

# East Coast, Kauai, Hawaii



Papaa

Anahola

Lae Lipoa

Donkey

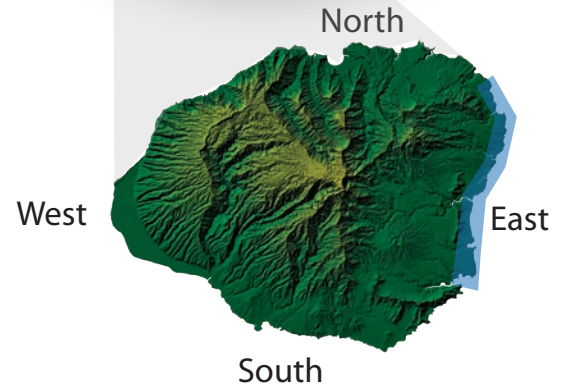
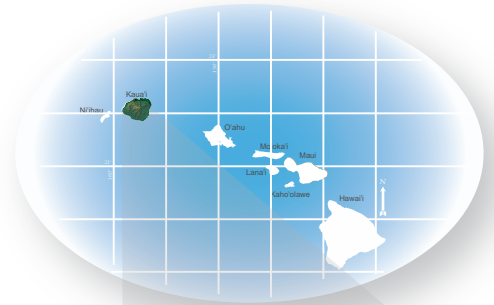
Kapaa

Wailua

Lydgate

Nukolii

Nawiliwili



# Nawiliwili Bay, Kauai, Hawaii

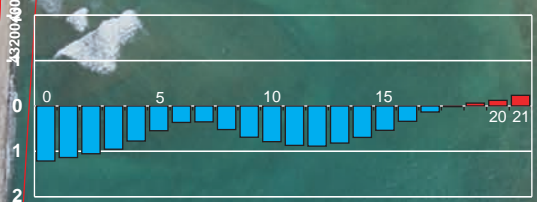
## AREA DESCRIPTION

The Nawiliwili Bay study area (transects 0 - 30) is located on the east coast of Kauai. The area is bounded by Ninini Point to the northeast and Carter Point to the southwest. The shoreline is characterized by small pocket beaches interspersed among basaltic headlands.

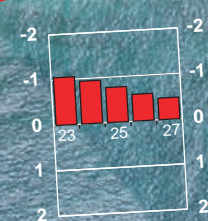
Overall, the area is experiencing accretion at an average rate of 0.2 ft/yr. There are three pocket beaches within the study area. Kalapaki Beach (transects 0 - 21) is located within Nawiliwili Bay to the north of Kukii Point. This section of the study area is accreting at an average rate of 0.6 ft/yr. Ninini Beach (transects 23 - 27) has experienced erosion at an average rate of -0.8 ft/yr. The next beach (transects 28 - 30) has experienced erosion at -0.9 ft/yr. Previous studies<sup>1</sup> did not analyze the Nawiliwili Bay study area shoreline.

<sup>1</sup> 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)



Shoreline Change Rate (ft/yr)

## HISTORICAL SHORELINES

- 1927T-sheet
- Jan 1951
- Mar 1960
- Sept 1968
- Apr 10 1975
- Apr 12 1975
- Oct 1981
- Jul 1987
- May 1988
- Sept 1992
- Jan 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

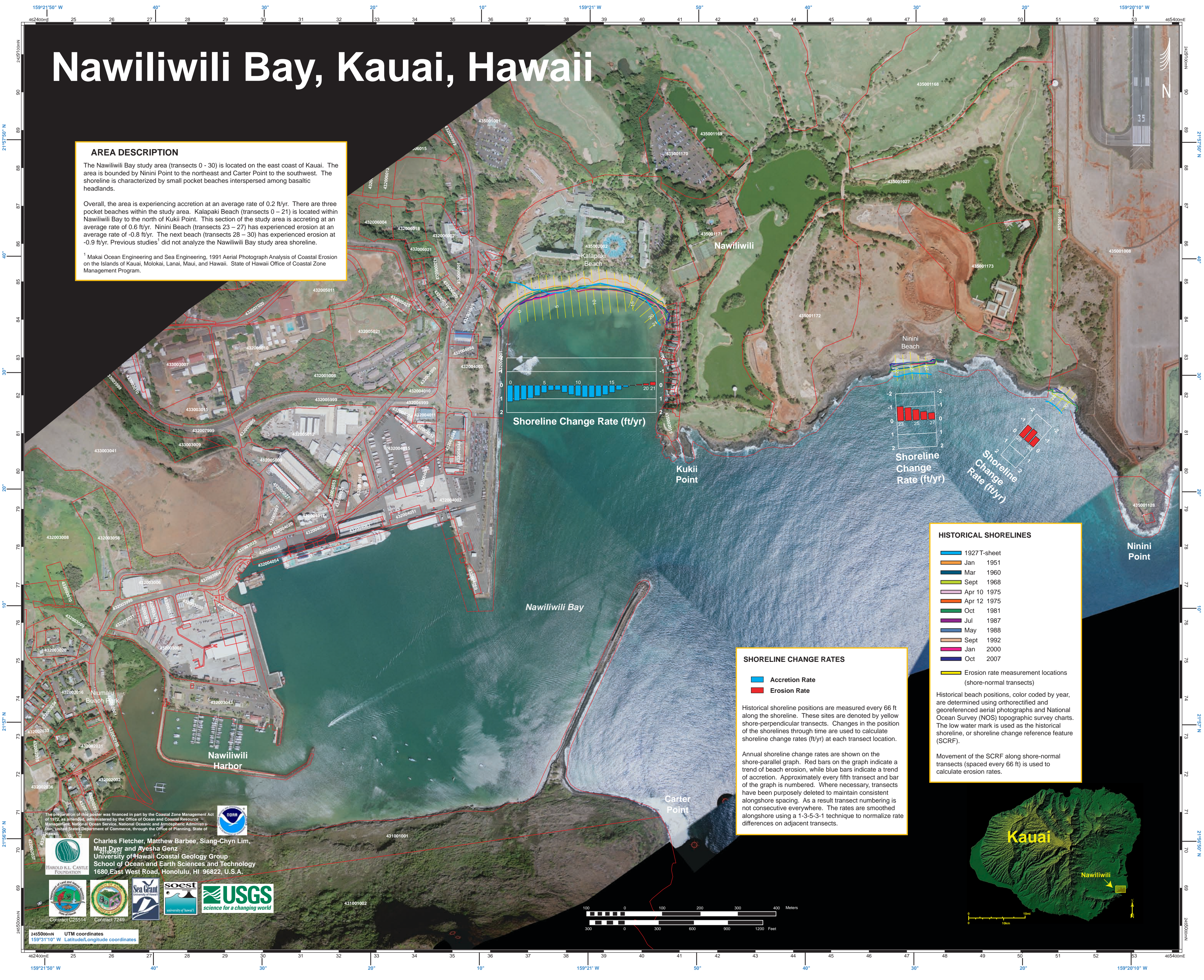
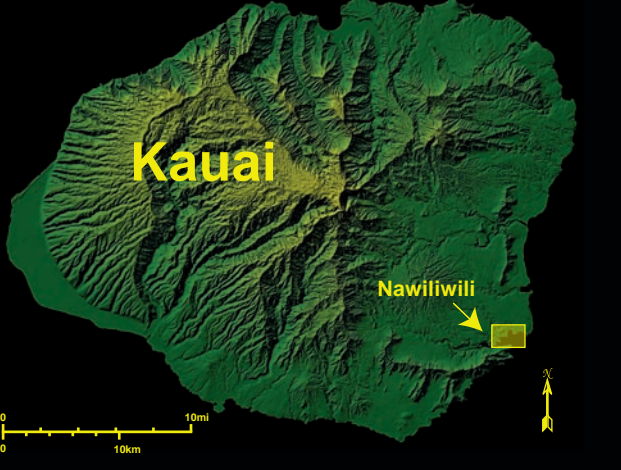
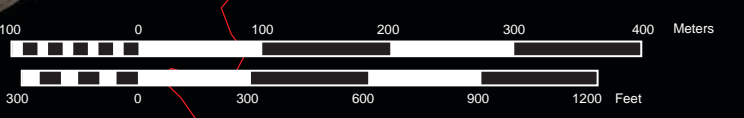
Historical shoreline positions are measured every 66 ft along the shoreline. These sites are denoted by yellow shore-perpendicular transects. Changes in the position of the shorelines through time are used to calculate shoreline change rates (ft/yr) at each transect location.

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.

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.

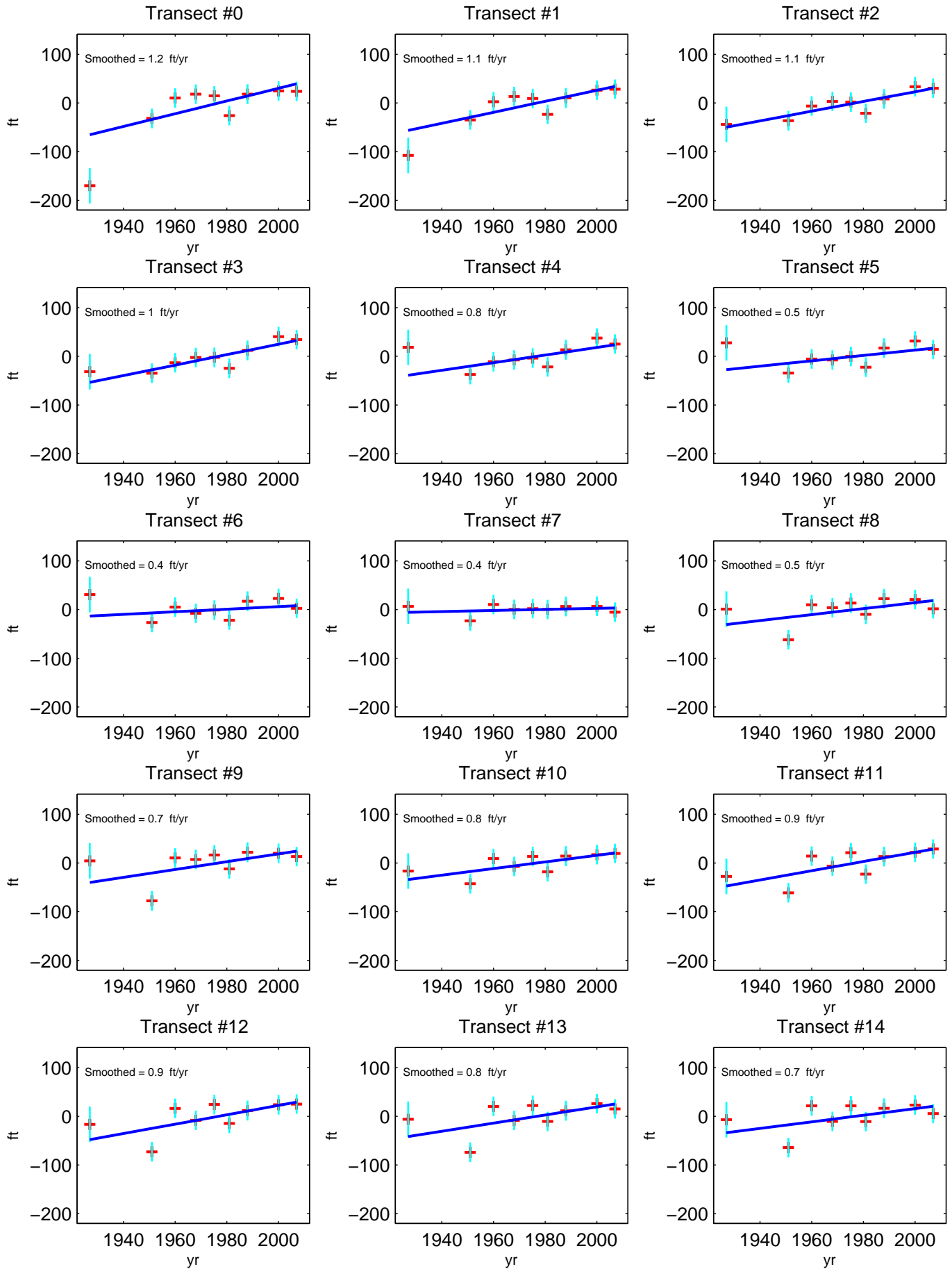
Logos for NOAA, Harold K.L. Castle Foundation, Sea Grant, SOEST, and USGS.





# Nawiliwili Bay - Smoothed Shoreline Change Rates

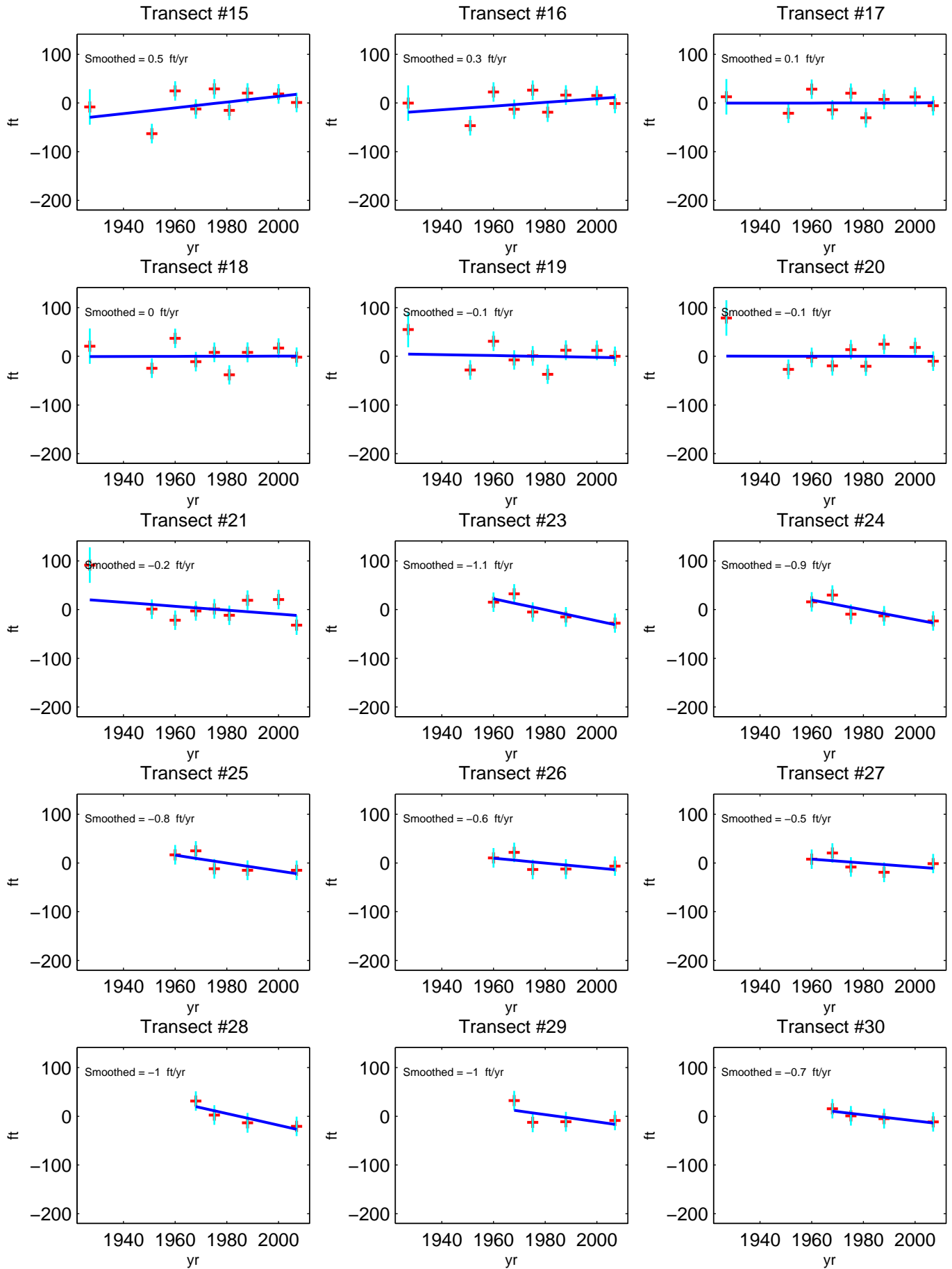
Positive Rate = Accretion  
Negative Rate = Erosion



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

# Nawiliwili Bay - Smoothed Shoreline Change Rates

Positive Rate = Accretion  
Negative Rate = Erosion



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# Nukolii, Kauai, Hawaii

## HISTORICAL SHORELINES

- █ Feb 1927 T-sheet
- █ Nov 1950
- █ Apr 1975
- █ Jul 1987
- █ May 1988
- █ Sept 1992
- █ May 1992
- █ Apr 1994
- █ Mar 1997
- █ Feb 2002
- █ 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.

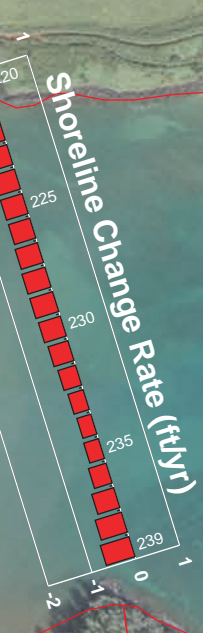
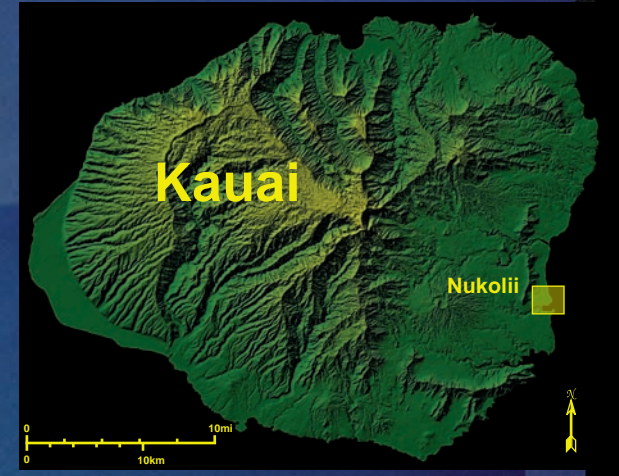
Annual shoreline change rates are shown on the shore-parallel graph. Red bars on the graph indicate a trend of beach erosion, while blue bars indicate a trend of accretion. Approximately every fifth transect and bar of the graph is numbered. Where necessary, transects have been purposely deleted to maintain 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 Nukolii study area (transects 145 – 239) is located on the east coast of Kauai. The area extends from Nukolii Beach to Hanamaulu Bay. The shoreline is composed of carbonate sand beach, exposed beach rock and engineered jetties with a fringing reef offshore. The area experiences persistent tradewinds and rough seas throughout the year.

Overall, the area is undergoing erosion at an average rate of -0.9 ft/yr. The area lends itself to division into two portions. The northern section is Nukolii Beach (transects 145 – 219). This area has experienced erosion over time with an average rate of -1.0 ft/yr. The southern portion is Hanamaulu Bay (transects 220 – 239). This section of shoreline has experienced erosion with an average rate of -0.5 ft/yr. Previous studies<sup>1</sup> found similar trends in shoreline change for the Nukolii study area.

<sup>1</sup> 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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464300mE 22°01'N UTM coordinates  
 Latitude/Longitude coordinates

100 0 100 200 300 400 Meters  
 300 437002016 0 300 600 900 1200 Feet

Contract C25514 Contract 7249

**Nukolii - Smoothed Rates**

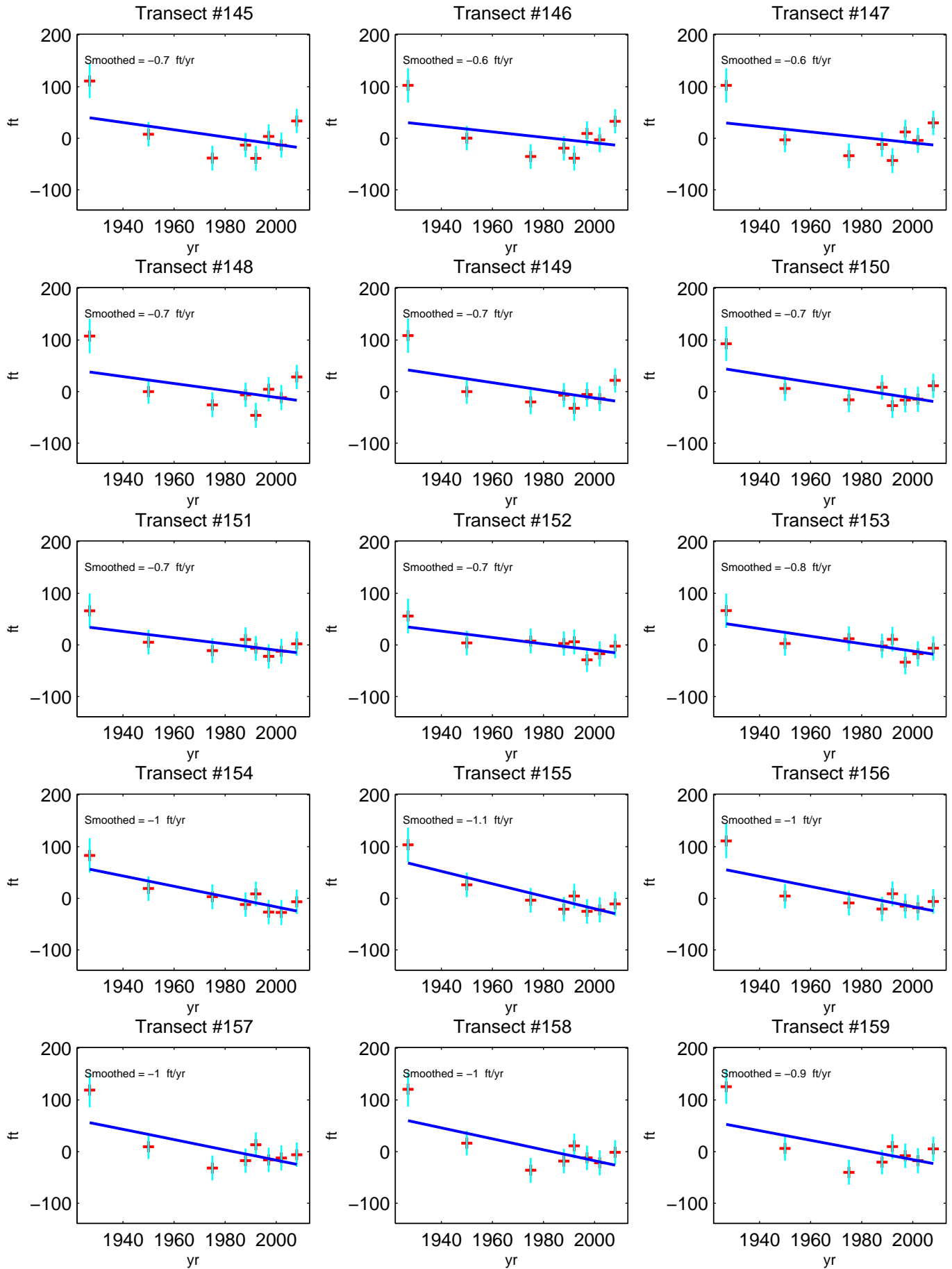
Positive Rate = Accretion  
Negative Rate = Erosion

Transect	Smoothed Rate (ft/yr)	Transect	Smoothed Rate (ft/yr)	Transect	Smoothed Rate (ft/yr)
145	-0.7	192	-0.5	238	-0.6
146	-0.6	193	-0.6	239	-0.7
147	-0.6	194	-0.6		
148	-0.7	195	-0.5		
149	-0.7	196	-0.5		
150	-0.7	197	-0.6		
151	-0.7	198	-0.8		
152	-0.7	199	-1.0		
153	-0.8	200	-1.2		
154	-1.0	201	-1.3		
155	-1.1	202	-1.3		
156	-1.0	203	-1.3		
157	-1.0	204	-1.2		
158	-1.0	205	-1.2		
159	-0.9	206	-1.2		
160	-0.8	207	-1.2		
161	-0.7	208	-1.4		
162	-0.6	209	-1.5		
163	-0.5	210	-1.6		
164	-0.4	211	-1.6		
165	-0.3	212	-1.5		
166	-0.2	213	-1.4		
167	-0.2	214	-1.5		
168	-0.3	215	-1.6		
169	-0.4	216	-1.6		
170	-0.5	217	-1.5		
171	-0.6	218	-1.3		
172	-0.6	219	-1.1		
173	-0.6	220	-0.5		
174	-0.5	221	-0.6		
176	-0.9	222	-0.6		
177	-0.9	223	-0.6		
178	-0.8	224	-0.5		
179	-0.9	225	-0.5		
180	-1.0	226	-0.5		
181	-1.3	227	-0.5		
182	-1.6	228	-0.5		
183	-1.9	229	-0.5		
184	-1.9	230	-0.5		
185	-1.7	231	-0.5		
186	-1.5	232	-0.4		
187	-1.3	233	-0.3		
188	-1.1	234	-0.3		
189	-0.9	235	-0.3		
190	-0.6	236	-0.4		
191	-0.5	237	-0.5		

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

# Nukulii - Smoothed Shoreline Change Rates

Positive Rate = Accretion  
Negative Rate = Erosion

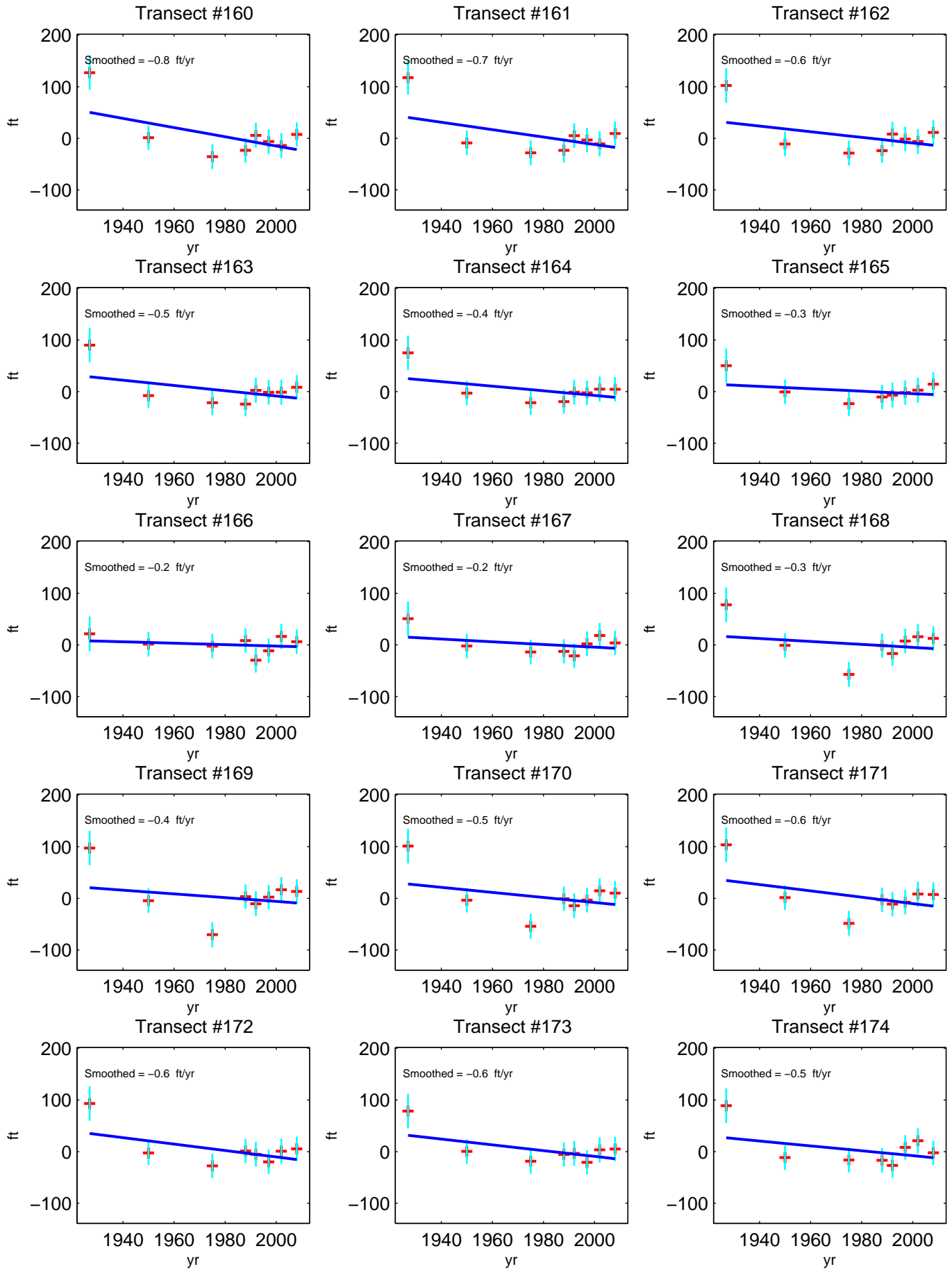


\*Hardened Shorelines with no beach are shown with a blue square. The analysis stops at the first hardened shoreline.



