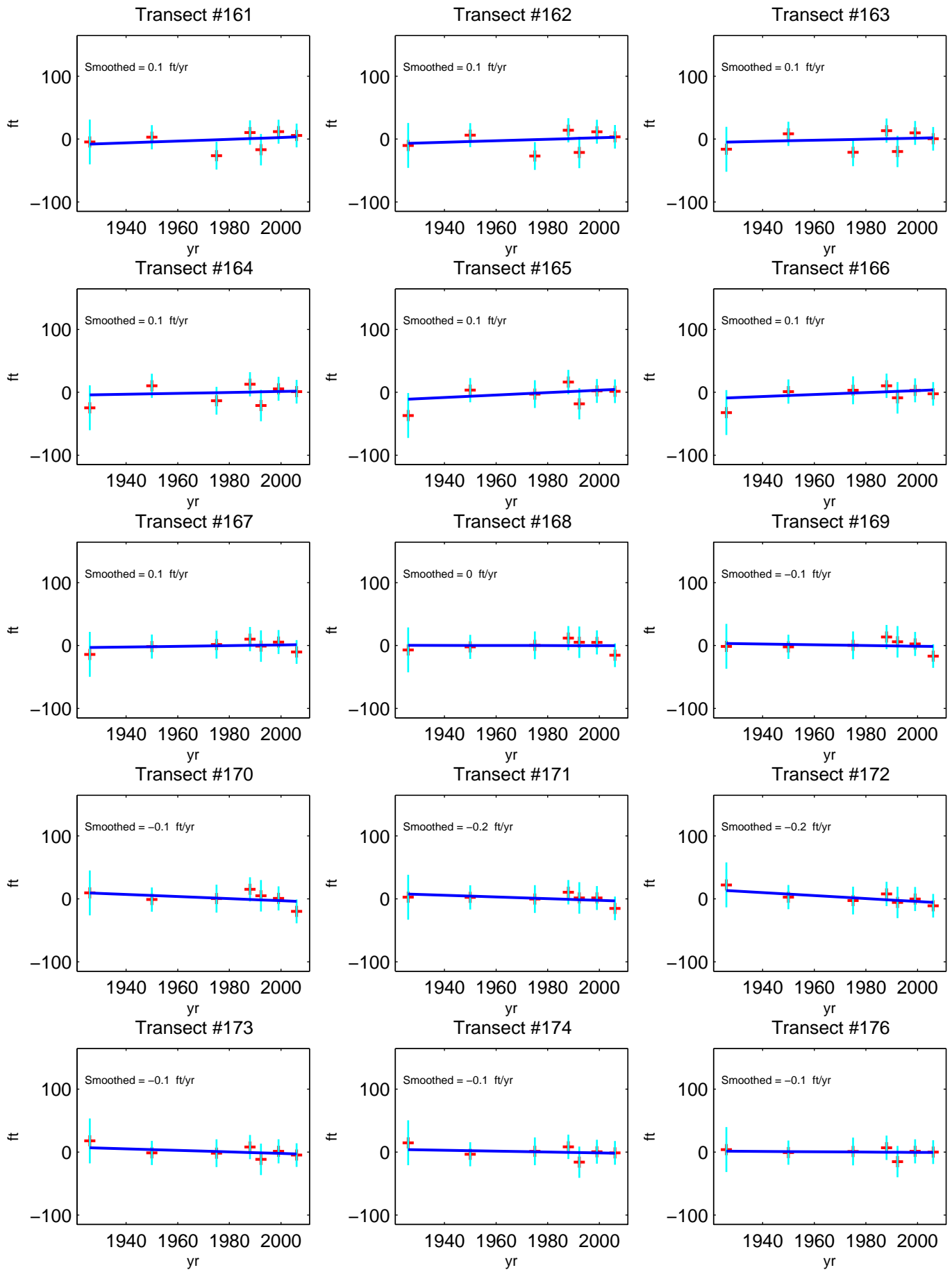
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Pakala - Smoothed Shoreline Change Rates

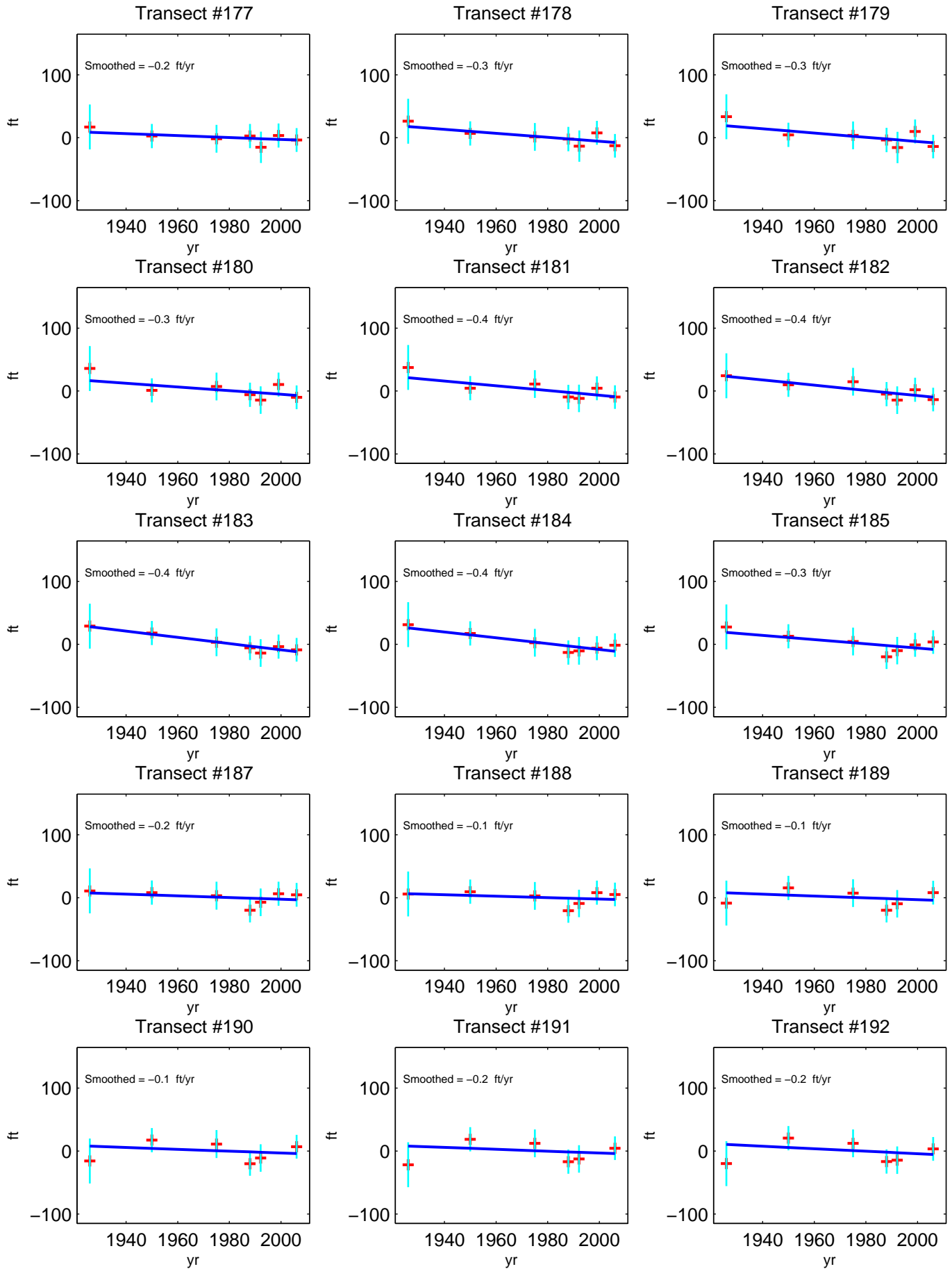
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Pakala - Smoothed Shoreline Change Rates

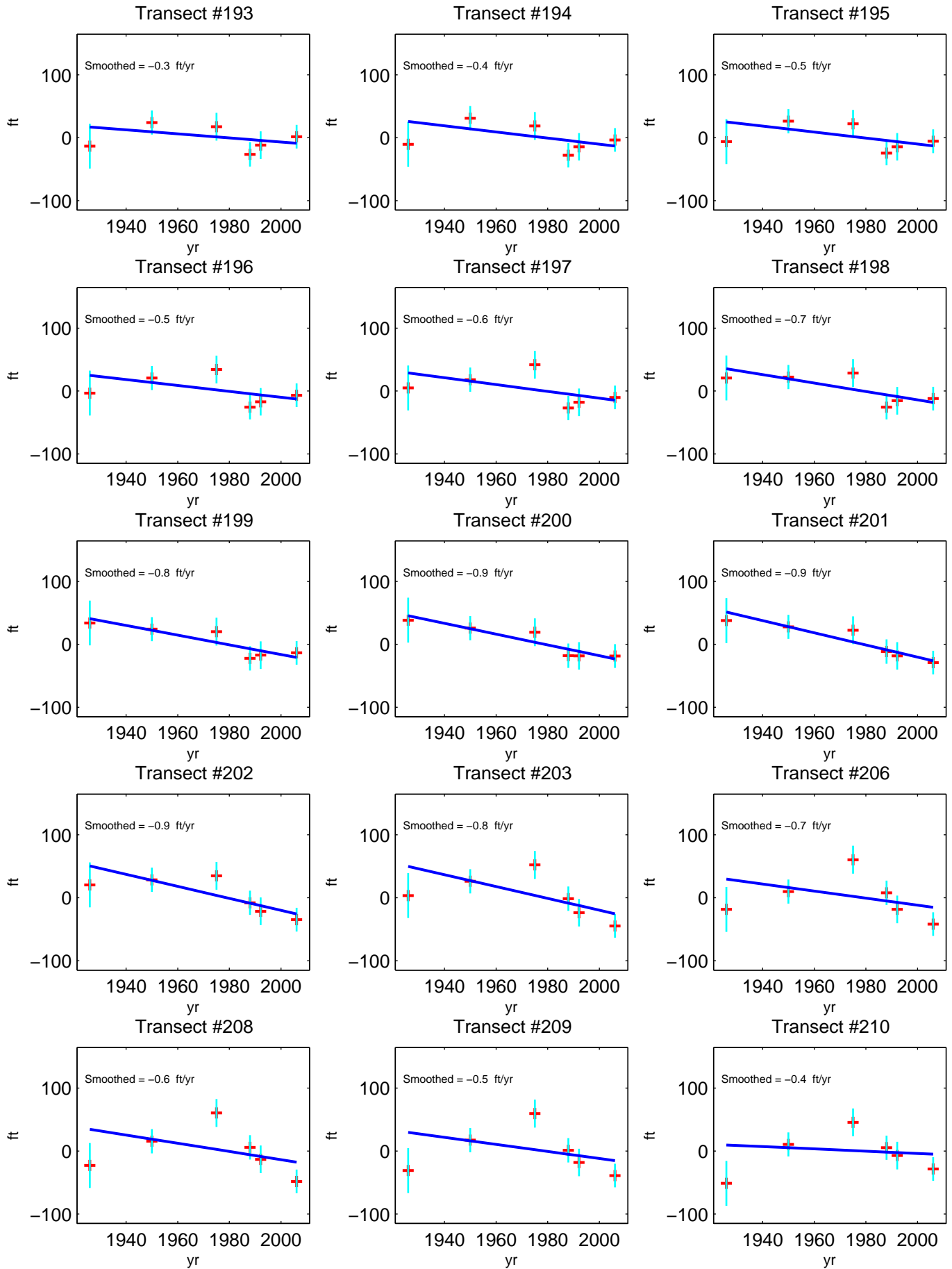
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Pakala - Smoothed Shoreline Change Rates

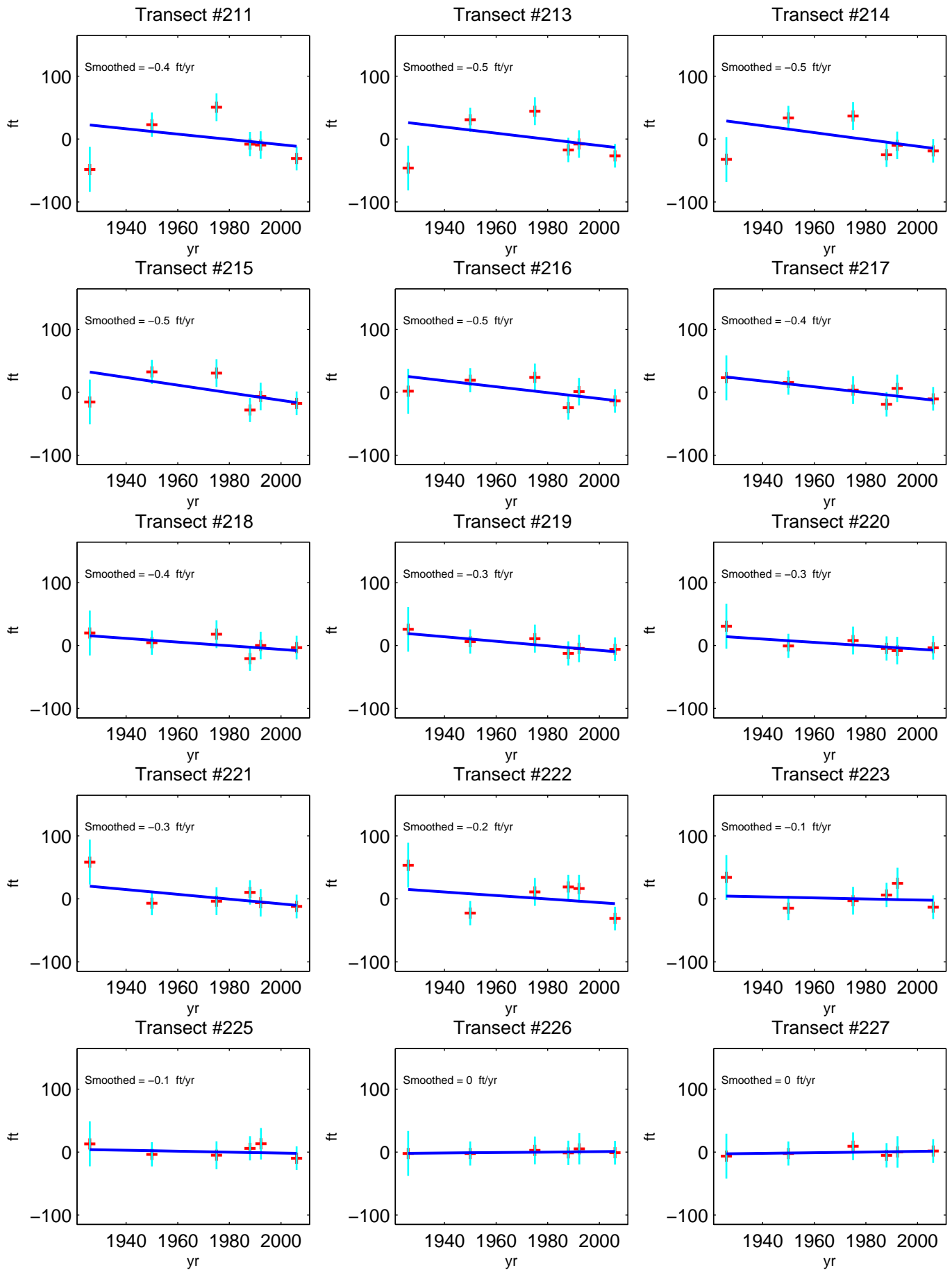
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Pakala - Smoothed Shoreline Change Rates

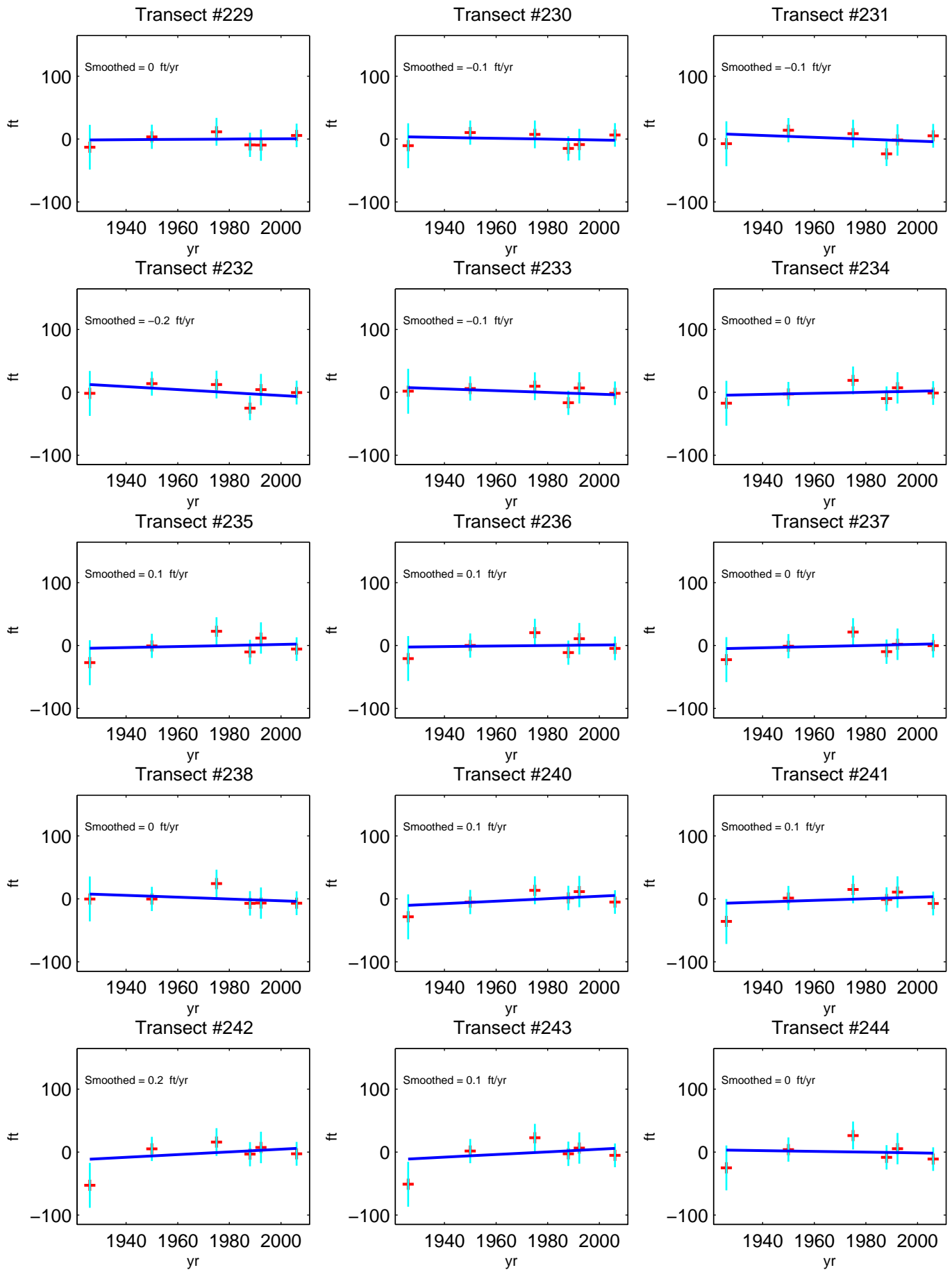
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Pakala - Smoothed Shoreline Change Rates

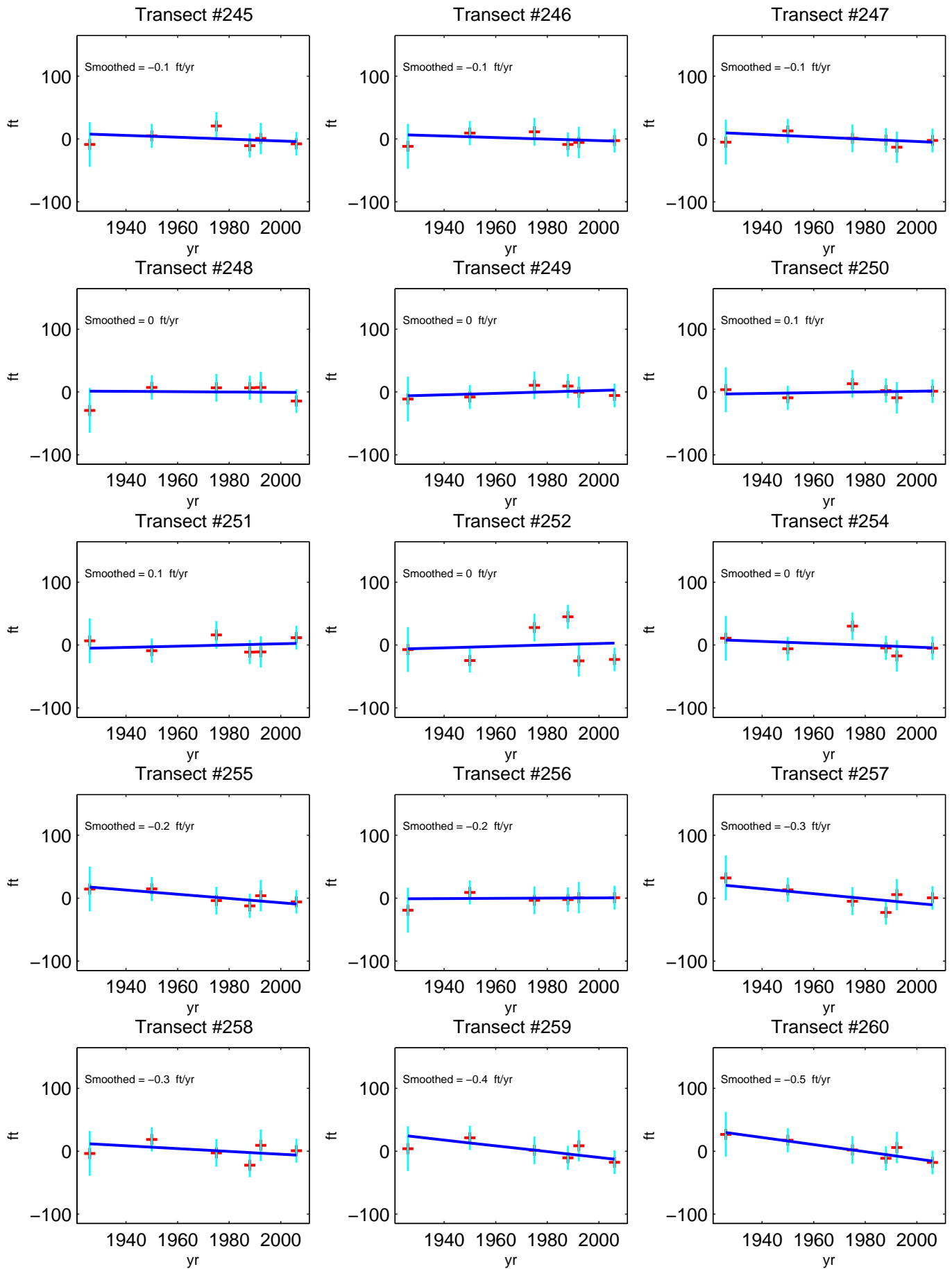
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Pakala - Smoothed Shoreline Change Rates

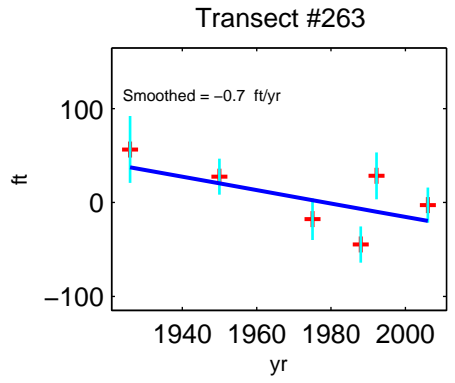
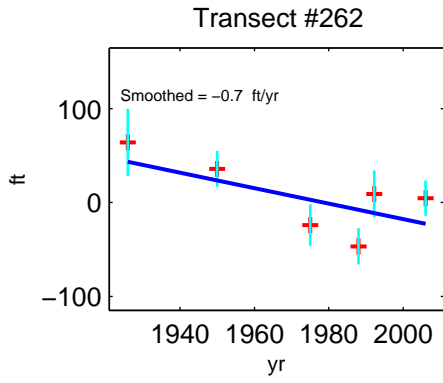
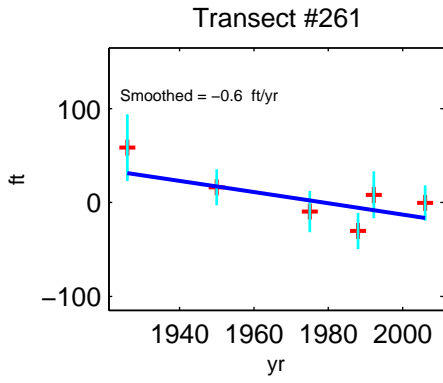
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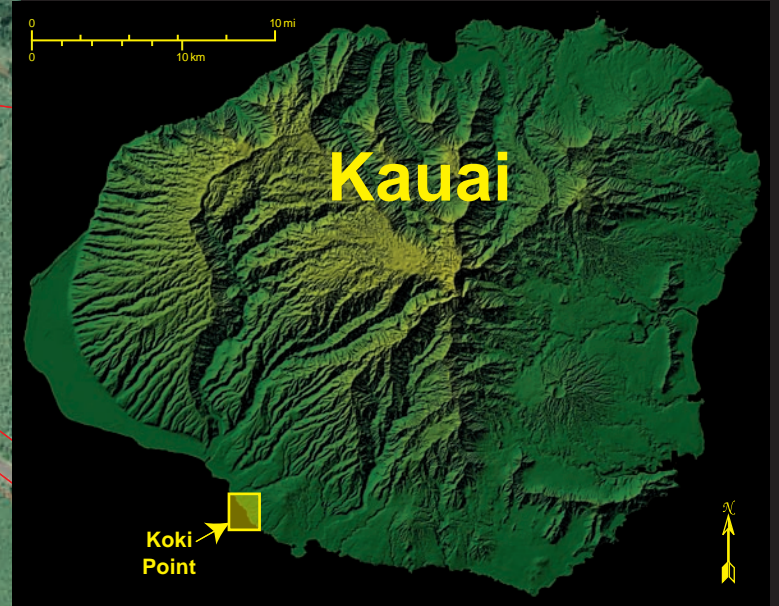
Pakala - Smoothed Shoreline Change Rates

Positive Rate = Accretion
Negative Rate = Erosion



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Koki Point, Kauai, Hawaii



AREA DESCRIPTION

The Koki Point study area is located on the southwest shore of Kauai. The area extends north from Hoaka Point to Mahinauli Gulch. The shoreline is composed of basalt rock headlands, sand perched on rocky shoreline, and sand beaches. The area is exposed to swell from the south and southwest during the summer as well as persistent tradewinds.

There are six beaches within the Koki Point area. Between Koki Point and Hoaka Point there are two small beaches. The southern beach (transects 0 – 5) is experiencing erosion at an average rate of -1.2 ft/yr. The northern beach (transects 7 – 9) is experiencing slight erosion at an average rate of -0.6 ft/yr. North of Koki Point is a small beach (transects 11 – 15) experiencing erosion at an average rate of -1.7 ft/yr. The next beach to the north (transects 17 – 31) is divided into two sections. The southern section (transects 17 – 24) is eroding at an average rate of -3.1 ft/yr while the northern section (transects 25 – 31) is changing at an average rate of -1.4 ft/yr over the period of study. The sandy beach at Kaluapuhi (transects 32 – 61) is experiencing erosion at an average rate of -0.9 ft/yr. Previous studies¹ did not analyze the Koki Point study area.

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.

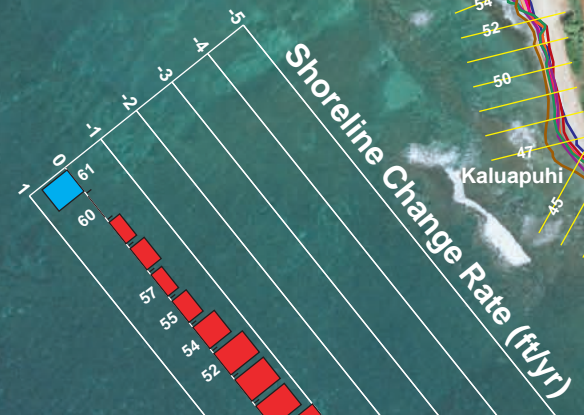
HISTORICAL SHORELINES

- █ Apr 1975
- █ Jul 1987
- █ Mar 1988
- █ May 26 1992
- █ May 27 1992
- █ Sept 1992
- █ Nov 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.