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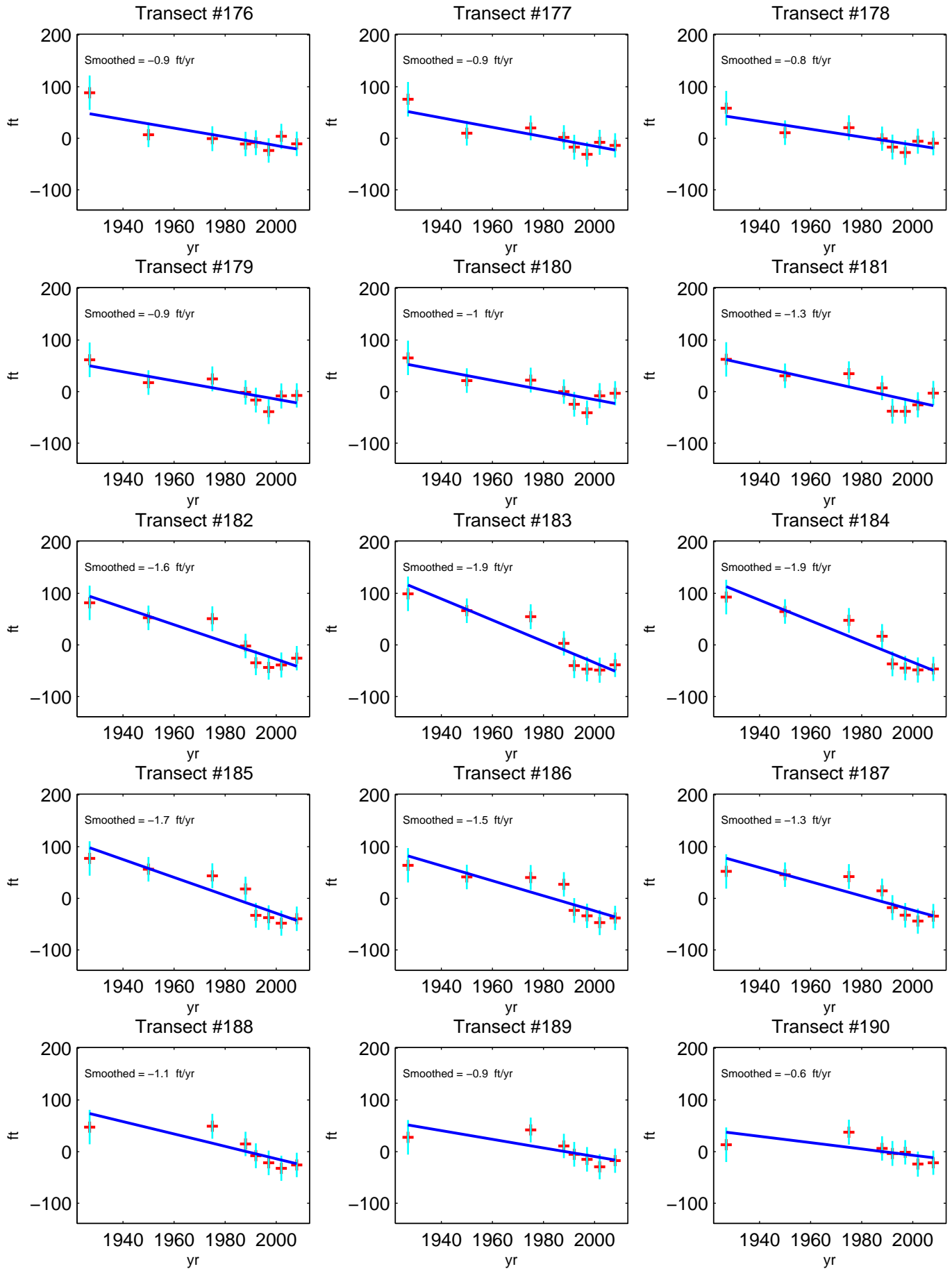
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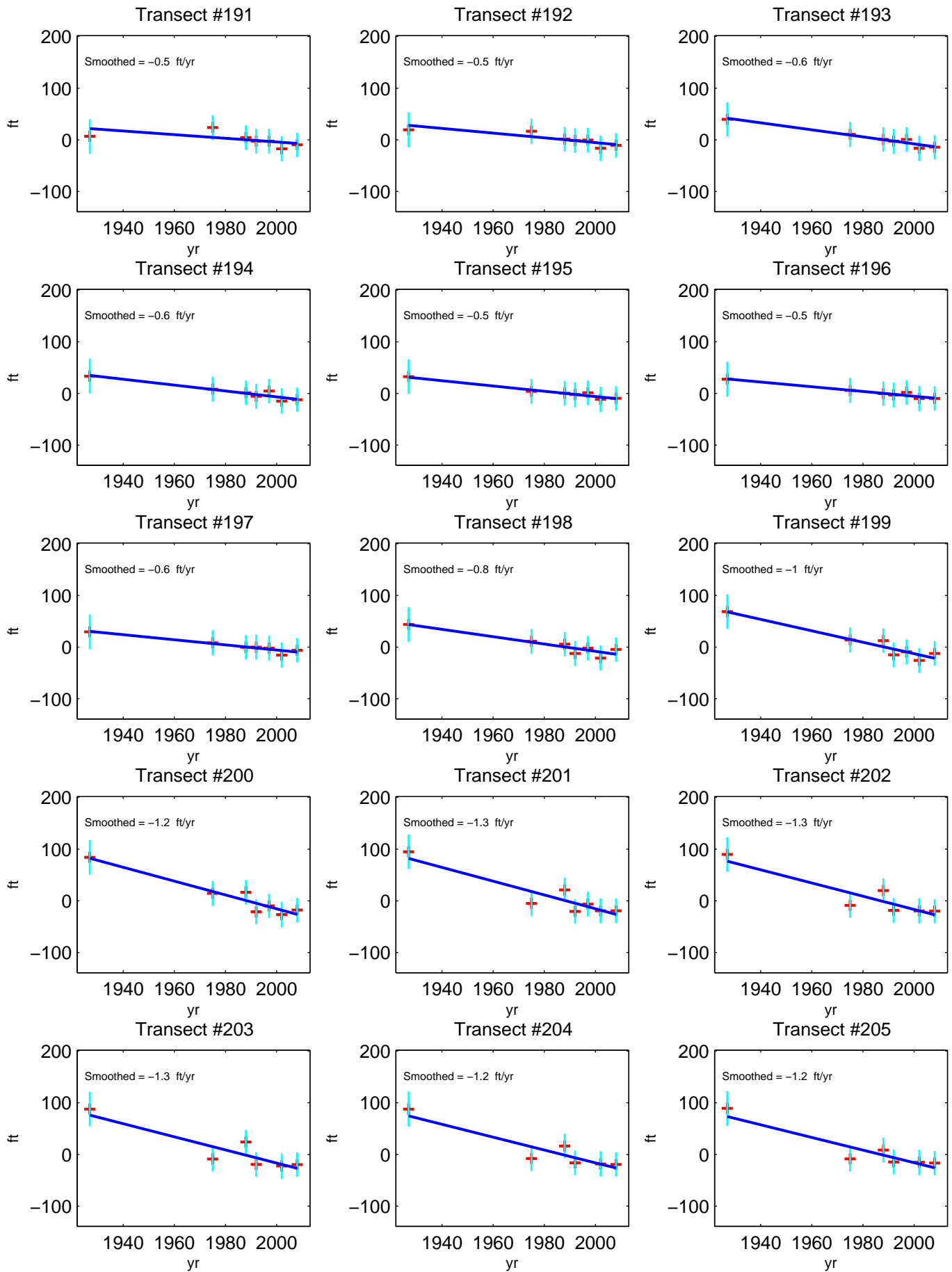
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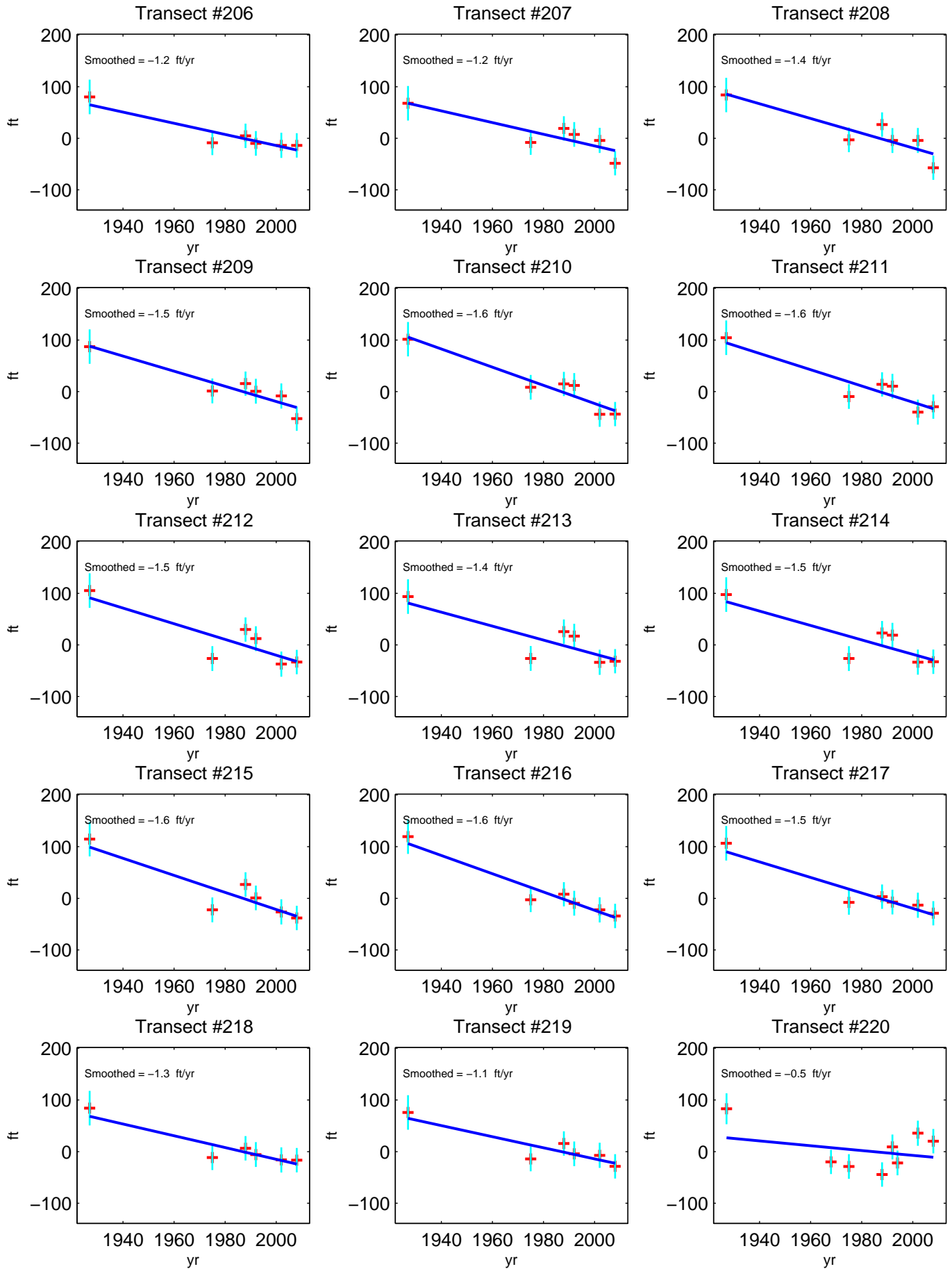
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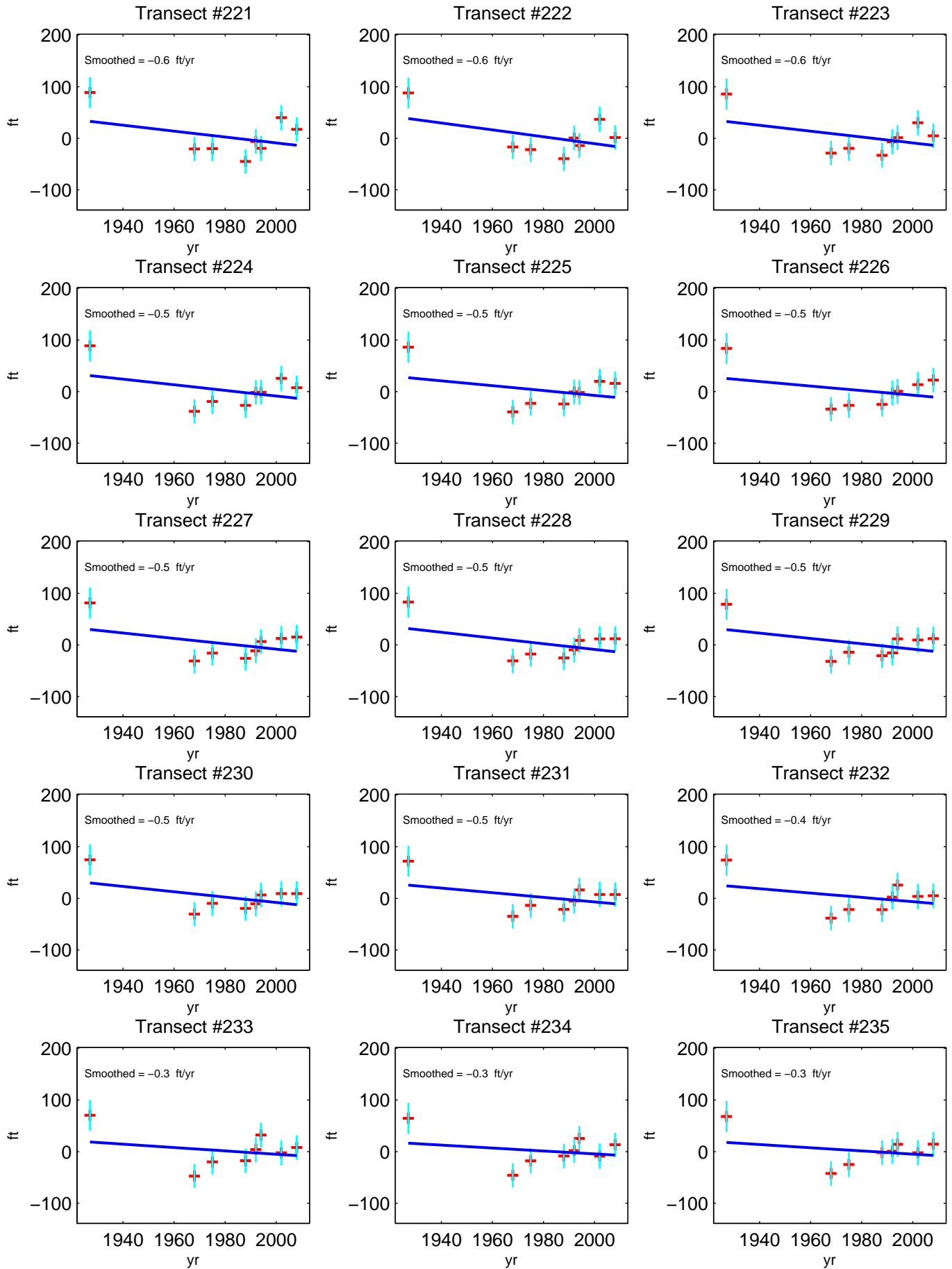
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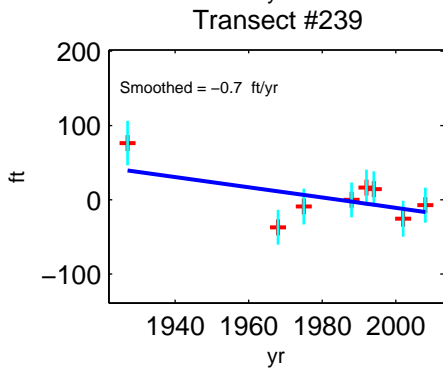
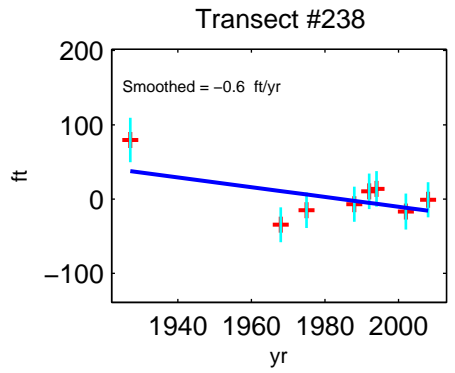
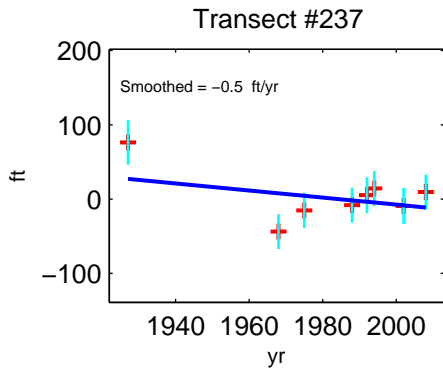
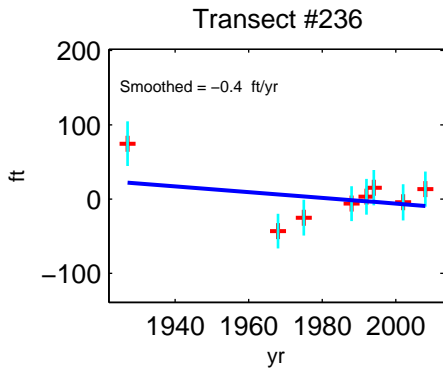
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# Nukolii - Smoothed Shoreline Change Rates

Positive Rate = Accretion  
Negative Rate = Erosion



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# Lydgate, Kauai, Hawaii

## AREA DESCRIPTION

The Lydgate study area (transects 0 – 144) is located on the east coast of Kauai south of the Wailua River mouth. The shoreline is composed of carbonate sand beach interrupted by occasional outcrops of beachrock with a fringing reef offshore. The area is exposed to persistent tradewinds and rough seas throughout the year.

Overall, the area is experiencing erosion at an average rate of  $-0.4$  ft/yr. The area lends itself to division into three portions. The most northern portion (transects 0 – 4) has experienced erosion over time with an average rate of  $-0.7$  ft/yr. Previous studies<sup>1</sup> found accretion for this beach but stated that it is relatively unstable, alternating between accretion and erosion. The engineered swimming lagoon (transects 5 – 11) is experiencing chronic erosion at an average rate of  $-1.2$  ft/yr. The southern portion of the beach (transects 12 – 144) has experienced erosion with an average rate of  $-0.3$  ft/yr.

<sup>1</sup> 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

- Jul 1927 T-sheet
- Nov 1950
- Apr 1975
- Jul 1987
- May 1988
- Sept 1992
- May 1992
- Mar 1997
- Feb 2002
- 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).

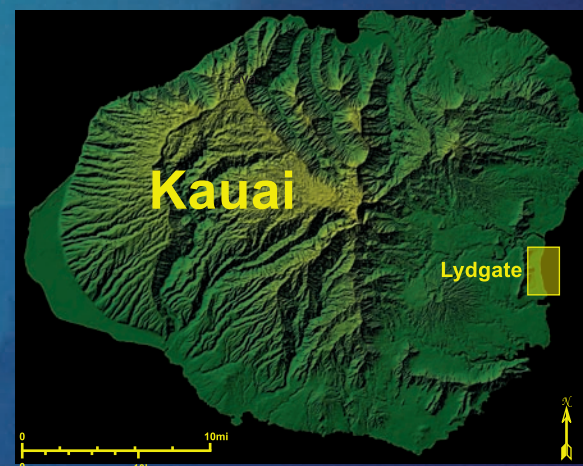
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## SHORELINE CHANGE RATES

- █ Accretion Rate
- █ Erosion Rate

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Contract C25514

Contract 7249



464300mE 22°01'N UTM coordinates  
 Latitude/Longitude coordinates

**Lydgate - 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	48	-0.7	94	0.4
1	-0.7	49	-0.6	95	0.1
2	-0.8	50	-0.6	96	-0.1
3	-0.8	51	-0.5	97	-0.2
4	-0.7	52	-0.5	98	-0.2
5	-1.0	53	-0.4	99	-0.2
8	-1.3	54	-0.4	100	-0.2
9	-1.3	55	-0.3	101	-0.2
10	-1.2	56	-0.3	102	-0.3
11	-1.0	57	-0.2	103	-0.4
12	-0.3	58	-0.1	104	-0.5
13	-0.3	59	-0.1	105	-0.7
14	-0.3	60	-0.1	106	-0.9
15	-0.4	61	0.0	107	-1.0
16	-0.5	62	0.0	108	-1.0
17	-0.5	63	0.0	109	-1.0
18	-0.5	64	0.0	110	-0.9
19	-0.6	65	0.0	111	-0.7
20	-0.6	66	0.1	112	-0.6
21	-0.7	67	0.1	113	-0.4
22	-0.8	68	0.1	114	-0.4
23	-0.9	69	0.1	115	-0.3
24	-1.0	70	0.0	116	-0.2
25	-1.0	71	-0.1	117	0.0
26	-1.1	72	-0.2	118	0.2
27	-1.1	73	-0.2	119	0.3
28	-1.0	74	-0.1	120	0.4
29	-1.0	75	-0.1	121	0.5
30	-0.9	76	-0.1	122	0.5
31	-0.9	77	-0.2	123	0.5
32	-1.0	78	-0.3	124	0.5
33	-1.1	79	-0.3	125	0.4
34	-1.1	80	-0.3	126	0.3
35	-1.1	81	-0.2	127	0.2
36	-1.2	82	0.0	128	0.1
37	-1.0	83	0.2	129	0.1
38	-1.0	84	0.5	130	0.0
39	-1.0	85	0.6	131	0.0
40	-1.0	86	0.7	132	-0.1
41	-1.0	87	0.7	133	-0.2
42	-0.9	88	0.7	134	-0.2
43	-0.9	89	0.7	135	-0.3
44	-0.8	90	0.7	136	-0.4
45	-0.8	91	0.8	137	-0.5
46	-0.8	92	0.9	138	-0.5
47	-0.8	93	0.7	139	-0.6

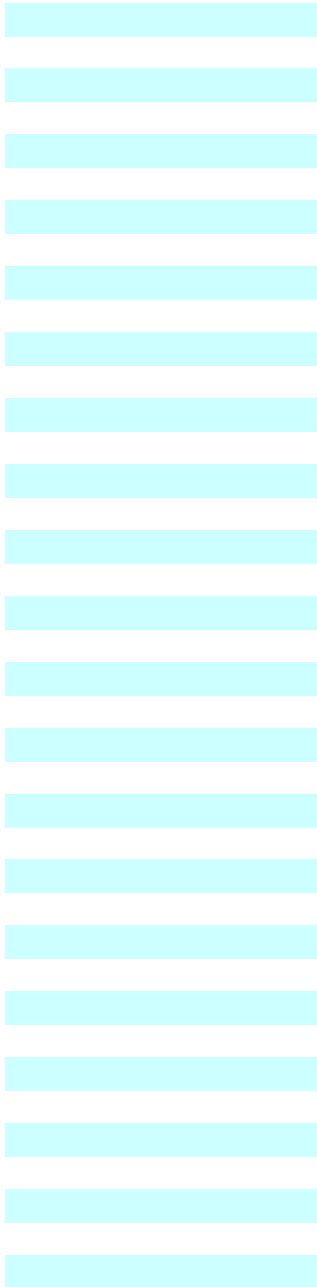
\*Imagery indicates beachwidth of zero during period of analysis. Rate calculation reflects data with beach existence.