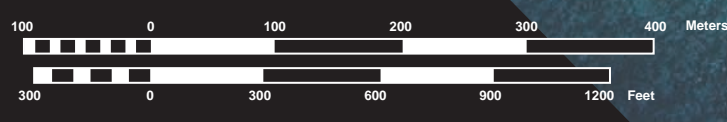
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2441600mN UTM coordinates
 159°45'50" W Latitude/Longitude coordinates



Koki Point - Smoothed Rates

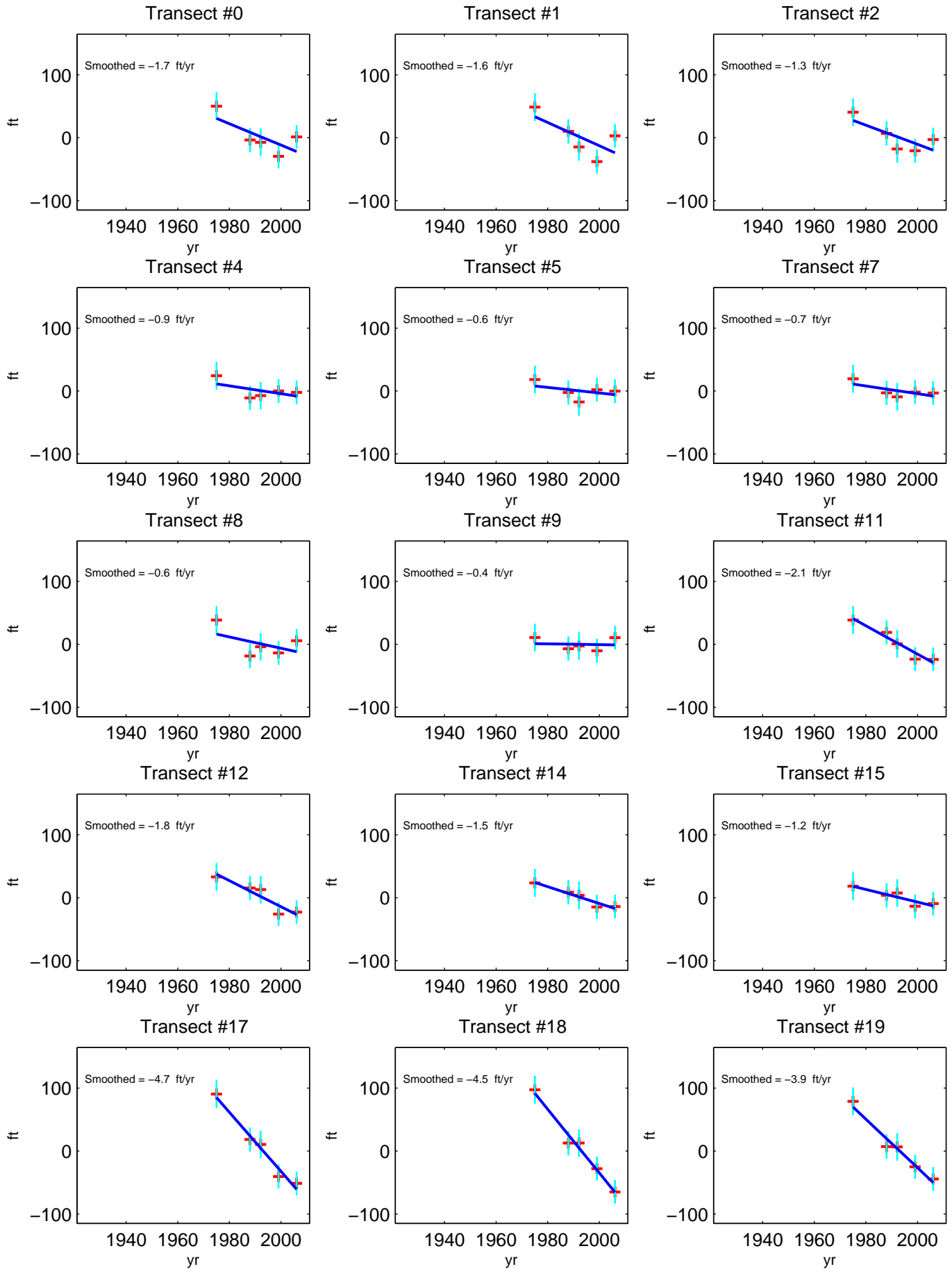
Positive Rate = Accretion
 Negative Rate = Erosion

Transect	Smoothed Rate (ft/yr)	Transect	Smoothed Rate (ft/yr)
0	-1.7	55	-0.4
1	-1.6	57	-0.3
2	-1.3	58	-0.4
4	-0.9	59	-0.3
5	-0.6	60	0.0
7	-0.7	61	0.7
8	-0.6		
9	-0.4		
11	-2.1		
12	-1.8		
14	-1.5		
15	-1.2		
17	-4.7		
18	-4.5		
19	-3.9		
20	-3.1		
22	-2.4		
23*	-1.9		
24*	-1.0		
25*	-1.3		
26*	-1.7		
27*	-1.8		
28*	-1.7		
29*	-1.6		
30	-1.2		
31	-0.8		
32	-0.5		
33	-0.9		
34	-1.2		
35	-1.4		
36	-1.5		
38	-1.3		
39	-1.1		
40	-0.9		
41	-0.9		
42	-1.1		
43	-1.3		
44	-1.6		
45	-1.8		
47	-1.8		
48	-1.5		
49	-1.0		
50	-0.8		
51	-0.8		
52	-0.8		
54	-0.6		

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

Koki Point - Smoothed Shoreline Change Rates

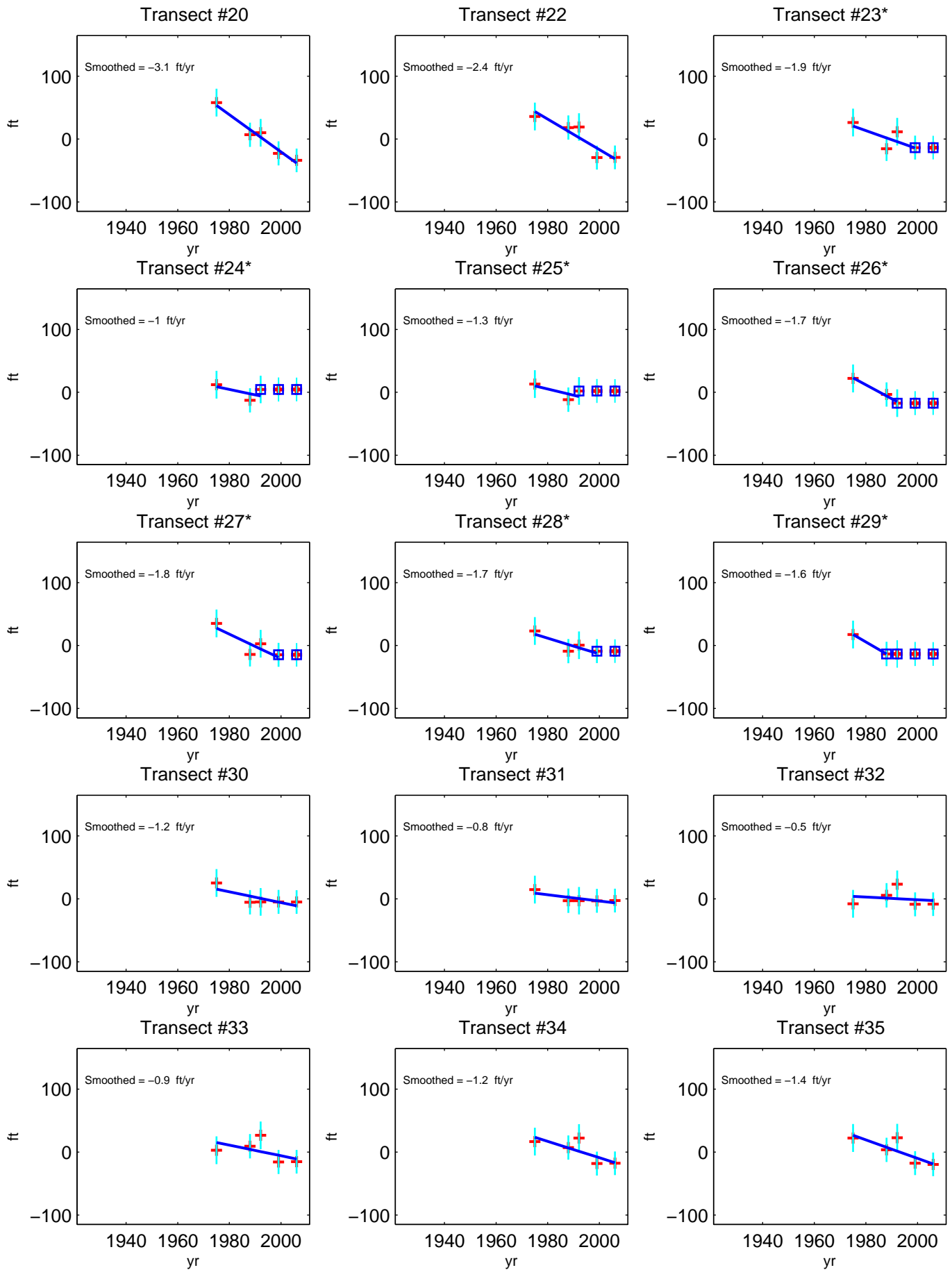
Positive Rate = Accretion
Negative Rate = Erosion



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

Koki Point - Smoothed Shoreline Change Rates

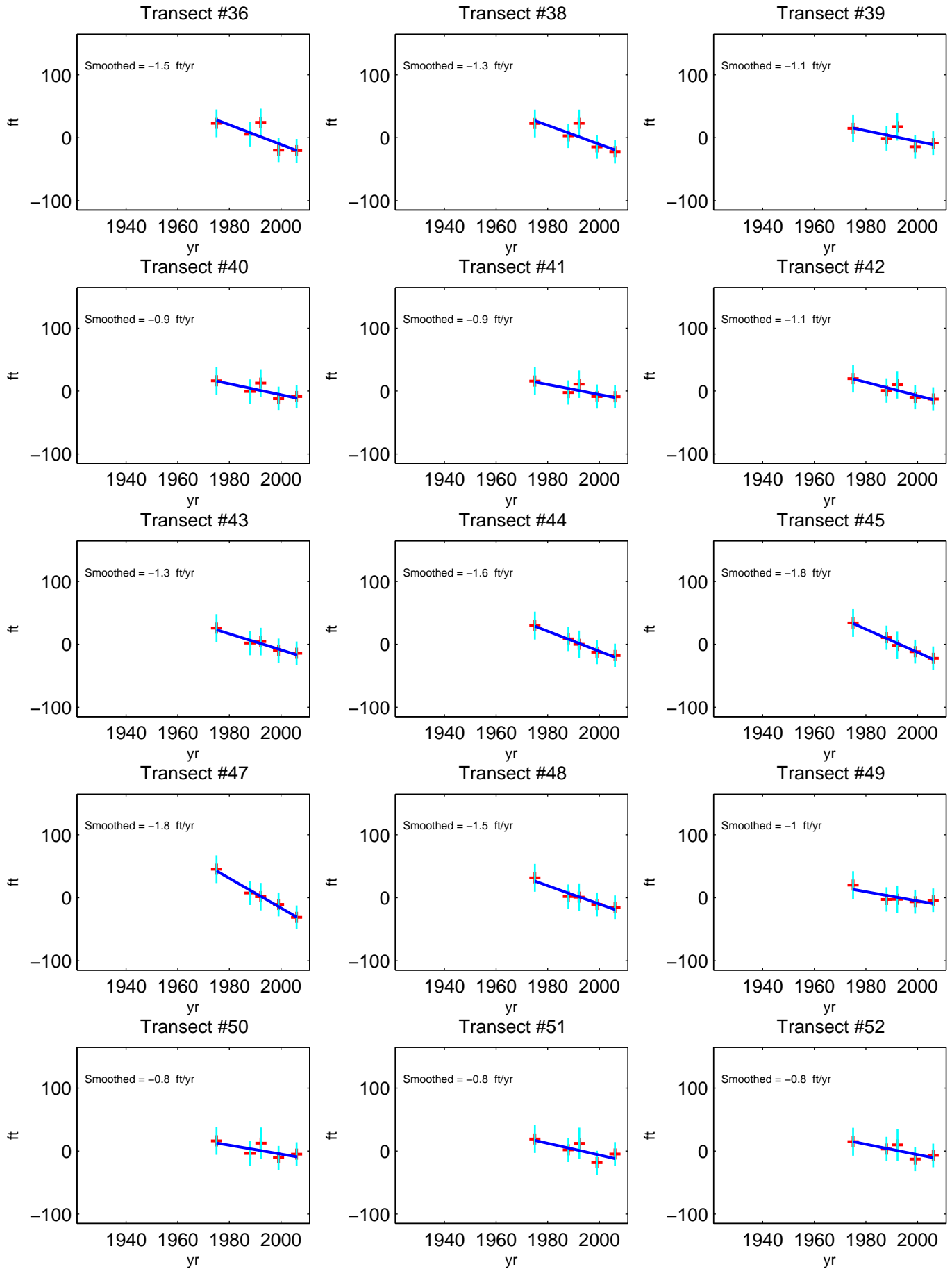
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Koki Point - Smoothed Shoreline Change Rates

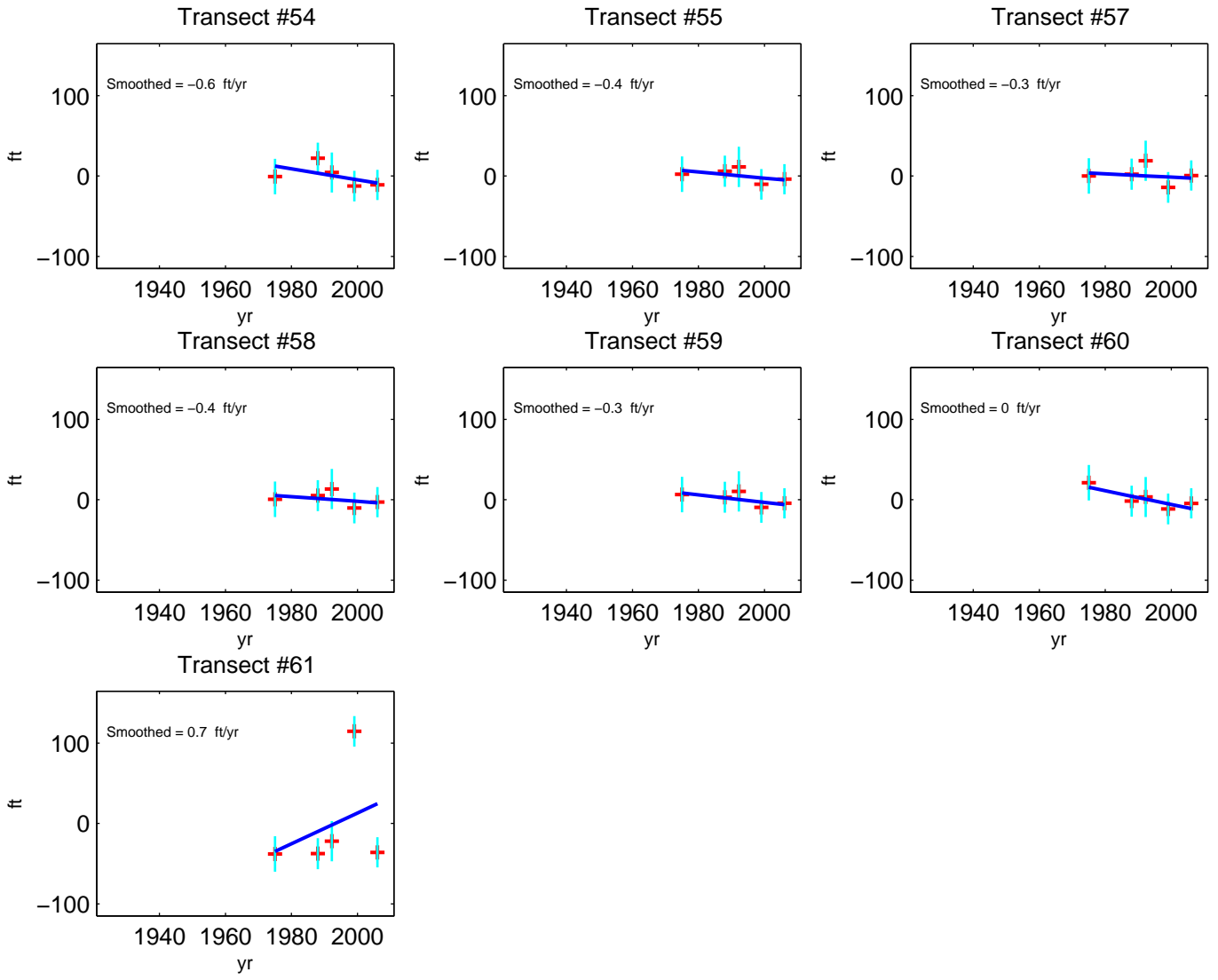
Positive Rate = Accretion
Negative Rate = Erosion



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Koki 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.

Salt Pond, Kauai, Hawaii

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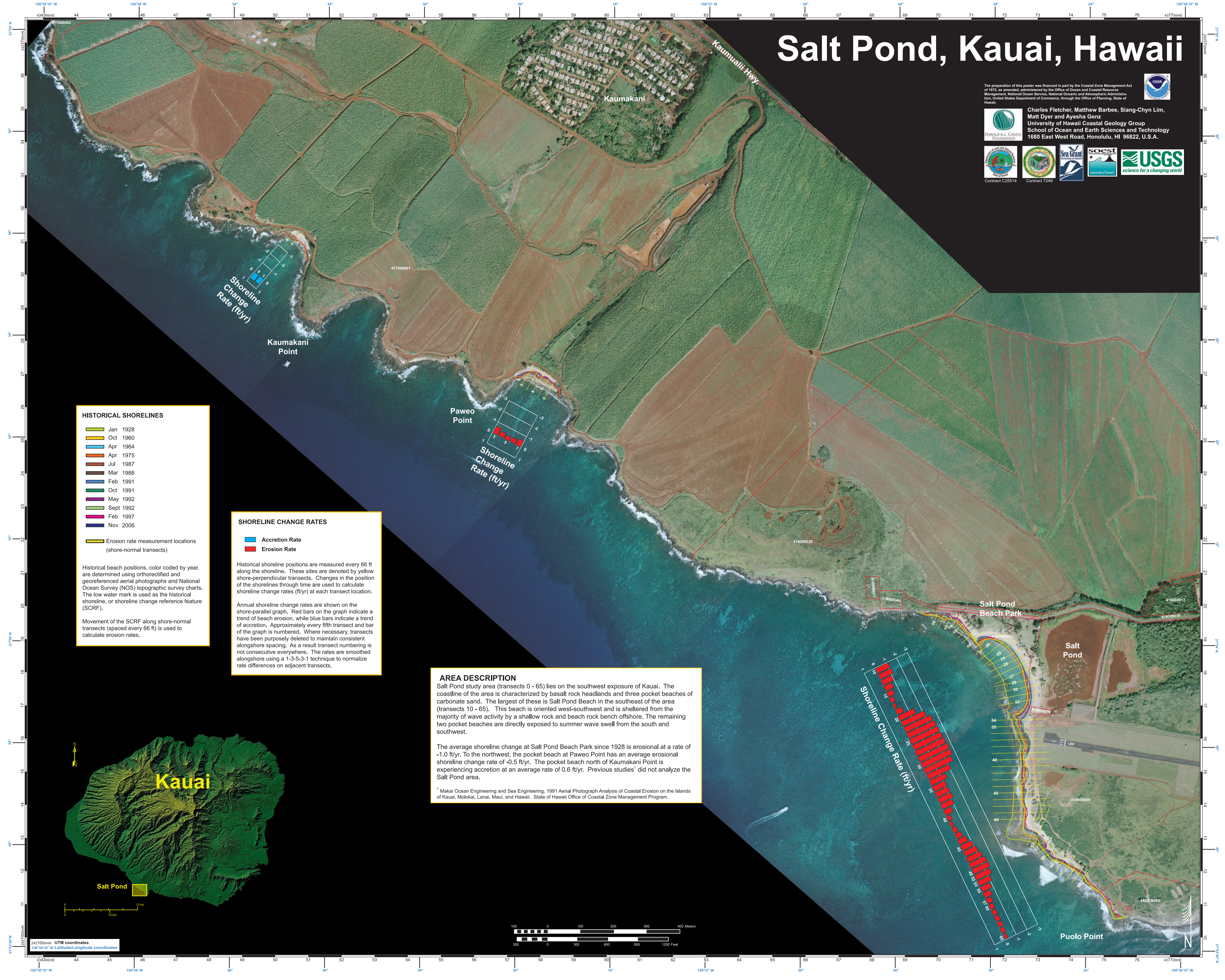


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HISTORICAL SHORELINES

- Jan 1928
- Oct 1960
- Apr 1964
- Apr 1975
- Jul 1987
- Mar 1988
- Feb 1991
- Oct 1991
- May 1992
- Sept 1992
- Feb 1997
- 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.

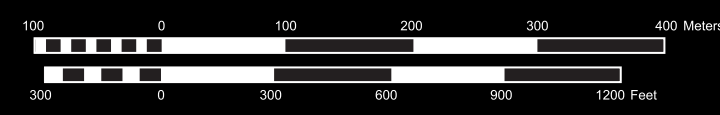
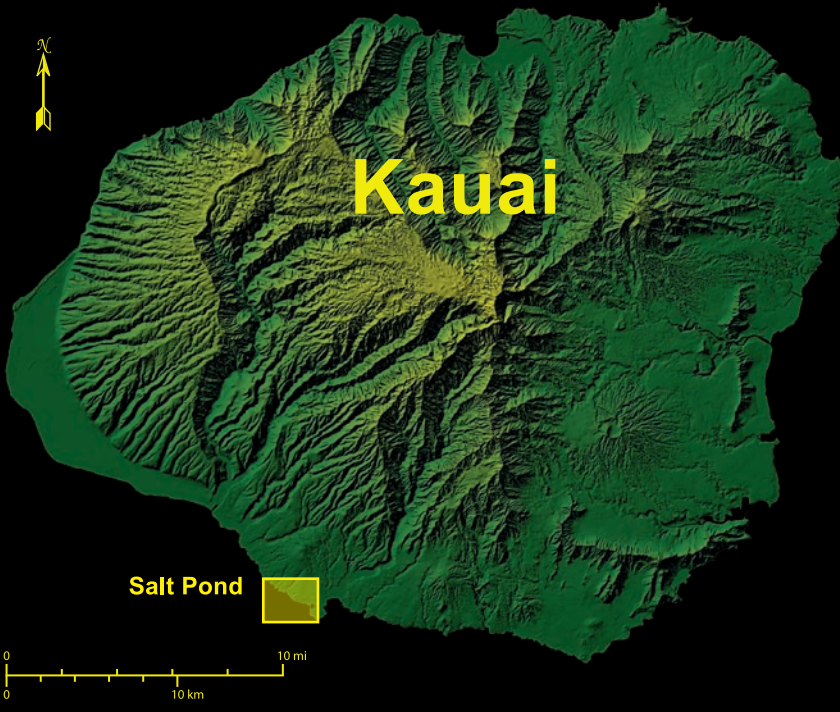
Annual shoreline change rates are shown on the shore-parallel graph. Red bars on the graph indicate a trend of beach erosion, while blue bars indicate a trend of accretion. Approximately every fifth transect and bar of the graph is numbered. Where necessary, transects have been purposely deleted to maintain 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

Salt Pond study area (transects 0 - 65) lies on the southwest exposure of Kauai. The coastline of the area is characterized by basalt rock headlands and three pocket beaches of carbonate sand. The largest of these is Salt Pond Beach in the southeast of the area (transects 10 - 65). This beach is oriented west-southwest and is sheltered from the majority of wave activity by a shallow rock and beach rock bench offshore. The remaining two pocket beaches are directly exposed to summer wave swell from the south and southwest.

The average shoreline change at Salt Pond Beach Park since 1928 is erosional at a rate of -1.0 ft/yr. To the northwest, the pocket beach at Pawee Point has an average erosional shoreline change rate of -0.5 ft/yr. The pocket beach north of Kaumakani Point is experiencing accretion at an average rate of 0.6 ft/yr. Previous studies¹ did not analyze the Salt Pond area.

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.



2421000mN UTM coordinates
 159°38'10" W Longitude/Longitude coordinates

Salt Pond - Smoothed Rates

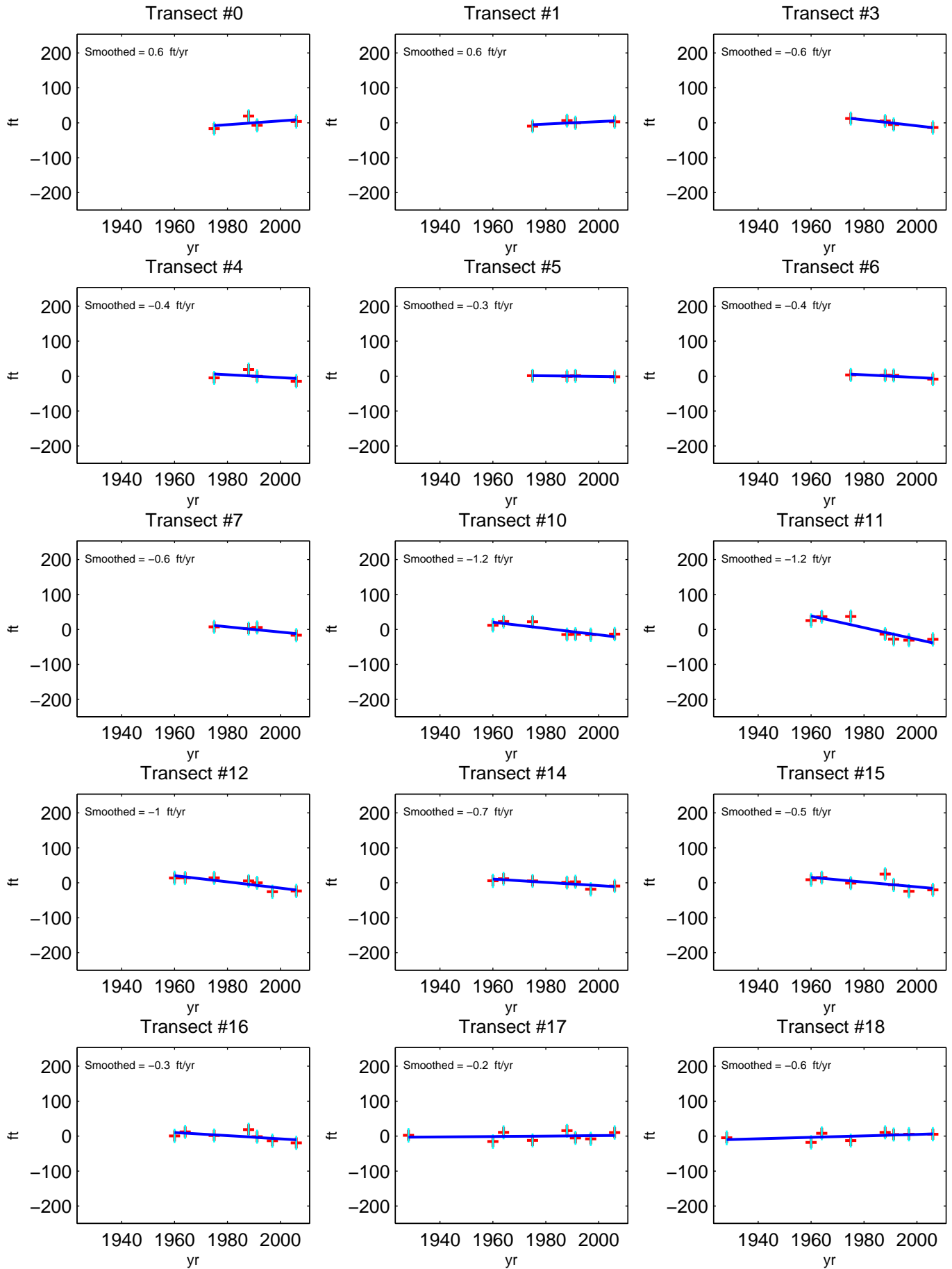
Positive Rate = Accretion
 Negative Rate = Erosion