**Lydgate - Smoothed Rates**

Positive Rate = Accretion  
Negative Rate = Erosion

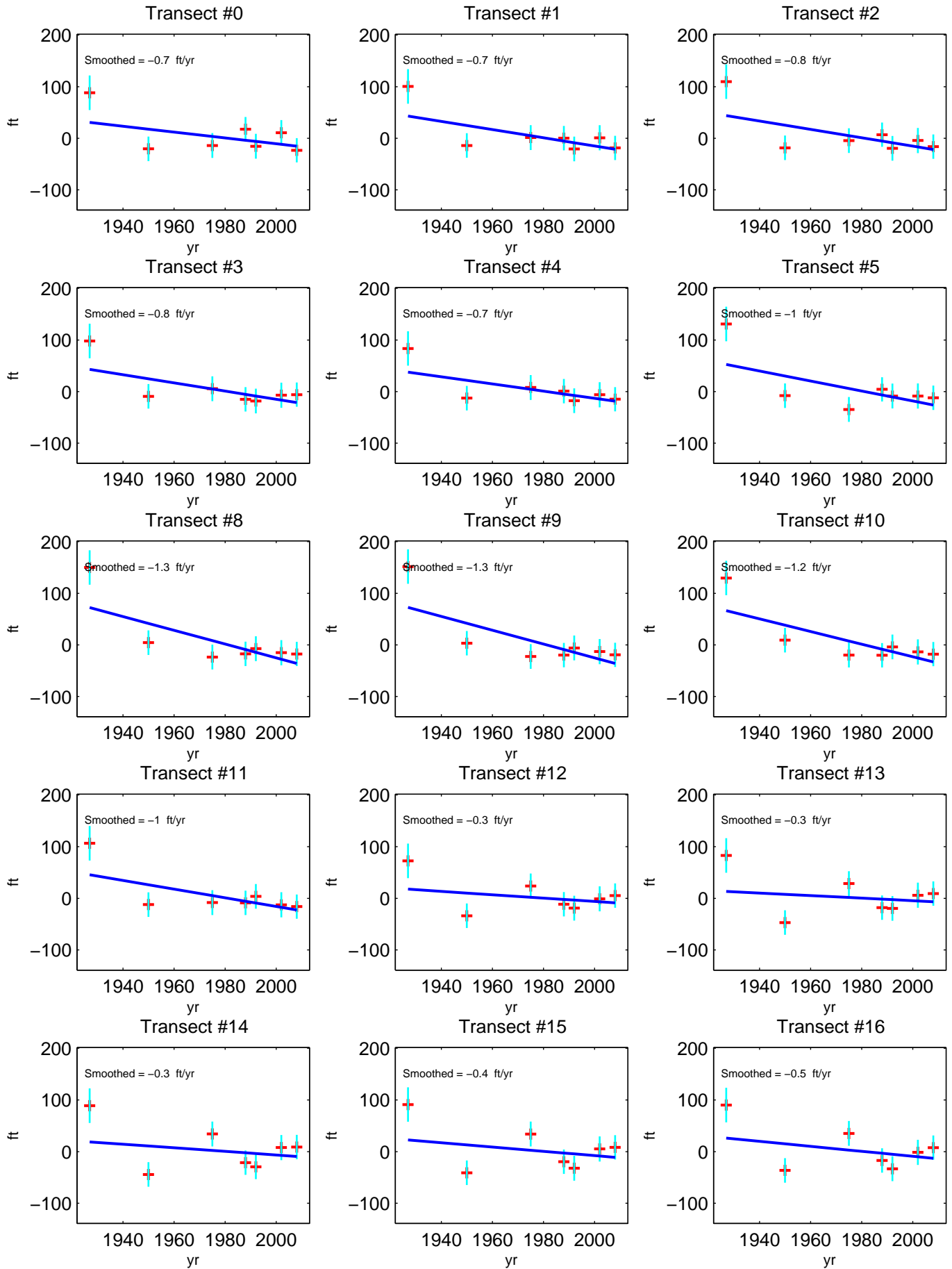
Transect	Smoothed Rate (ft/yr)
140	-0.7
141	-0.9
142	-1.0
143	-1.0
144	-0.9



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

# Lydgate - Smoothed Shoreline Change Rates

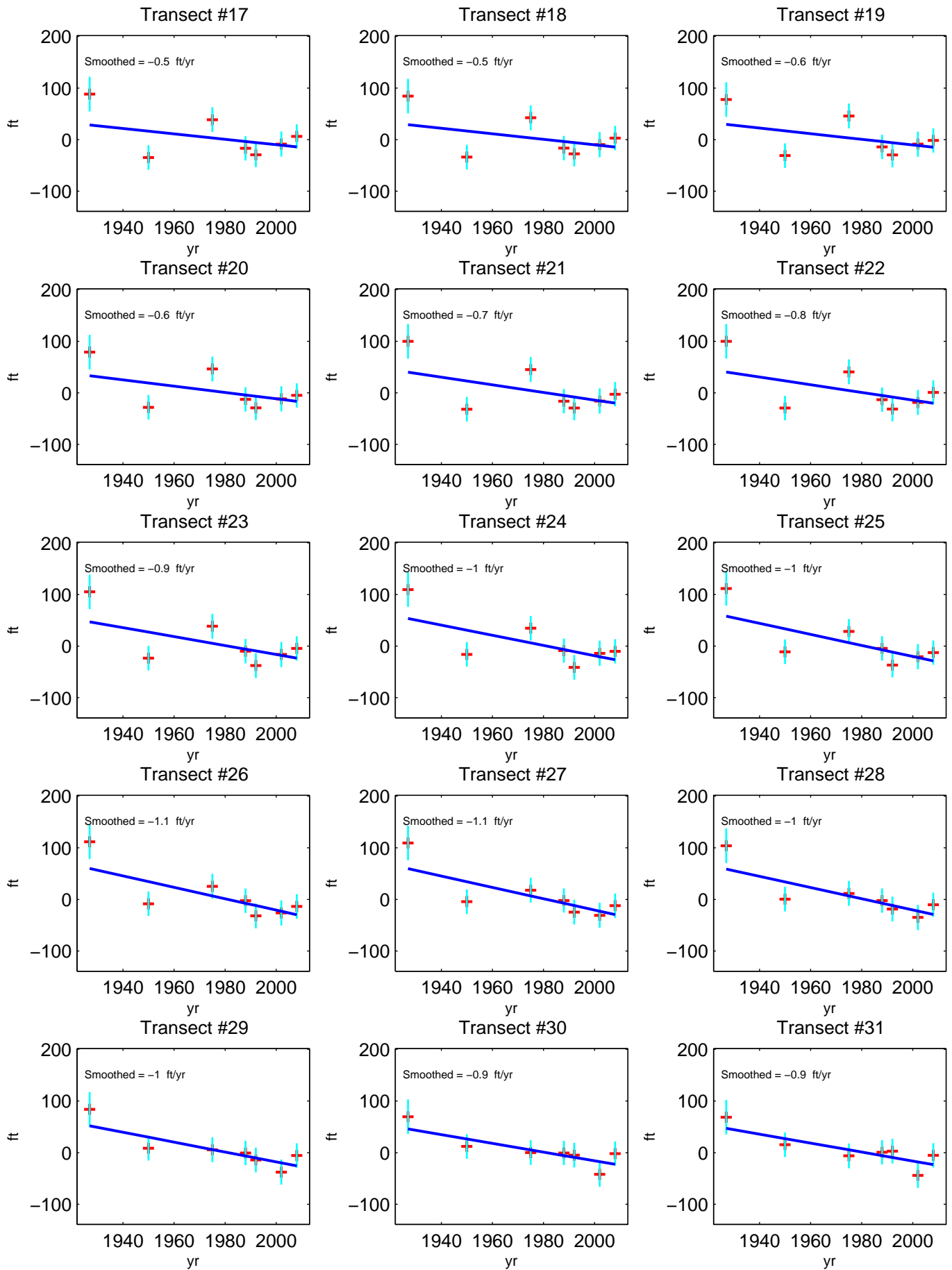
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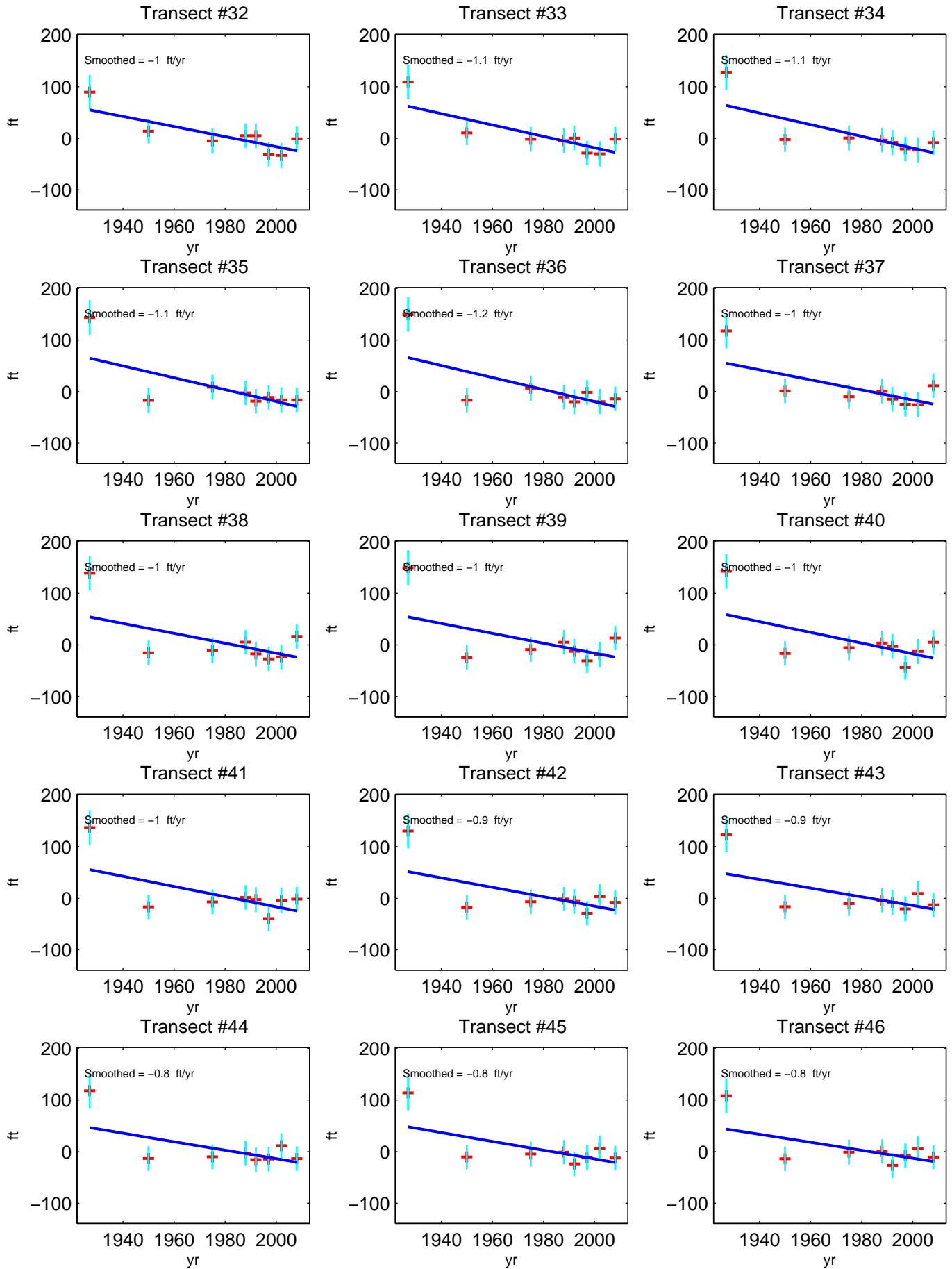
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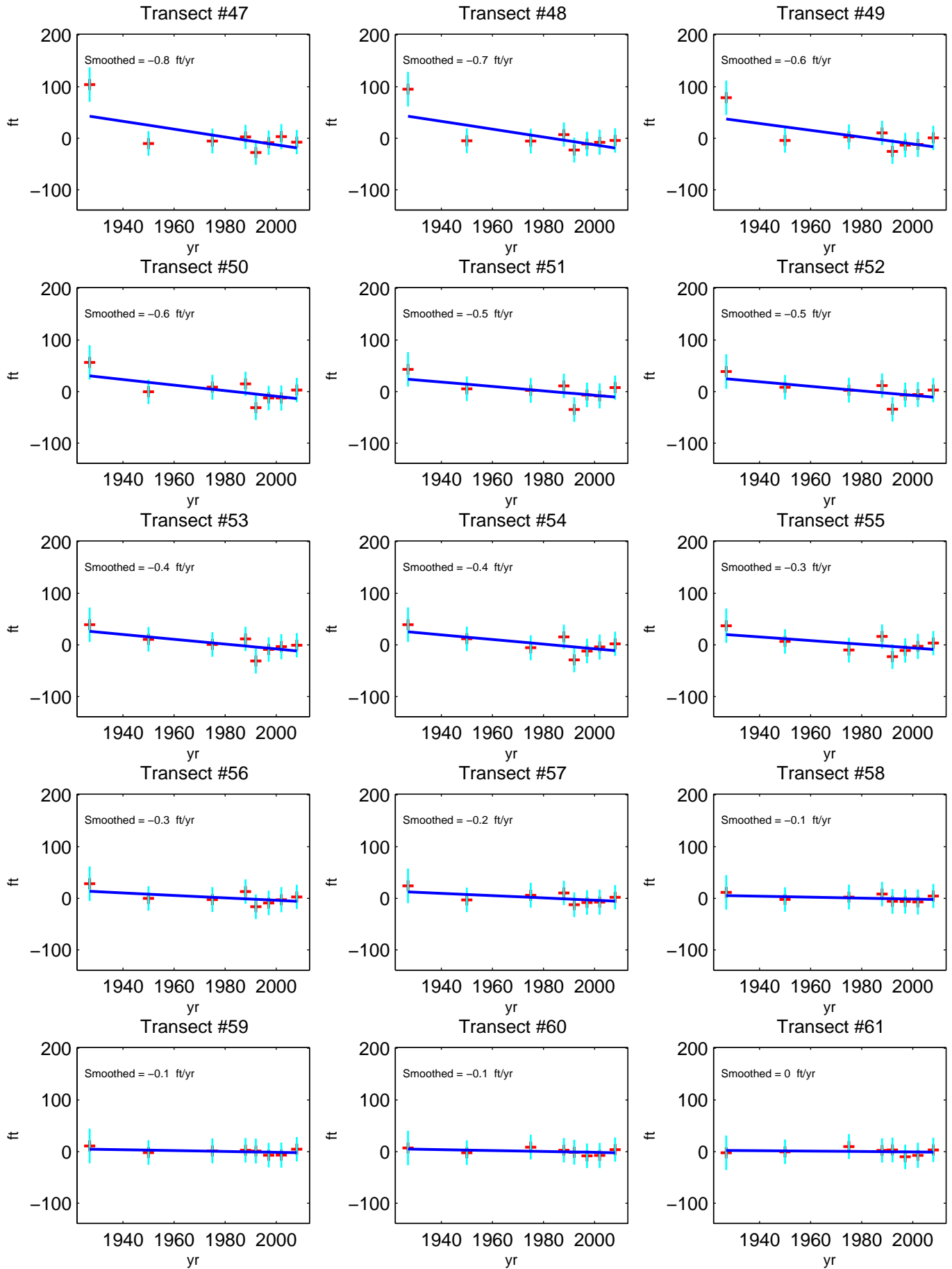
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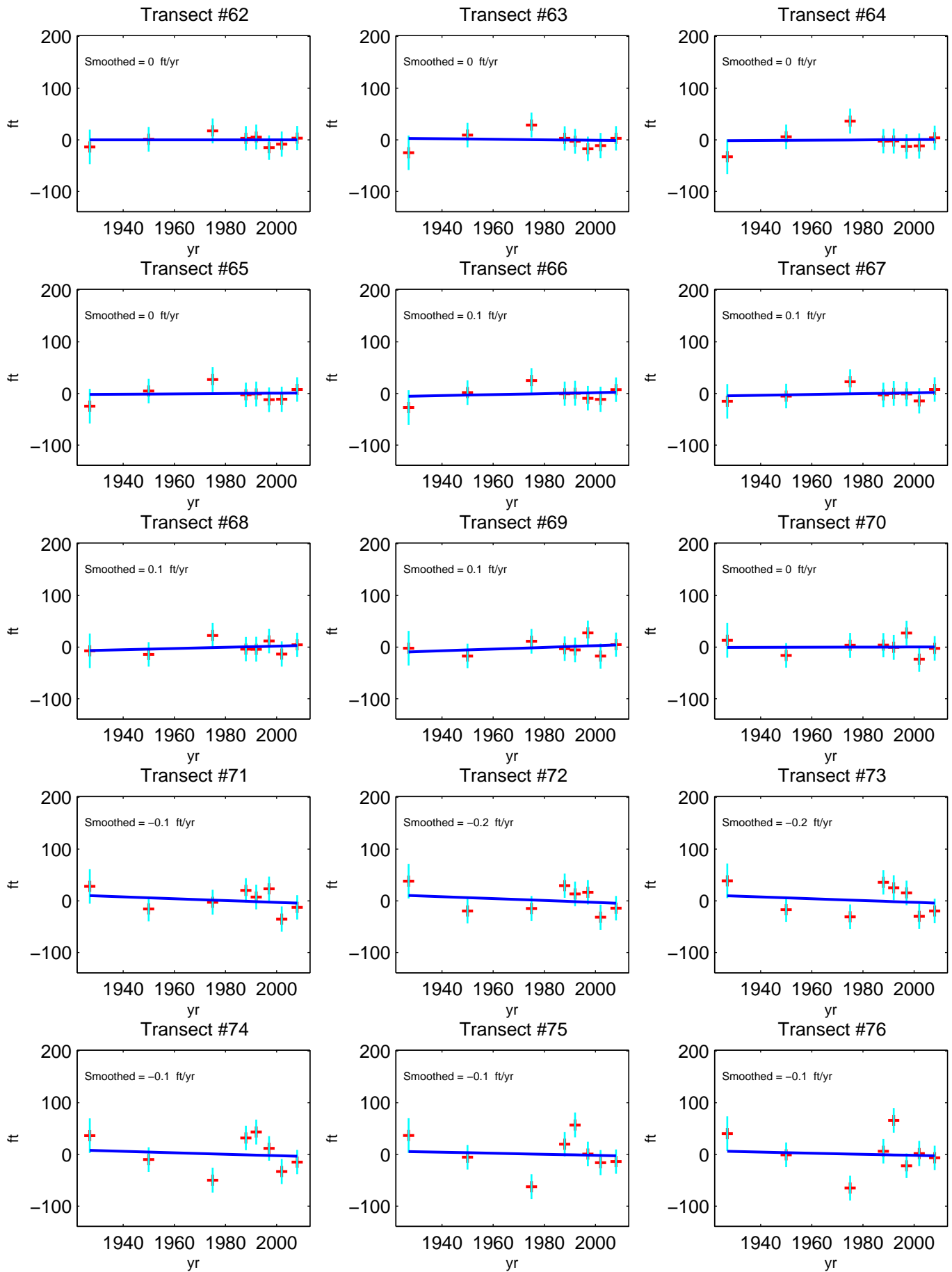
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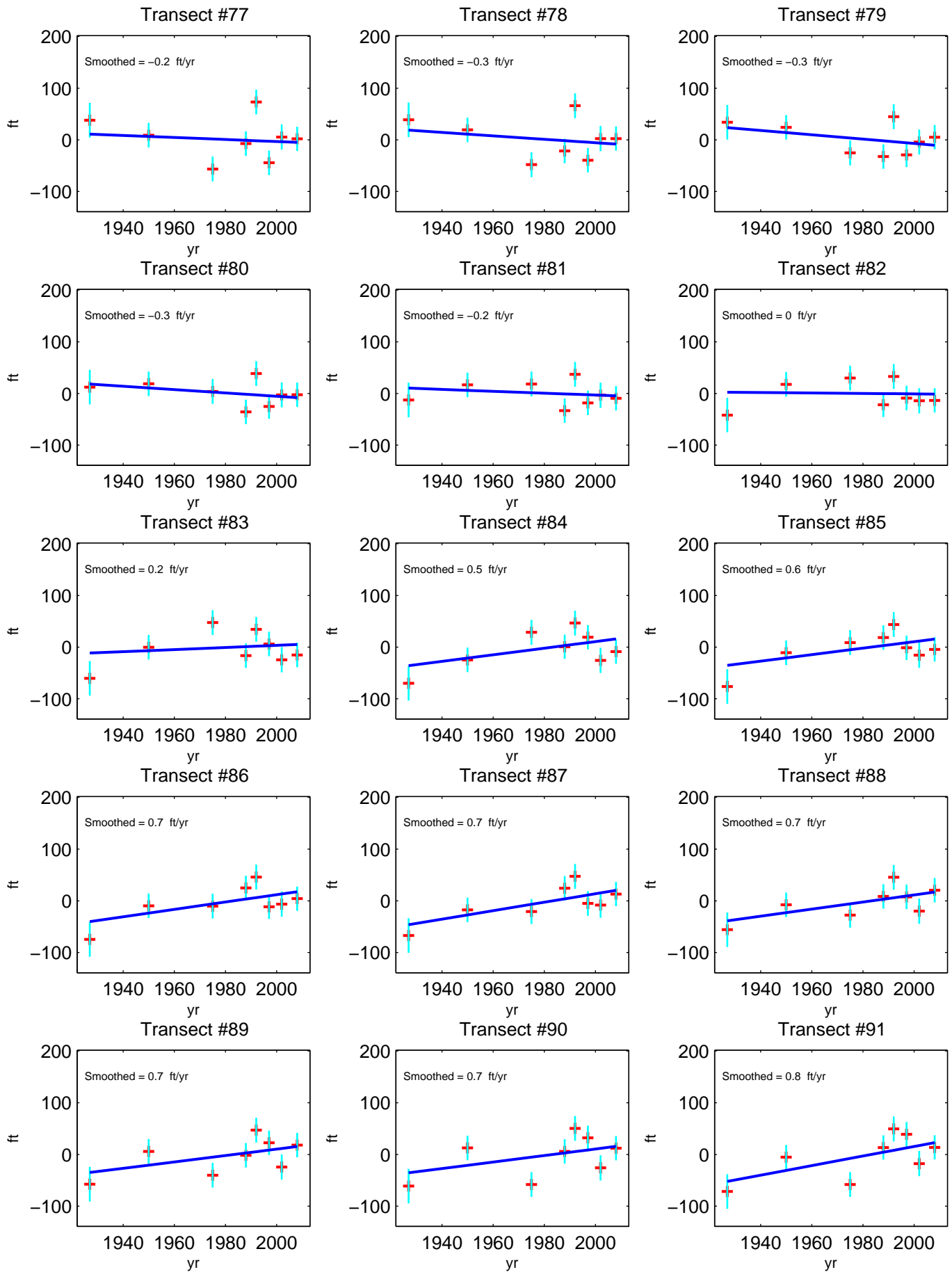
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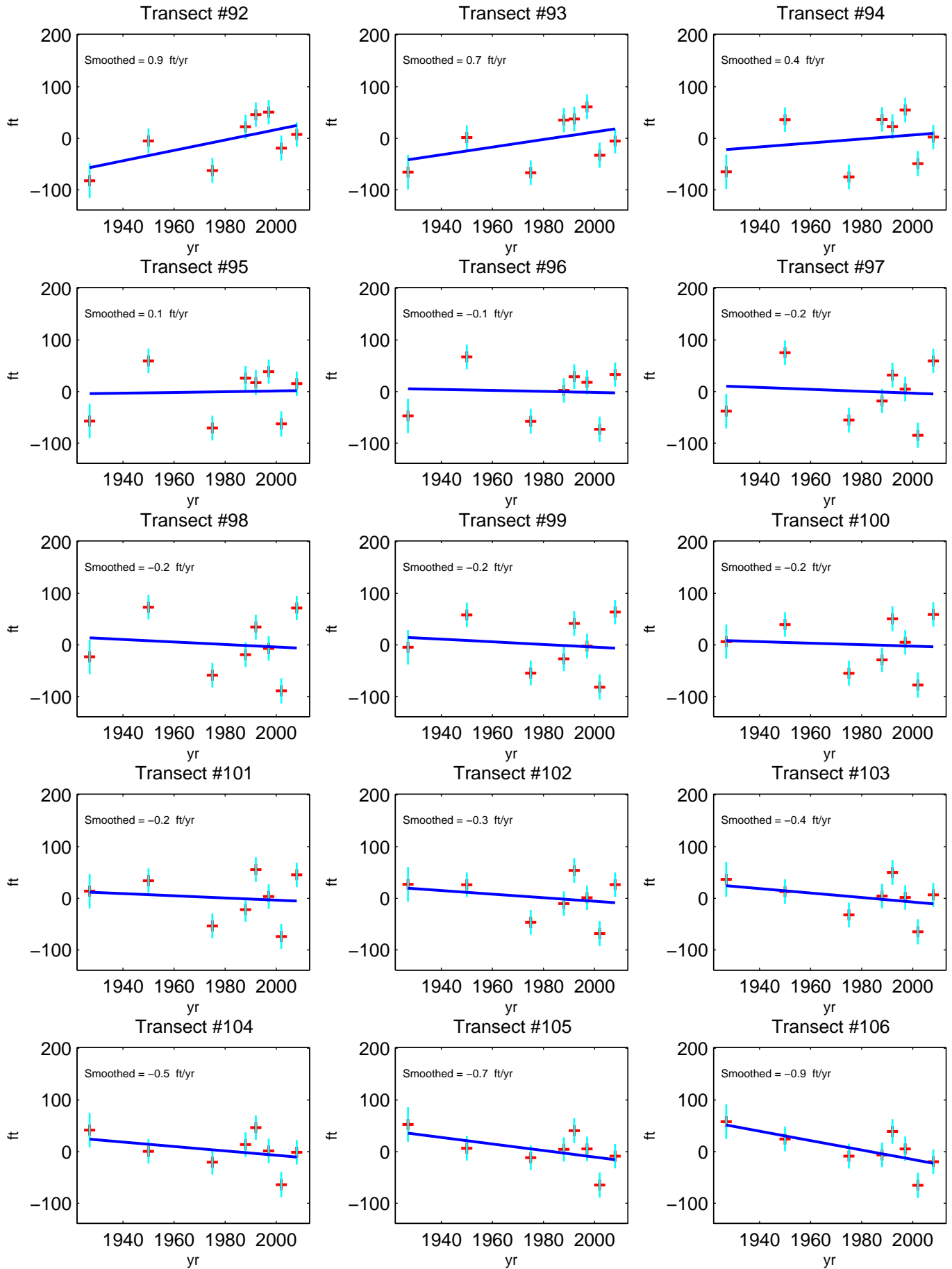
Positive Rate = Accretion  
Negative Rate = Erosion



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# Lydgate - Smoothed Shoreline Change Rates

Positive Rate = Accretion  
Negative Rate = Erosion

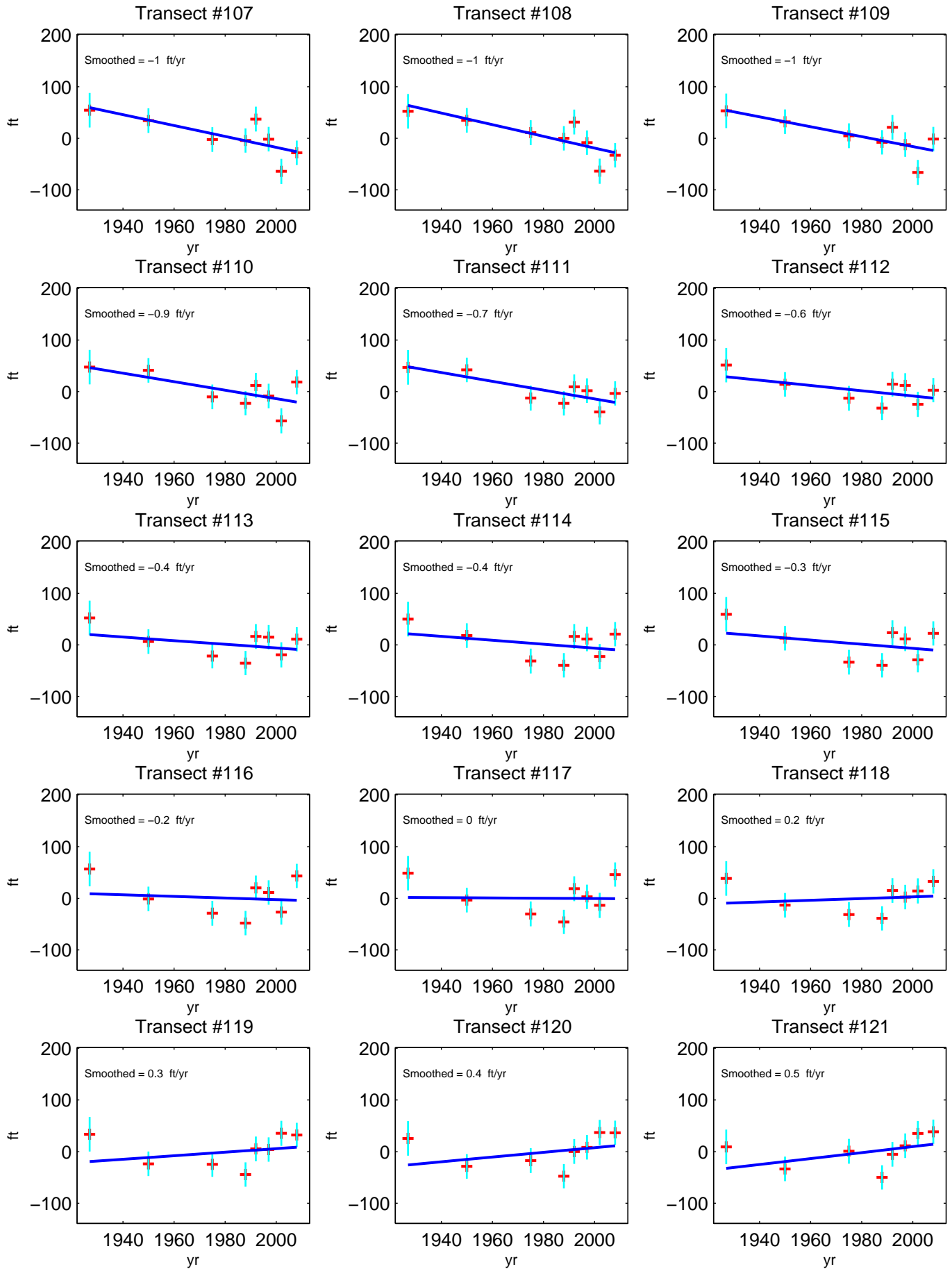


\*Hardened Shorelines with no beach are shown with a blue square. The analysis stops at the first hardened shoreline.



# Lydgate - Smoothed Shoreline Change Rates

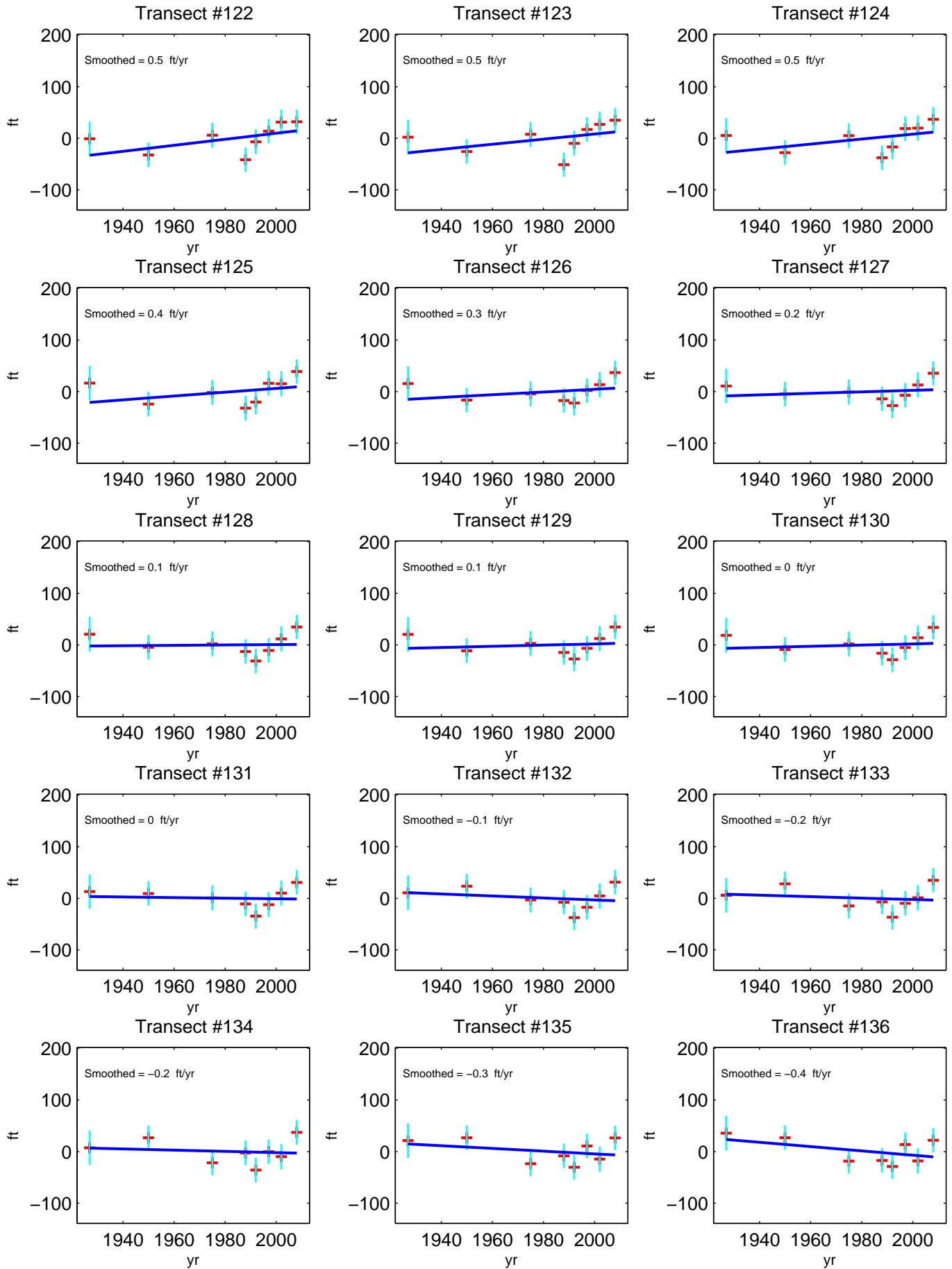
Positive Rate = Accretion  
Negative Rate = Erosion



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

# Lydgate - Smoothed Shoreline Change Rates

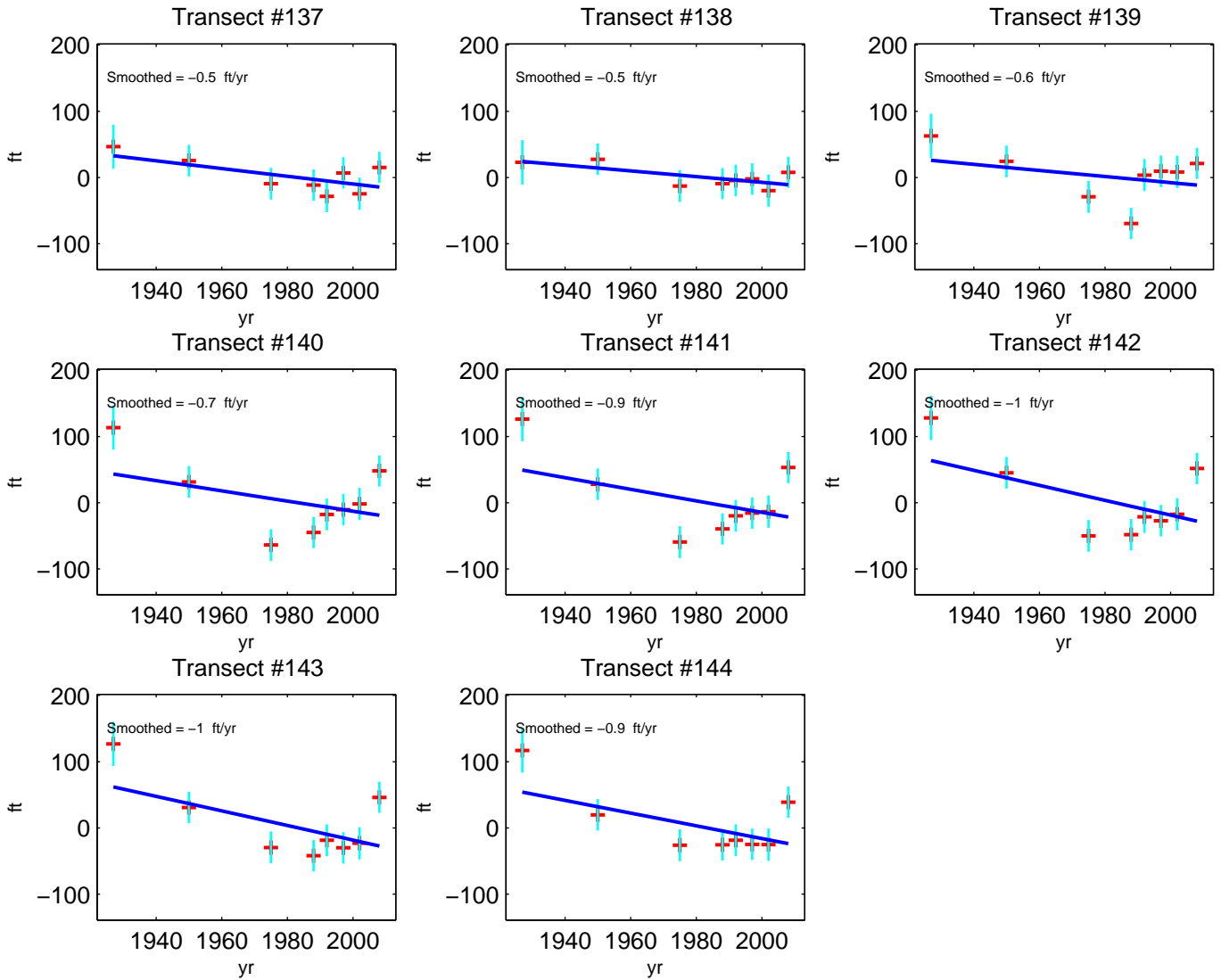
Positive Rate = Accretion  
Negative Rate = Erosion



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

# Lydgate - 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.

# Wailua Bay, 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

- █ Feb 1927 T-sheet
- █ Nov 1950
- █ Mar 1972
- █ Apr 1975
- █ Jul 1987
- █ May 1988
- █ Sept 1992
- █ May 1992
- █ Sept 2000
- █ Feb 2002
- █ 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).

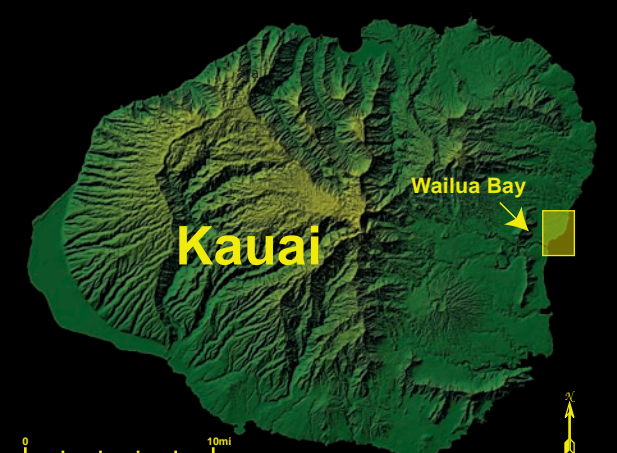
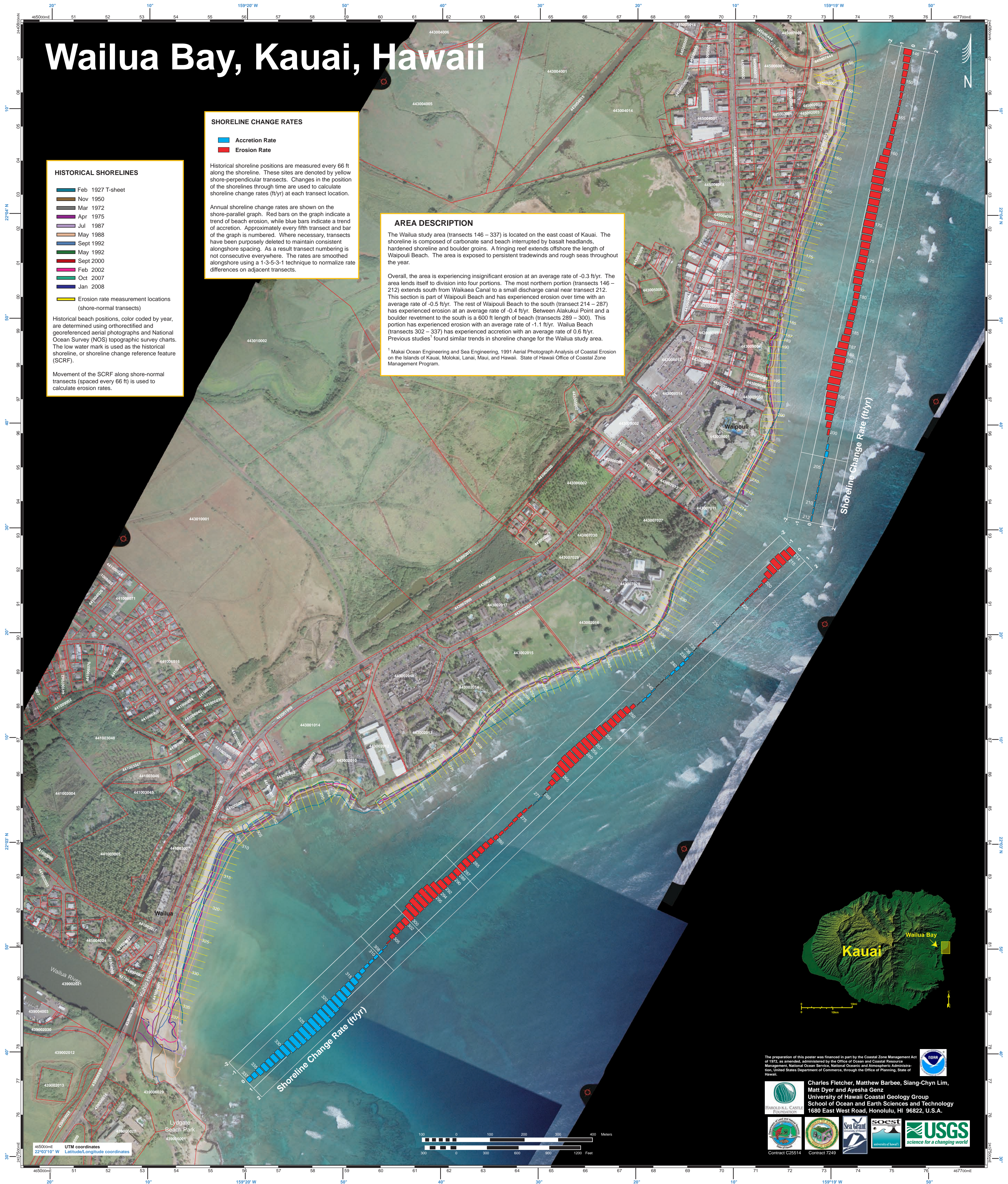
Movement of the SCRF along shore-normal transects (spaced every 66 ft) is used to calculate erosion rates.

## AREA DESCRIPTION

The Wailua study area (transects 146 – 337) is located on the east coast of Kauai. The shoreline is composed of carbonate sand beach interrupted by basalt headlands, hardened shoreline and boulder groins. A fringing reef extends offshore the length of Waipouli Beach. The area is exposed to persistent tradewinds and rough seas throughout the year.

Overall, the area is experiencing insignificant erosion at an average rate of -0.3 ft/yr. The area lends itself to division into four portions. The most northern portion (transects 146 – 212) extends south from Waikaea Canal to a small discharge canal near transect 212. This section is part of Waipouli Beach and has experienced erosion over time with an average rate of -0.5 ft/yr. The rest of Waipouli Beach to the south (transect 214 – 287) has experienced erosion at an average rate of -0.4 ft/yr. Between Alakukui Point and a boulder revetment to the south is a 600 ft length of beach (transects 289 – 300). This portion has experienced erosion with an average rate of -1.1 ft/yr. Wailua Beach (transects 302 – 337) has experienced accretion with an average rate of 0.6 ft/yr. Previous studies<sup>1</sup> found similar trends in shoreline change for the Wailua study area.

<sup>1</sup> 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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 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



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

**Wailua - Smoothed Rates**

Positive Rate = Accretion  
Negative Rate = Erosion

Transect	Smoothed Rate (ft/yr)	Transect	Smoothed Rate (ft/yr)	Transect	Smoothed Rate (ft/yr)
146	-0.7	193	-1.0	241	0.2
147	-0.6	194	-1.0	242	0.1
148	-0.5	195	-1.0	243	0.0
149	-0.4	196	-0.8	244	0.0
150	-0.4	197	-0.7	245	0.1
151	-0.3	198	-0.6	246	0.2
152	-0.2	199	-0.4	247	0.2
153	-0.2	200	-0.2	248	0.0
154	-0.2	201	0.0	249	-0.3
155	-0.3	202	0.2	250	-0.6
156	-0.3	203	0.3	251	-0.7
157	-0.3	204	0.1	252	-0.8
158	-0.3	205	0.1	253	-0.7
159	-0.4	206	0.1	254	-0.8
160	-0.6	207	0.1	255	-0.9
161	-0.8	208	0.1	256	-1.0
162	-0.9	209	0.1	257	-1.1
163	-1.0	210	0.1	259	-1.1
164	-1.0	211	0.1	260	-1.1
165	-1.0	212	0.1	261	-1.2
166	-0.9	214*	-0.8	262	-1.2
167	-0.9	215*	-0.9	263	-1.2
168	-0.9	216*	-1.0	264	-1.1
169	-0.9	217*	-1.0	265	-0.9
170	-0.9	218*	-0.9	266	-0.7
171	-0.9	219*	-0.6	267	-0.5
172	-0.8	220	-0.3	268	-0.2
173	-0.8	221	-0.2	269	0.0
174	-0.7	222	-0.1	271	0.1
175	-0.7	223	-0.1	272	0.1
176	-0.8	224	-0.1	273	-0.1
177	-0.8	225	-0.1	274	-0.2
178	-0.7	226	-0.1	275	-0.3
179	-0.6	227	0.0	276	-0.3
180	-0.5	228	0.0	277	-0.2
181	-0.4	229	0.0	278	-0.2
182	-0.5	230	0.1	279	-0.2
183	-0.5	231	0.1	280	-0.3
184	-0.6	232	0.0	281	-0.4
185	-0.6	233	-0.1	282	-0.5
186	-0.7	234	-0.1	283	-0.5
187	-0.9	235	0.0	284	-0.6
189	-1.0	236	0.1	285	-0.6
190	-1.0	238	0.2	286	-0.7
191	-1.0	239	0.3	287	-0.7
192	-1.0	240	0.3	289	-0.6

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

## Wailua - Smoothed Rates

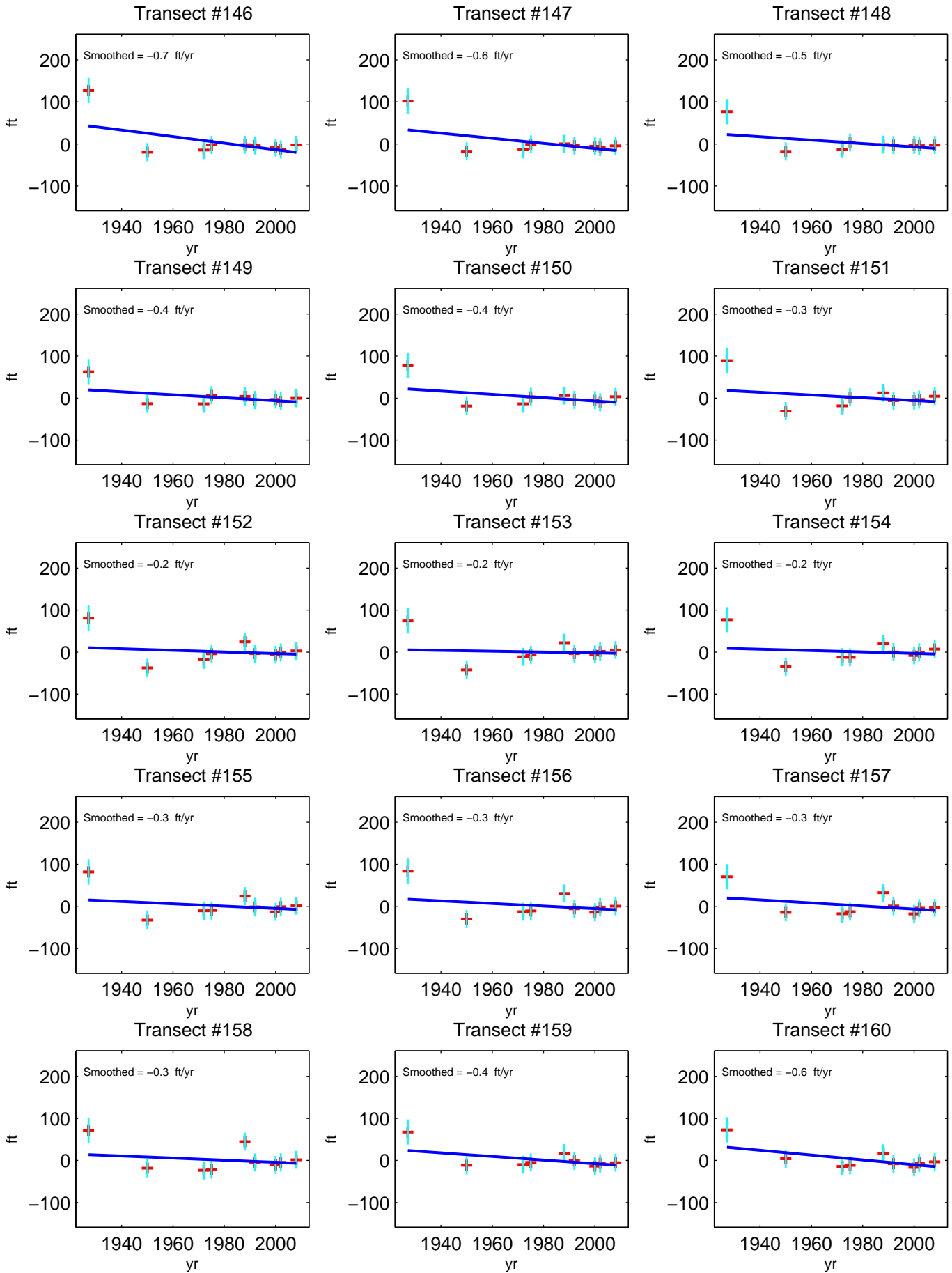
Positive Rate = Accretion  
Negative Rate = Erosion

Transect	Smoothed Rate (ft/yr)
290	-0.6
291	-0.7
292	-0.9
294	-1.1
295	-1.3
296	-1.4
297	-1.4
298	-1.3
299	-1.3
300	-1.1
302	-0.6
303	-0.6
304	-0.6
305	-0.4
306	-0.1
307	0.1
308	0.2
310	0.3
311	0.2
312	0.3
313	0.4
314	0.5
315	0.7
316	0.8
317	0.9
318	1.0
319	1.1
320	1.2
321	1.3
322	1.3
323	1.3
324	1.3
325	1.3
326	1.3
327	1.3
328	1.2
329	1.1
330	1.0
331	0.9
332	0.8
333	0.8
334	0.7
335	0.6
336	0.5
337	0.4

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

# Wailua - Smoothed Shoreline Change Rates

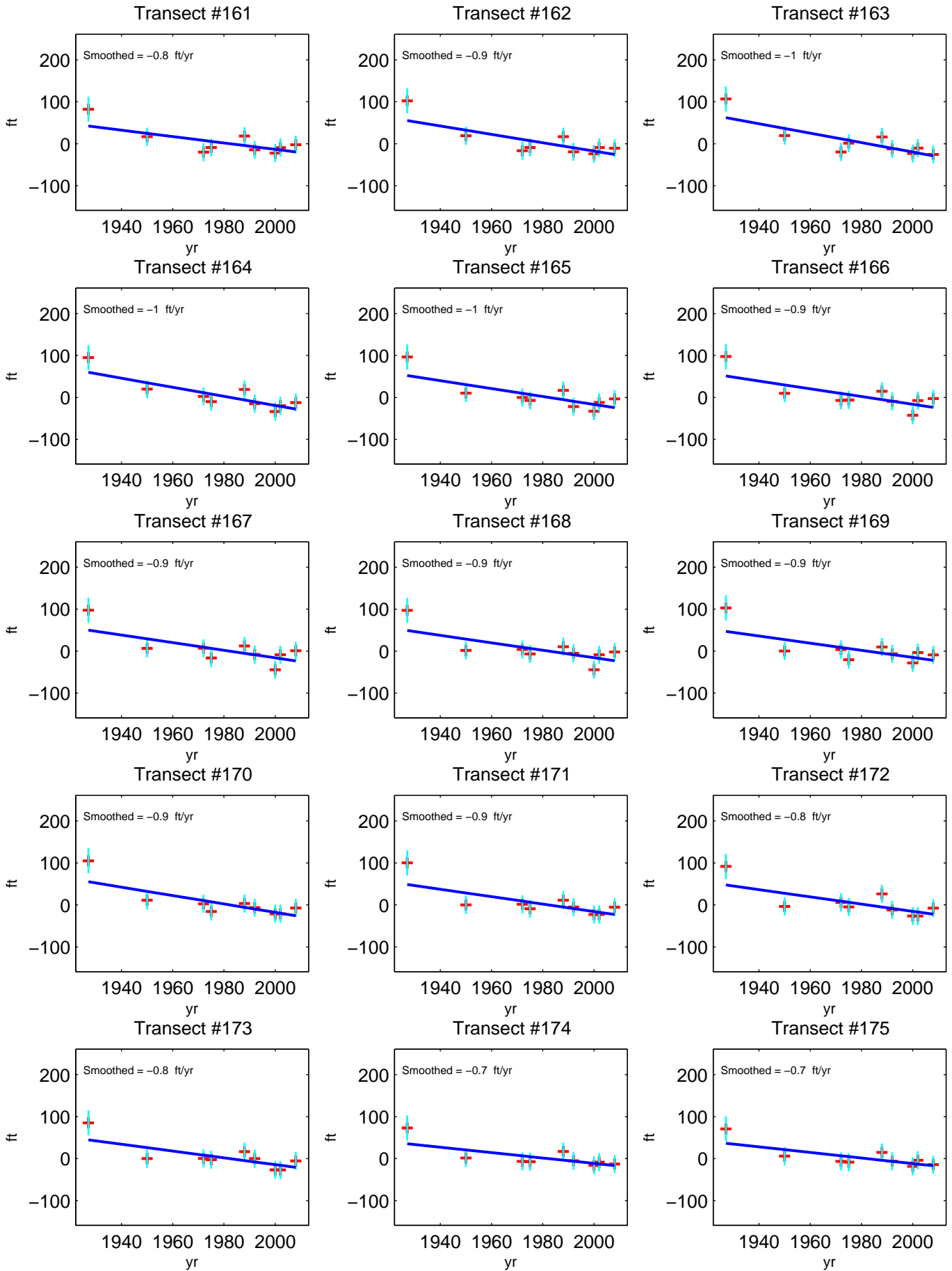
Positive Rate = Accretion  
Negative Rate = Erosion