Transect	Smoothed Rate (ft/yr)	Transect	Smoothed Rate (ft/yr)
0	0.6	57	-0.5
1	0.6	60	-0.4
3	-0.6	61	-0.4
4	-0.4	62	-0.4
5	-0.3	63	-0.4
6	-0.4	64	-0.3
7	-0.6	65	-0.3
10	-1.2		
11	-1.2		
12	-1.0		
14	-0.7		
15	-0.5		
16	-0.3		
17	-0.2		
18	-0.6		
20	-1.4		
21	-2.1		
22	-2.5		
24	-2.6		
25	-2.6		
26	-2.6		
27	-2.7		
29	-2.7		
30	-2.7		
31	-2.5		
32	-2.1		
34	-1.5		
35	-1.2		
36	-1.2		
37	-1.2		
38	-1.0		
39	-0.7		
40	-0.4		
41	-0.3		
42	-0.4		
43	-0.5		
44	-0.8		
45	-1.0		
46	-1.2		
47	-1.3		
48	-1.5		
49	-1.5		
52	-1.4		
53	-1.1		
55	-0.9		
56	-0.6		

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

Salt Pond - Smoothed Shoreline Change Rates

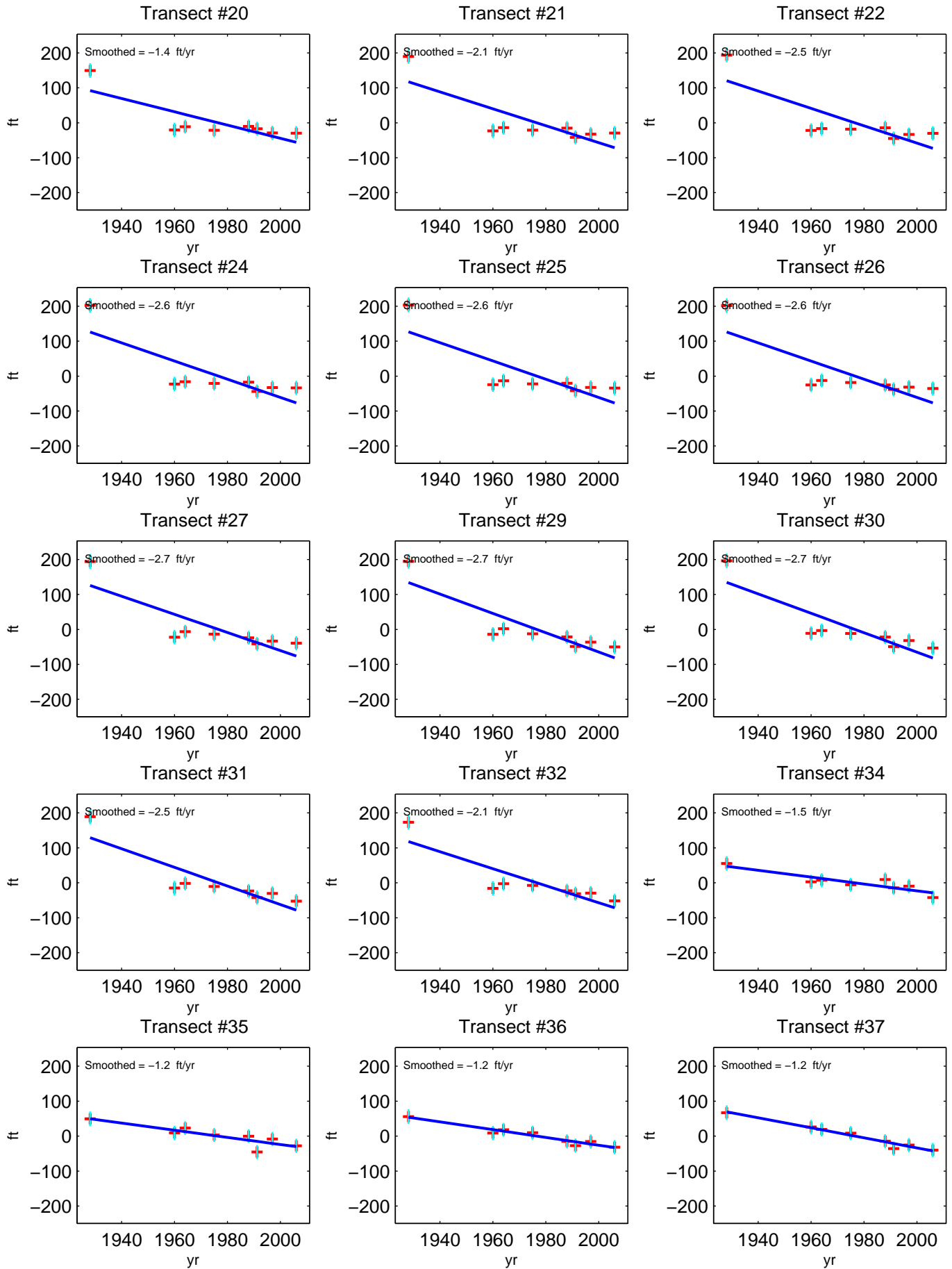
Positive Rate = Accretion
Negative Rate = Erosion



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

Salt Pond - Smoothed Shoreline Change Rates

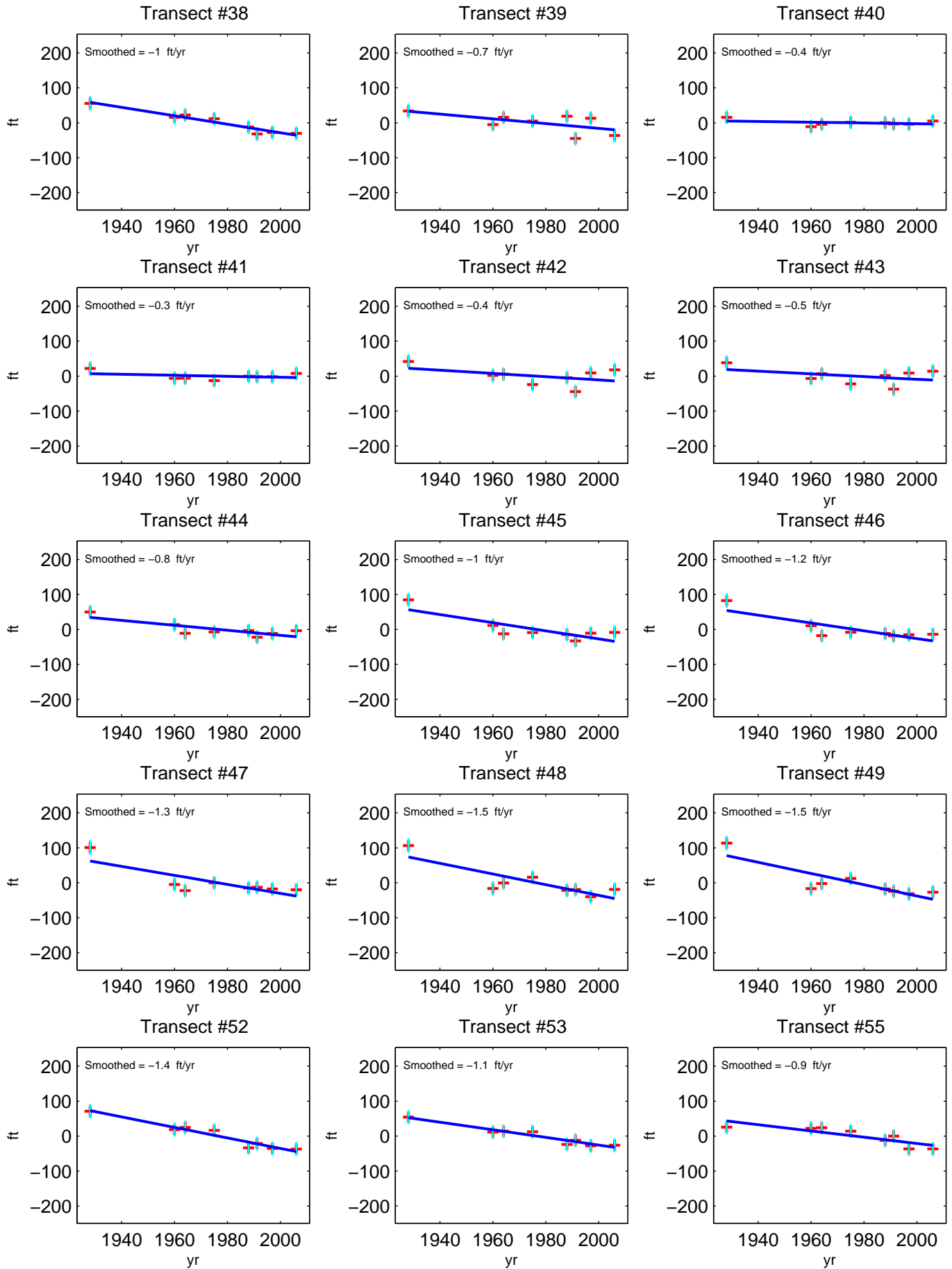
Positive Rate = Accretion
Negative Rate = Erosion



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Salt Pond - Smoothed Shoreline Change Rates

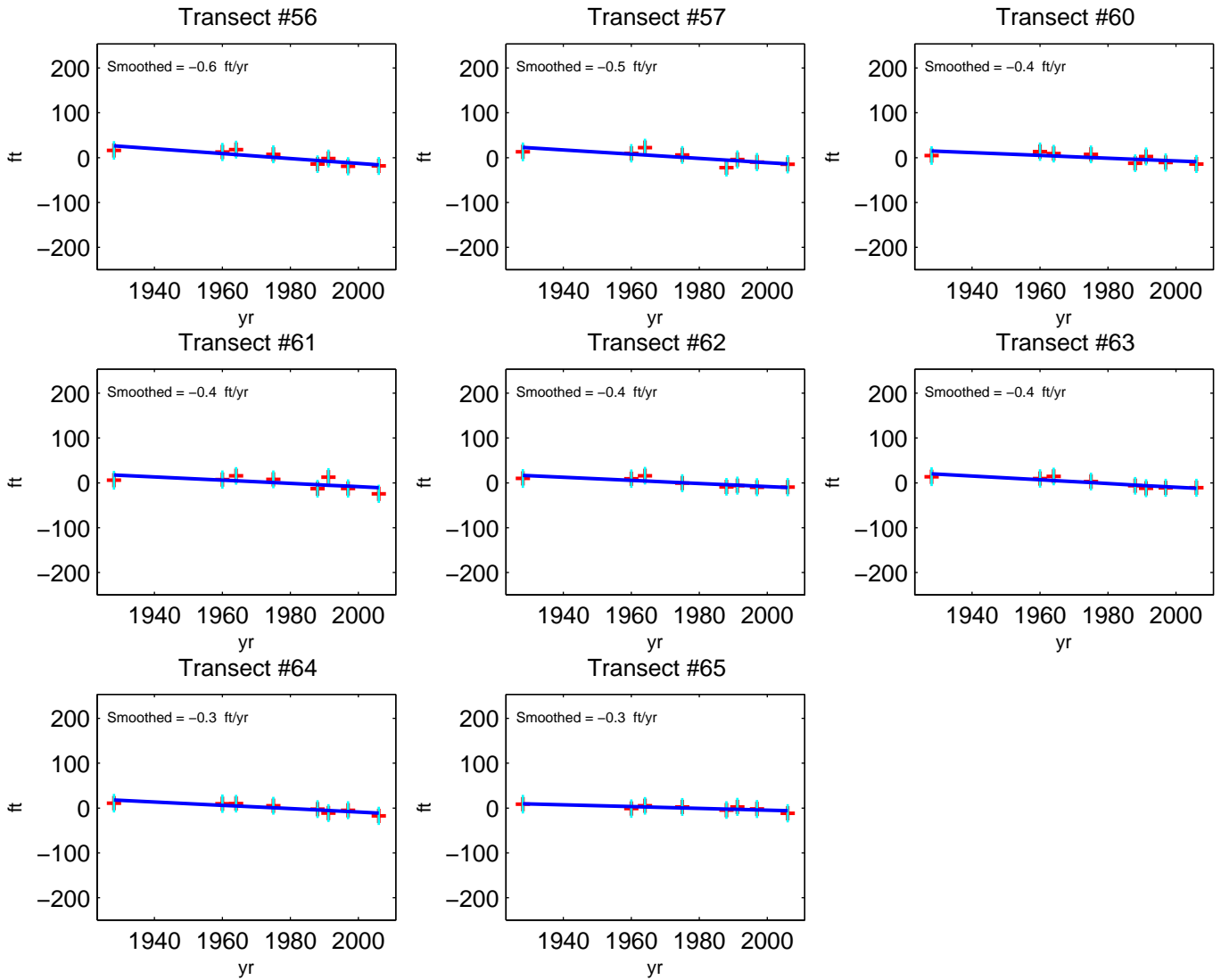
Positive Rate = Accretion
Negative Rate = Erosion



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Salt 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.

Hanapepe, Kauai, Hawaii

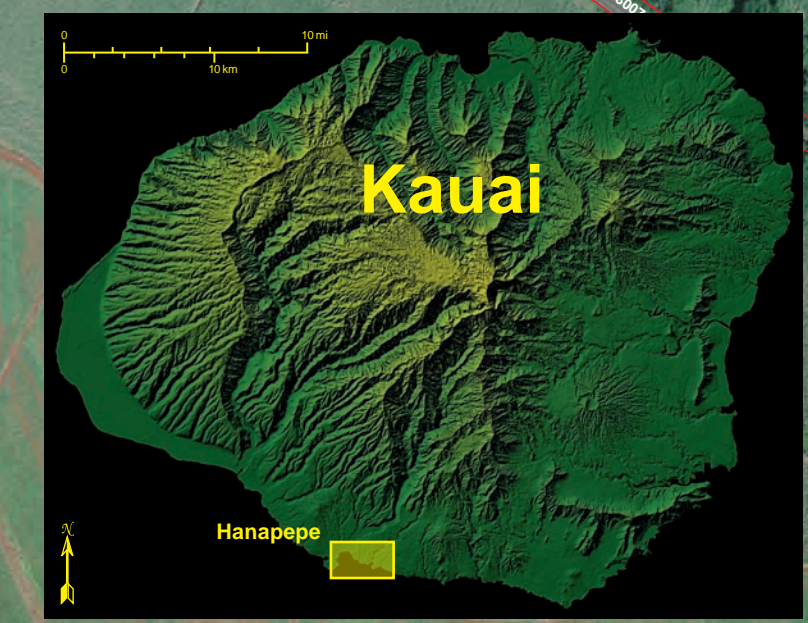
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HISTORICAL SHORELINES

- Jan 1928
- Nov 1950
- Oct 1960
- Apr 1975
- Oct 1981
- Jul 1987
- Mar 1988
- Oct 1991
- May 1992
- Sept 15 1992
- Sept 18 1992
- Nov 2006

Erosion rate measurement locations (shore-normal transects)

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 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).

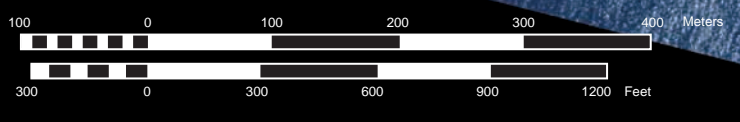
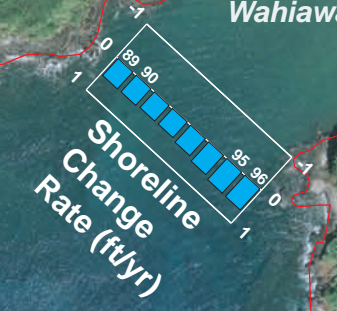
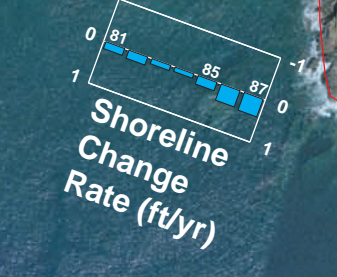
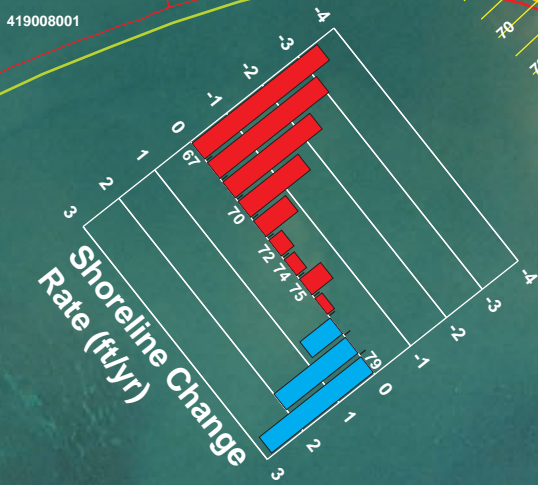
Movement of the SCRF along shore-normal transects (spaced every 66 ft) is used to calculate erosion rates.

AREA DESCRIPTION

The coastline of Hanapepe study area is composed of basalt rock bluffs and embayments with small pocket sandy beaches. There are three pocket beaches within the study area. The beach within Hanapepe Bay (transects 67 - 79) lies immediately to the north of Port Allen Small Boat Harbor east of the mouth of Hanapepe Stream. The location and orientation of the beach means that it is sheltered from the majority of seasonal wave activity from the south. Glass Beach (transects 81 - 87) lies to the east of Hanapepe Bay entrance. Wahiawa Bay (transects 89 - 96) contains a small pocket beach and river mouth. Glass Beach and Wahiawa Beach are exposed to seasonal south swells with the embayment at Wahiawa offering a smaller window of exposure to waves.

The average shoreline change of the beach north of Port Allen Small Boat Harbor is erosional at an average rate of -0.6 ft/yr. At Glass Beach, the shoreline change is accretional (0.2 ft/yr). Wahiawa Bay is experiencing accretion at an average rate of 0.5 ft/yr. Previous studies¹ did not analyze the Hanapepe study area.

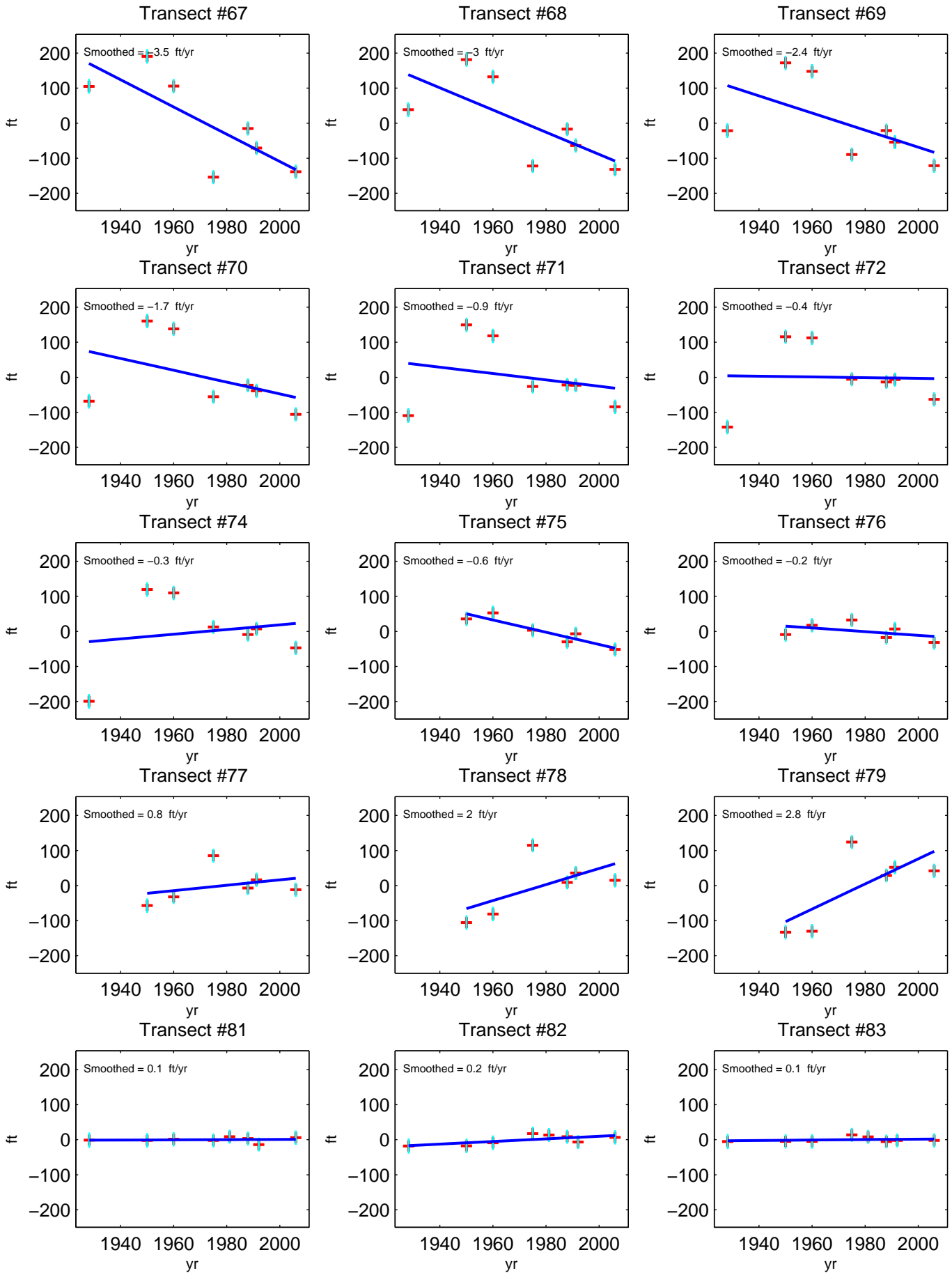
¹ Makalu Ocean Engineering and Sea Engineering, 1991 Aerial Photograph Analysis of Coastal Erosion on the Islands of Kauai, Molokai, Lanai, Maui, and Hawaii. State of Hawaii Office of Coastal Zone Management Program.



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

Hanapepe - Smoothed Shoreline Change Rates

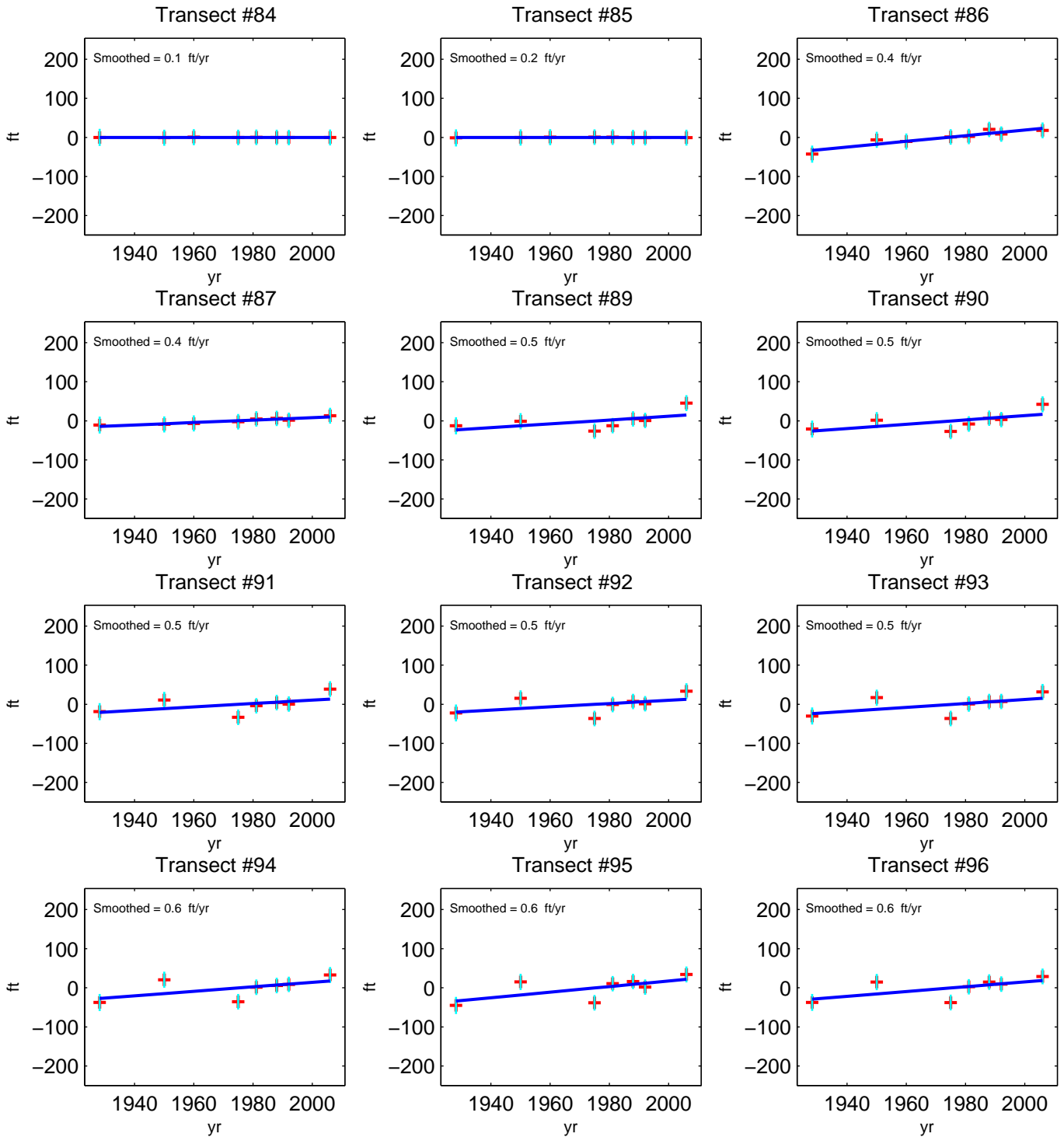
Positive Rate = Accretion
Negative Rate = Erosion



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

Hanapepe - 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.

Palama, Kauai, Hawaii

AREA DESCRIPTION

The Palama study area extends from Koheo Point in the west to Palama Beach in the east. The area is comprised of basalt rock bluffs and headlands with boulders, cobble, and sand dominating the shoreline. The coastline is exposed to swell from the south during the summer months. The two sandy beaches within this study area are located at the eastern end, to the south and east of Nomilu Fishpond.

The average shoreline change at the beach at Makaokahai Point (transects 98 – 100) is experiencing slight erosion at an average rate of -0.2 ft/yr. Palama Beach (transects 102 - 121) also exhibits erosion with an average shoreline change rate of -0.5 ft/yr. Previous studies¹ do not include the Palama region in their analysis.