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

# Wailua - Smoothed Shoreline Change Rates

Positive Rate = Accretion  
Negative Rate = Erosion

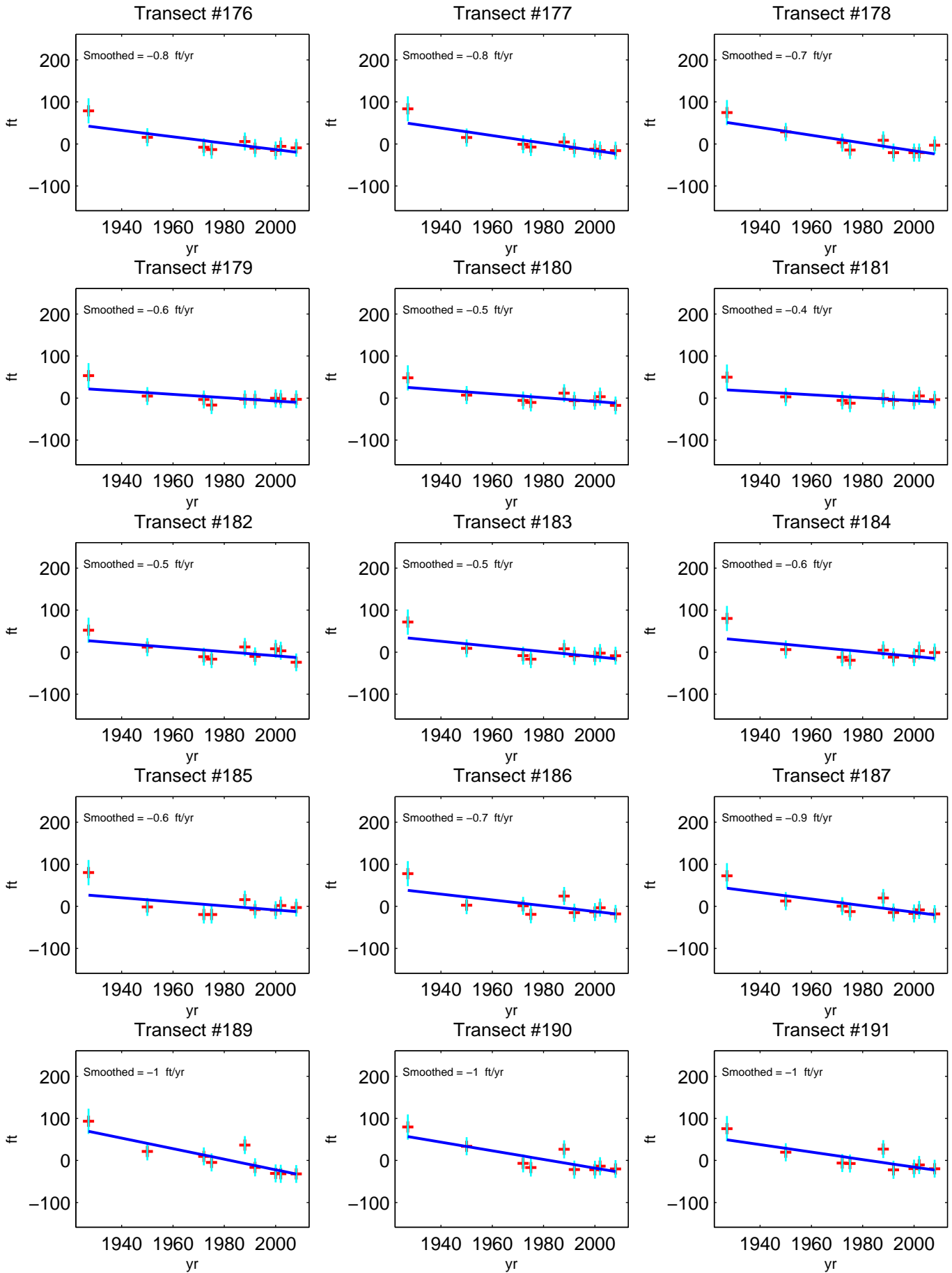


\*Hardened Shorelines with no beach are shown with a blue square. The analysis stops at the first hardened shoreline.



# Wailua - Smoothed Shoreline Change Rates

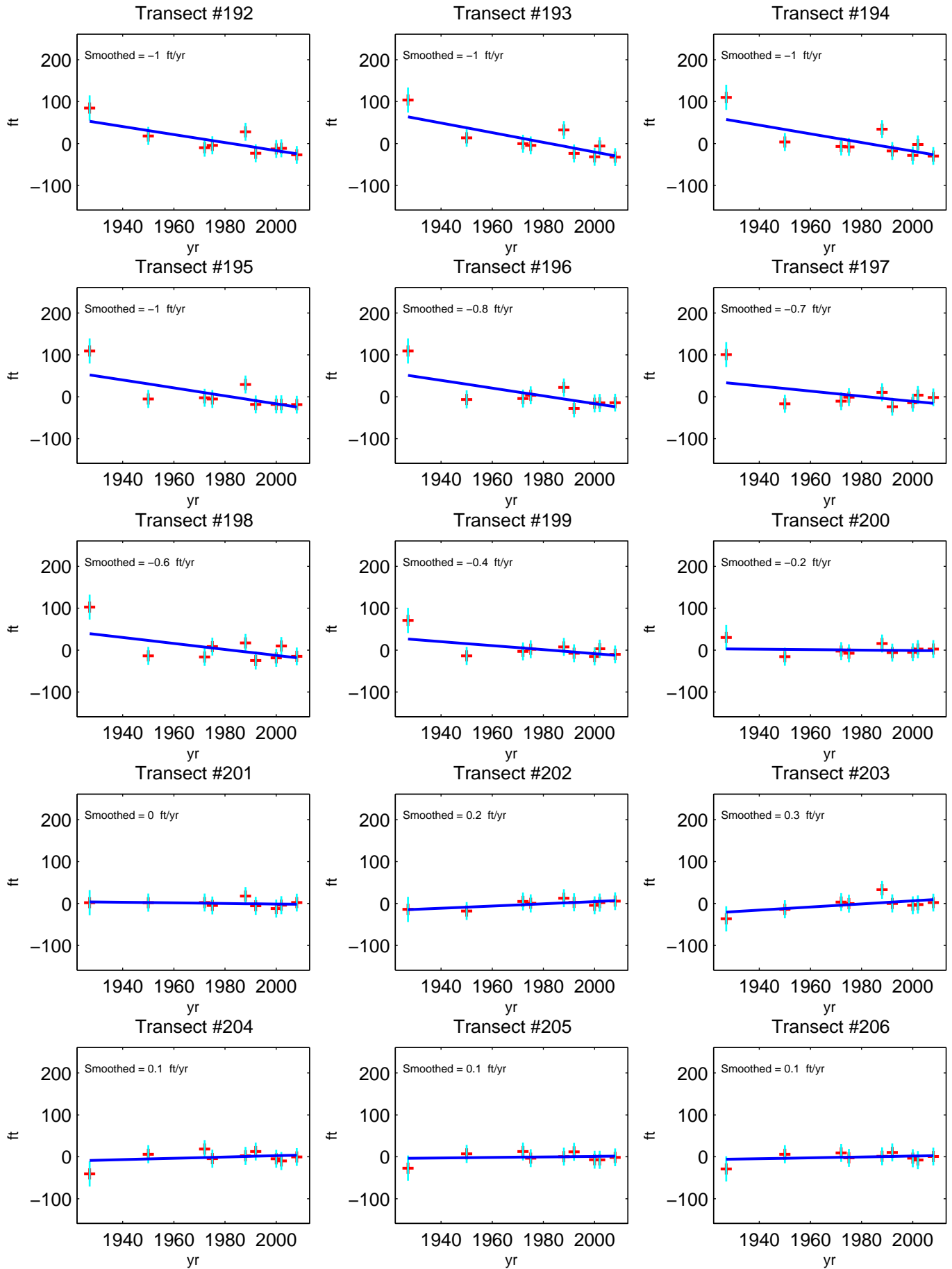
Positive Rate = Accretion  
Negative Rate = Erosion



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# Wailua - Smoothed Shoreline Change Rates

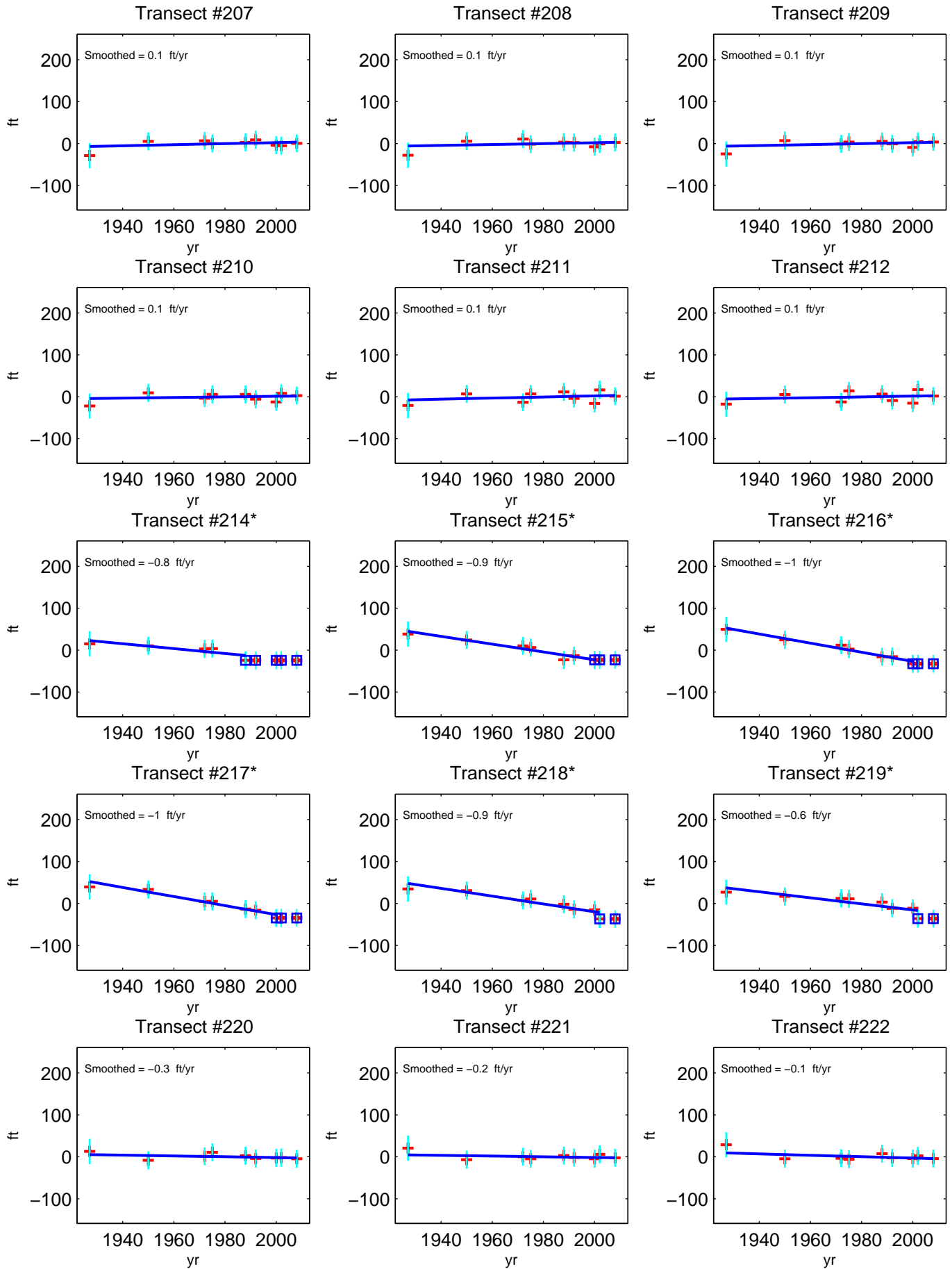
Positive Rate = Accretion  
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# Wailua - Smoothed Shoreline Change Rates

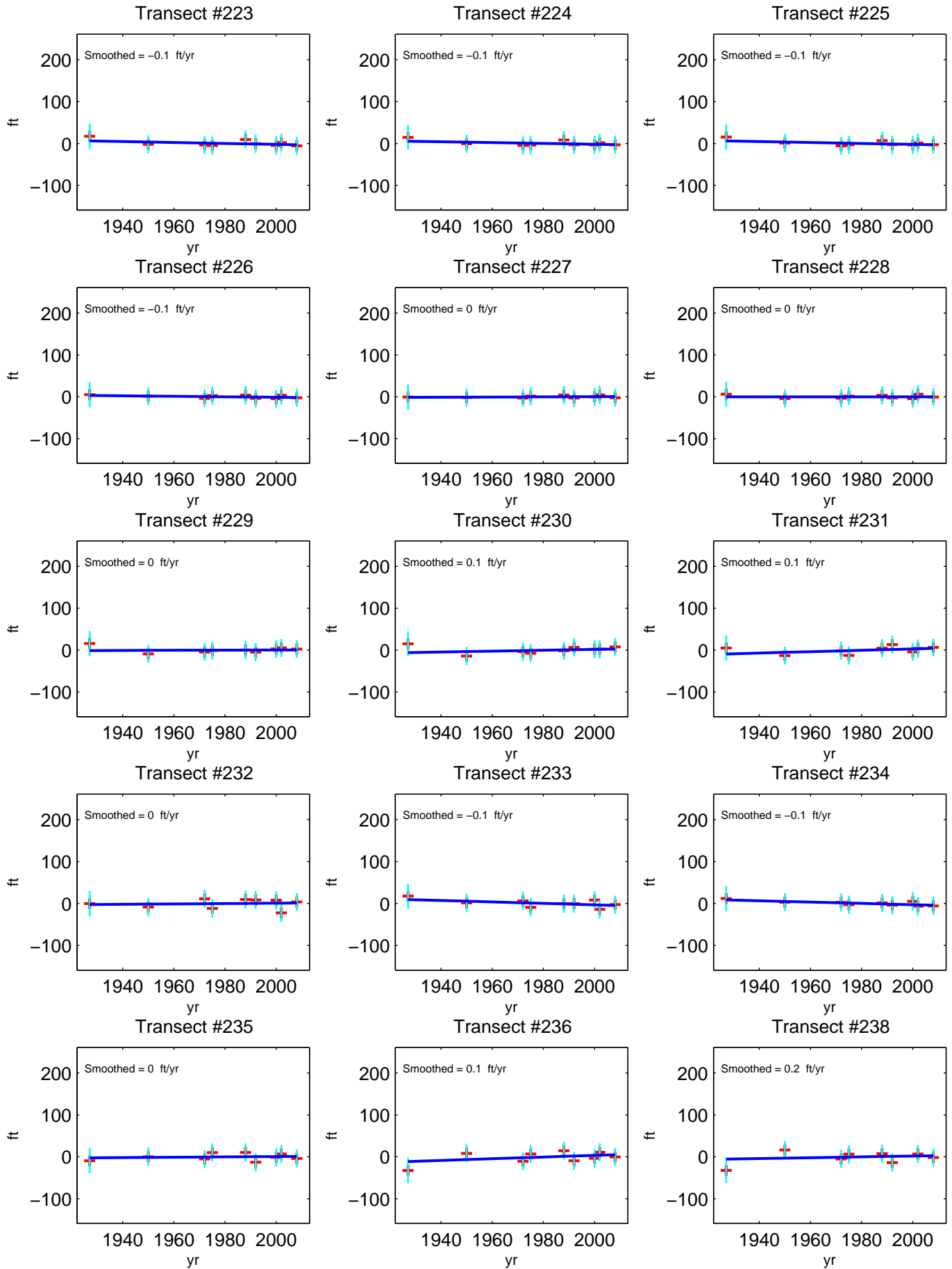
Positive Rate = Accretion  
Negative Rate = Erosion



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# Wailua - Smoothed Shoreline Change Rates

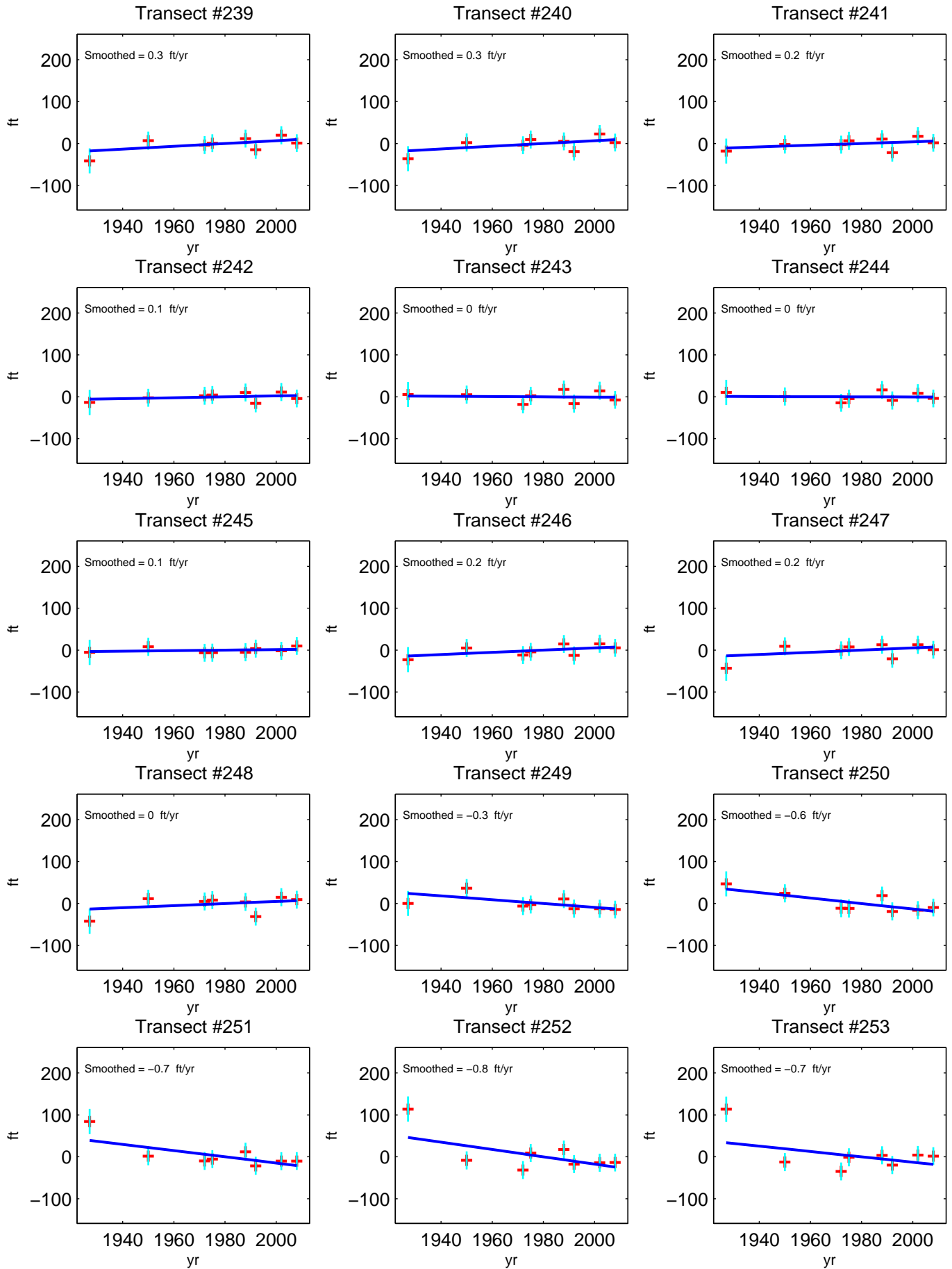
Positive Rate = Accretion  
Negative Rate = Erosion



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# Wailua - Smoothed Shoreline Change Rates

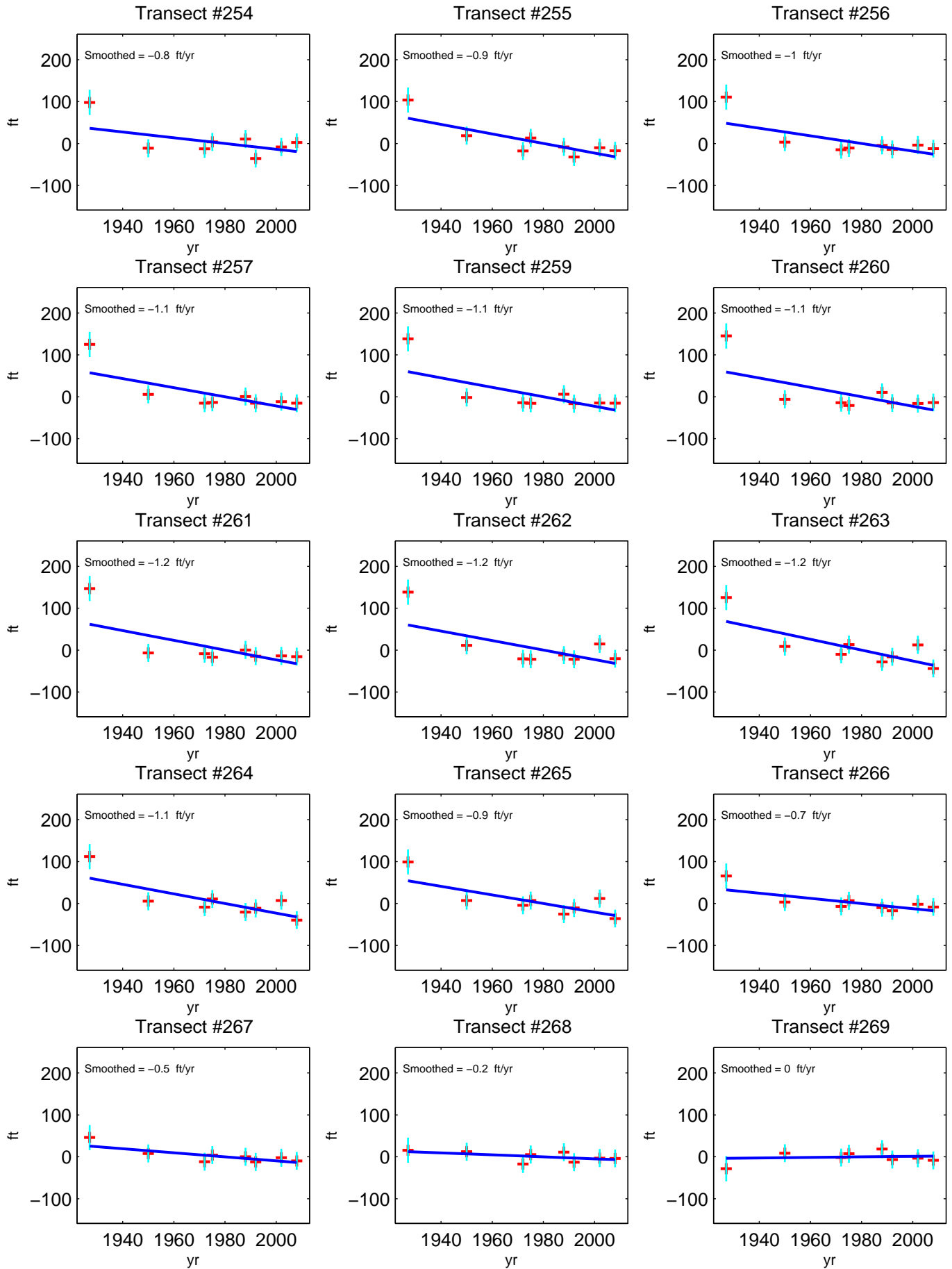
Positive Rate = Accretion  
Negative Rate = Erosion



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# Wailua - Smoothed Shoreline Change Rates

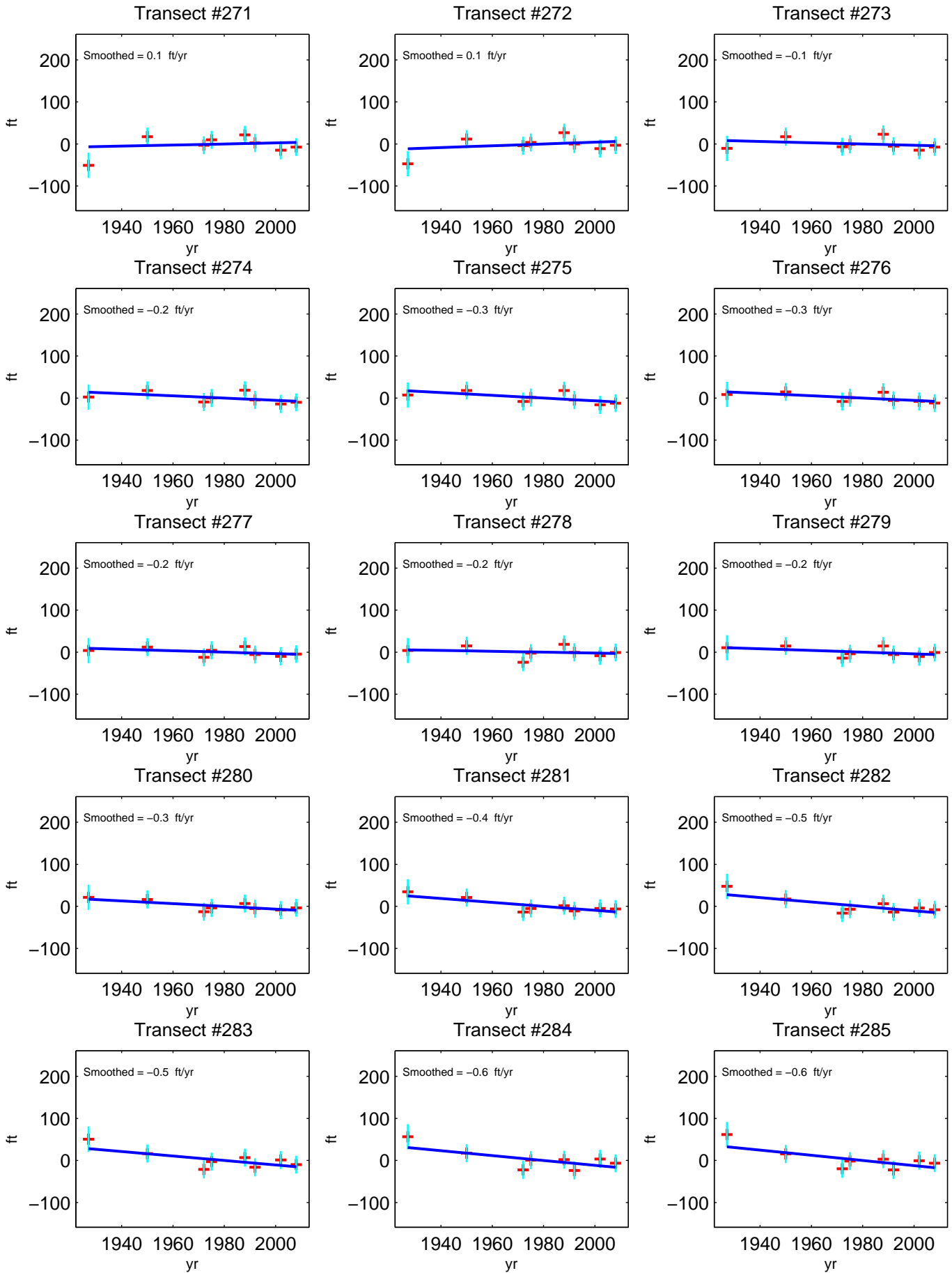
Positive Rate = Accretion  
Negative Rate = Erosion