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 1928
- Apr 1975
- Oct 1981
- Jul 1987
- Mar 1988
- 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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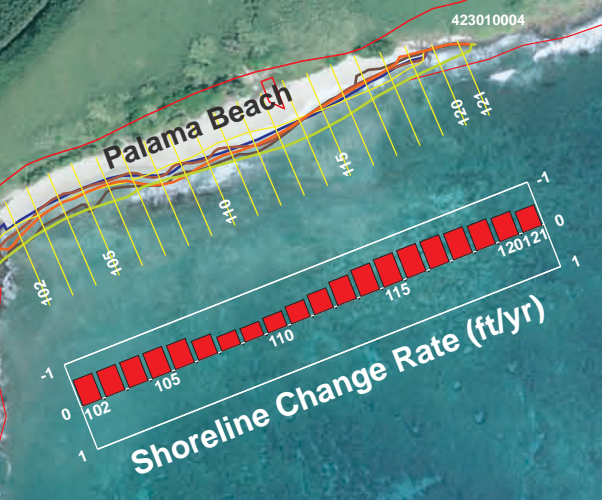
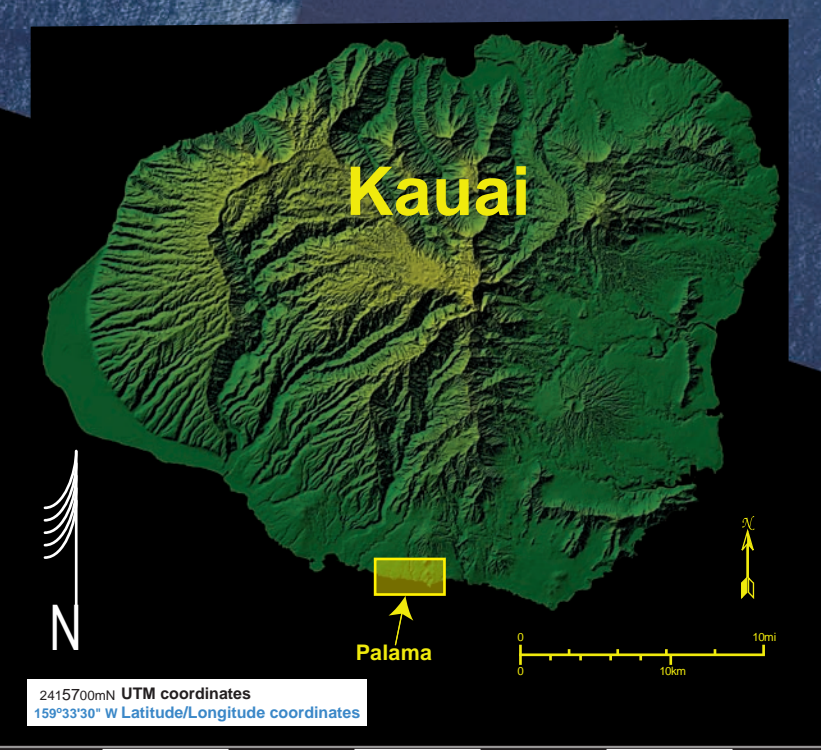







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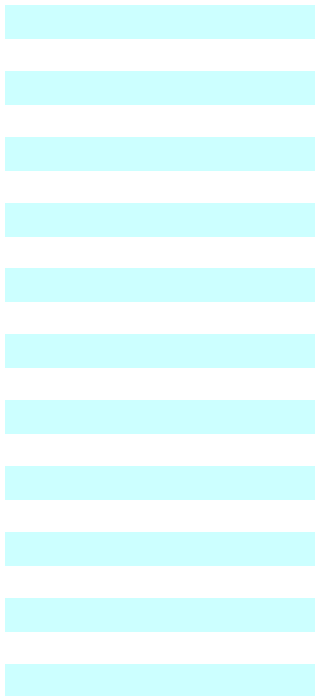
Contract C25514 Contract 7249



Palama - Smoothed Rates

Positive Rate = Accretion
Negative Rate = Erosion

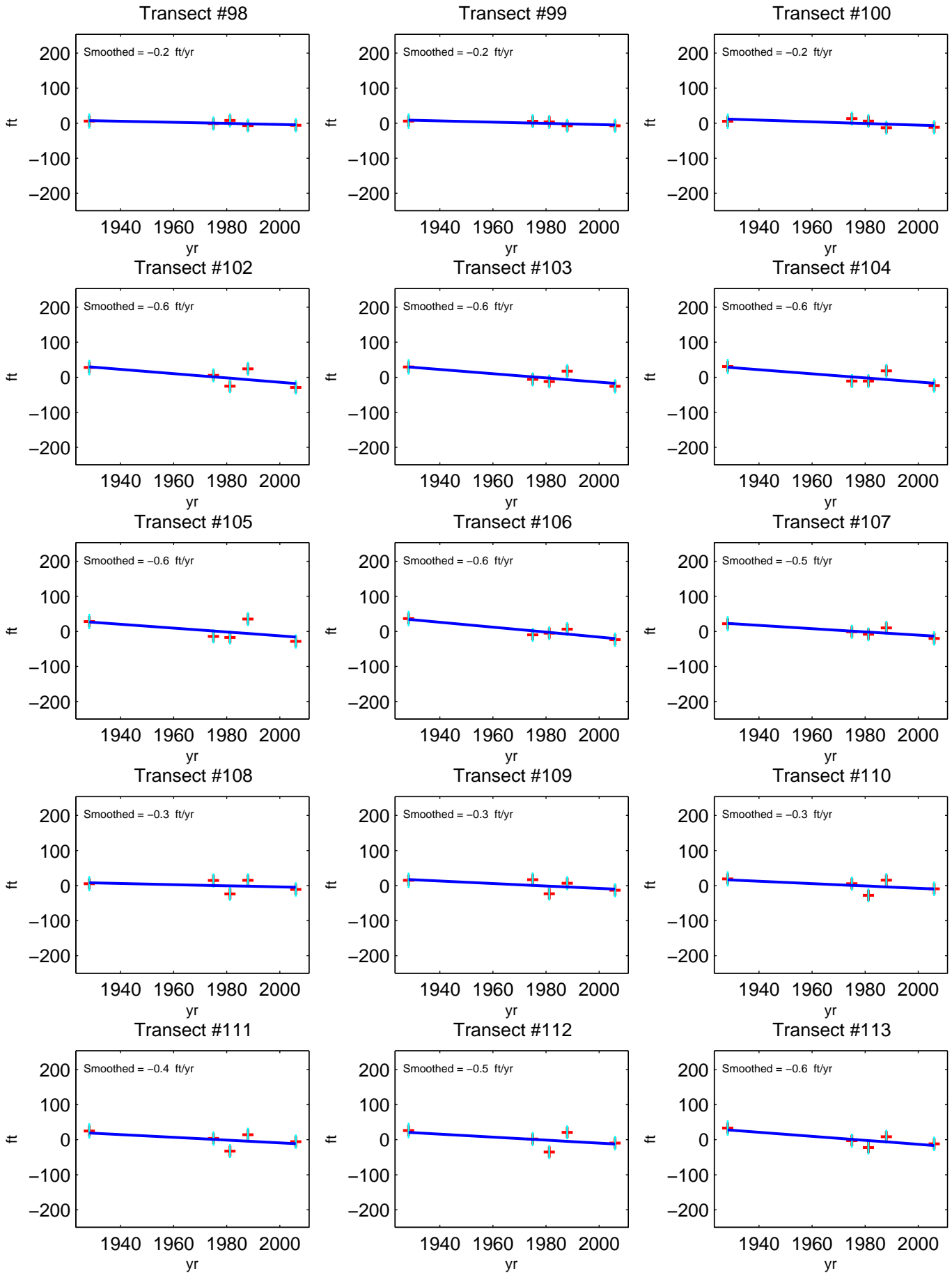
Transect	Smoothed Rate (ft/yr)
98	-0.2
99	-0.2
100	-0.2
102	-0.6
103	-0.6
104	-0.6
105	-0.6
106	-0.6
107	-0.5
108	-0.3
109	-0.3
110	-0.3
111	-0.4
112	-0.5
113	-0.6
114	-0.6
115	-0.6
116	-0.6
117	-0.6
118	-0.6
119	-0.6
120	-0.5
121	-0.5



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

Palama - Smoothed Shoreline Change Rates

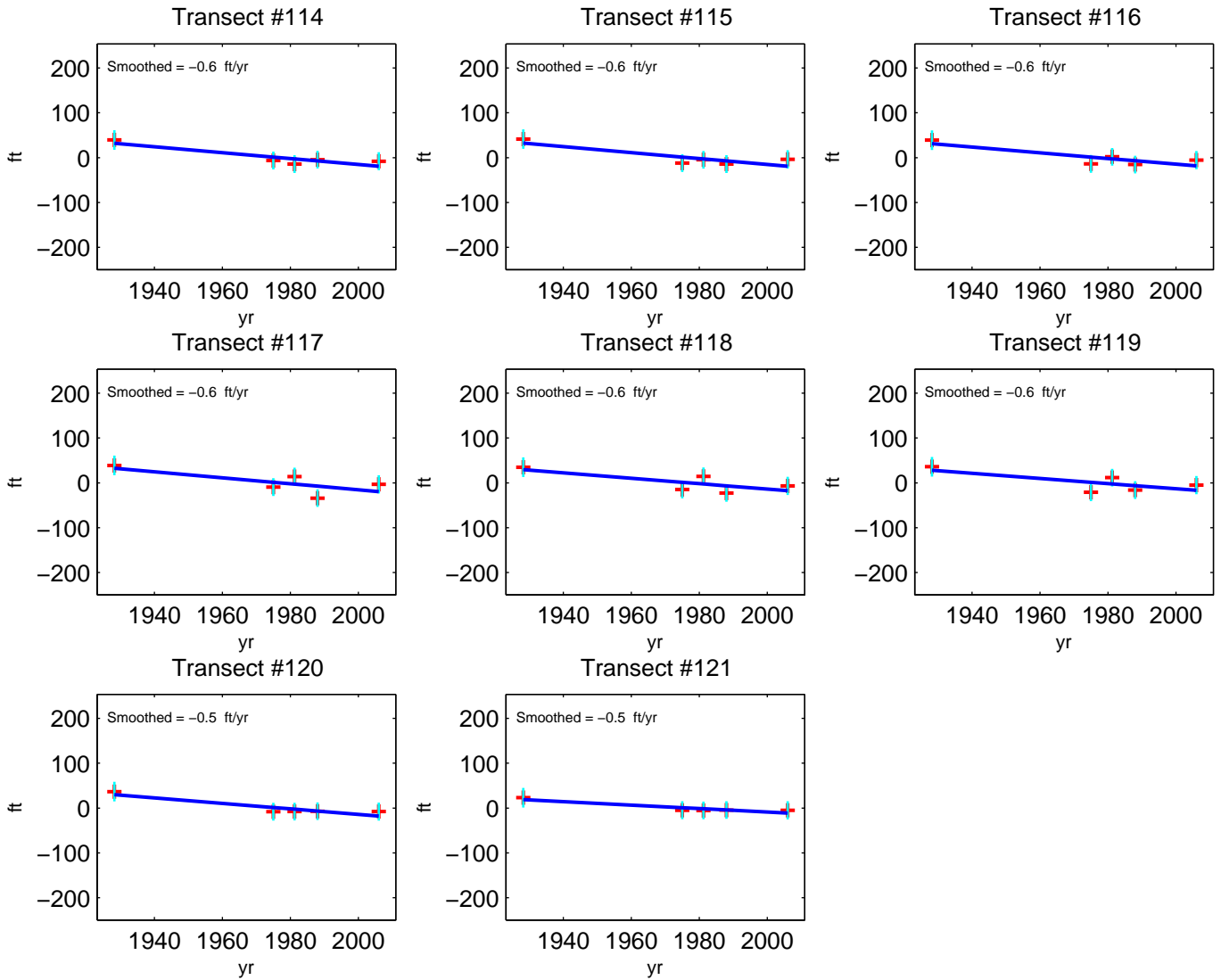
Positive Rate = Accretion
Negative Rate = Erosion



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

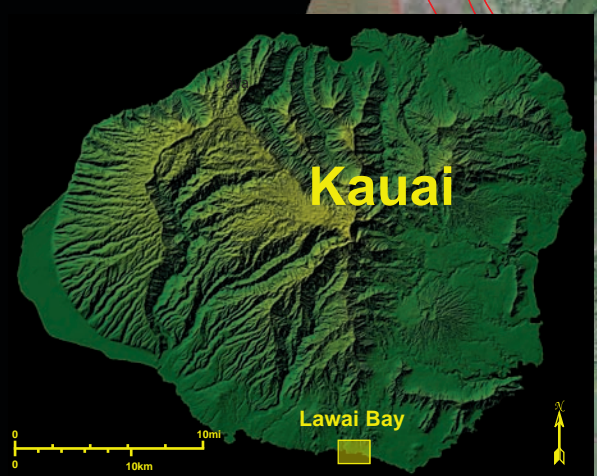
Palama - Smoothed Shoreline Change Rates

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.

Lawai Bay, Kauai, Hawaii



HISTORICAL SHORELINES

- Jan 1928
- May 1966
- Apr 1975
- Jan 1982
- Sep 1984
- Jul 1987
- Mar 1988
- Sept 1992
- Aug 2000
- Oct 2007
- Jan 2008

█ 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).

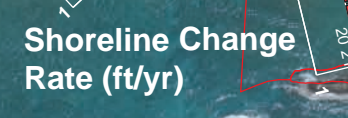
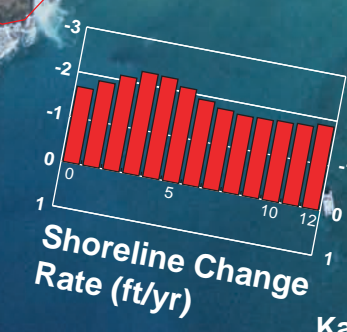
Movement of the SCRF along shore-normal transects (spaced every 66 ft) is used to calculate erosion rates.

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 Lawai Bay study area (transects 0 - 21) is located on the south coast of Kauai. The area is bounded by Lawai Bay to the west and La Lae Kiki to the east. The shoreline is characterized by small pocket beaches interspersed among basaltic headlands.

Overall, the area is eroding at an average rate of -1.2 ft/yr. There are three pocket beaches within the study area. Lawai Bay (transects 0 - 12) is located to the west of Ka Lae O Kaiwa. This section of the study area is experiencing erosion at an average rate of -1.9 ft/yr. The next beach (transects 13 - 14) to the east of Spouting Horn Park has experienced erosion at an average rate of -0.2 ft/yr. The beach (transects 15 - 21) by Kukuiula Landing Park has experienced no net trend over the period of study. Previous studies¹ did not analyze the Lawai Bay study area shoreline.

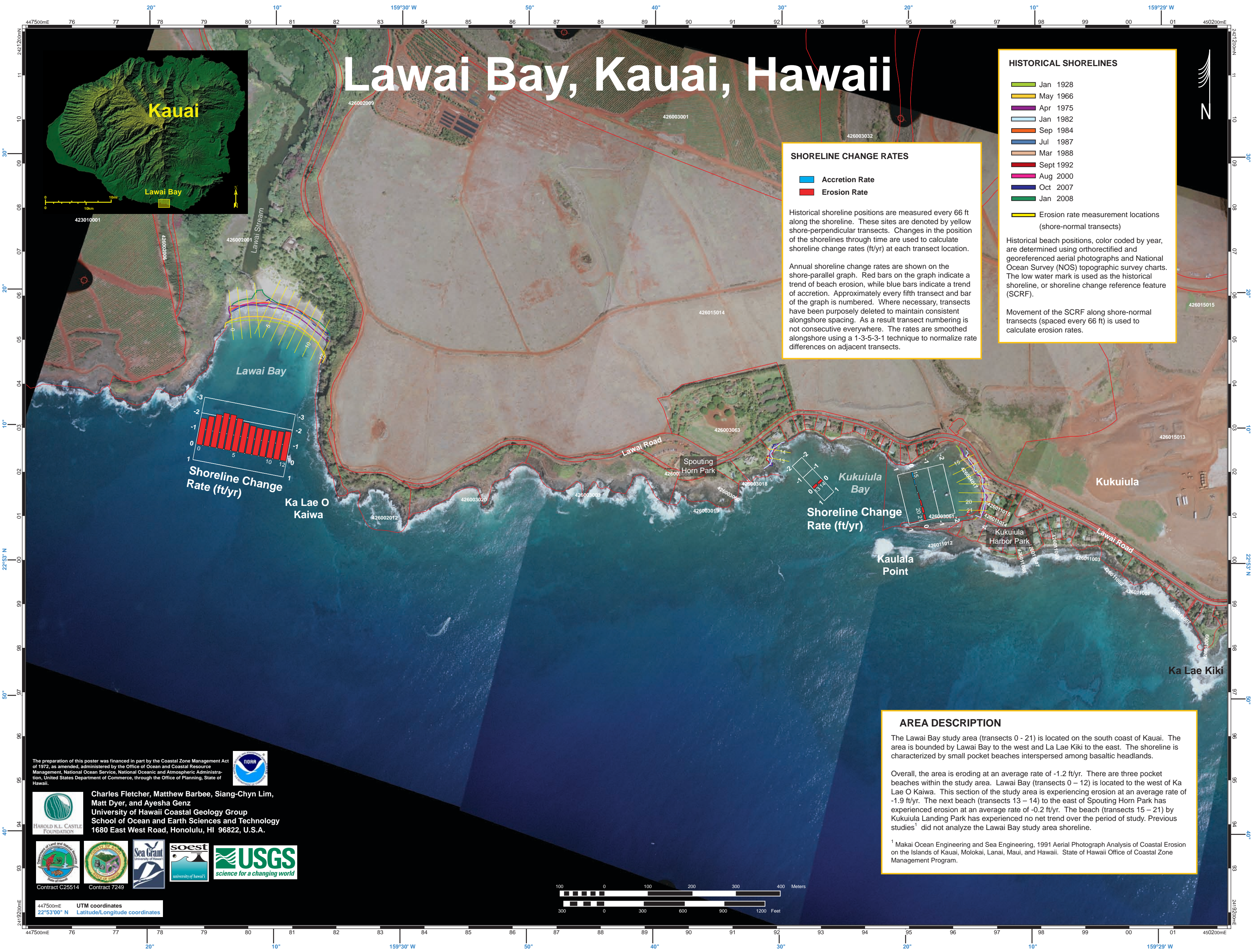
¹ Makai Ocean Engineering and Sea Engineering, 1991 Aerial Photograph Analysis of Coastal Erosion on the Islands of Kauai, Molokai, Lanai, Maui, and Hawaii. State of Hawaii Office of Coastal Zone Management Program.

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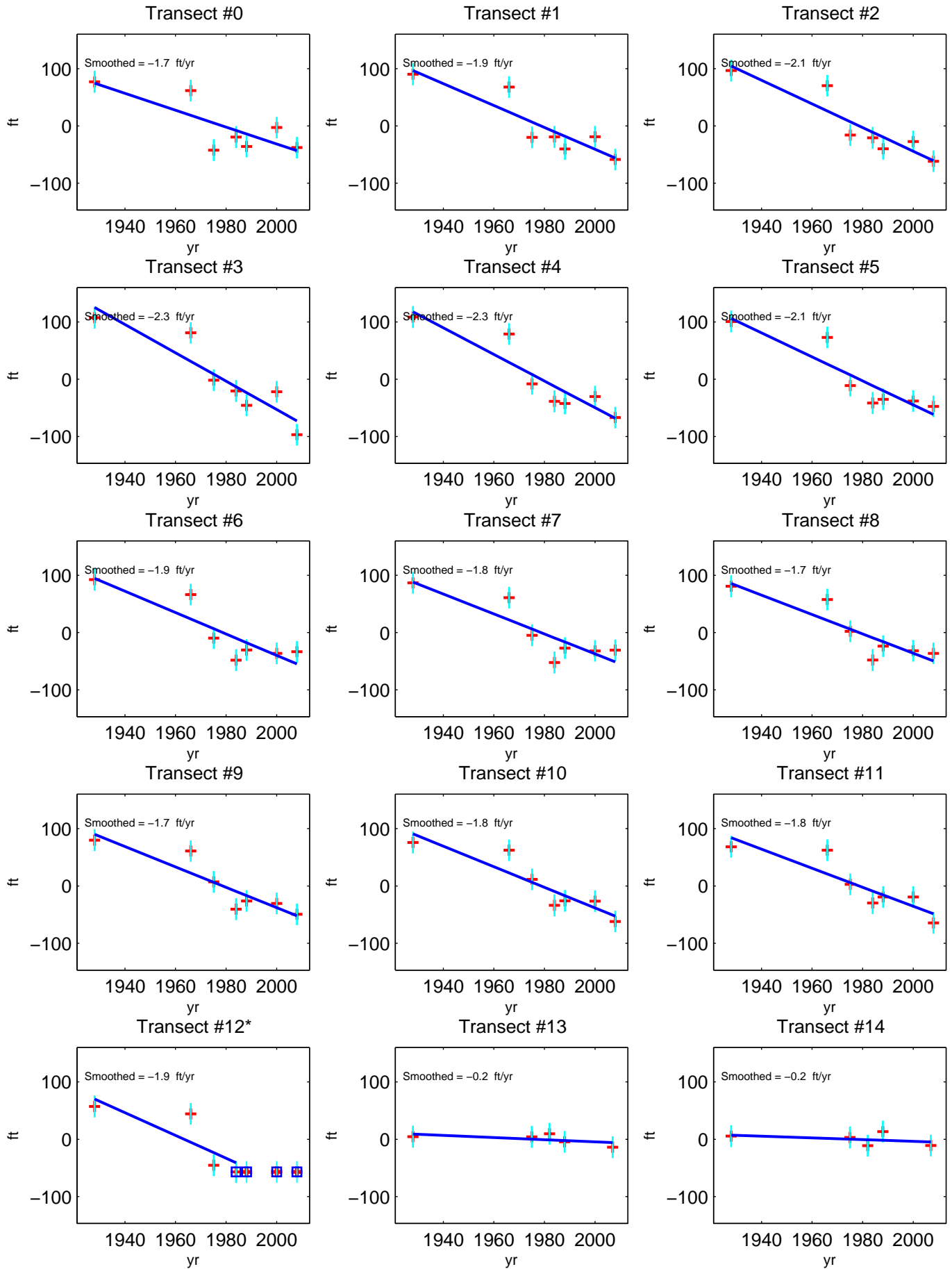


Contract C25514 Contract 7249
 447500mE UTM coordinates
 22°53'00" N Latitude/Longitude coordinates



Lawai - Smoothed Shoreline Change Rates

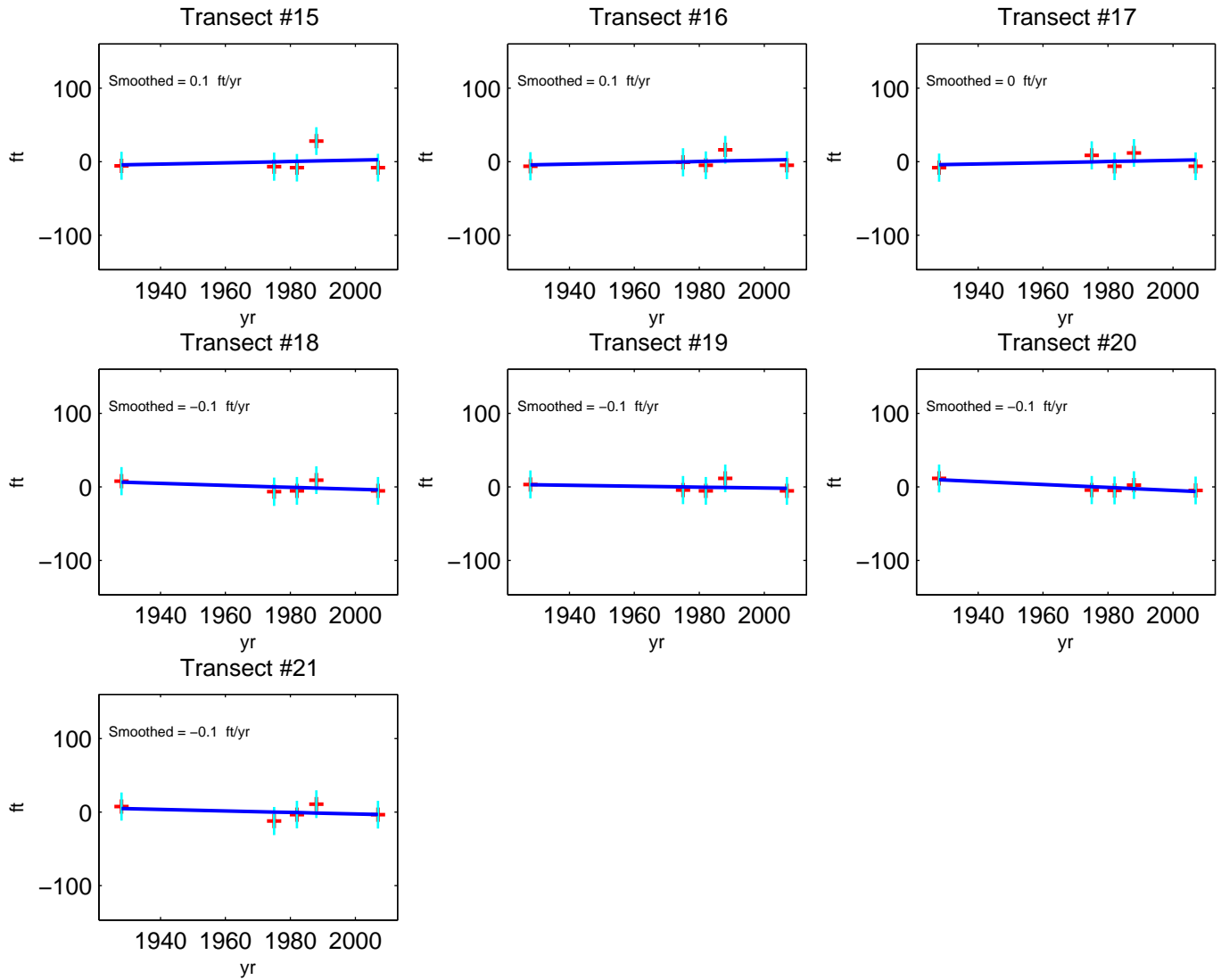
Positive Rate = Accretion
Negative Rate = Erosion



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

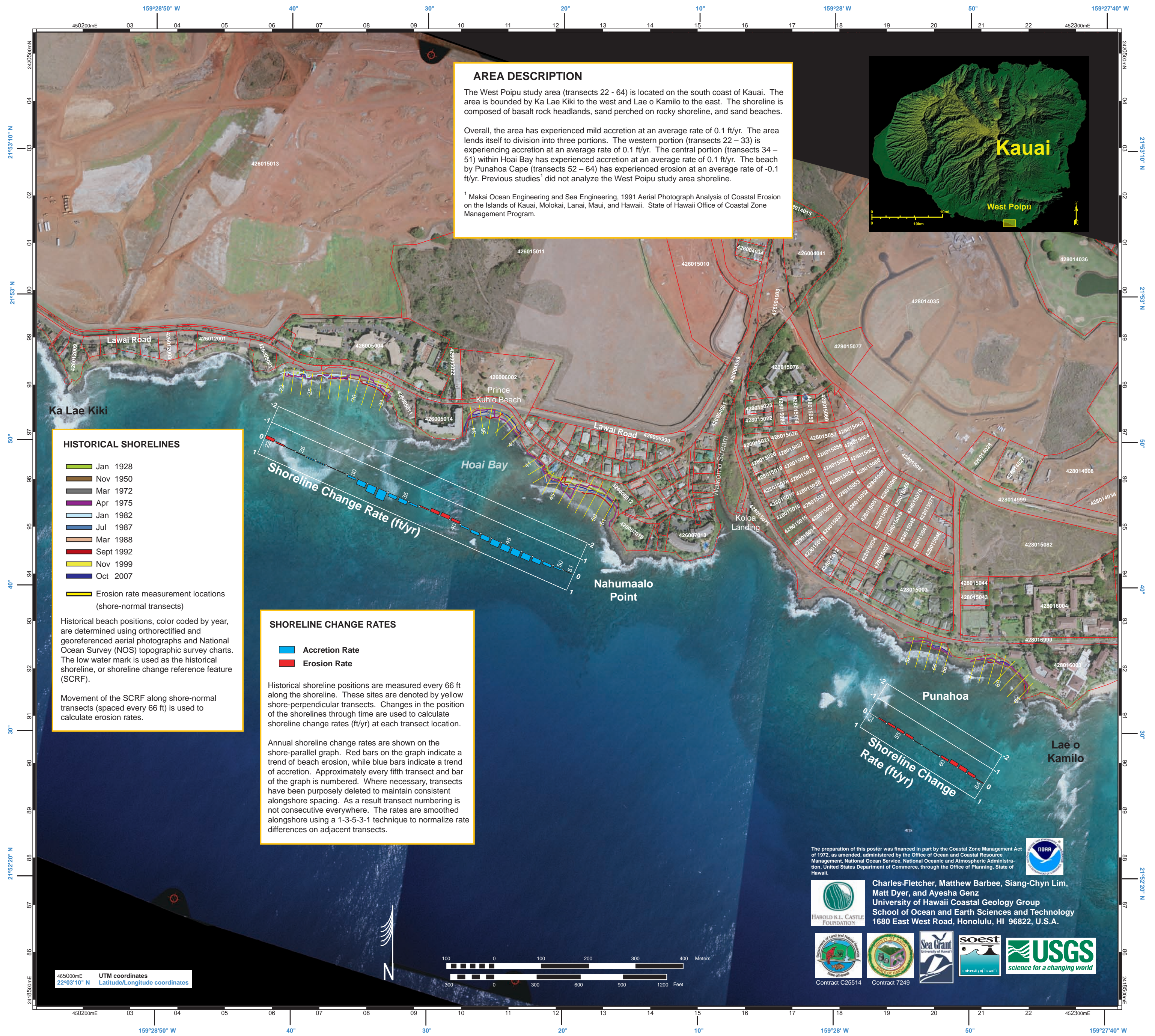
Lawai - Smoothed Shoreline Change Rates

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.

West Poipu, Kauai, Hawaii

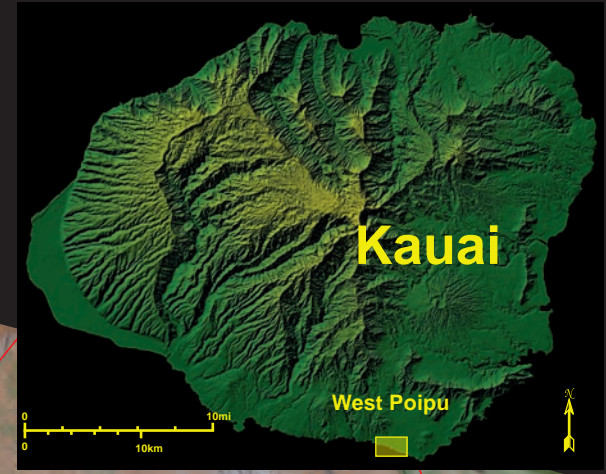


AREA DESCRIPTION

The West Poipu study area (transects 22 - 64) is located on the south coast of Kauai. The area is bounded by Ka Lae Kiki to the west and Lae o Kamilo to the east. The shoreline is composed of basalt rock headlands, sand perched on rocky shoreline, and sand beaches.

Overall, the area has experienced mild accretion at an average rate of 0.1 ft/yr. The area lends itself to division into three portions. The western portion (transects 22 – 33) is experiencing accretion at an average rate of 0.1 ft/yr. The central portion (transects 34 – 51) within Hoai Bay has experienced accretion at an average rate of 0.1 ft/yr. The beach by Punahoa Cape (transects 52 – 64) has experienced erosion at an average rate of -0.1 ft/yr. Previous studies¹ did not analyze the West Poipu 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 1928
- Nov 1950
- Mar 1972
- Apr 1975
- Jan 1982
- Jul 1987
- Mar 1988
- Sept 1992
- Nov 1999
- Oct 2007

— 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.

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Contract C25514 Contract 7249

465000mE UTM coordinates
 22°03'10" N Latitude/Longitude coordinates



West Poipu - Smoothed Rates

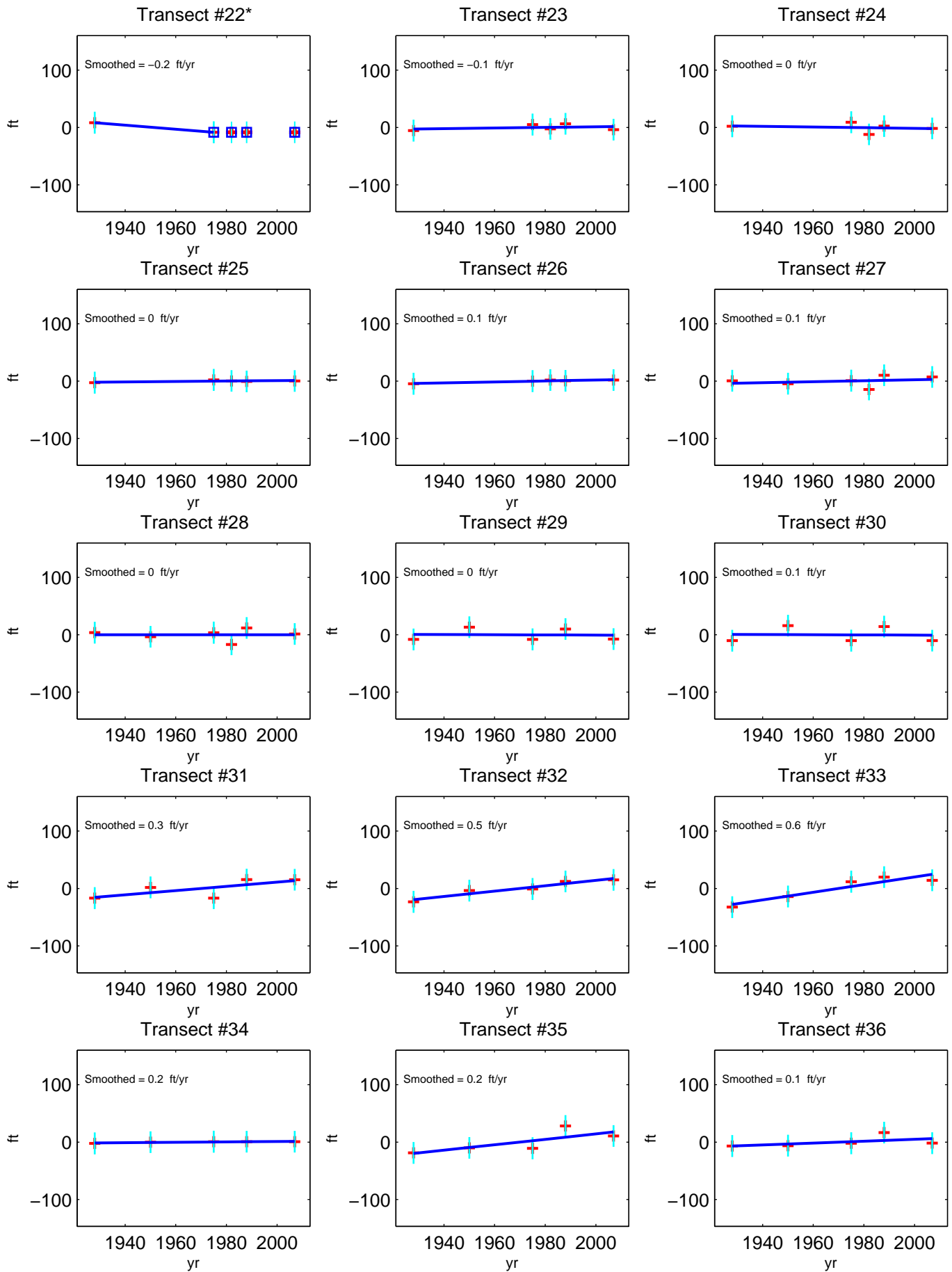
Positive Rate = Accretion
Negative Rate = Erosion

Transect	Smoothed Rate (ft/yr)
22*	-0.2
23	-0.1
24	0.0
25	0.0
26	0.1
27	0.1
28	0.0
29	0.0
30	0.1
31	0.3
32	0.5
33	0.6
34	0.2
35	0.2
36	0.1
37	-0.1
38	-0.2
39	-0.2
40	-0.1
41	0.1
42	0.2
43	0.3
44	0.4
45	0.4
46	0.4
47	0.3
48	0.3
49	0.2
50	0.1
51	0.0
52	--
53	-0.1
54	-0.1
55	-0.1
56	-0.1
57	0.0
58	0.0
59	0.0
60	-0.1
61*	-0.2
62*	-0.2
63*	-0.2
64*	0.0

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

West Poipu - Smoothed Shoreline Change Rates

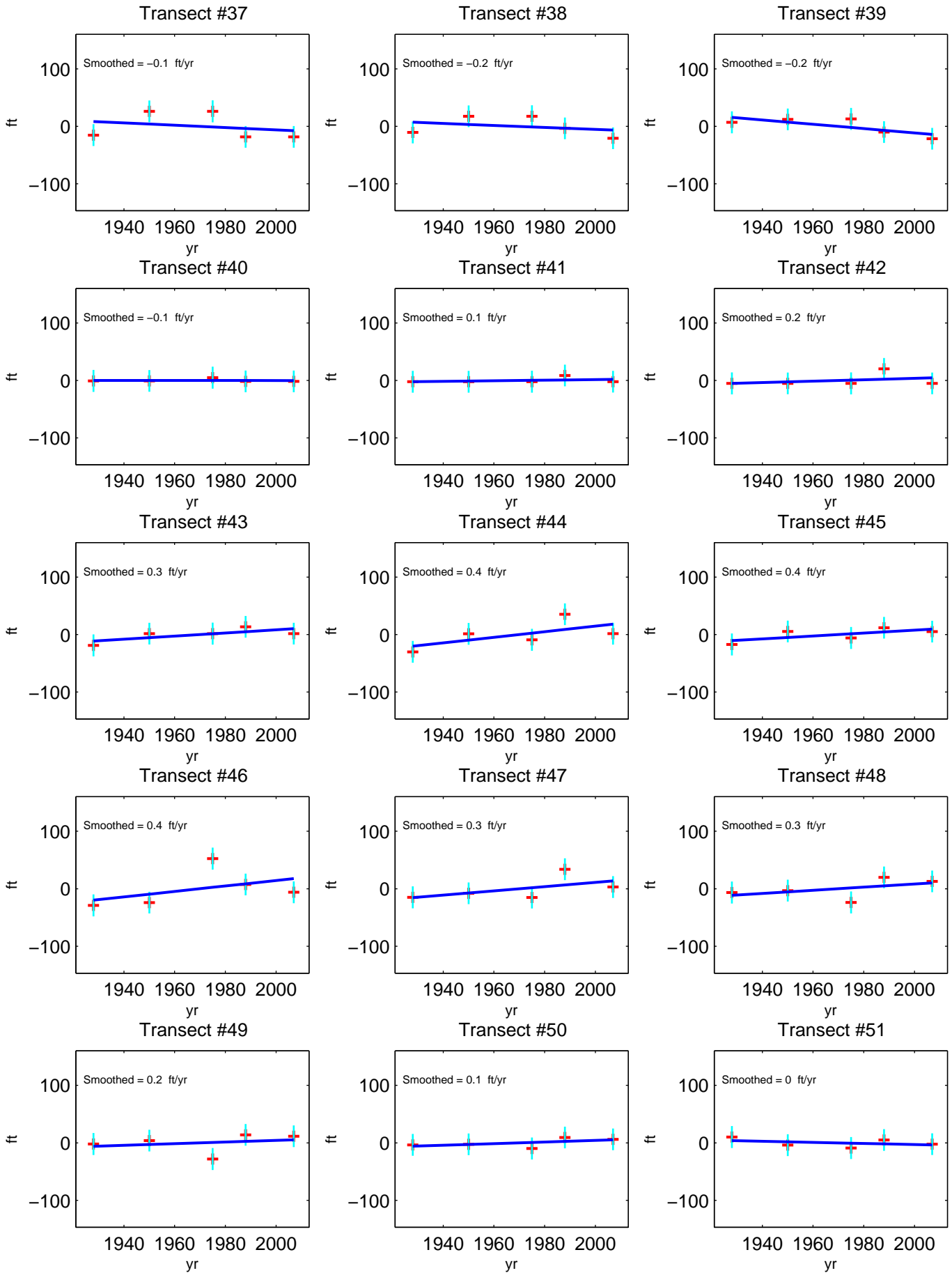
Positive Rate = Accretion
Negative Rate = Erosion



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

West Poipu - Smoothed Shoreline Change Rates

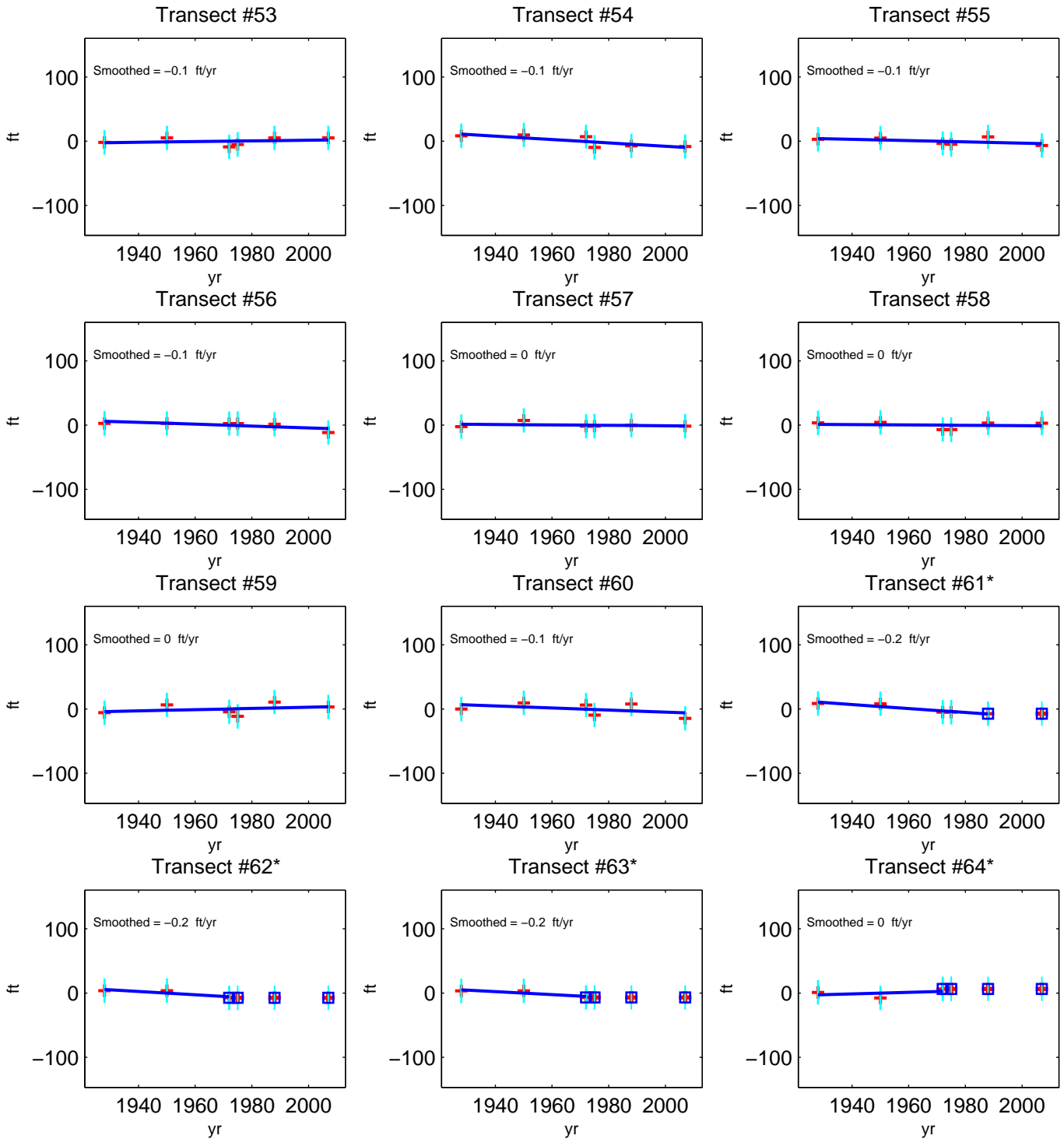
Positive Rate = Accretion
Negative Rate = Erosion



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

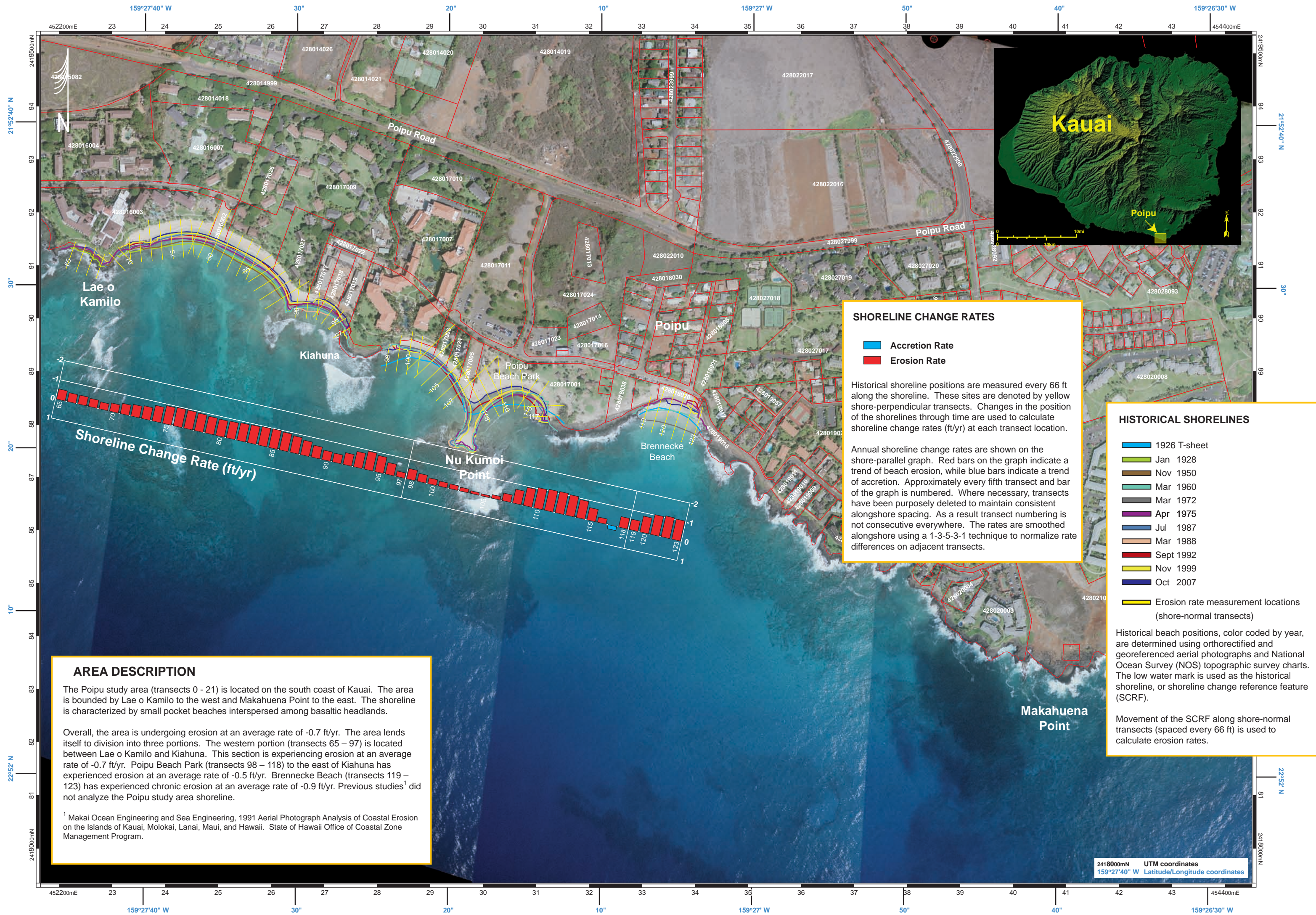
West Poipu - Smoothed Shoreline Change Rates

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.

Poipu, Kauai, Hawaii



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

- █ 1926 T-sheet
- █ Jan 1928
- █ Nov 1950
- █ Mar 1960
- █ Mar 1972
- █ Apr 1975
- █ Jul 1987
- █ Mar 1988
- █ Sept 1992
- █ Nov 1999
- █ Oct 2007

█ 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).

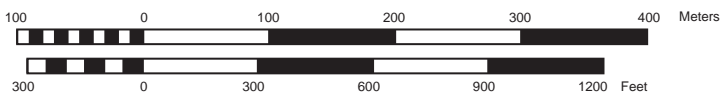
Movement of the SCRF along shore-normal transects (spaced every 66 ft) is used to calculate erosion rates.

AREA DESCRIPTION

The Poipu study area (transects 0 - 21) is located on the south coast of Kauai. The area is bounded by Lae o Kamilo to the west and Makahuena Point to the east. The shoreline is characterized by small pocket beaches interspersed among basaltic headlands.

Overall, the area is undergoing erosion at an average rate of -0.7 ft/yr. The area lends itself to division into three portions. The western portion (transects 65 - 97) is located between Lae o Kamilo and Kiahuna. This section is experiencing erosion at an average rate of -0.7 ft/yr. Poipu Beach Park (transects 98 - 118) to the east of Kiahuna has experienced erosion at an average rate of -0.5 ft/yr. Brennecke Beach (transects 119 - 123) has experienced chronic erosion at an average rate of -0.9 ft/yr. Previous studies¹ did not analyze the Poipu 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.



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Poipu - Smoothed Rates

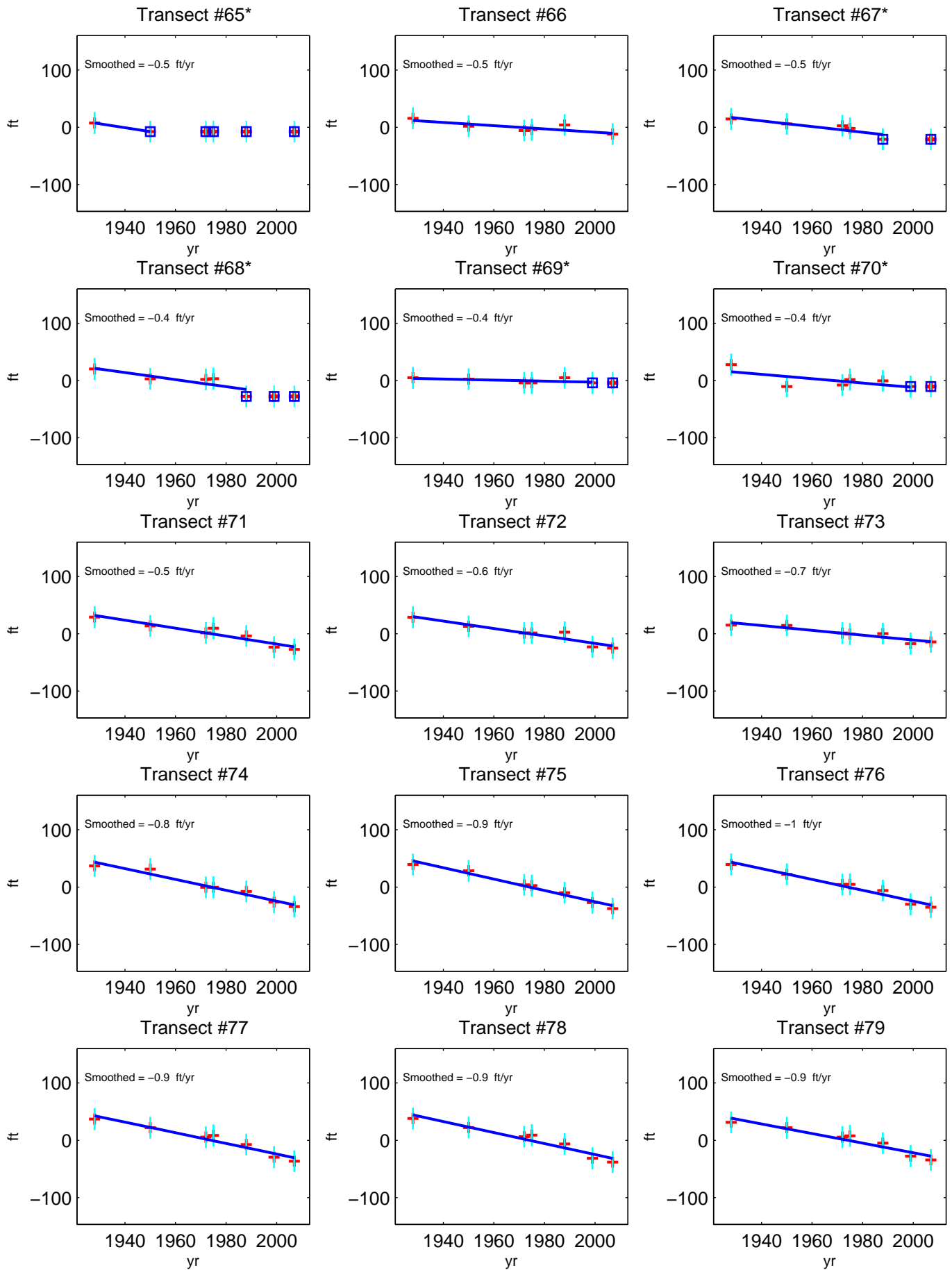
Positive Rate = Accretion
 Negative Rate = Erosion

Transect	Smoothed Rate (ft/yr)	Transect	Smoothed Rate (ft/yr)
65*	-0.5	111	-1.1
66	-0.5	112	-1.1
67*	-0.5	113	-1.1
68*	-0.4	114	-0.9
69*	-0.4	115	-0.6
70*	-0.4	116	-0.3
71	-0.5	117	0.2
72	-0.6	118	-0.5
73	-0.7	119*	-0.5
74	-0.8	120	-0.8
75	-0.9	121	-1.0
76	-1.0	122	-1.1
77	-0.9	123	-1.0
78	-0.9		
79	-0.9		
80	-0.9		
81	-0.9		
82	-0.9		
83	-0.9		
84	-1.0		
85	-1.0		
86	-0.9		
87	-0.9		
88	-0.8		
89	-0.6		
90	-0.5		
91	-0.5		
92	-0.6		
93	-0.8		
94	-0.9		
95	-0.8		
96	-0.6		
97	-0.3		
98	-0.5		
99	-0.4		
100	-0.3		
101	-0.3		
102	-0.2		
103	-0.2		
104	-0.1		
105	-0.1		
106	-0.2		
107	-0.4		
108	-0.7		
109	-0.9		
110	-1.0		

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

Poipu - Smoothed Shoreline Change Rates

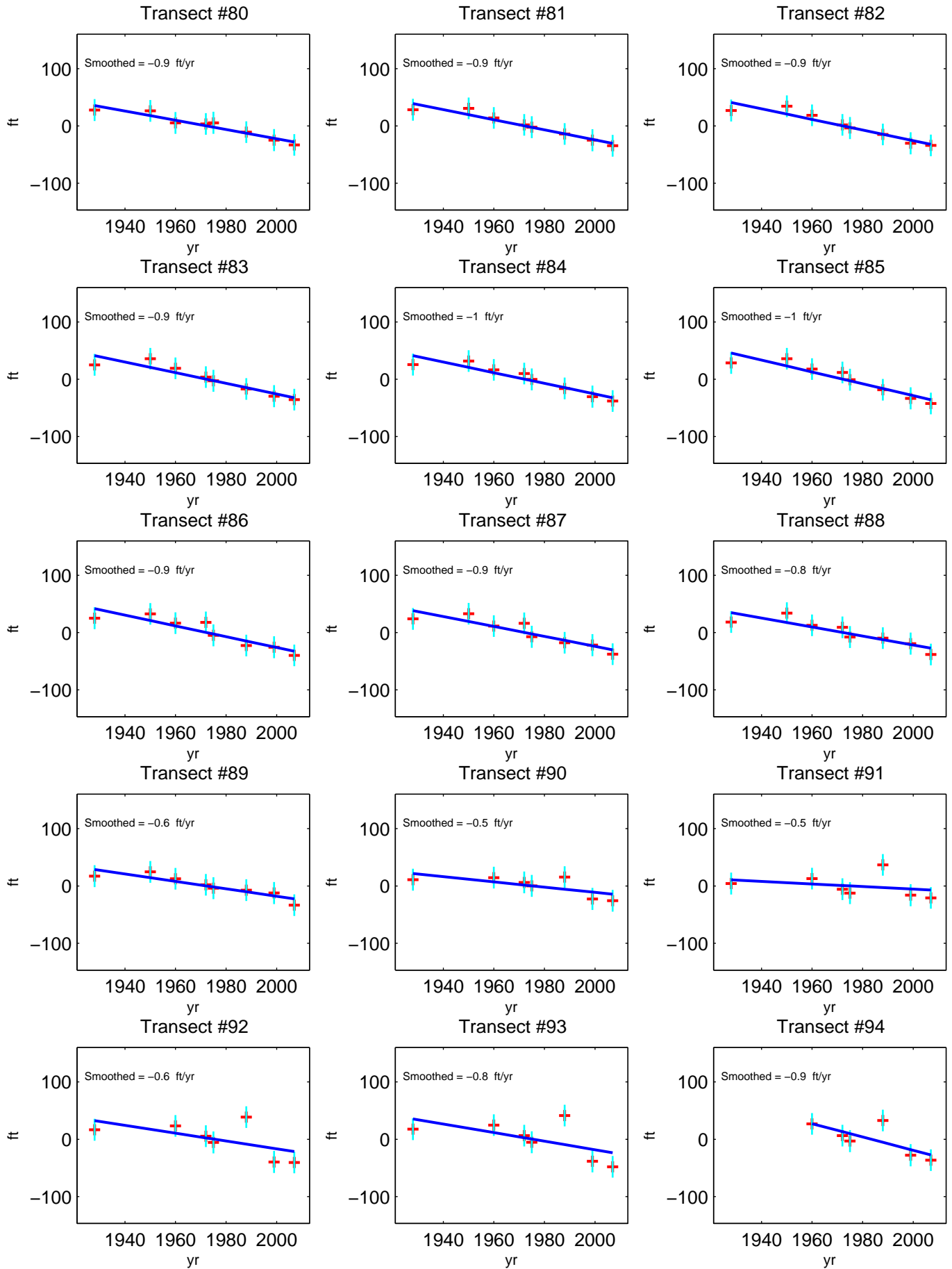
Positive Rate = Accretion
Negative Rate = Erosion