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# Wailua - Smoothed Shoreline Change Rates

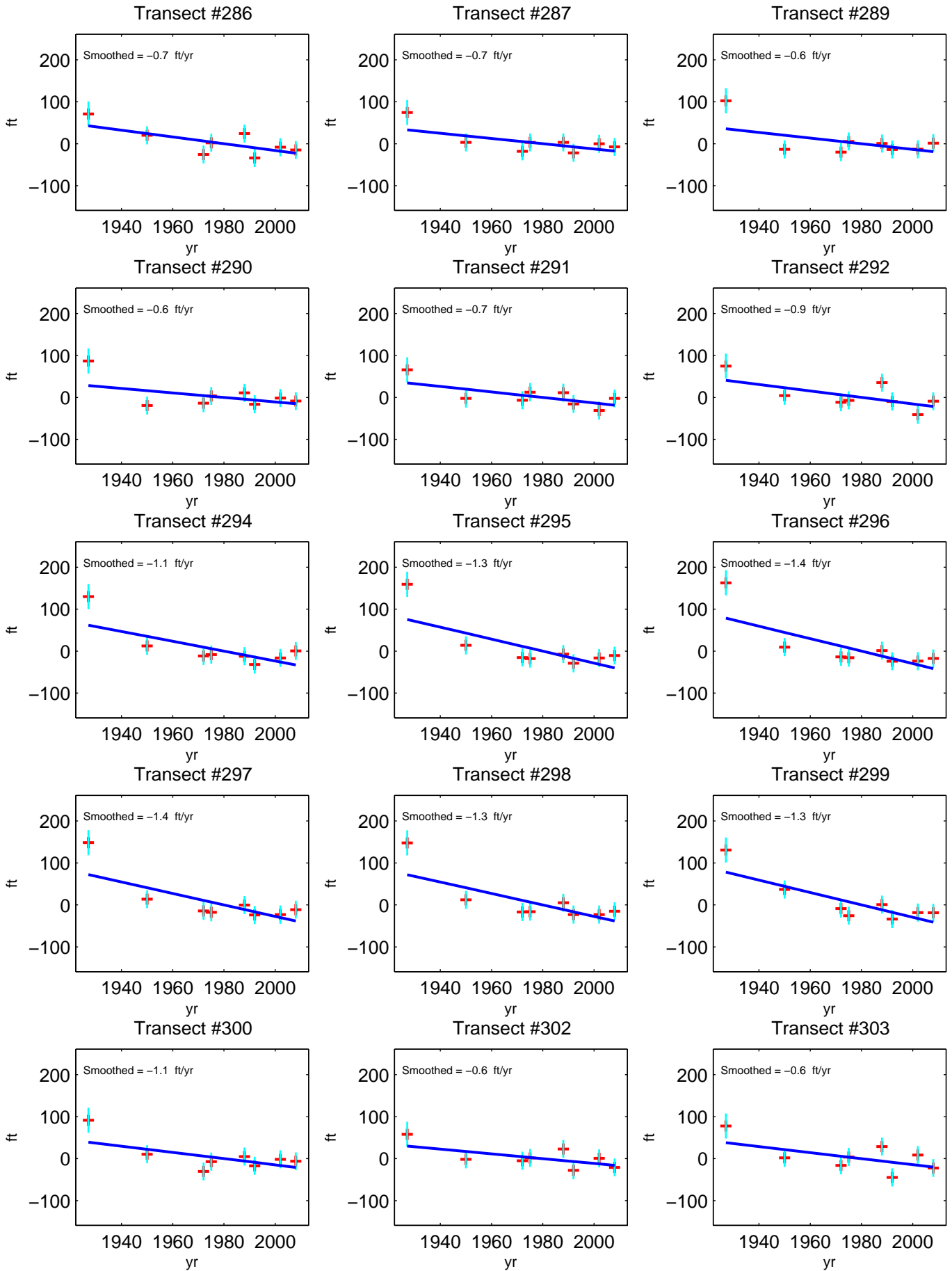
Positive Rate = Accretion  
Negative Rate = Erosion



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# Wailua - Smoothed Shoreline Change Rates

Positive Rate = Accretion  
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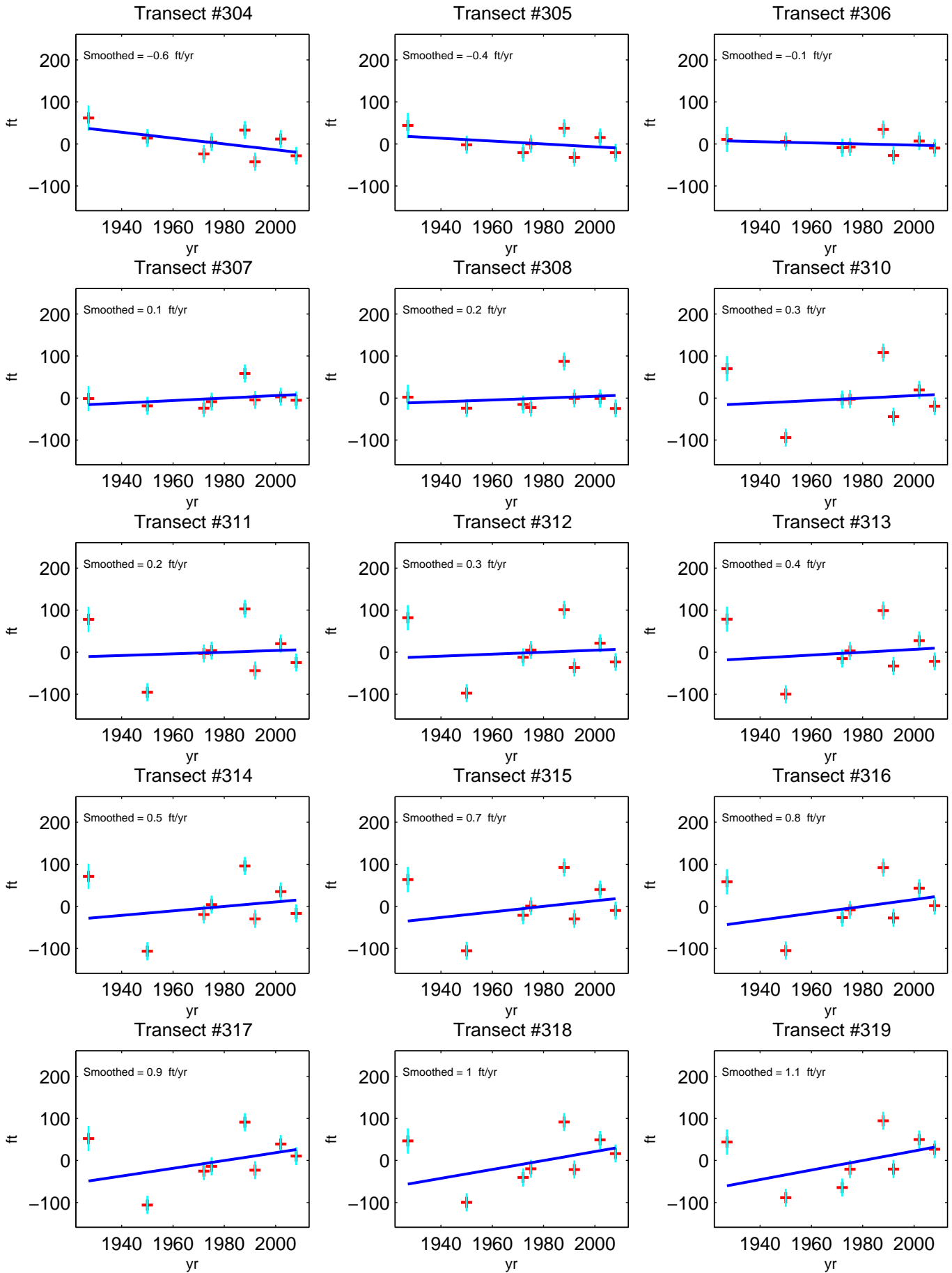


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# Wailua - Smoothed Shoreline Change Rates

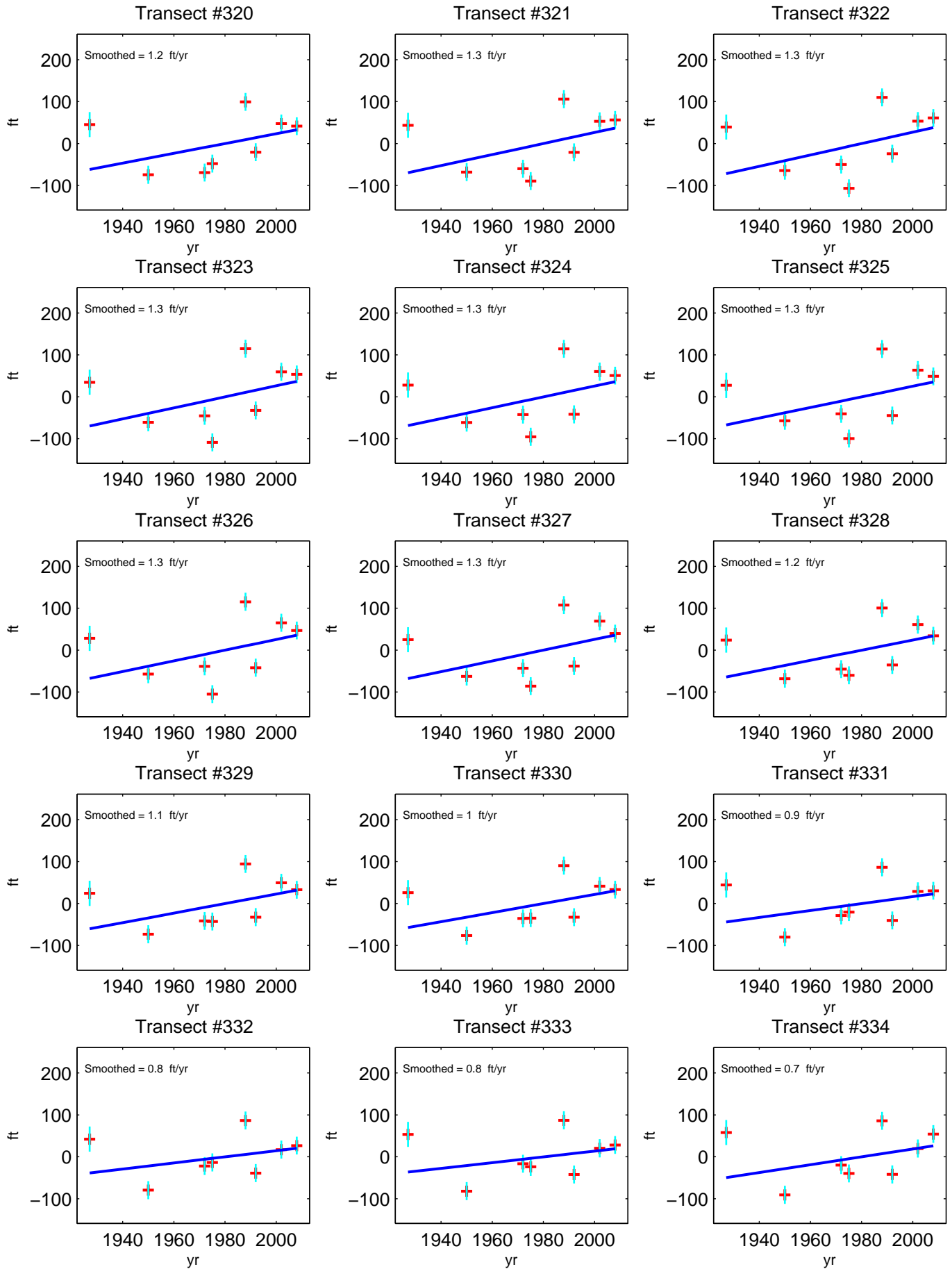
Positive Rate = Accretion  
Negative Rate = Erosion



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# Wailua - Smoothed Shoreline Change Rates

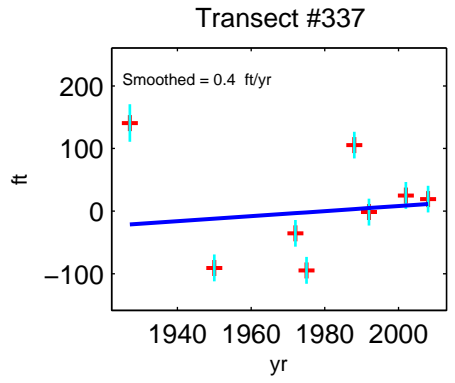
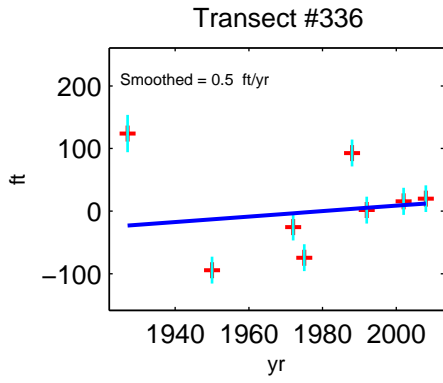
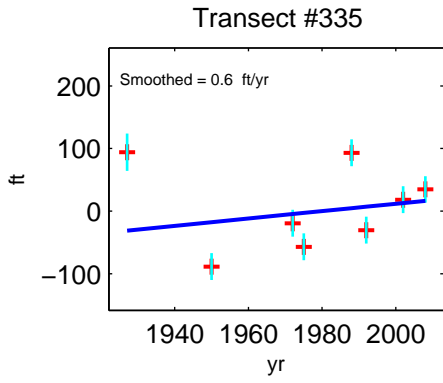
Positive Rate = Accretion  
Negative Rate = Erosion



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# Wailua - 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.

# Kapaa, Kauai, Hawaii

**HISTORICAL SHORELINES**

- Feb 1927 T-sheet
- Jul 1927 T-sheet
- Nov 1950
- Mar 1972
- Apr 1975
- Jan 1982
- Feb 1983
- Jul 1987
- May 1988
- Sept 1992
- May 1992
- Sept 2000
- Feb 2002
- 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.

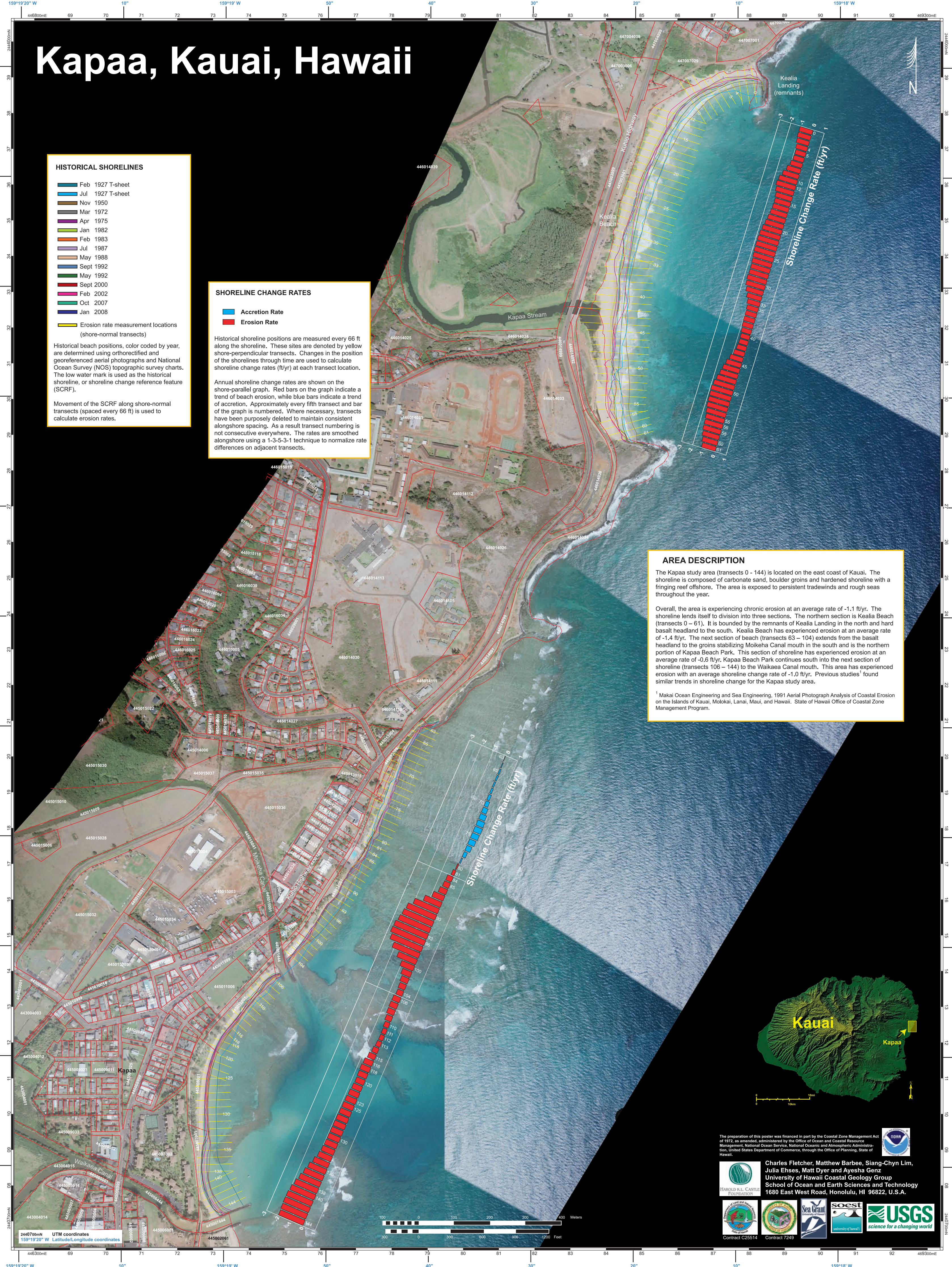
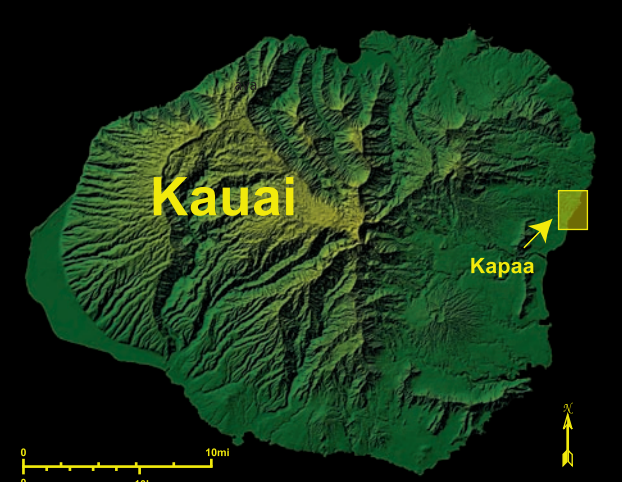
Annual shoreline change rates are shown on the shore-parallel graph. Red bars indicate a trend of beach erosion, while blue bars indicate a trend of accretion. Approximately every fifth transect and bar of the graph is numbered. Where necessary, transects have been purposely deleted to maintain consistent 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 Kapaa study area (transects 0 - 144) is located on the east coast of Kauai. The shoreline is composed of carbonate sand, boulder groins and hardened shoreline with a fringing reef offshore. The area is exposed to persistent tradewinds and rough seas throughout the year.

Overall, the area is experiencing chronic erosion at an average rate of -1.1 ft/yr. The shoreline lends itself to division into three sections. The northern section is Kealia Beach (transects 0 - 61). It is bounded by the remnants of Kealia Landing in the north and hard basalt headland to the south. Kealia Beach has experienced erosion at an average rate of -1.4 ft/yr. The next section of beach (transects 63 - 104) extends from the basalt headland to the groins stabilizing Moikeha Canal mouth in the south and is the northern portion of Kapaa Beach Park. This section of shoreline has experienced erosion at an average rate of -0.6 ft/yr. Kapaa Beach Park continues south into the next section of shoreline (transects 106 - 144) to the Waikaea Canal mouth. This area has experienced erosion with an average shoreline change rate of -1.0 ft/yr. Previous studies<sup>1</sup> found similar trends in shoreline change for the Kapaa study area.

<sup>1</sup> 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

**Kapaa - Smoothed Rates**

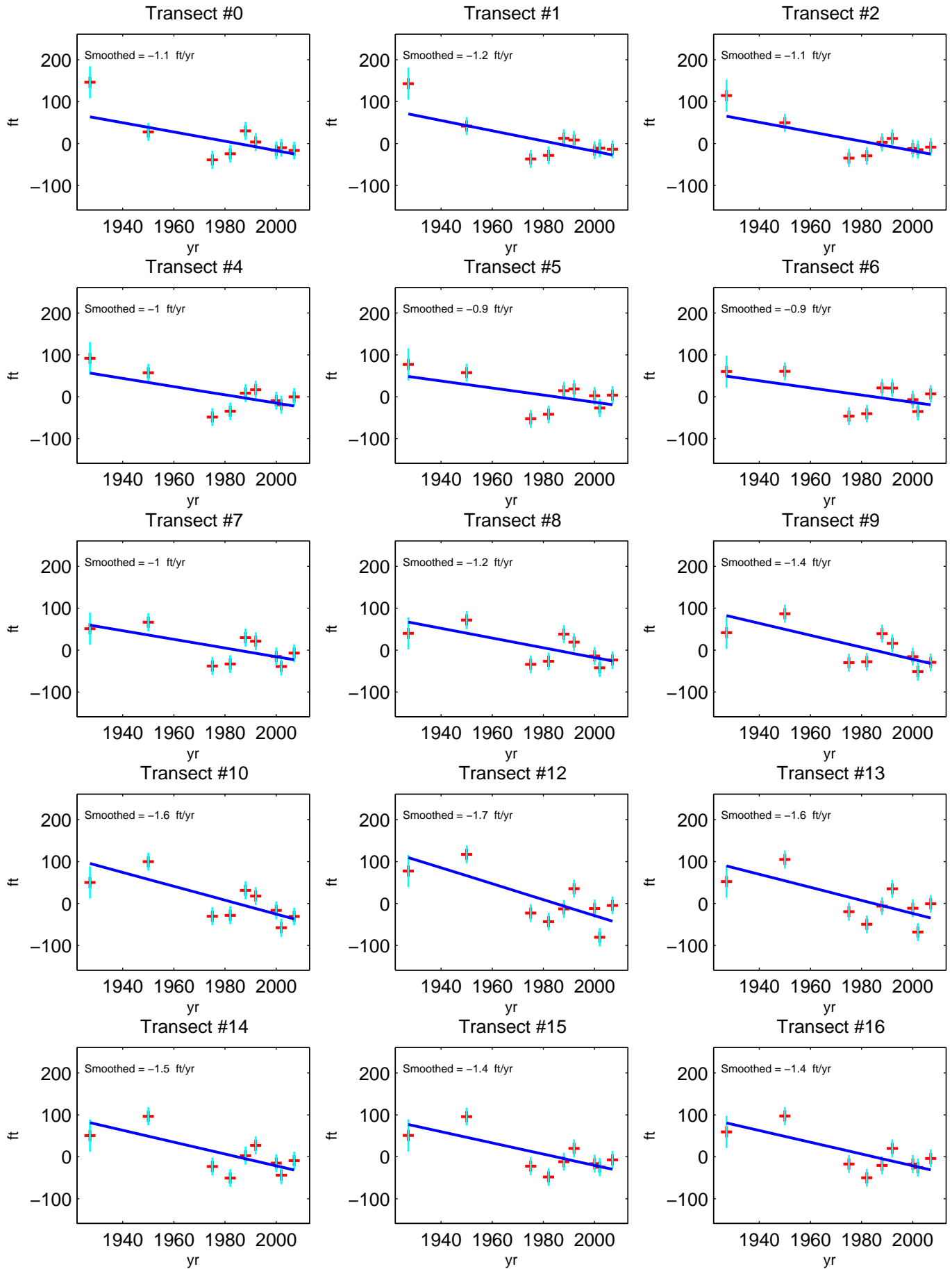
Positive Rate = Accretion  
Negative Rate = Erosion

Transect	Smoothed Rate (ft/yr)	Transect	Smoothed Rate (ft/yr)	Transect	Smoothed Rate (ft/yr)
0	-1.1	49	-1.8	101	-0.8
1	-1.2	50	-1.9	102	-0.6
2	-1.1	51	-1.9	103	-0.5
4	-1.0	52	-1.9	104	-0.5
5	-0.9	53	-1.8	106	-0.6
6	-0.9	54	-1.7	107	-0.6
7	-1.0	55	-1.6	108	-0.6
8	-1.2	56	-1.6	109	-0.5
9	-1.4	58	-1.6	110	-0.4
10	-1.6	59	-1.5	111	-0.3
12	-1.7	60	-1.3	112	-0.3
13	-1.6	61	-1.2	113	-0.4
14	-1.5	63	0.0	114	-0.5
15	-1.4	64	0.1	115	-0.6
16	-1.4	65	0.1	116	-0.7
17	-1.5	66	0.1	118	-0.8
18	-1.5	67	0.1	119	-0.7
19	-1.6	68	0.1	120	-0.7
20	-1.7	69	0.2	121	-0.8
21	-1.8	70	0.3	122	-0.8
22	-1.8	71	0.4	123	-0.9
23	-1.8	72	0.5	125	-0.9
24	-1.8	73	0.6	126	-0.9
25	-1.8	74	0.6	127	-0.9
26	-1.7	75	0.6	128	-0.9
27	-1.7	76	0.5	129	-0.9
28	-1.7	77	0.4	130	-0.9
29	-1.7	78	0.3	131	-1.0
30	-1.7	79	0.1	132	-1.0
31	-1.5	80	-0.1	133	-1.1
32	-1.3	81	-0.2	134	-1.3
33	-1.1	84	-0.5	135	-1.4
35	-1.0	85	-0.5	136	-1.6
36	-1.0	86	-0.6	137	-1.7
37	-1.0	87	-0.9	138	-1.9
38	-0.9	88	-1.4	140	-2.0
39	-0.9	89*	-2.0	141	-2.1
40	-0.8	90*	-2.4	142	-2.1
41	-0.8	91*	-2.5	143	-2.1
42	-0.8	92*	-2.6	144	-2.0
43	-1.0	93*	-2.7		
44	-1.1	96*	-2.8		
45	-1.3	97*	-2.6		
46	-1.5	98*	-2.2		
47	-1.6	99	-1.6		
48	-1.7	100	-1.1		