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

Poipu - Smoothed Shoreline Change Rates

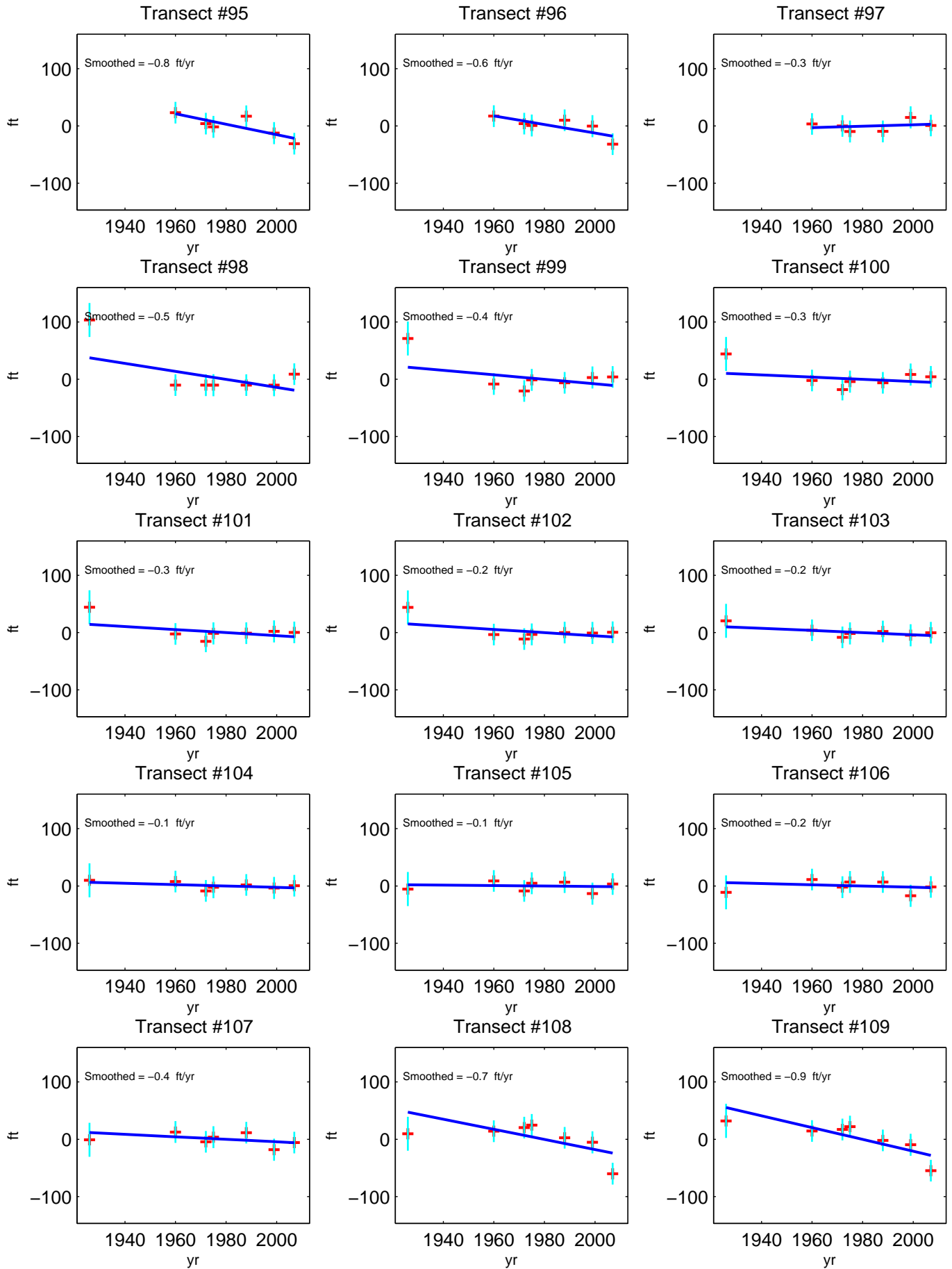
Positive Rate = Accretion
Negative Rate = Erosion



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Poipu - Smoothed Shoreline Change Rates

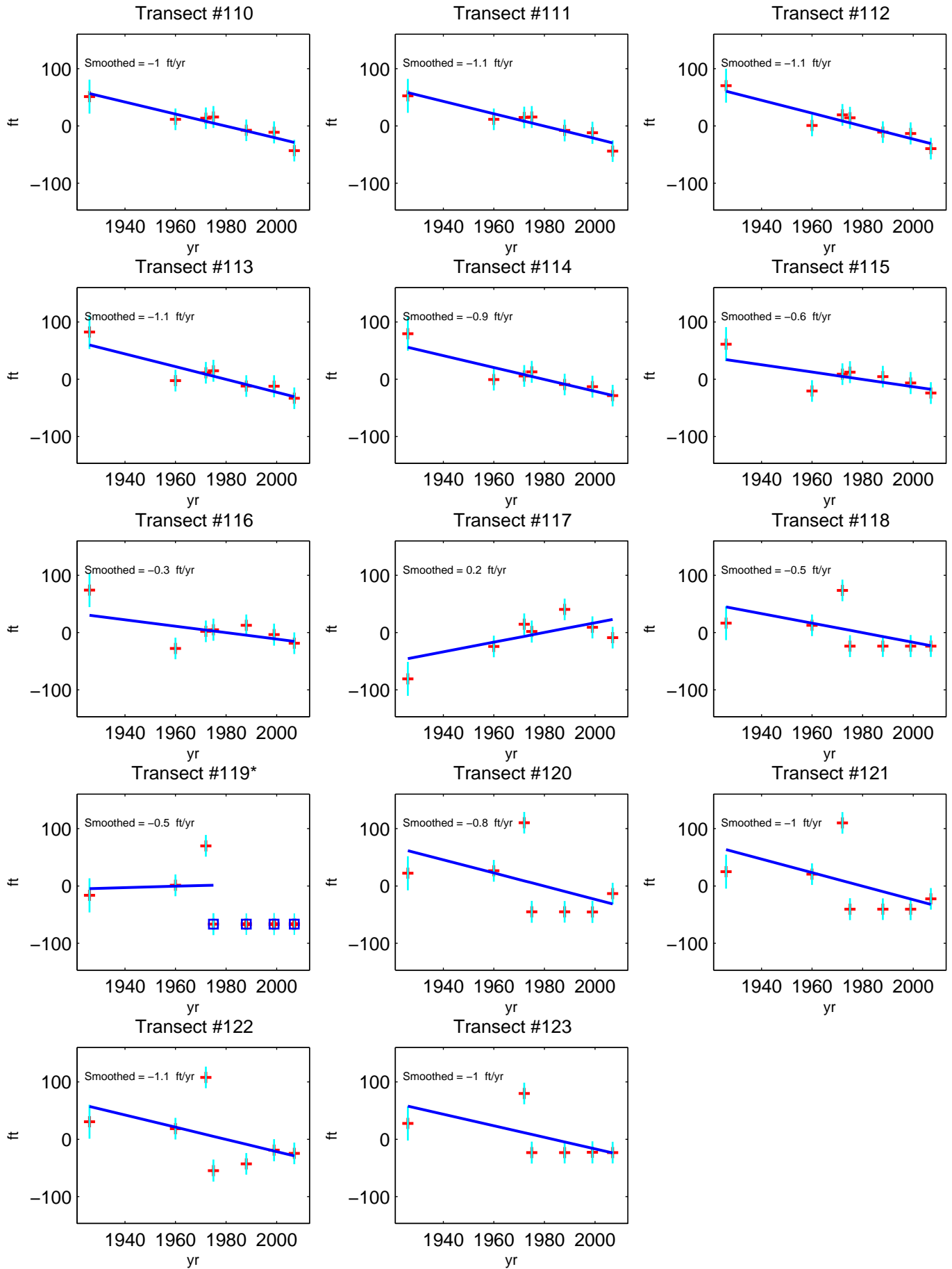
Positive Rate = Accretion
Negative Rate = Erosion



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

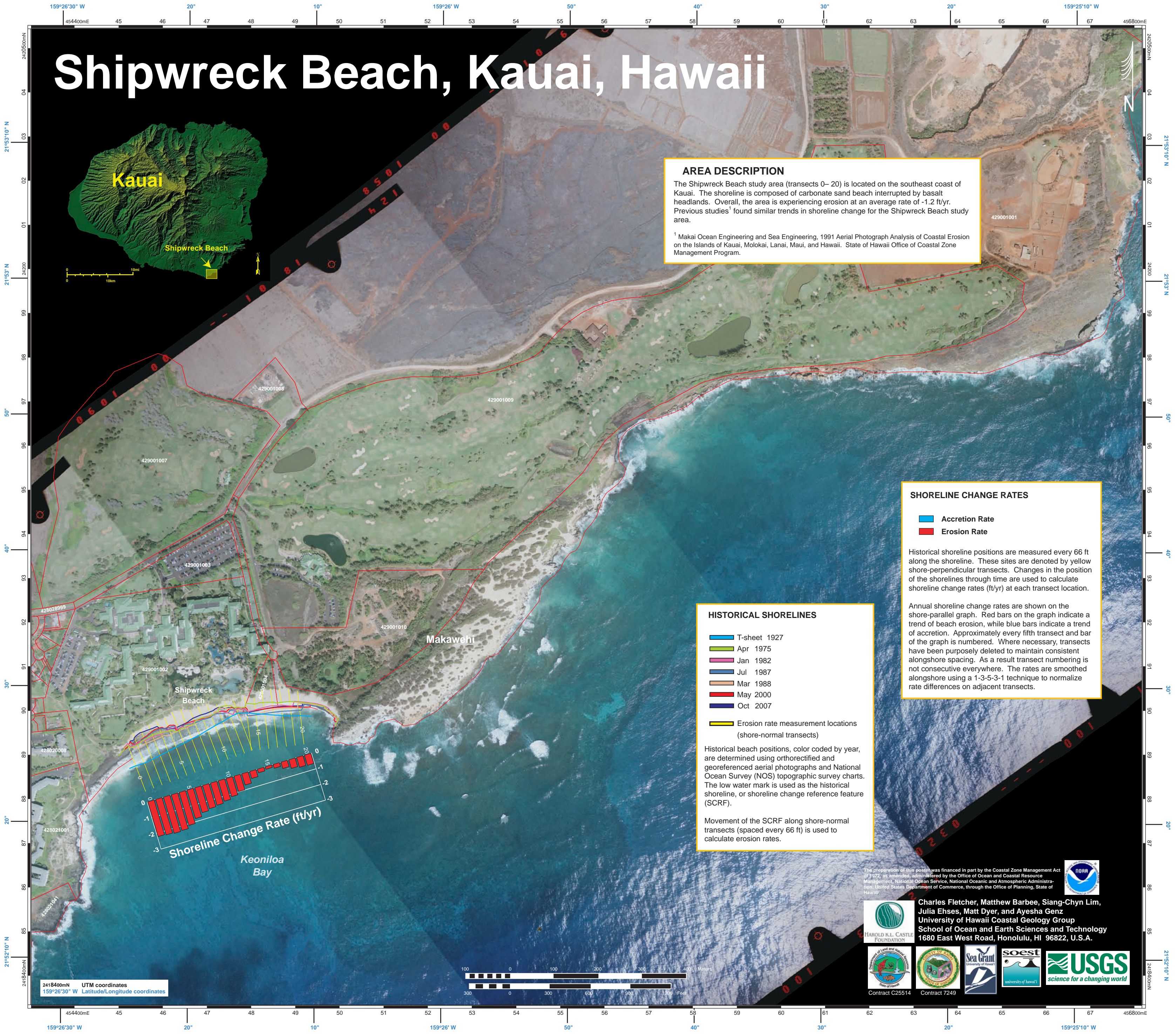
Poipu - Smoothed Shoreline Change Rates

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.

Shipwreck Beach, Kauai, Hawaii



AREA DESCRIPTION

The Shipwreck Beach study area (transects 0– 20) is located on the southeast coast of Kauai. The shoreline is composed of carbonate sand beach interrupted by basalt headlands. Overall, the area is experiencing erosion at an average rate of -1.2 ft/yr. Previous studies¹ found similar trends in shoreline change for the Shipwreck Beach study area.

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

- T-sheet 1927
- Apr 1975
- Jan 1982
- Jul 1987
- Mar 1988
- May 2000
- Oct 2007

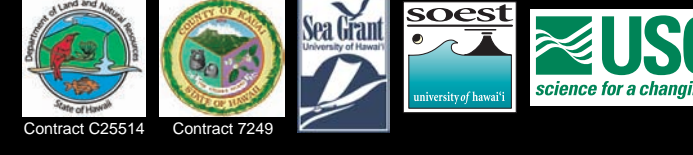
■ Erosion rate measurement locations (shore-normal transects)

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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2418400mN UTM coordinates
 159°26'30" W Latitude/Longitude coordinates



159°26'30" W 20° 10° 159°26' W 50° 40° 30° 20° 159°25'10" W

2420500mN 04 03 02 01 21°53'10" N 24200 99 98 97 50° 96 95 94 40° 93 92 91 30° 90 89 88 20° 87 86 85 21°52'10" N 2418400mN

454400mE 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 456800mE

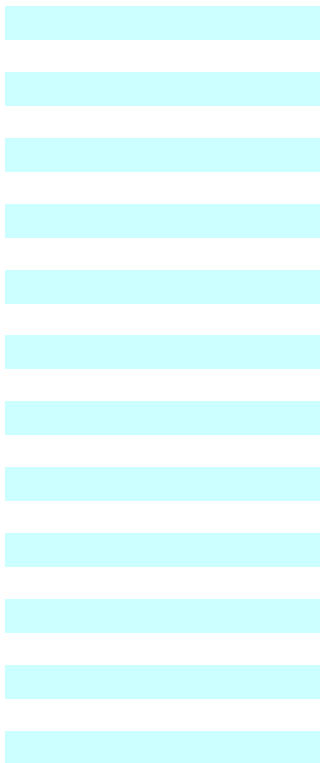
2420500mN 04 03 02 01 21°53'10" N 24200 99 98 97 50° 96 95 94 40° 93 92 91 30° 90 89 88 20° 87 86 85 21°52'10" N 2418400mN

159°26'30" W 20° 10° 159°26' W 50° 40° 30° 20° 159°25'10" W

Shipwreck - Smoothed Rates

Positive Rate = Accretion
Negative Rate = Erosion

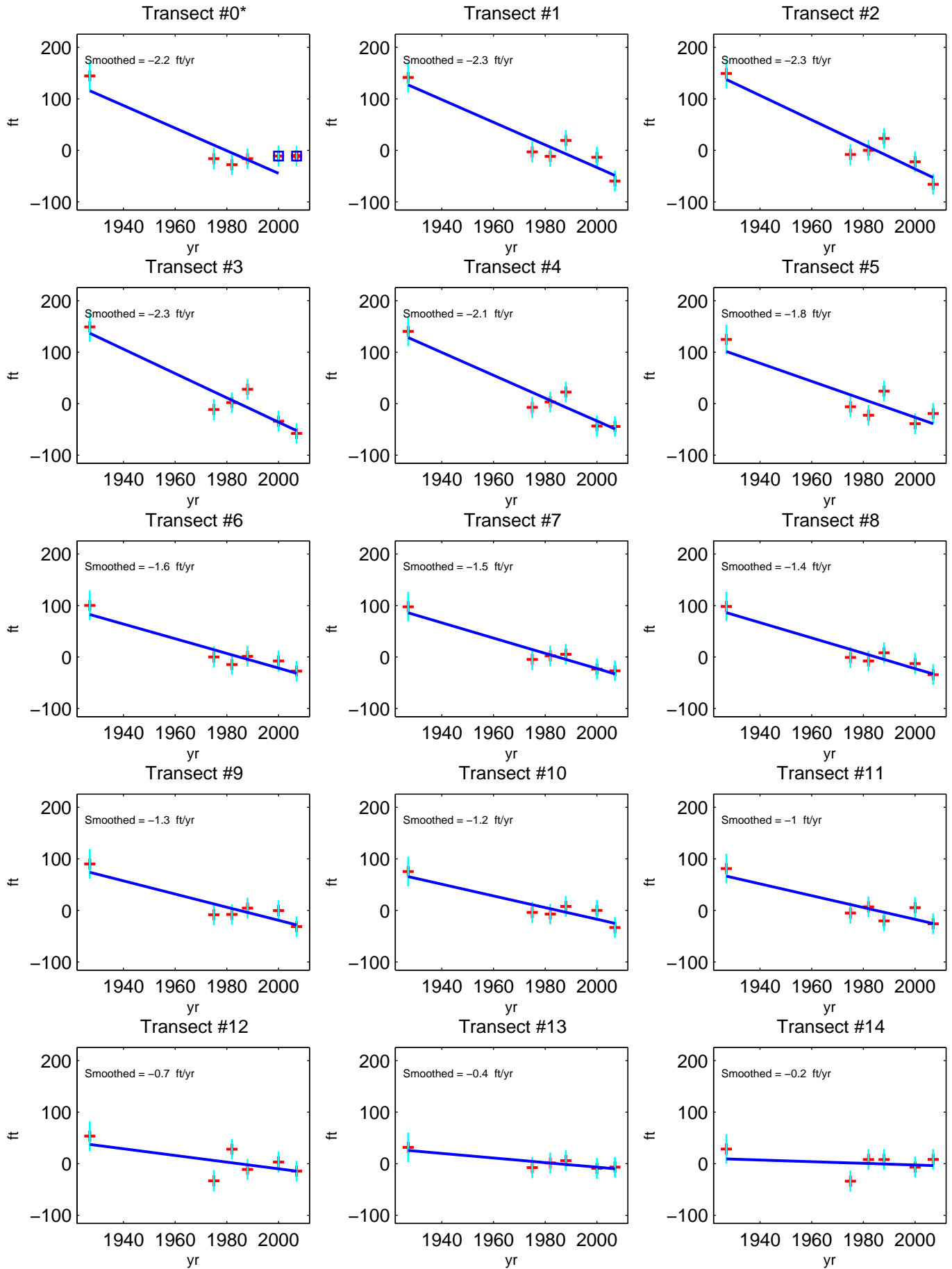
Transect	Smoothed Rate (ft/yr)
0*	-2.2
1	-2.3
2	-2.3
3	-2.3
4	-2.1
5	-1.8
6	-1.6
7	-1.5
8	-1.4
9	-1.3
10	-1.2
11	-1.0
12	-0.7
13	-0.4
14	-0.2
15	-0.2
16	-0.2
17	-0.4
18	-0.6
19	-0.6
20	-0.6



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

Shipwreck - Smoothed Shoreline Change Rates

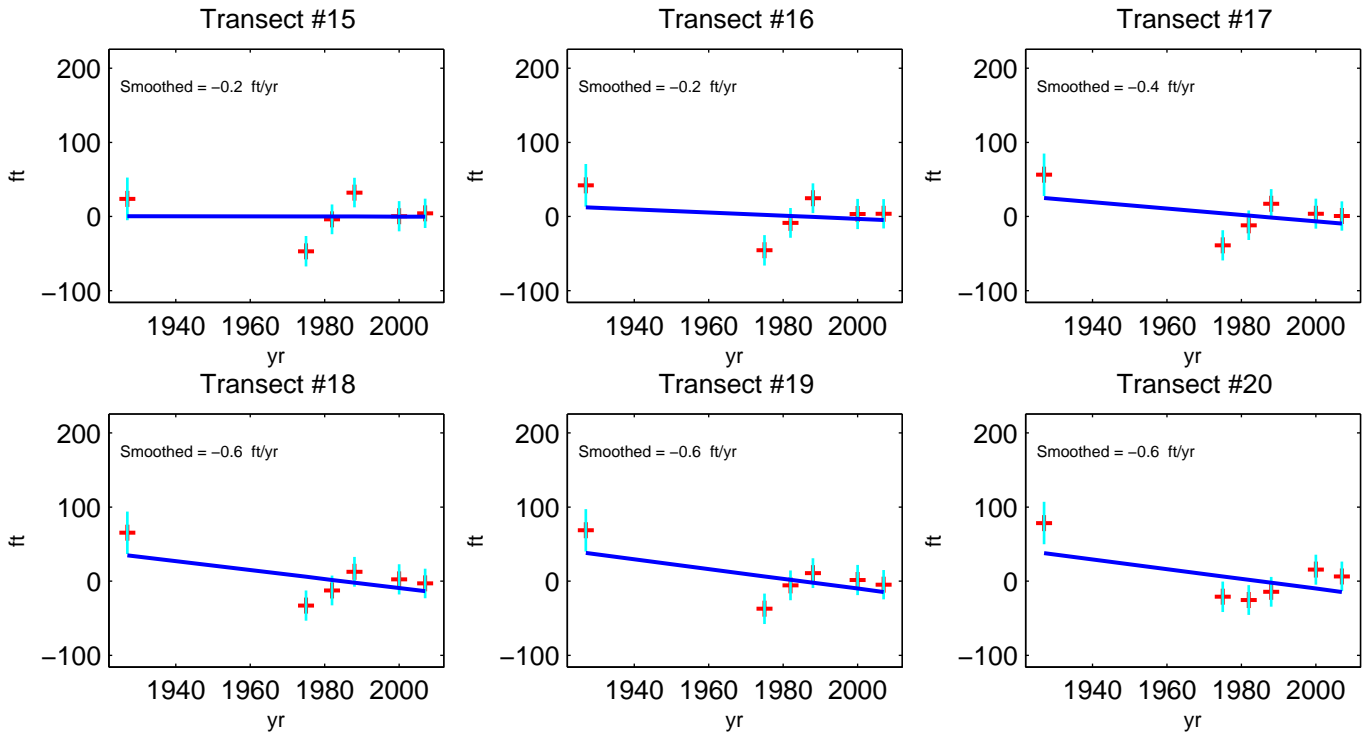
Positive Rate = Accretion
Negative Rate = Erosion



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

Shipwreck - 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.

Mahaulepu, Kauai, Hawaii

AREA DESCRIPTION

The Mahaulepu Beach study area (transects 21 – 87) is located on the southeast coast of Kauai. The shoreline is composed of carbonate sand beach interrupted by basalt sea cliffs and limestone.

Overall, the area is experiencing erosion at an average rate of -0.6 ft/yr. The area lends itself to division into five portions. The most southern portion (transects 21 – 24) has experienced erosion over time with an average rate of -1.1 ft/yr. North of Mahaulepu Stream (transects 25 – 58) has experienced erosion at an average rate of -0.4 ft/yr. Kawaiiloa Bay (transects 59 – 75) is undergoing erosion at an average rate of -0.6 ft/yr. North of Paoo Point (transects 77-82) is a small pocket beach that is experiencing chronic erosion at an average rate of -1.6 ft/yr. Haula Beach (transects 83-87) has experienced no change in average shoreline change rate. Previous studies¹ found similar trends in shoreline change for the Mahaulepu Beach study area.

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

- T-sheet 1927
- Apr 1975
- Sept 1981
- Sept 1984
- Jul 1987
- Mar 1988
- May 2000
- Oct 2007

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).

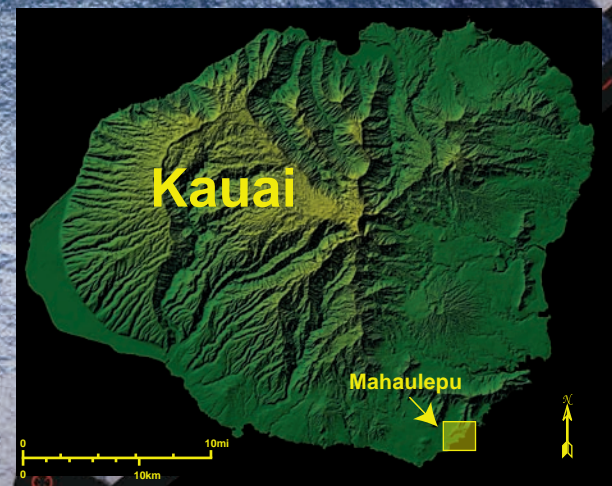
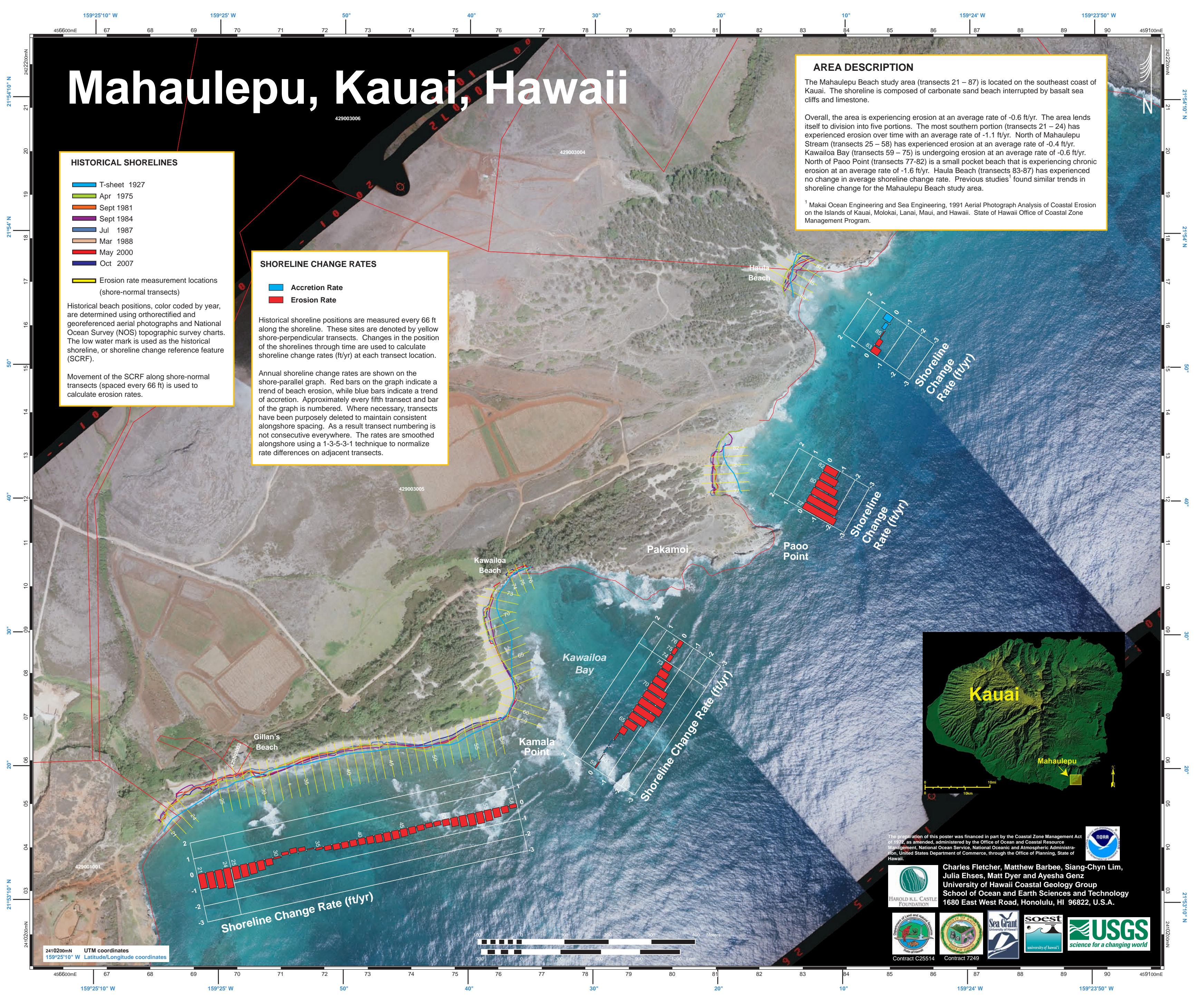
Movement of the SCRF along shore-normal transects (spaced every 66 ft) is used to calculate erosion rates.

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.



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Contract C25514

Contract 7249

2410200mN UTM coordinates
 159°25'10" W Latitude/Longitude coordinates

Mahaulepu - Smoothed Rates

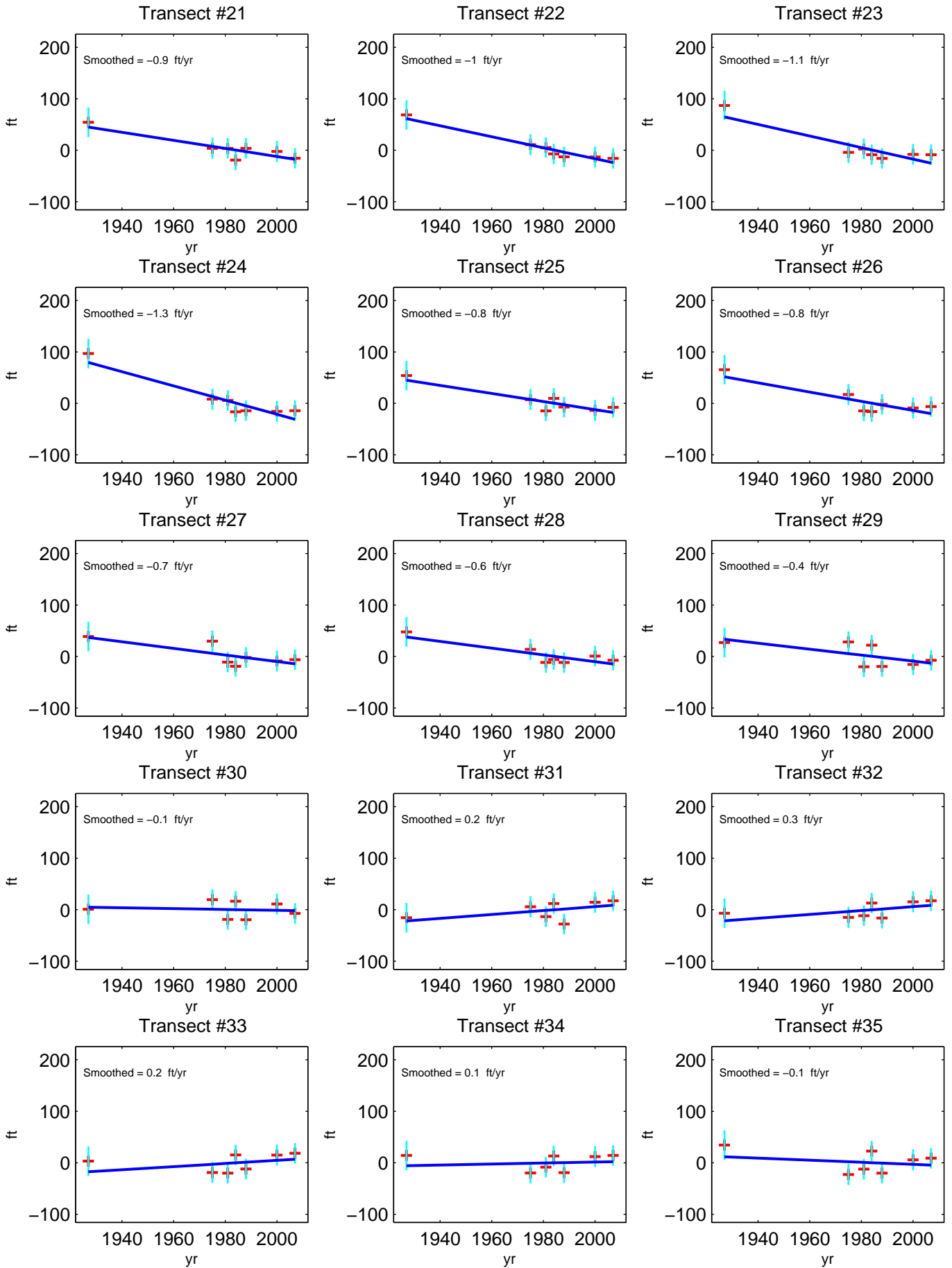
Positive Rate = Accretion
 Negative Rate = Erosion

Transect	Smoothed Rate (ft/yr)	Transect	Smoothed Rate (ft/yr)
21	-0.9	67	-1.4
22	-1.0	68	-1.6
23	-1.1	69	-1.5
24	-1.3	70	-1.2
25	-0.8	71	-0.9
26	-0.8	72	-0.6
27	-0.7	73	-0.5
28	-0.6	74	-0.2
29	-0.4	75	-0.2
30	-0.1	76	-0.3
31	0.2	77	-2.2
32	0.3	78	-2.0
33	0.2	79	-1.7
34	0.1	80	-1.4
35	-0.1	81	-1.1
36	-0.3	82*	-0.9
37	-0.4	83	-0.5
38	-0.4	84	-0.3
39	-0.4	85	-0.1
40	-0.4	86	0.2
41	-0.5	87	0.5
42	-0.5		
43	-0.5		
44	-0.5		
45	-0.5		
46	-0.4		
47	-0.3		
48	-0.3		
49	-0.3		
50	-0.4		
51	-0.5		
52	-0.7		
53	-0.7		
54	-0.7		
55	-0.7		
56	-0.6		
57	-0.4		
58	-0.2		
59	-0.1		
60	0.0		
61	0.1		
62	0.1		
63	-0.1		
64	-0.4		
65	-0.8		
66	-1.1		

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

Mahaulepu - Smoothed Shoreline Change Rates

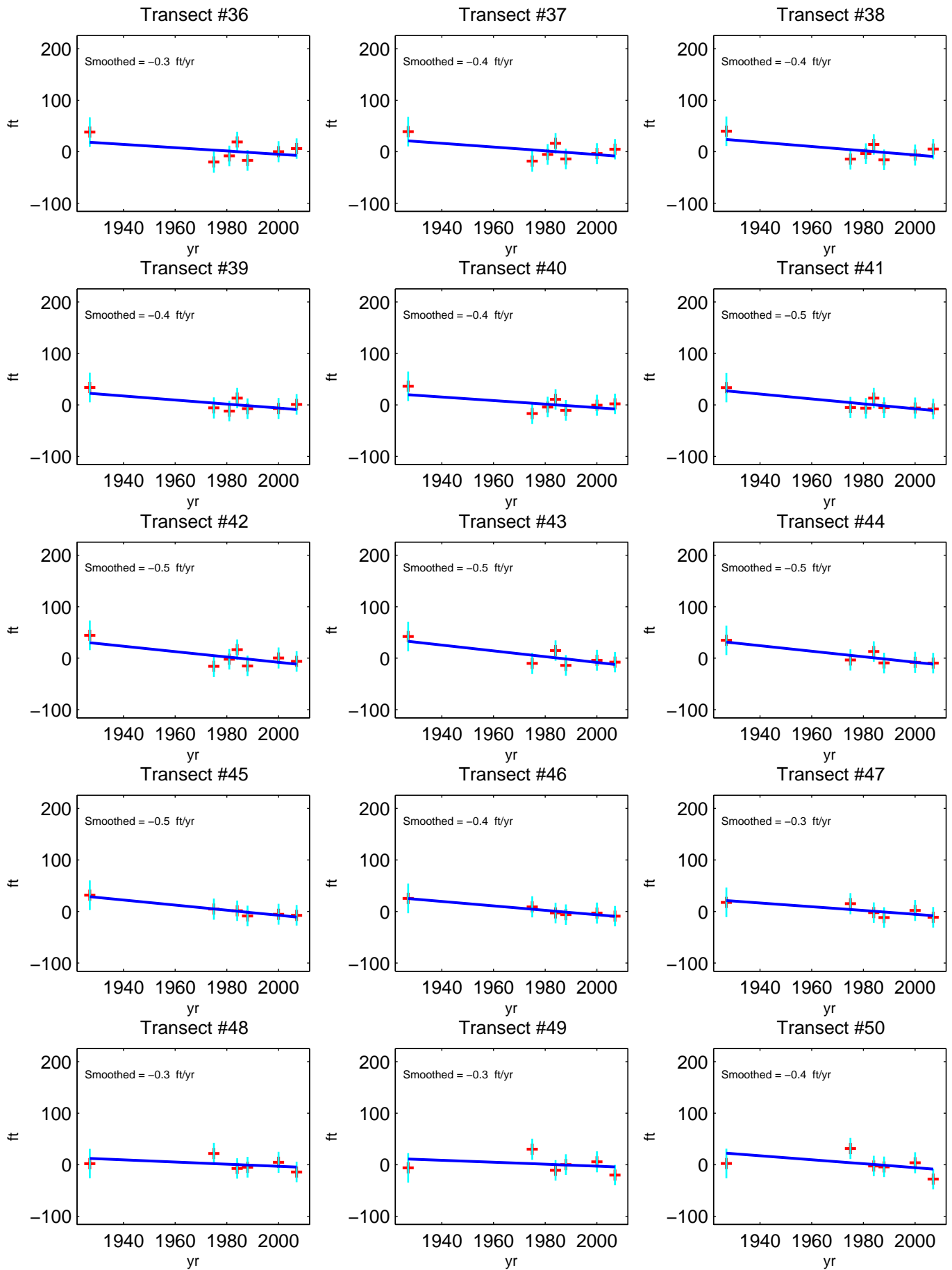
Positive Rate = Accretion
Negative Rate = Erosion



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

Mahaulepu - Smoothed Shoreline Change Rates

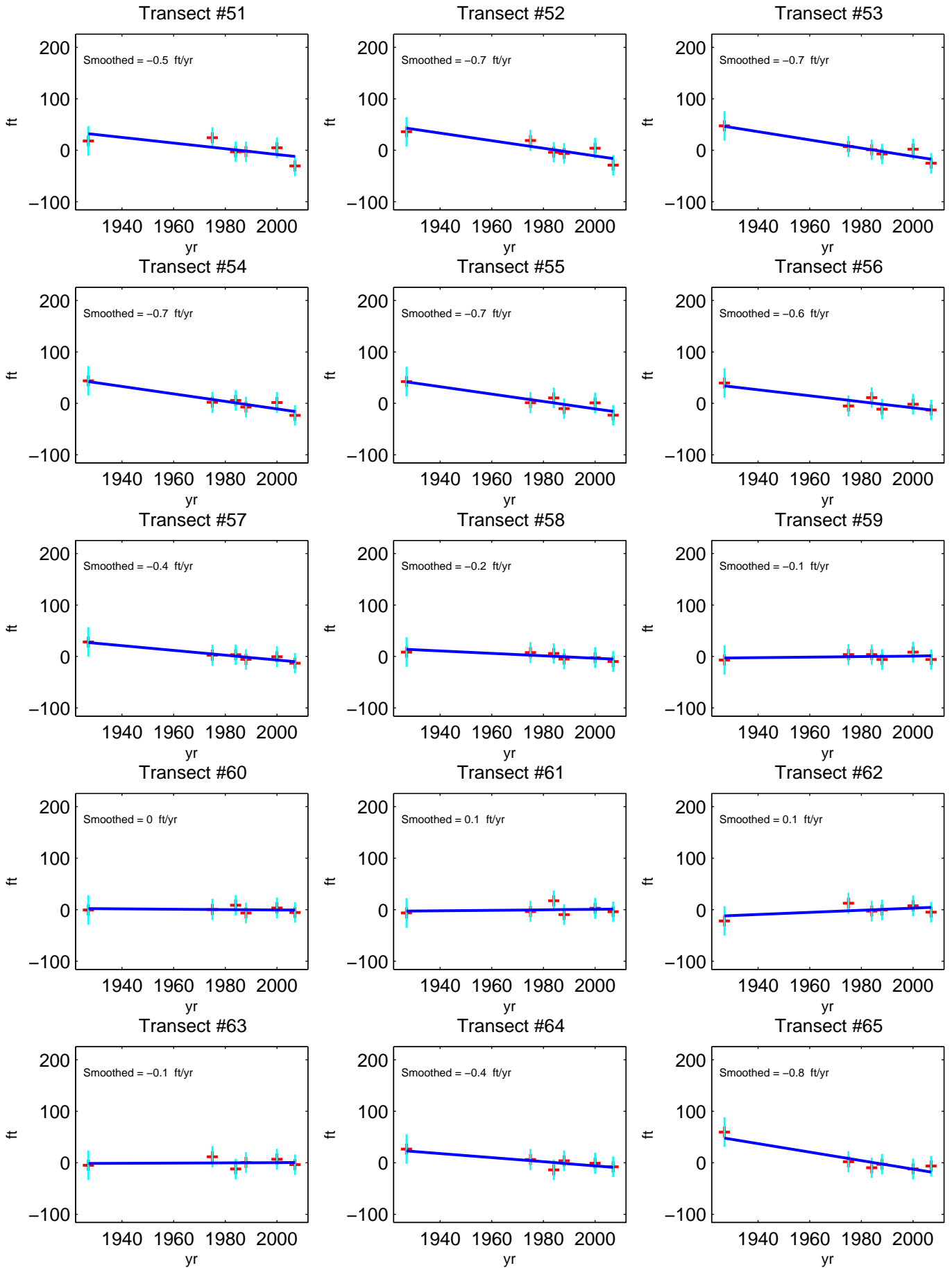
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Mahaulepu - Smoothed Shoreline Change Rates

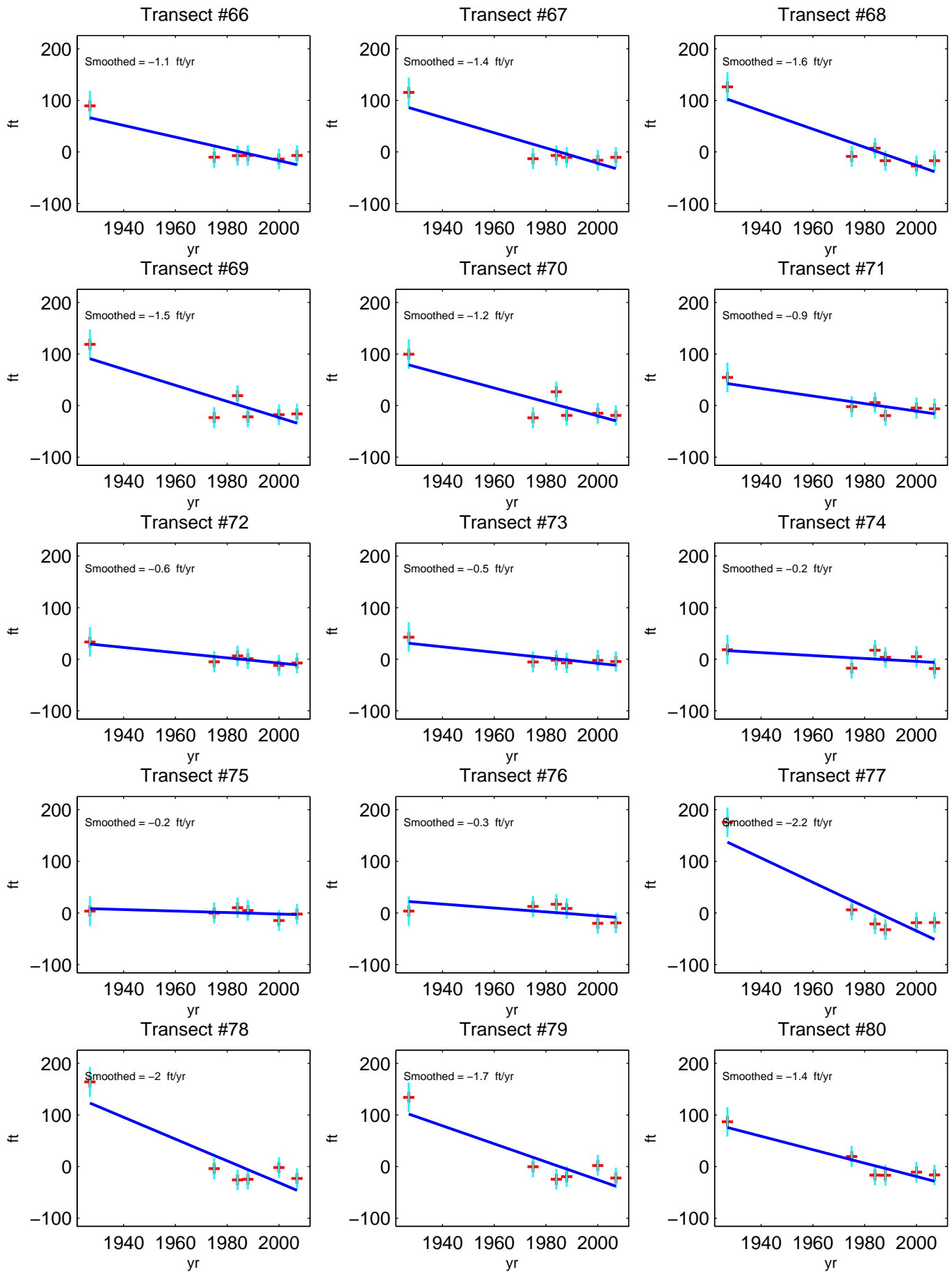
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Mahaulepu - Smoothed Shoreline Change Rates

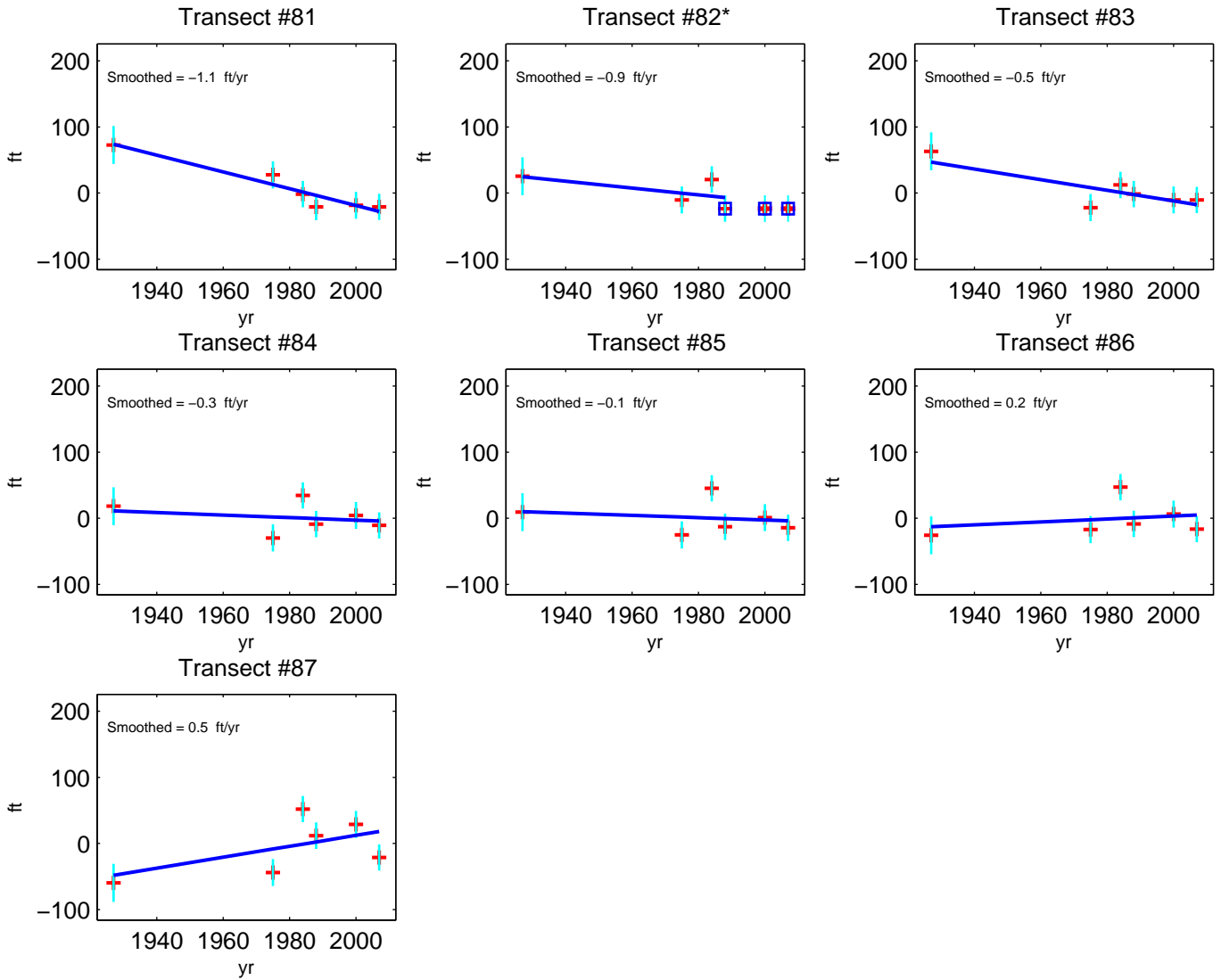
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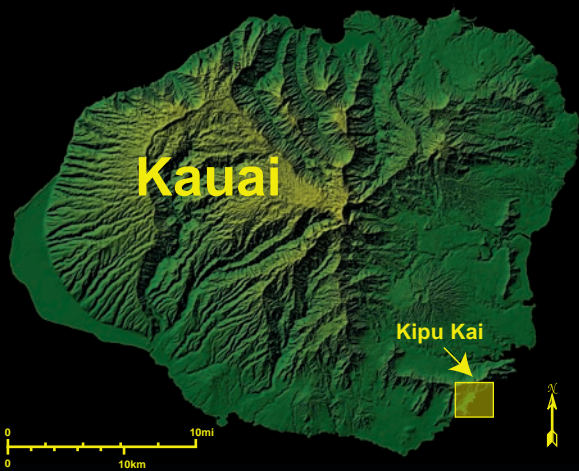
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Kipu Kai, Kauai, Hawaii



AREA DESCRIPTION

The Kipu Kai study area (transects 0 – 111) is located on the southeast coast of Kauai. The shoreline is composed of carbonate sand beach interrupted by basalt sea cliffs and limestone.

Overall, the area is experiencing erosion at an average rate of -0.5 ft/yr. The area lends itself to division into four portions. The southern section is Kipu Kai Beach (transects 0 – 47). It is bounded by Kaweliko Point and Molehu Point. Kipu Kai Beach has experienced erosion over time with an average rate of -0.3 ft/yr. Between Molehu Point and Kuahonu Point (transects 48 – 54) is a small pocket beach that is experiencing chronic erosion at an average rate of -1.7 ft/yr. North of Kuahonu beach (transects 55 – 79) the shoreline has experienced erosion at an average rate of -0.7 ft/yr. The northernmost beach (transects 80-111) is experiencing erosion at an average rate of -0.3 ft/yr. Previous studies¹ did not analyze the Kipu Kai 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 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

- █ T-sheet 1927
- █ Apr 1975
- █ Jul 1987
- █ Mar 1988
- █ Oct 2007
- █ 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.

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.



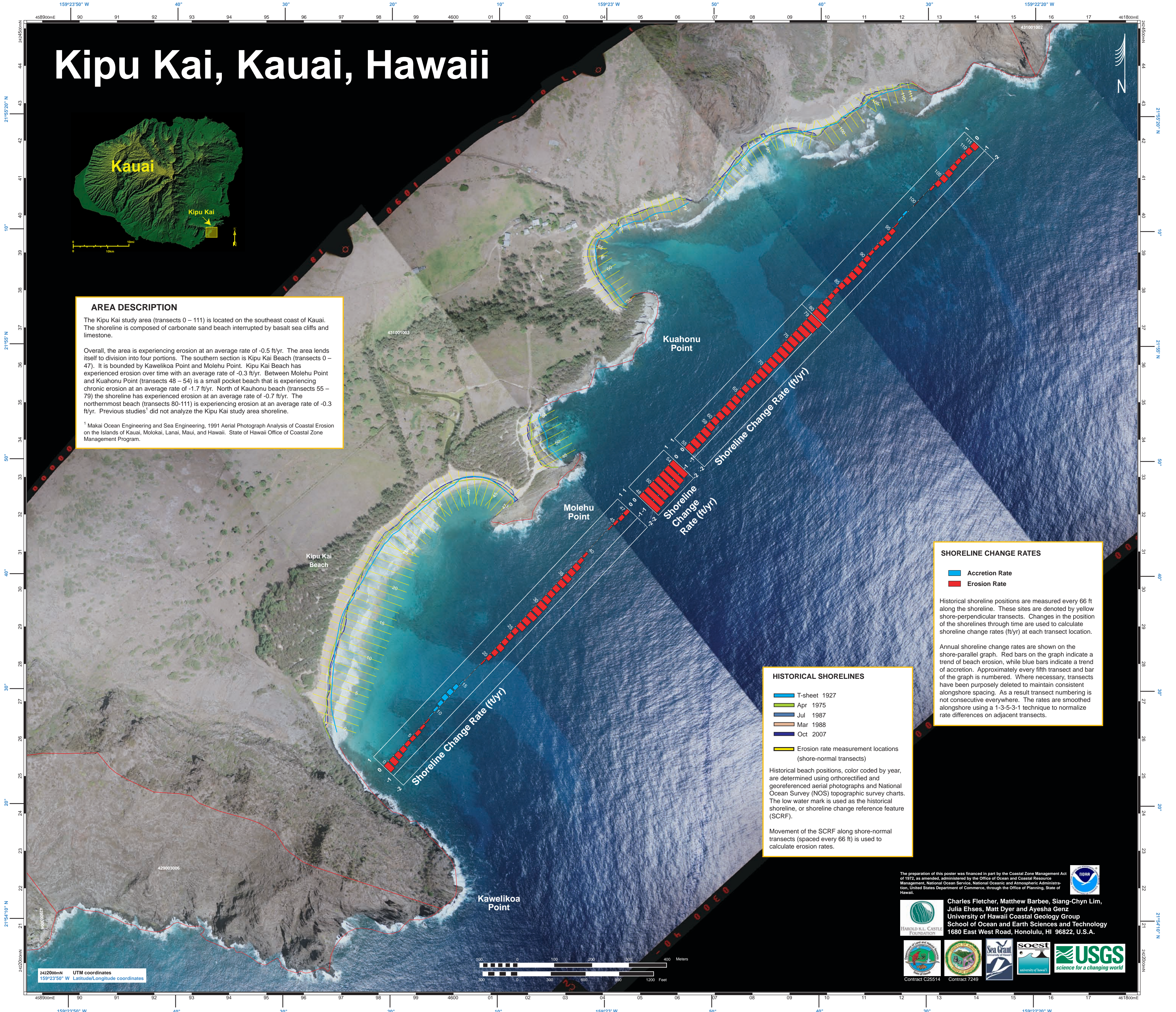
Charles Fletcher, Matthew Barbee, Siang-Chyn Lim, Julia Ehses, Matt Dyer and Ayesha Genz
 University of Hawaii Coastal Geology Group
 School of Ocean and Earth Sciences and Technology
 1680 East West Road, Honolulu, HI 96822, U.S.A.