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

# Kapaa - Smoothed Shoreline Change Rates

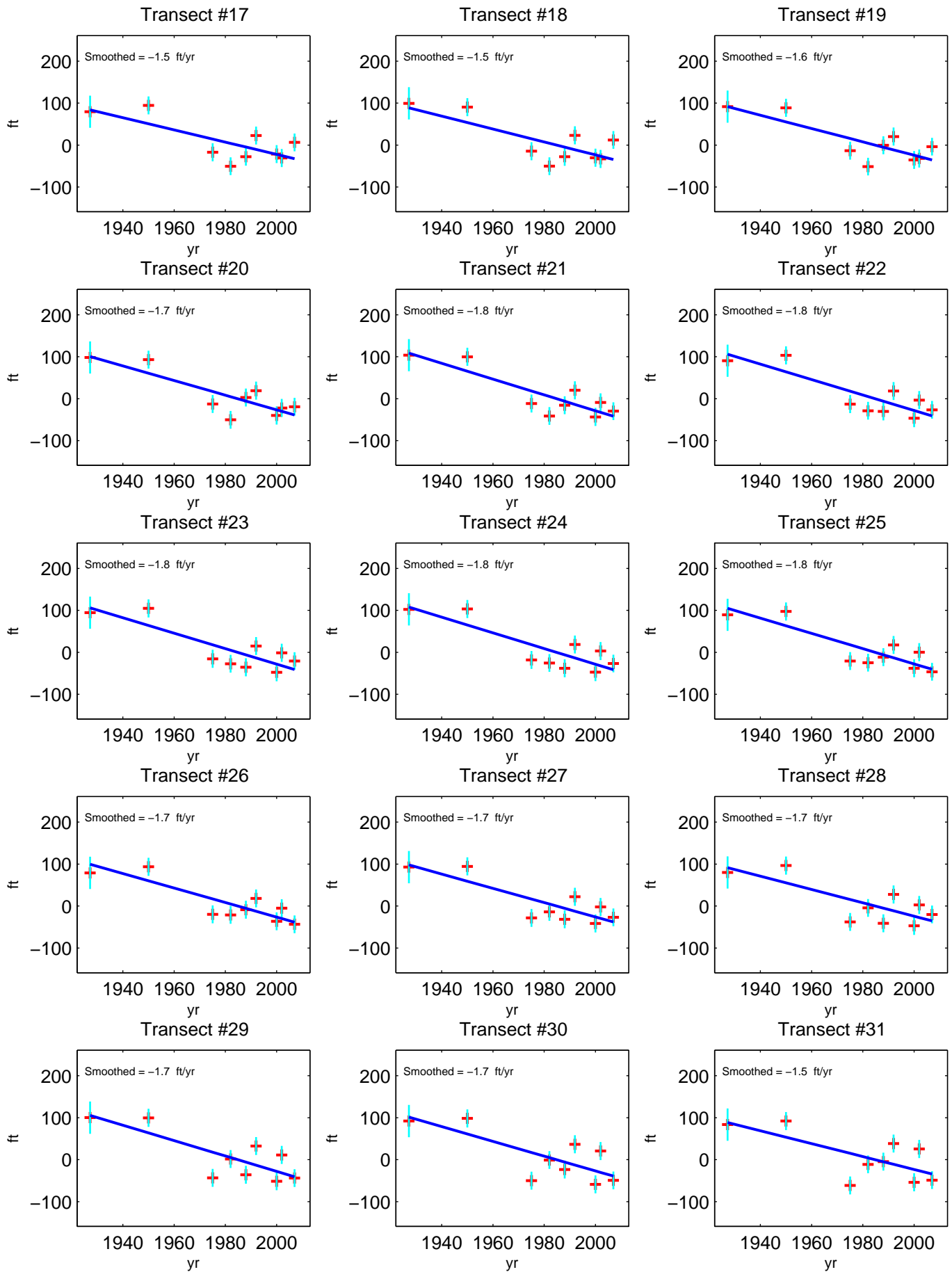
Positive Rate = Accretion  
Negative Rate = Erosion



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

# Kapaa - Smoothed Shoreline Change Rates

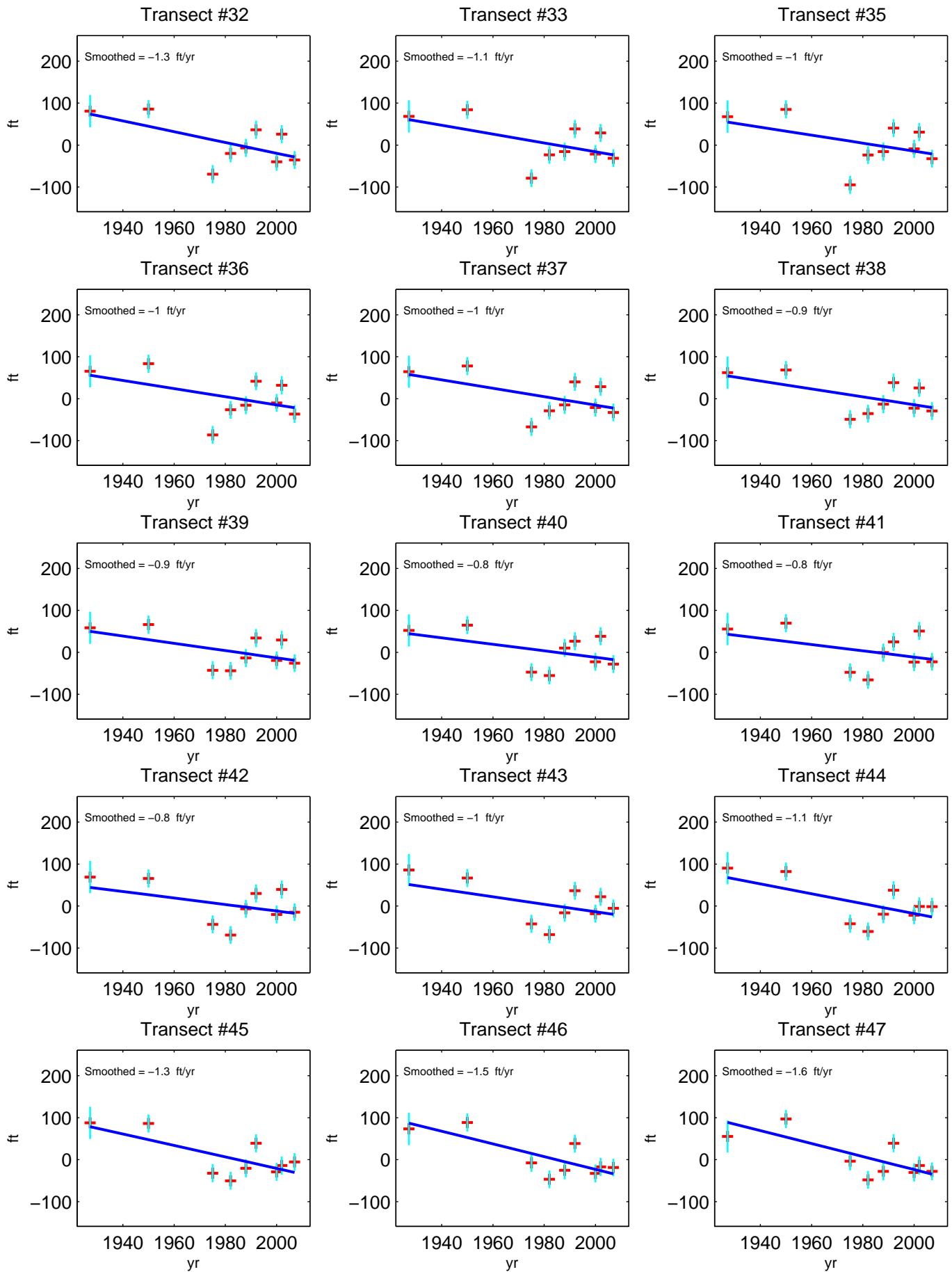
Positive Rate = Accretion  
Negative Rate = Erosion



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

# Kapaa - Smoothed Shoreline Change Rates

Positive Rate = Accretion  
Negative Rate = Erosion

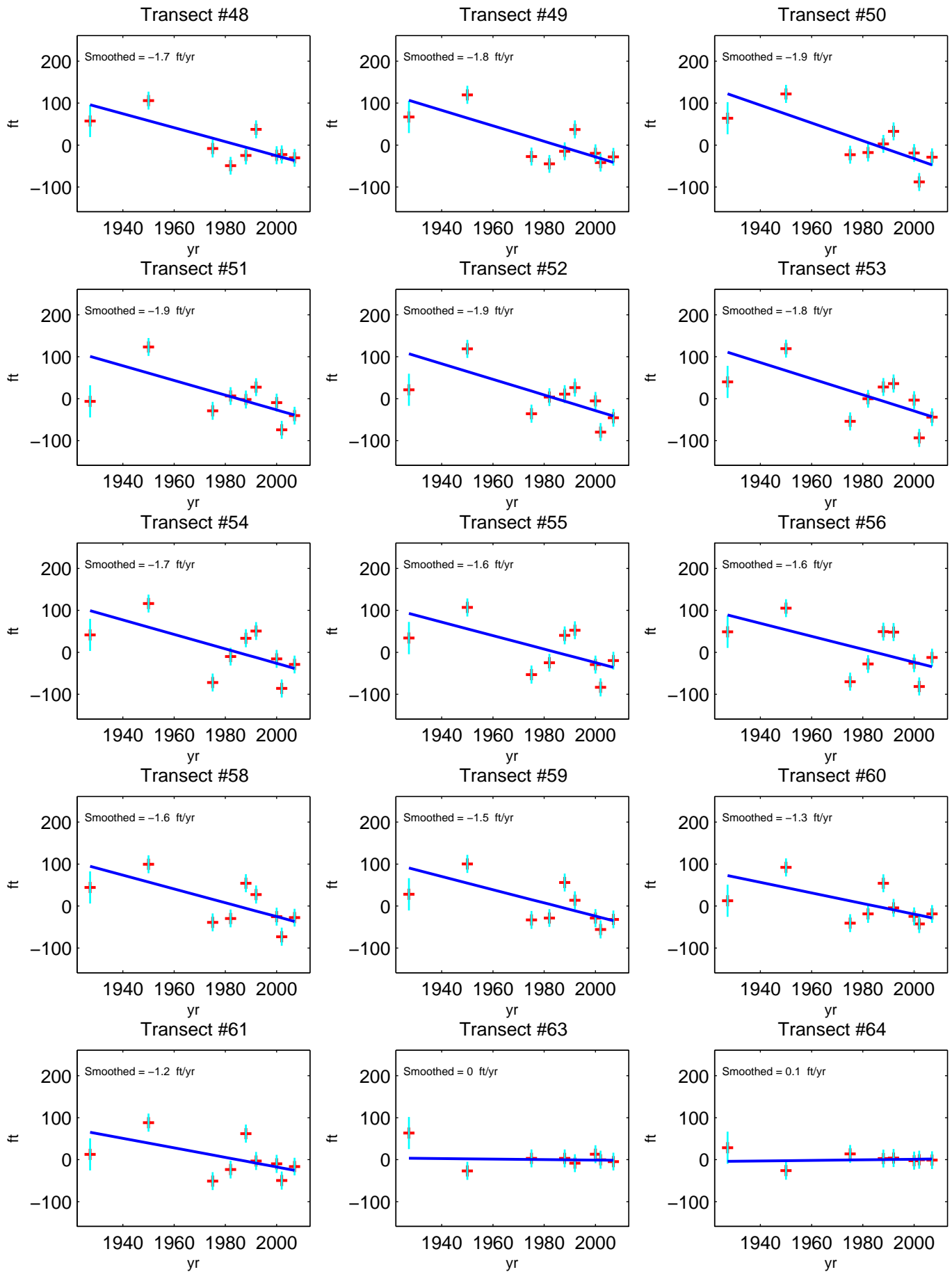


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# Kapaa - Smoothed Shoreline Change Rates

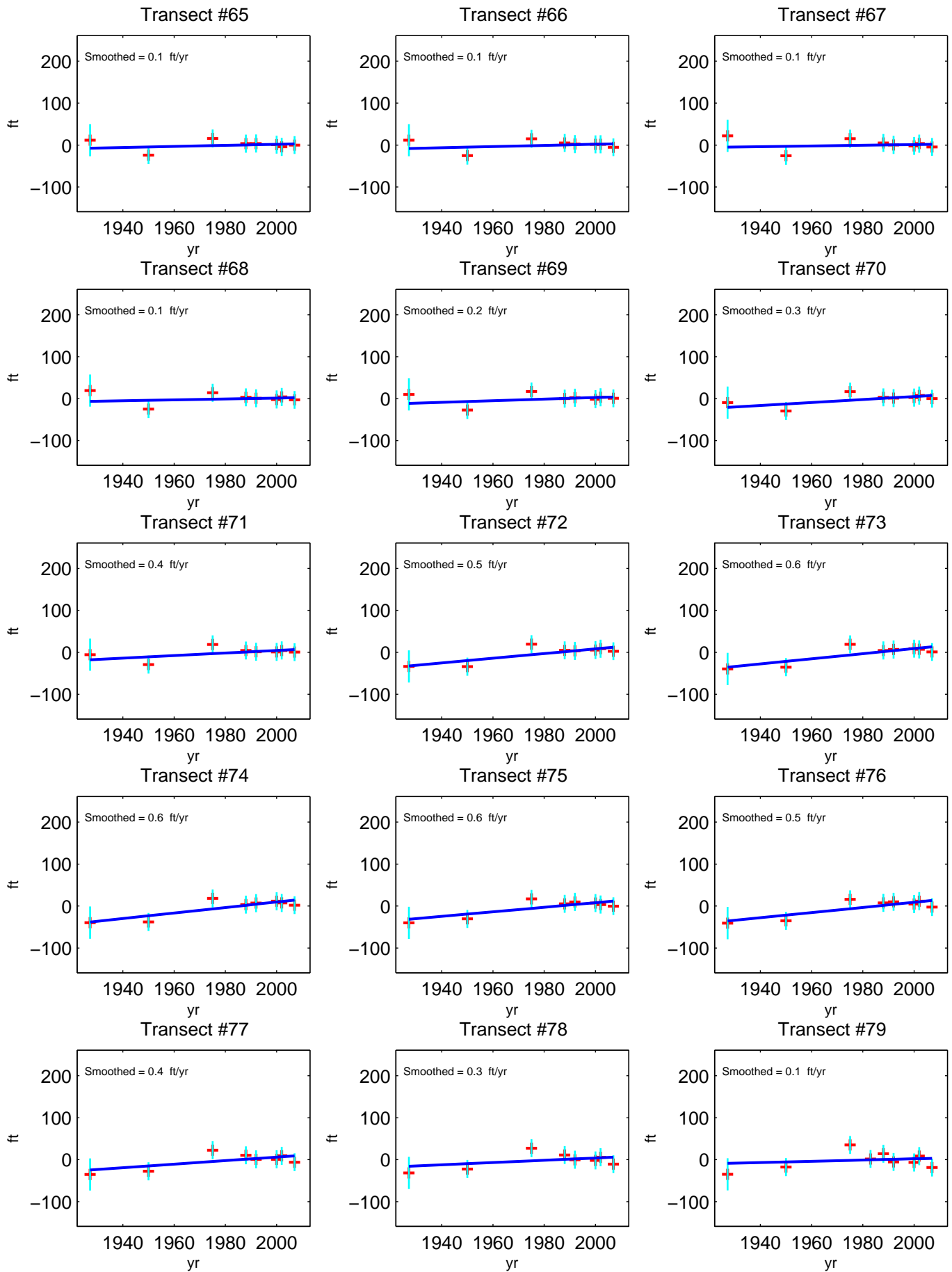
Positive Rate = Accretion  
Negative Rate = Erosion



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# Kapaa - Smoothed Shoreline Change Rates

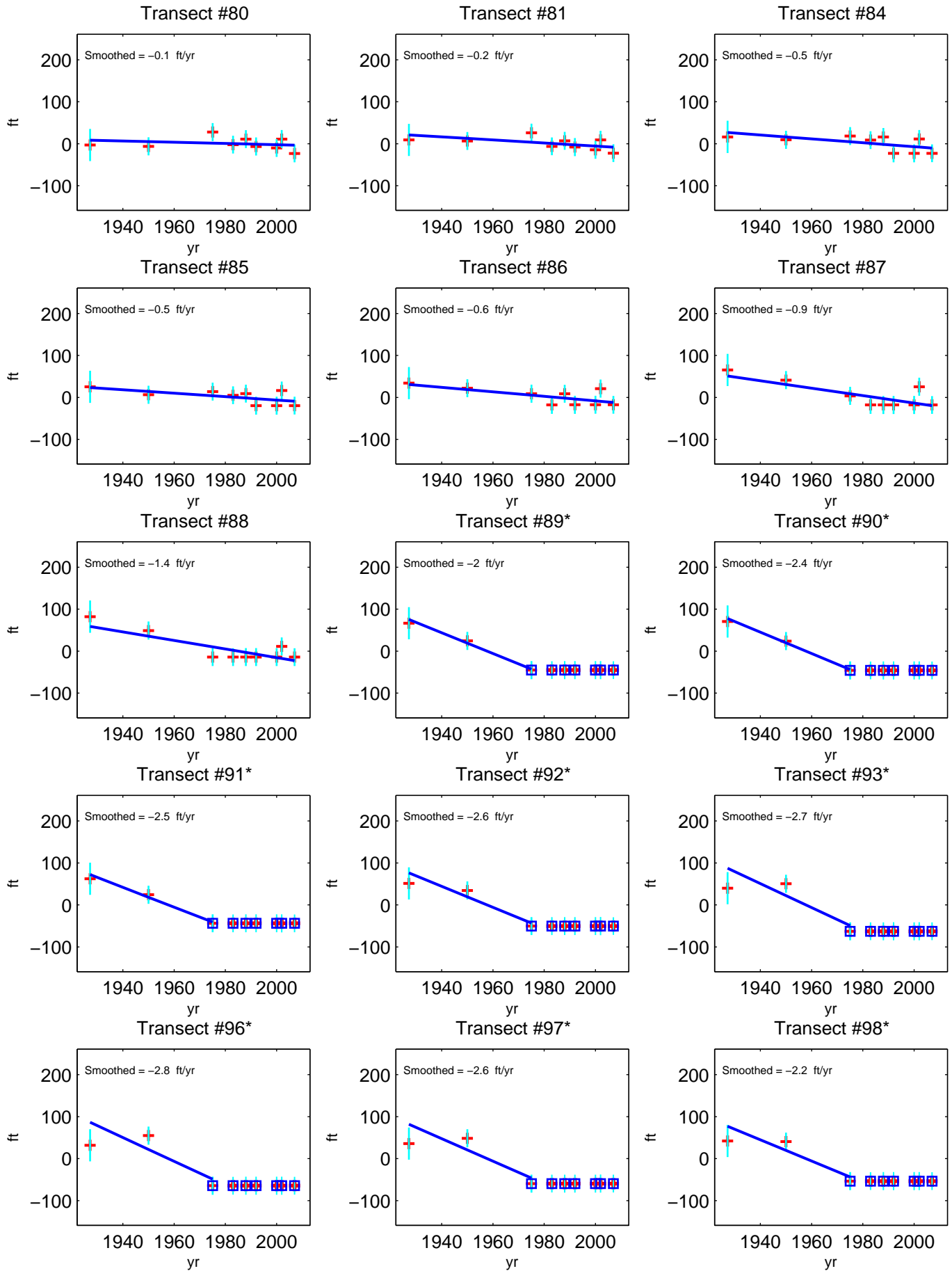
Positive Rate = Accretion  
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# Kapaa - Smoothed Shoreline Change Rates

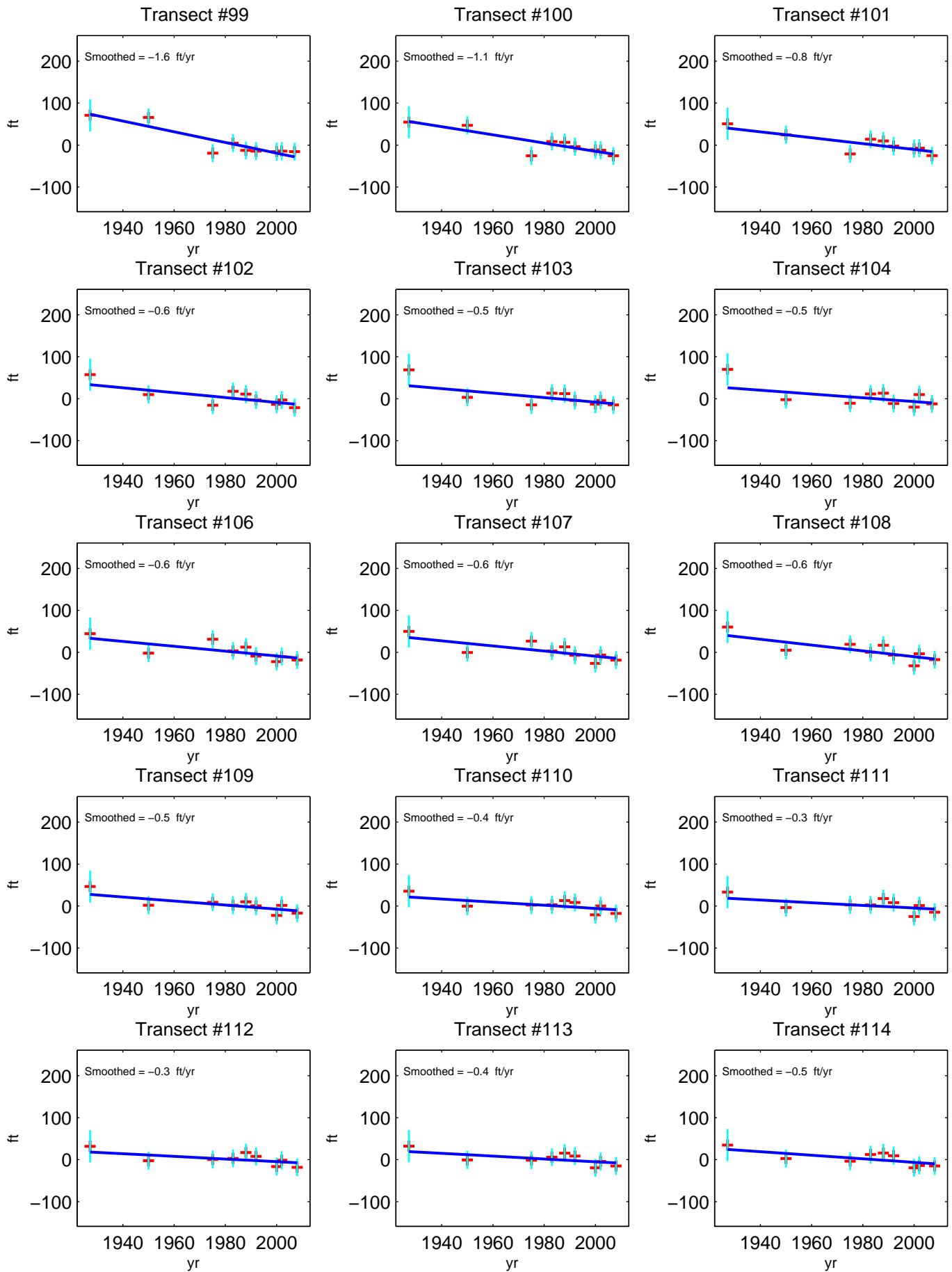
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Negative Rate = Erosion



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

# Kapaa - Smoothed Shoreline Change Rates

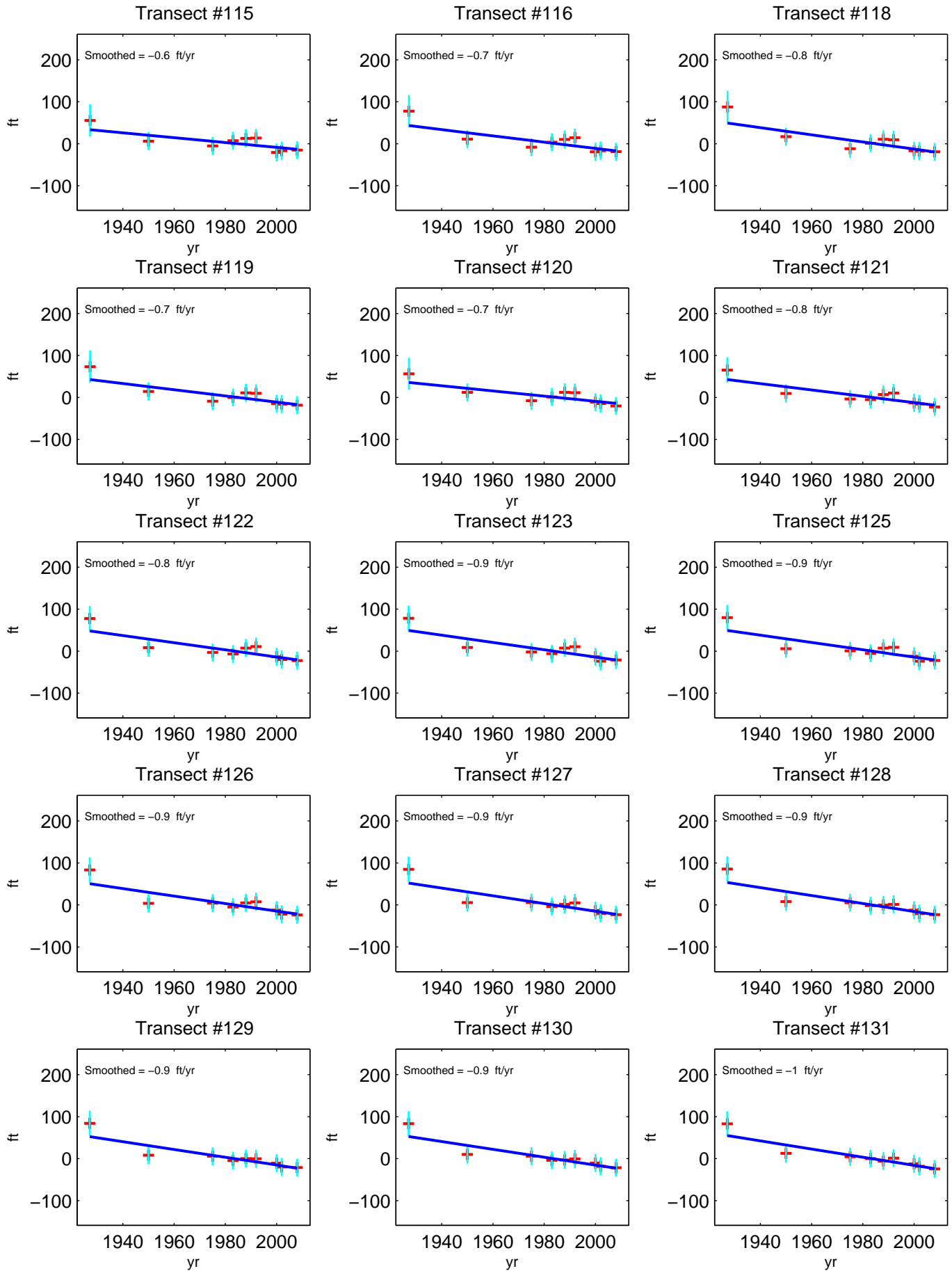
Positive Rate = Accretion  
Negative Rate = Erosion