Contract C25514

Contract 7249

242200mN UTM coordinates
 159°23'50" W Latitude/Longitude coordinates



Kipu Kai - Smoothed Rates

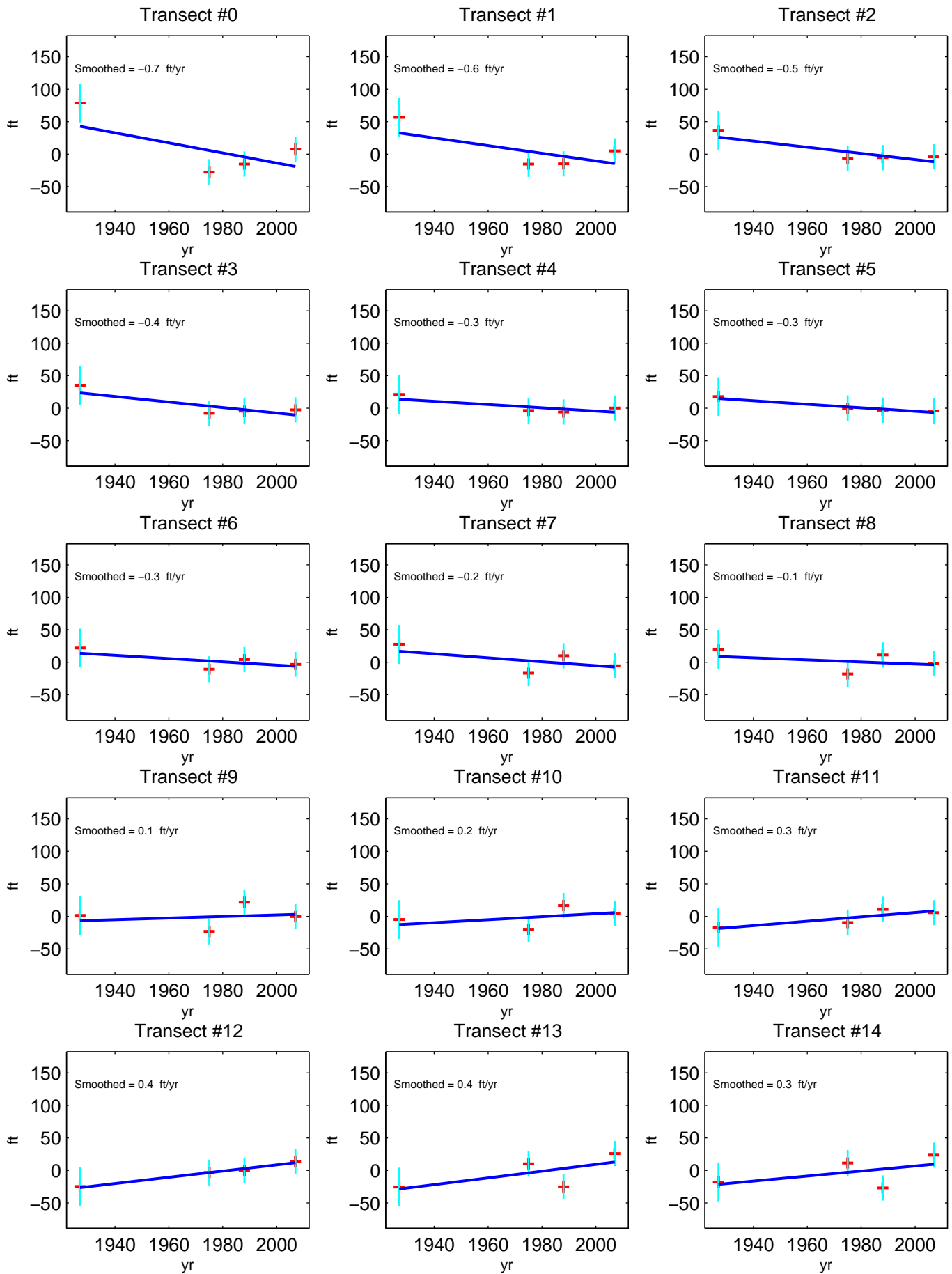
Positive Rate = Accretion
Negative Rate = Erosion

Transect	Smoothed Rate (ft/yr)	Transect	Smoothed Rate (ft/yr)	Transect	Smoothed Rate (ft/yr)
0	-0.7	46	-0.3	92	-0.2
1	-0.6	47	-0.3	93	-0.4
2	-0.5	48	-1.8	94	-0.4
3	-0.4	49	-1.7	95	-0.3
4	-0.3	50	-1.6	96	-0.1
5	-0.3	51	-1.7	97	0.1
6	-0.3	52	-1.7	98	0.2
7	-0.2	53	-1.6	99	0.1
8	-0.1	54	-1.5	100	0.0
9	0.1	55	-0.7	101	0.0
10	0.2	56	-0.7	102	0.0
11	0.3	57	-0.7	103	-0.2
12	0.4	58	-0.7	104	-0.4
13	0.4	59	-0.6	105	-0.5
14	0.3	60	-0.5	106	-0.5
15	0.1	61	-0.6	107	-0.4
16	0.0	62	-0.7	108	-0.3
17	0.0	63	-0.7	109	-0.3
18	0.0	64	-0.6	110	-0.4
19	-0.1	65	-0.5	111	-0.5
20	-0.3	66	-0.5		
21	-0.4	67	-0.6		
22	-0.5	68	-0.7		
23	-0.4	69	-0.8		
24	-0.4	70	-0.8		
25	-0.4	71	-0.8		
26	-0.6	72	-0.8		
27	-0.6	73	-0.9		
28	-0.7	74	-0.8		
29	-0.7	75	-0.8		
30	-0.7	76	-0.9		
31	-0.6	77	-1.0		
32	-0.5	78	-1.0		
33	-0.5	79*	-1.1		
34	-0.6	80*	-1.1		
35	-0.6	81	-0.8		
36	-0.5	82	-0.5		
37	-0.5	83	-0.3		
38	-0.3	84	-0.3		
39	-0.2	85	-0.4		
40	0.0	86	-0.5		
41	0.0	87	-0.6		
42	0.0	88	-0.6		
43	0.0	89	-0.5		
44	-0.1	90	-0.4		
45	-0.2	91	-0.2		

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

Kipu Kai - Smoothed Shoreline Change Rates

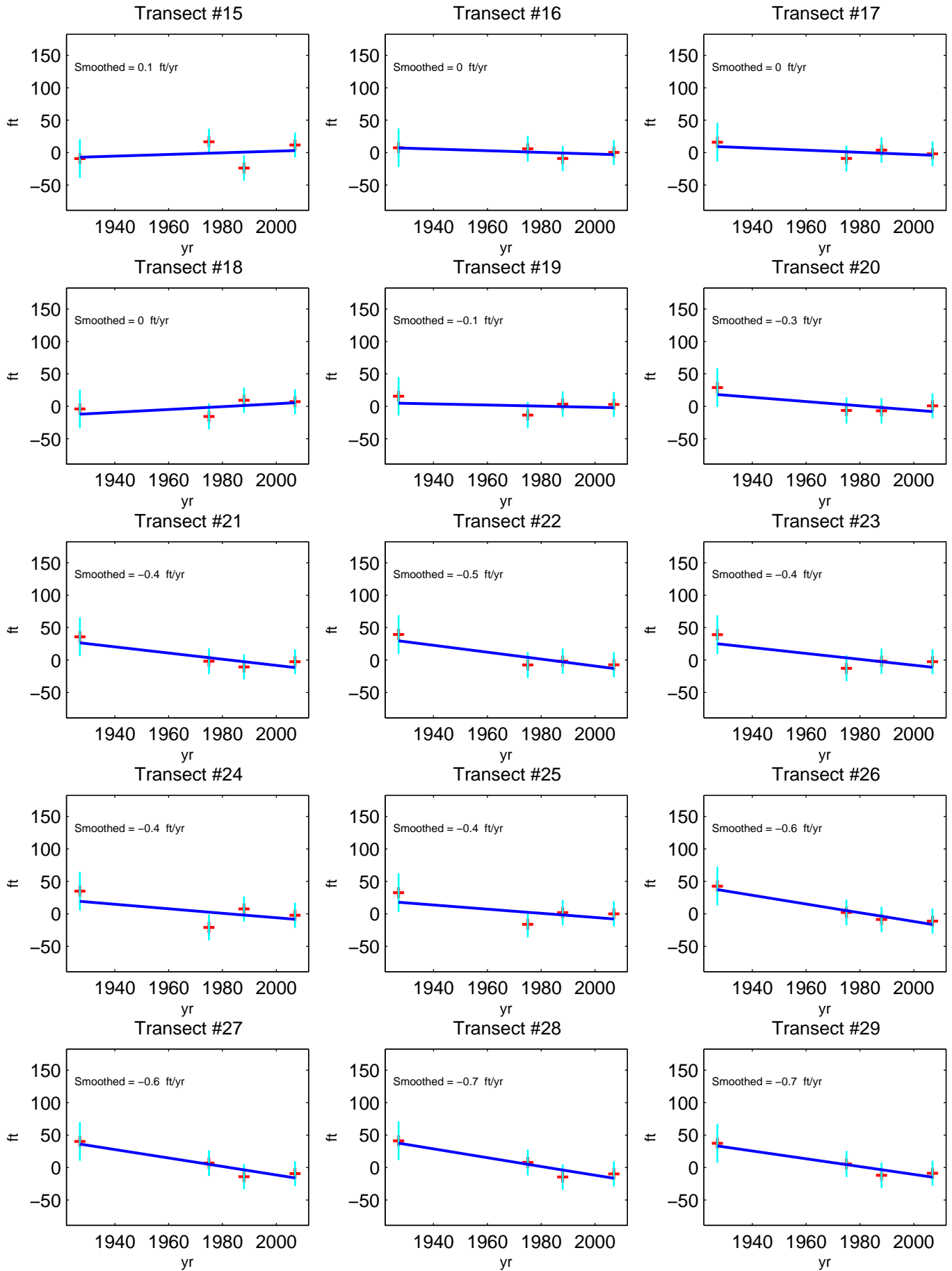
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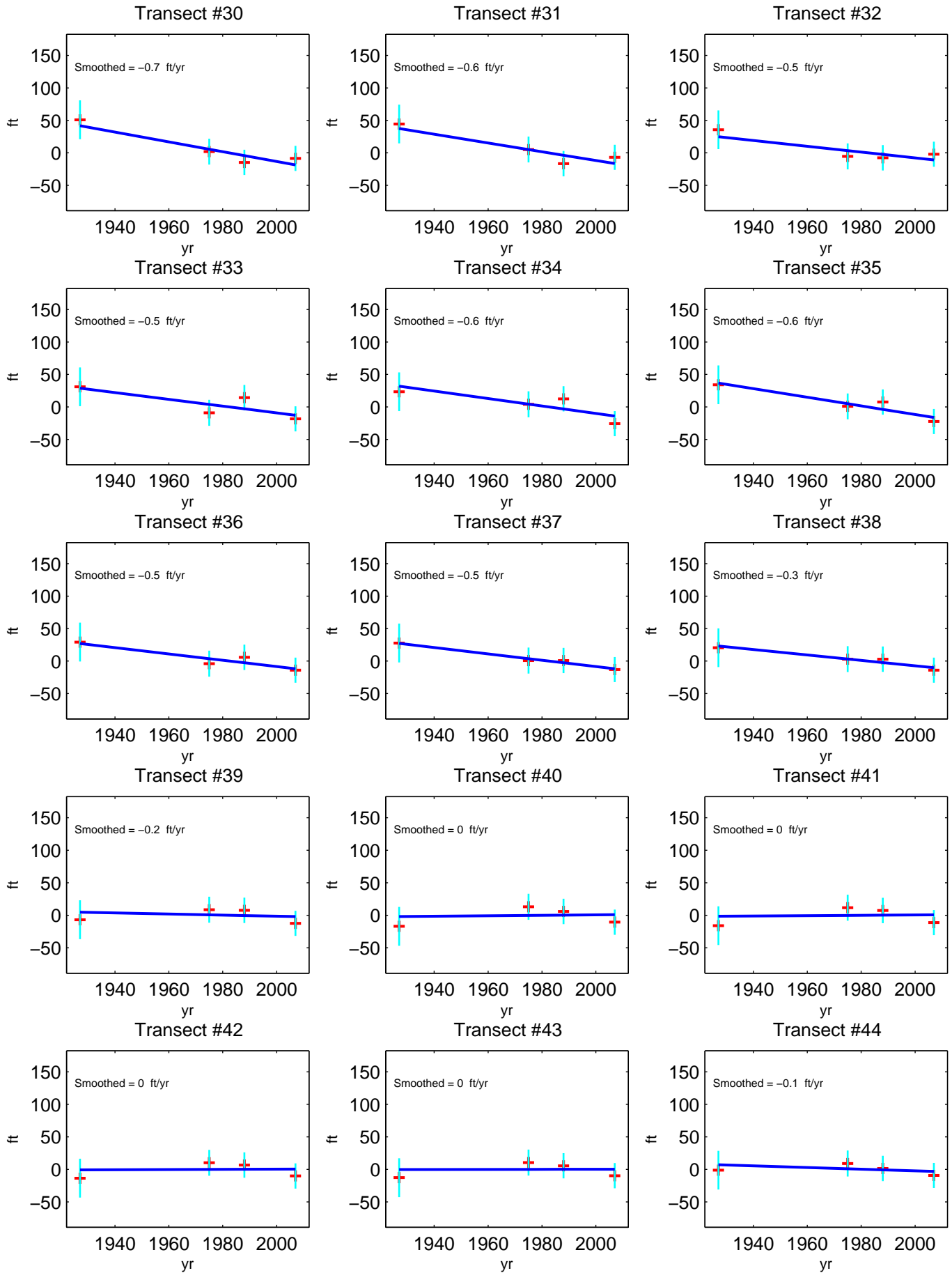
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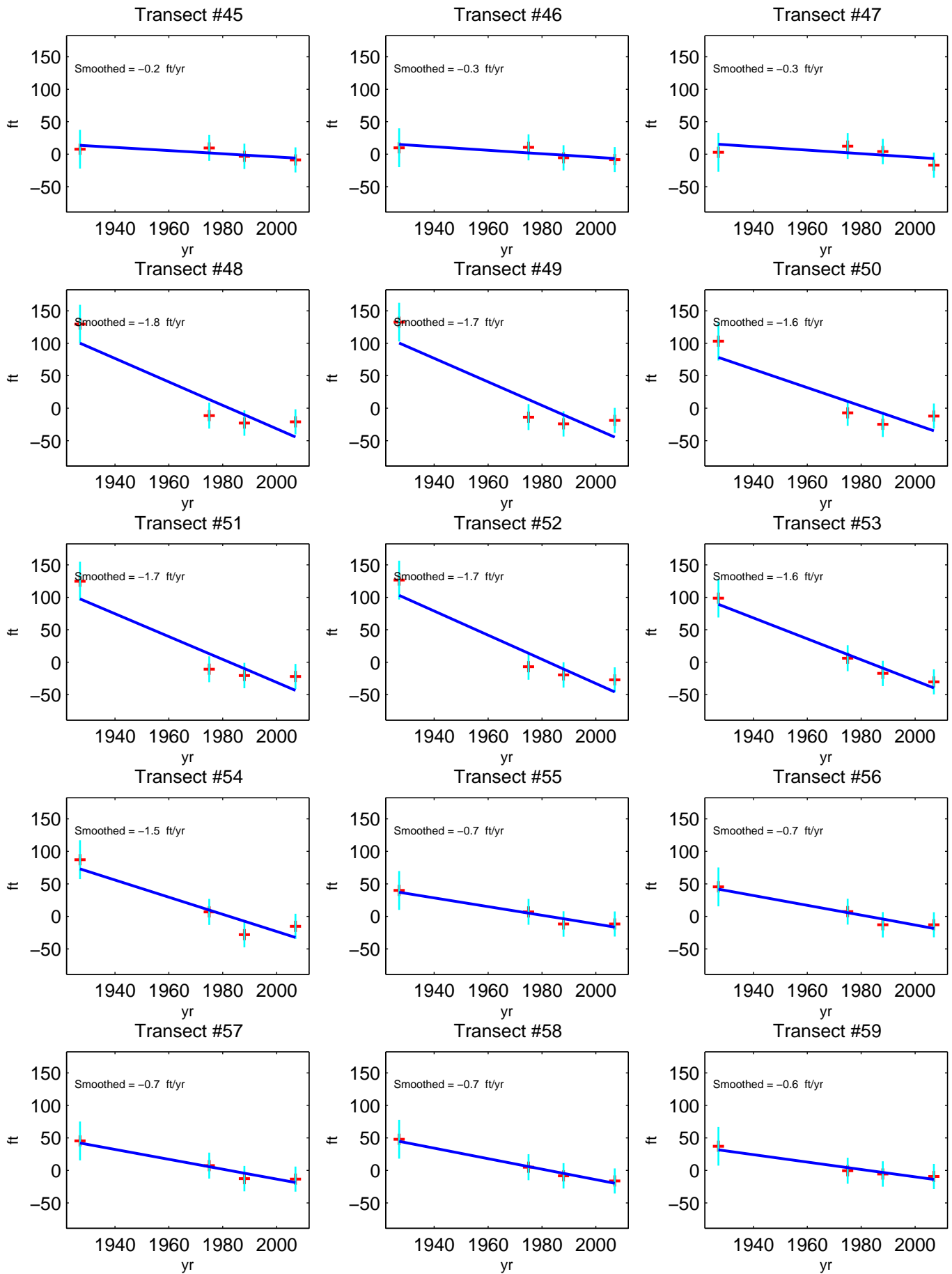
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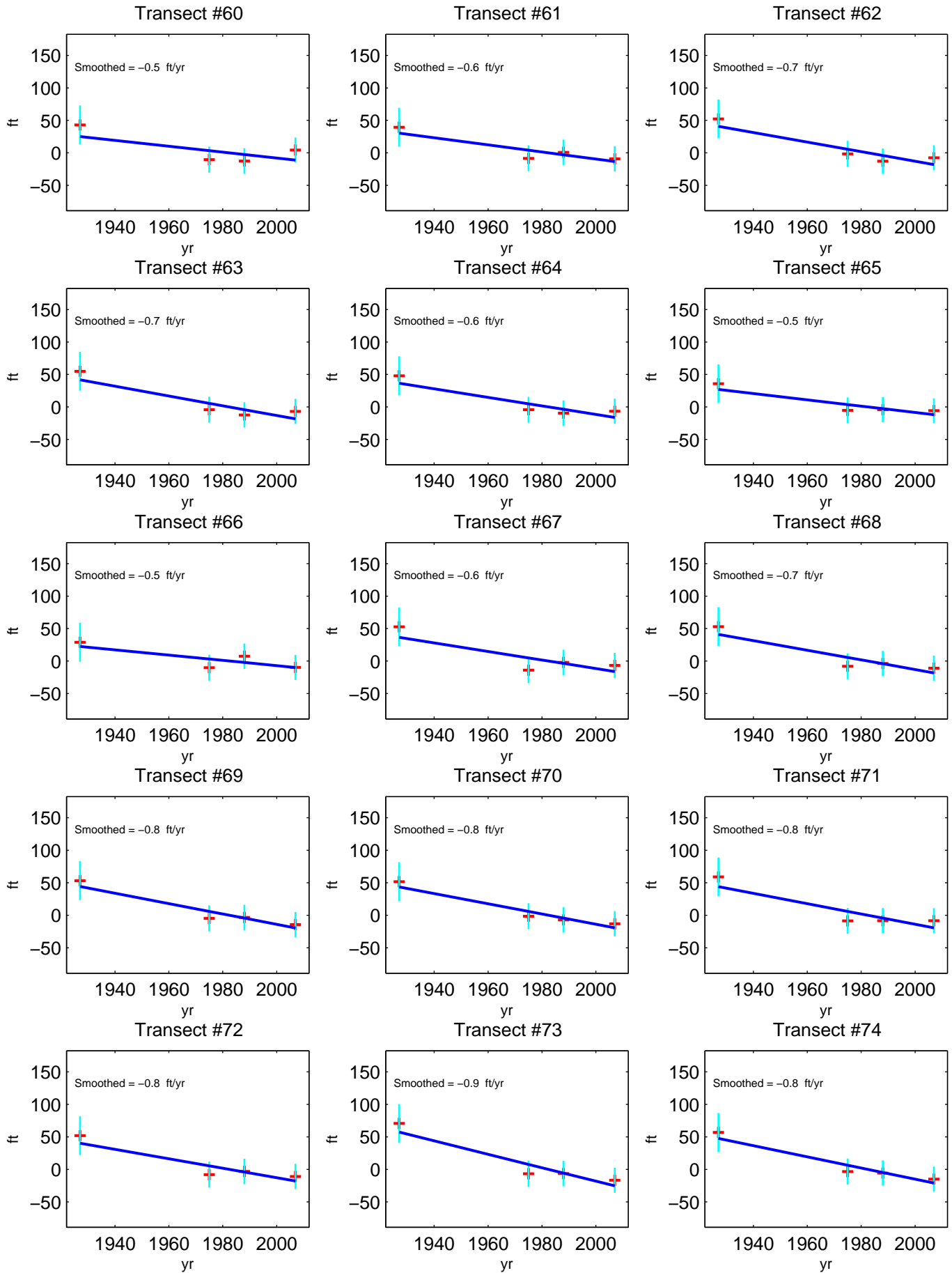
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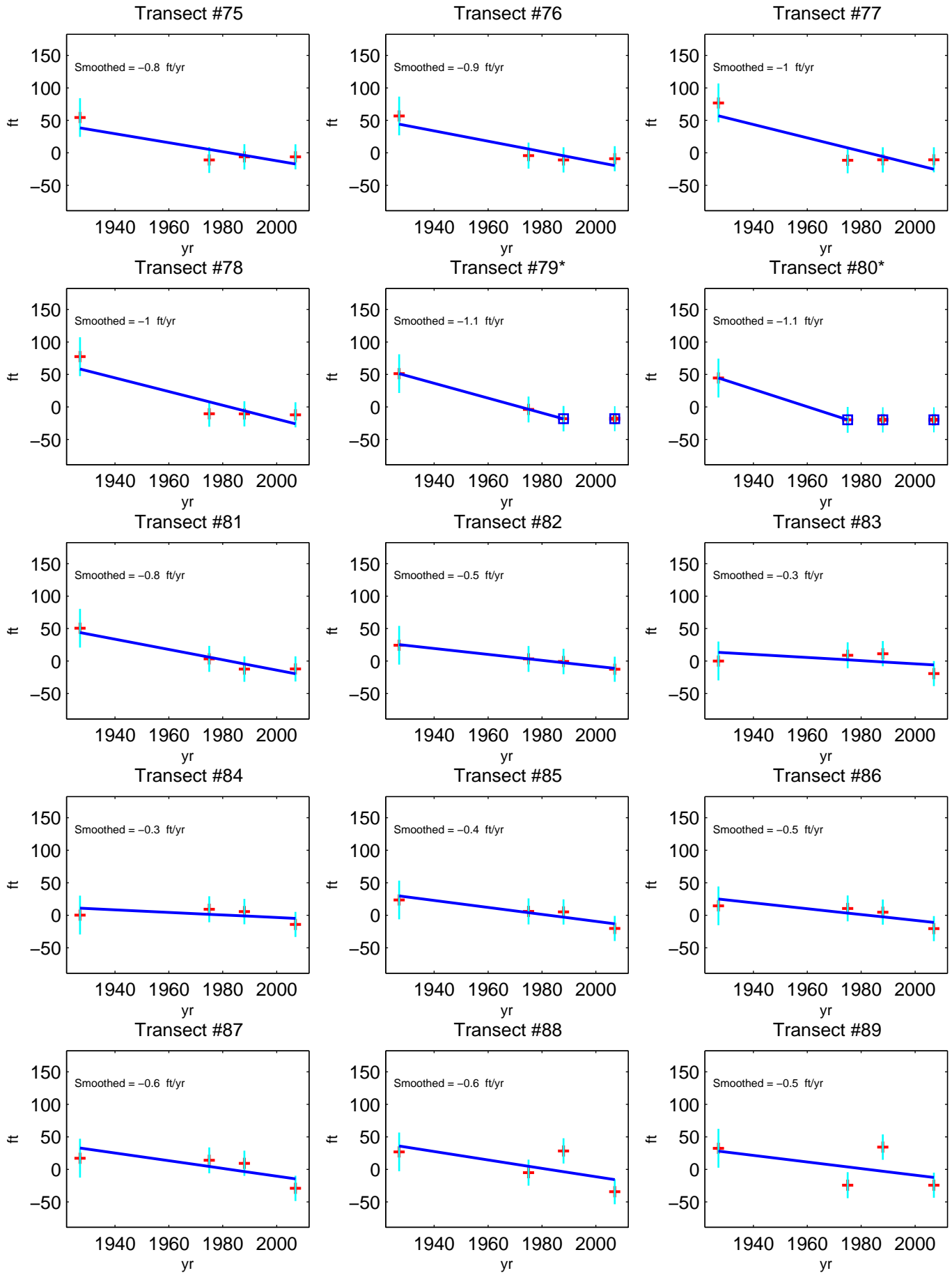
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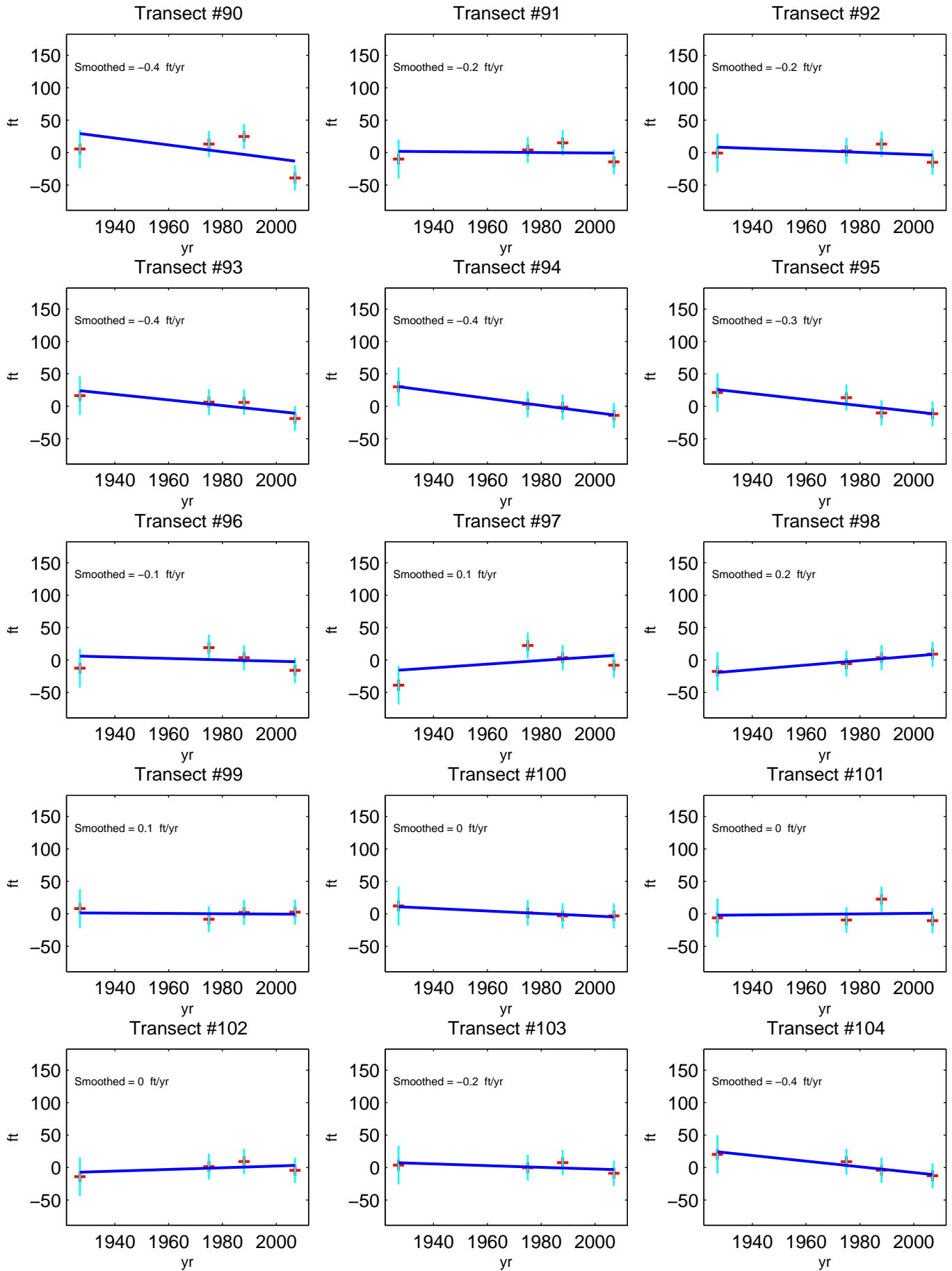
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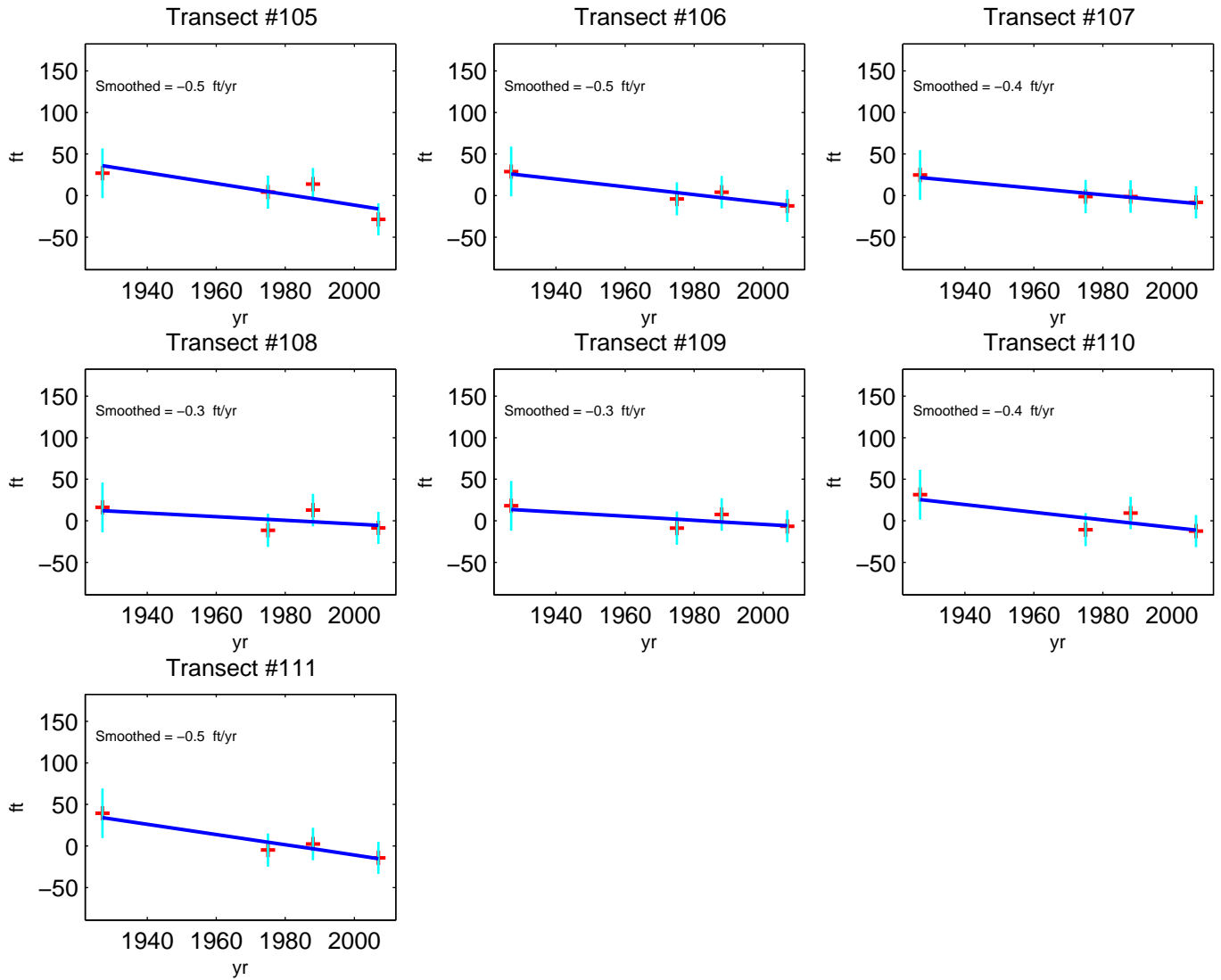
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