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

# Kapaa - Smoothed Shoreline Change Rates

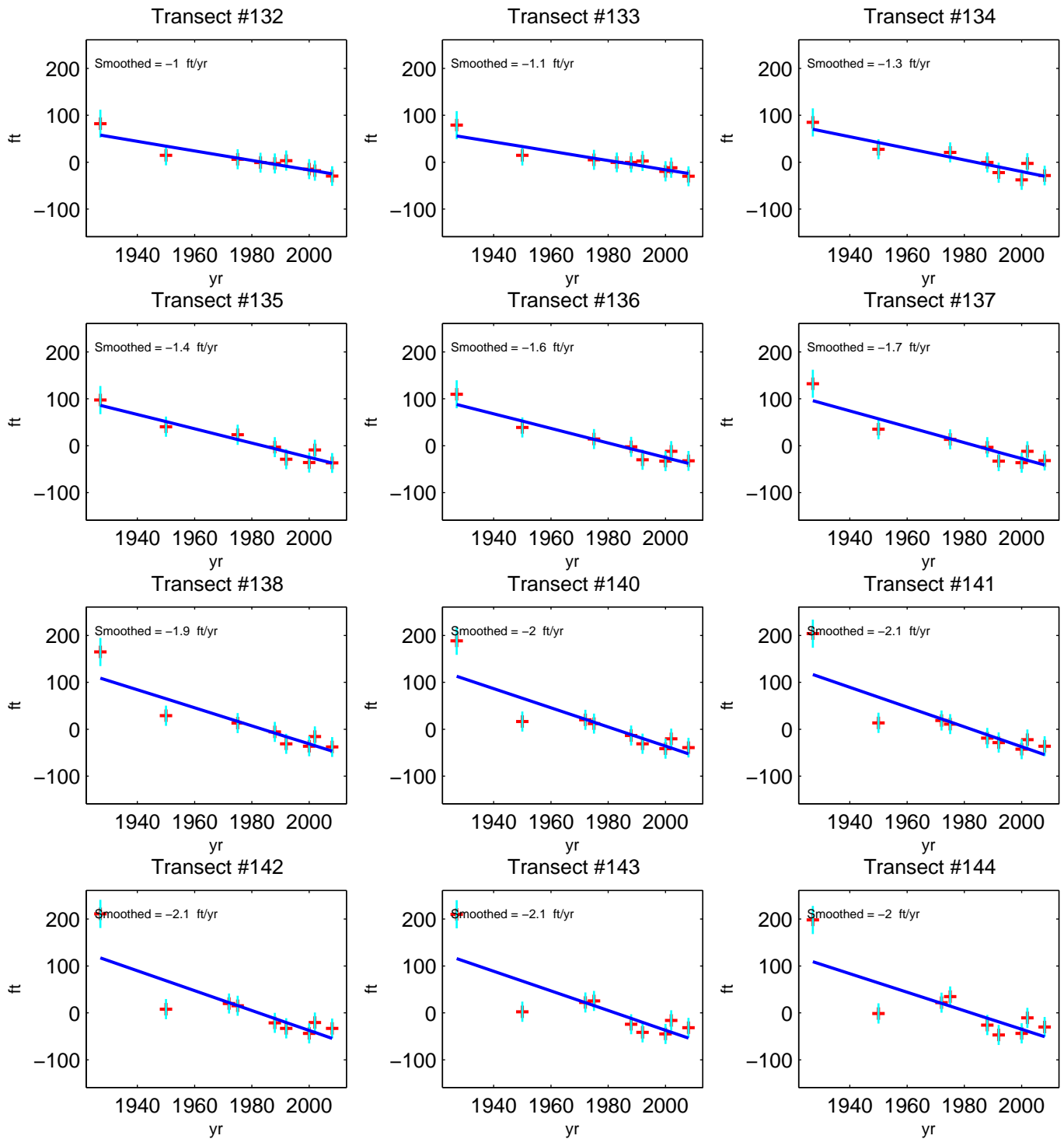
Positive Rate = Accretion  
Negative Rate = Erosion



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

# Kapaa - 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.

# Donkey Beach, Kauai, Hawaii










## AREA DESCRIPTION

The Donkey Beach study area (transects 52 - 111) is located on the east coast of Kauai. The area is bounded by Pohakuloa Point to the north and the remnants of Kealia Landing to the south. The shoreline is composed of carbonate sand, and basalt rock headlands.

Overall, the area is experiencing erosion at an average rate of -0.4 ft/yr. The shoreline lends itself to division into five pocket beaches. The northern beach (transects 52 - 64) is eroding at an average rate of -0.5 ft/yr. South of Anapalau Point (transects 66 - 81) the beach has experienced erosion at an average rate of -0.4 ft/yr. The next beach (transect 82) has experienced erosion at -0.2 ft/yr. Donkey Beach (transects 84 - 109) is a large pocket beach with a steep foreshore. This area has experienced erosion at an average rate of -0.4 ft/yr. South of Paliku Point (transects 110 - 111) is a small pocket beach that is experiencing erosion at an average rate of -0.5 ft/yr. Previous studies<sup>1</sup> did not analyze Donkey Beach study area shoreline.

<sup>1</sup> 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
-  Apr 1975
-  Jul 1987
-  May 1988
-  May 1992
-  Sept 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).

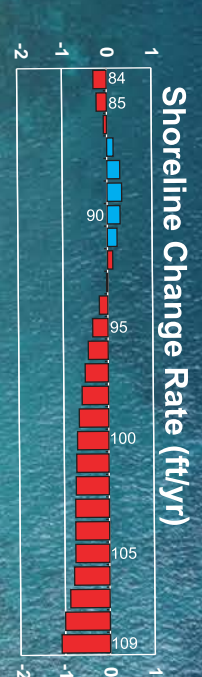
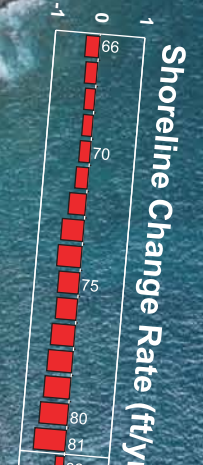
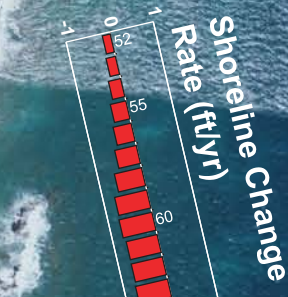
Movement of the SCRF along shore-normal transects (spaced every 66 ft) is used to calculate erosion rates.

## SHORELINE CHANGE RATES

-  Accretion Rate
-  Erosion Rate

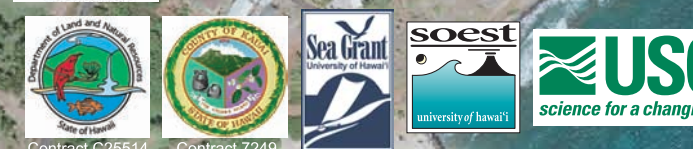
Historical shoreline positions are measured every 66 ft along the shoreline. These sites are denoted by yellow shore-perpendicular transects. Changes in the position of the shorelines through time are used to calculate shoreline change rates (ft/yr) at each transect location.

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.



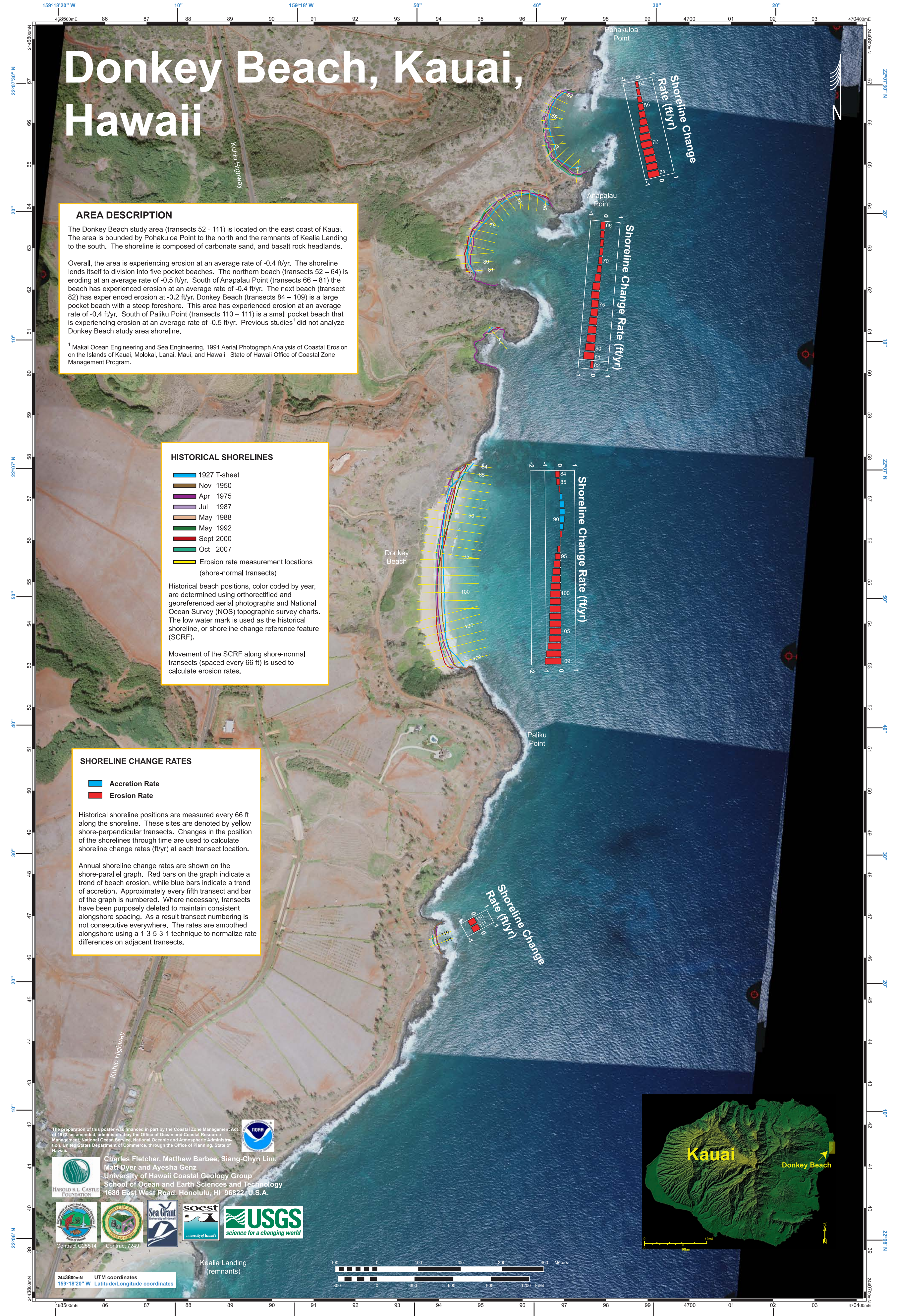
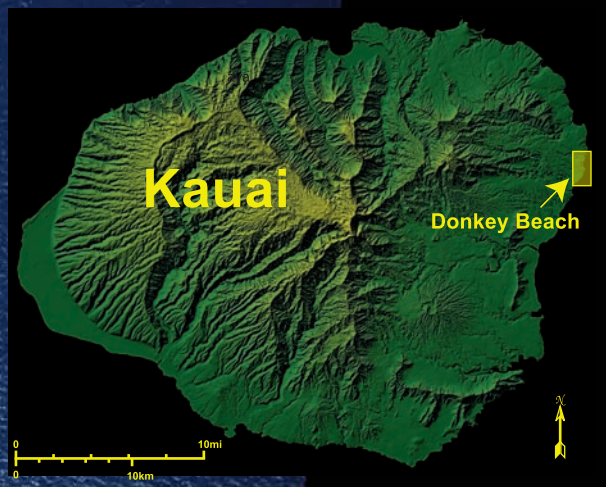
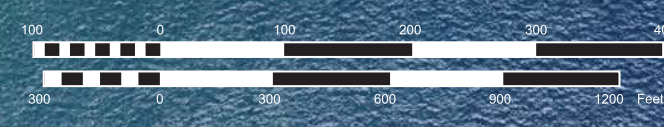
The preparation of this poster was financed in part by the Coastal Zone Management Act of 1972 as amended, administered by the Office of Ocean and Coastal Resource Management, National Ocean Service, National Oceanic and Atmospheric Administration, United States Department of Commerce, through the Office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

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



Contract C25514 Contract 7249  
 Kealia Landing (remnants)

2443800mN UTM coordinates  
 159°18'20" W Latitude/Longitude coordinates



**Donkey - Smoothed Rates**

Positive Rate = Accretion  
 Negative Rate = Erosion

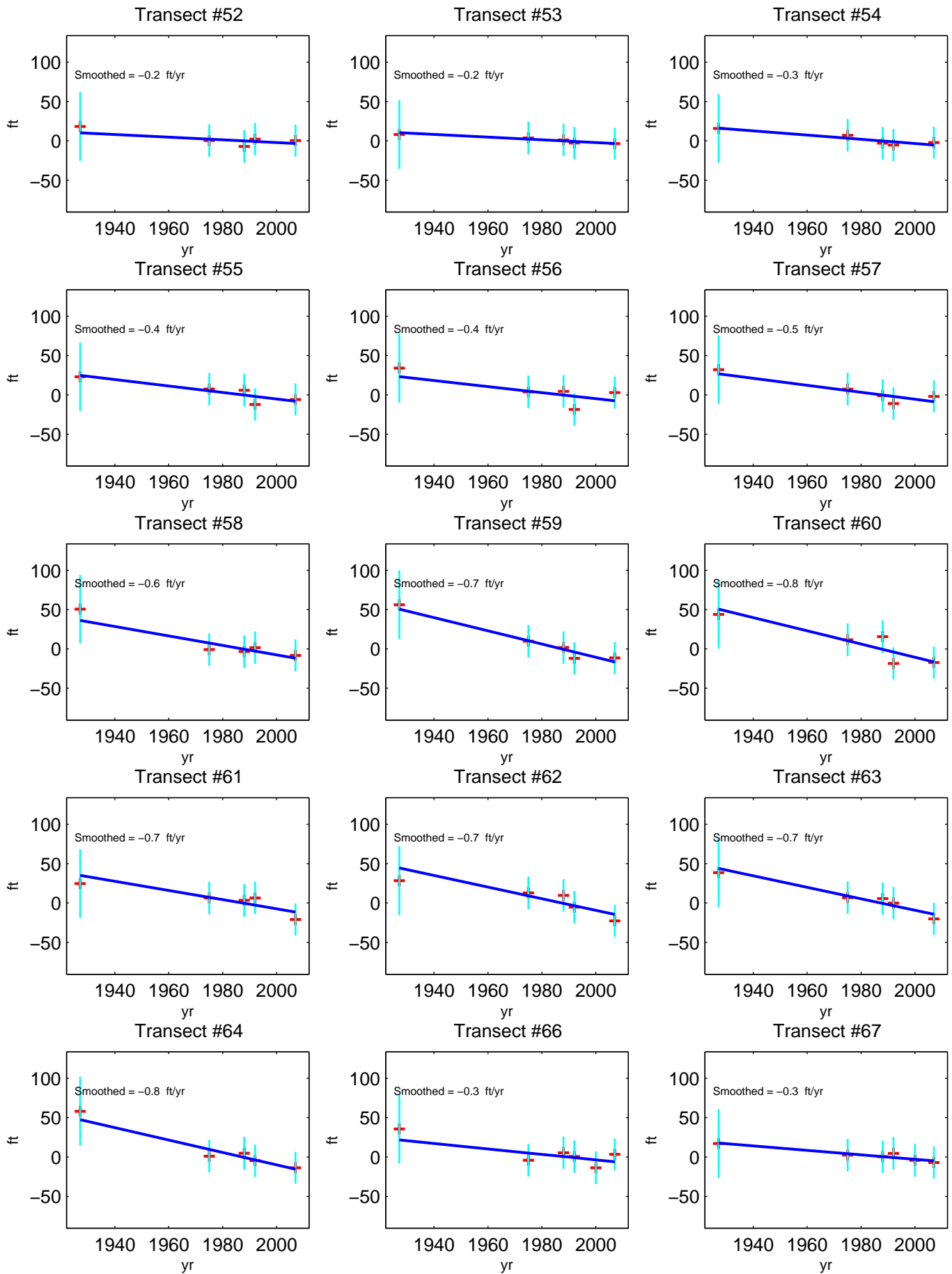
Transect	Smoothed Rate (ft/yr)	Transect	Smoothed Rate (ft/yr)
52	-0.2	100	-0.7
53	-0.2	101	-0.7
54	-0.3	102	-0.7
55	-0.4	103	-0.8
56	-0.4	104	-0.8
57	-0.5	105	-0.8
58	-0.6	106	-0.8
59	-0.7	107	-0.9
60	-0.8	108	-1.0
61	-0.7	109	-1.1
62	-0.7	110	-0.5
63	-0.7	111	-0.5
64	-0.8		
66	-0.3		
67	-0.3		
68	-0.2		
69	-0.2		
70	-0.2		
71	-0.3		
72	-0.4		
73	-0.5		
74	-0.5		
75	-0.5		
76	-0.5		
77	-0.5		
78	-0.6		
79	-0.6		
80	-0.6		
81	-0.7		
82	-0.2		
84	-0.3		
85	-0.2		
86	-0.1		
87	0.1		
88	0.3		
89	0.3		
90	0.3		
91	0.2		
92	0.1		
93	0.0		
94	-0.2		
95	-0.3		
96	-0.4		
97	-0.5		
98	-0.6		
99	-0.7		

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



# Donkey - Smoothed Shoreline Change Rates

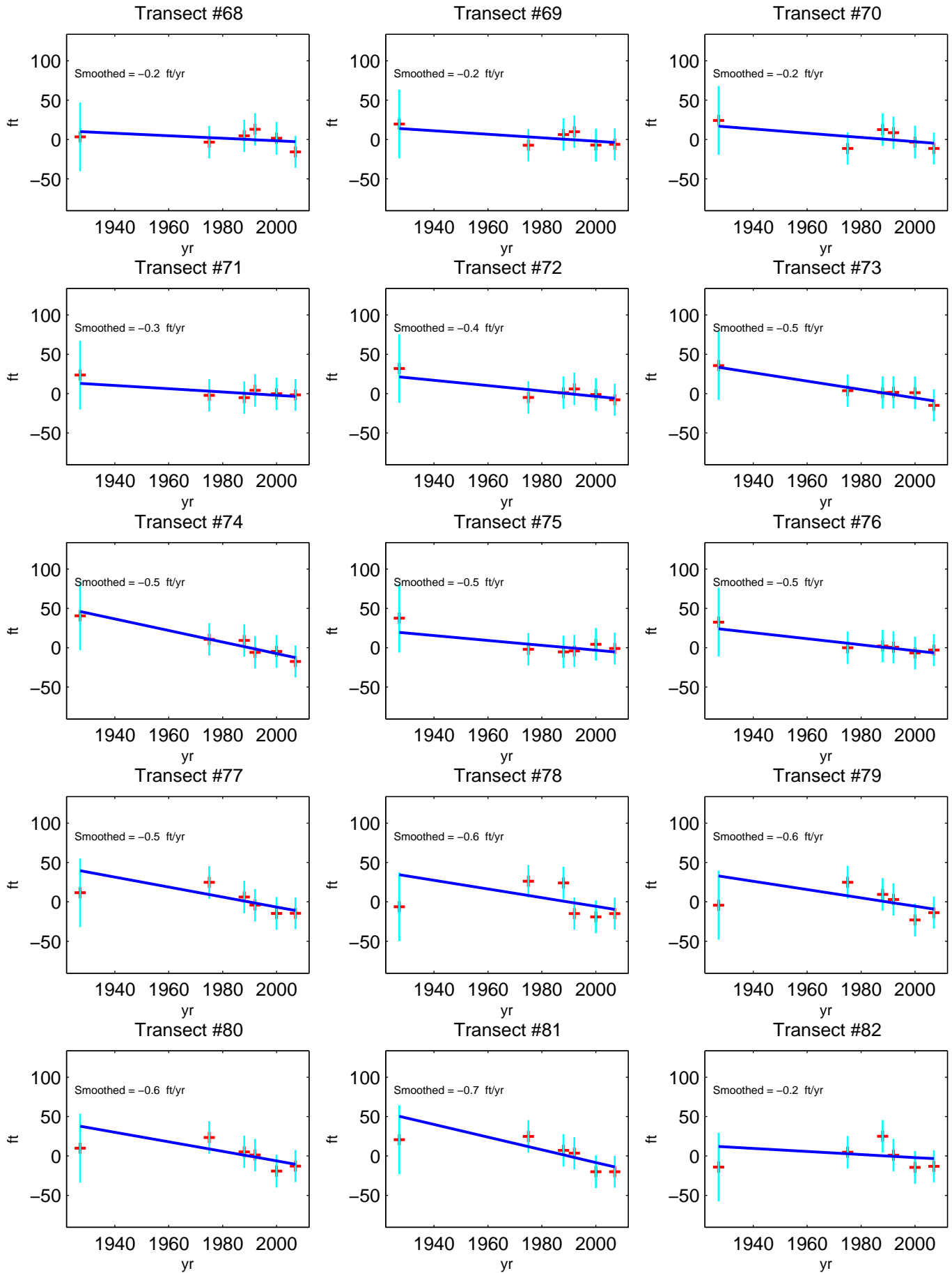
Positive Rate = Accretion  
Negative Rate = Erosion



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

# Donkey - Smoothed Shoreline Change Rates

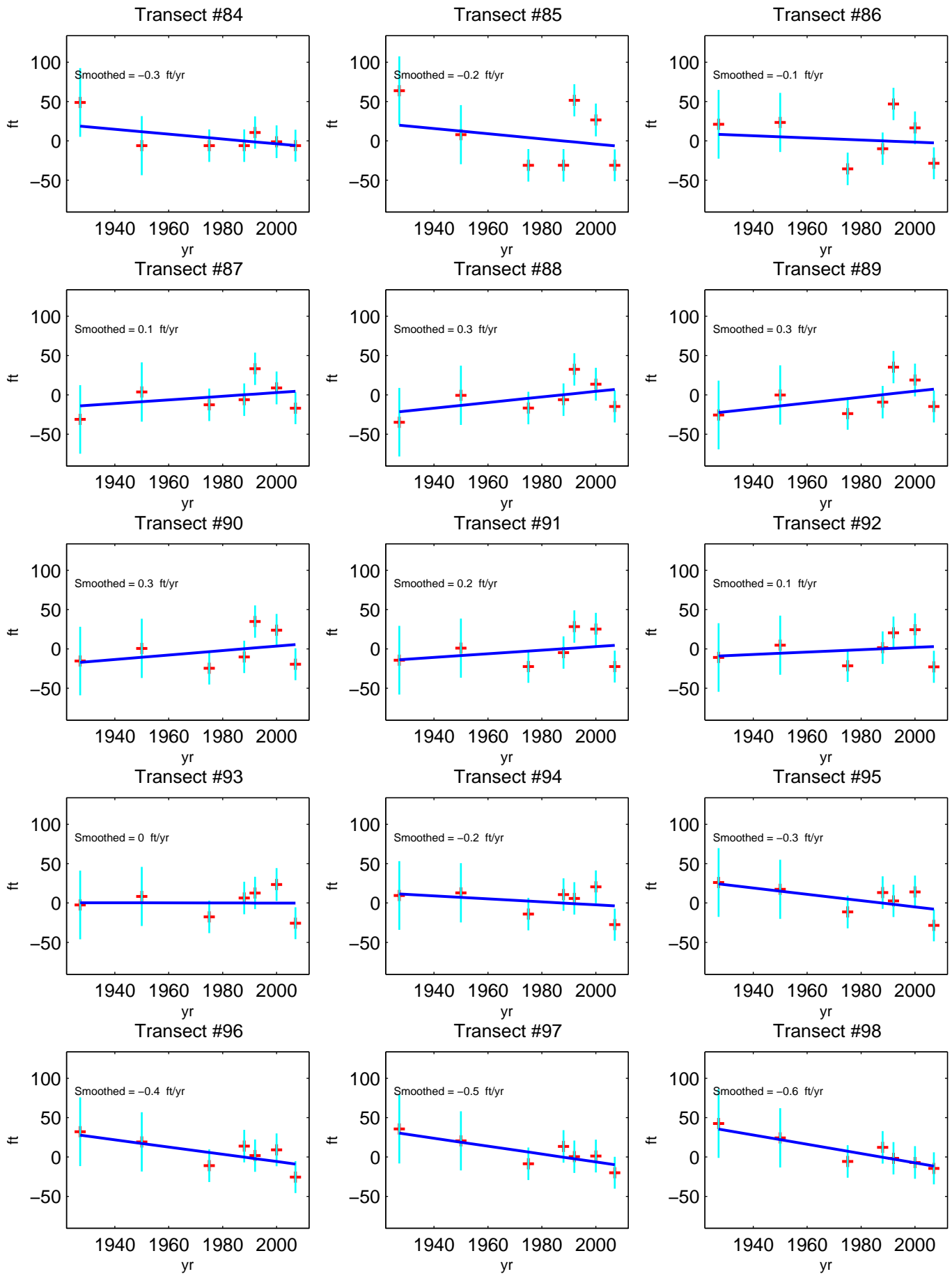
Positive Rate = Accretion  
Negative Rate = Erosion



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# Donkey - Smoothed Shoreline Change Rates

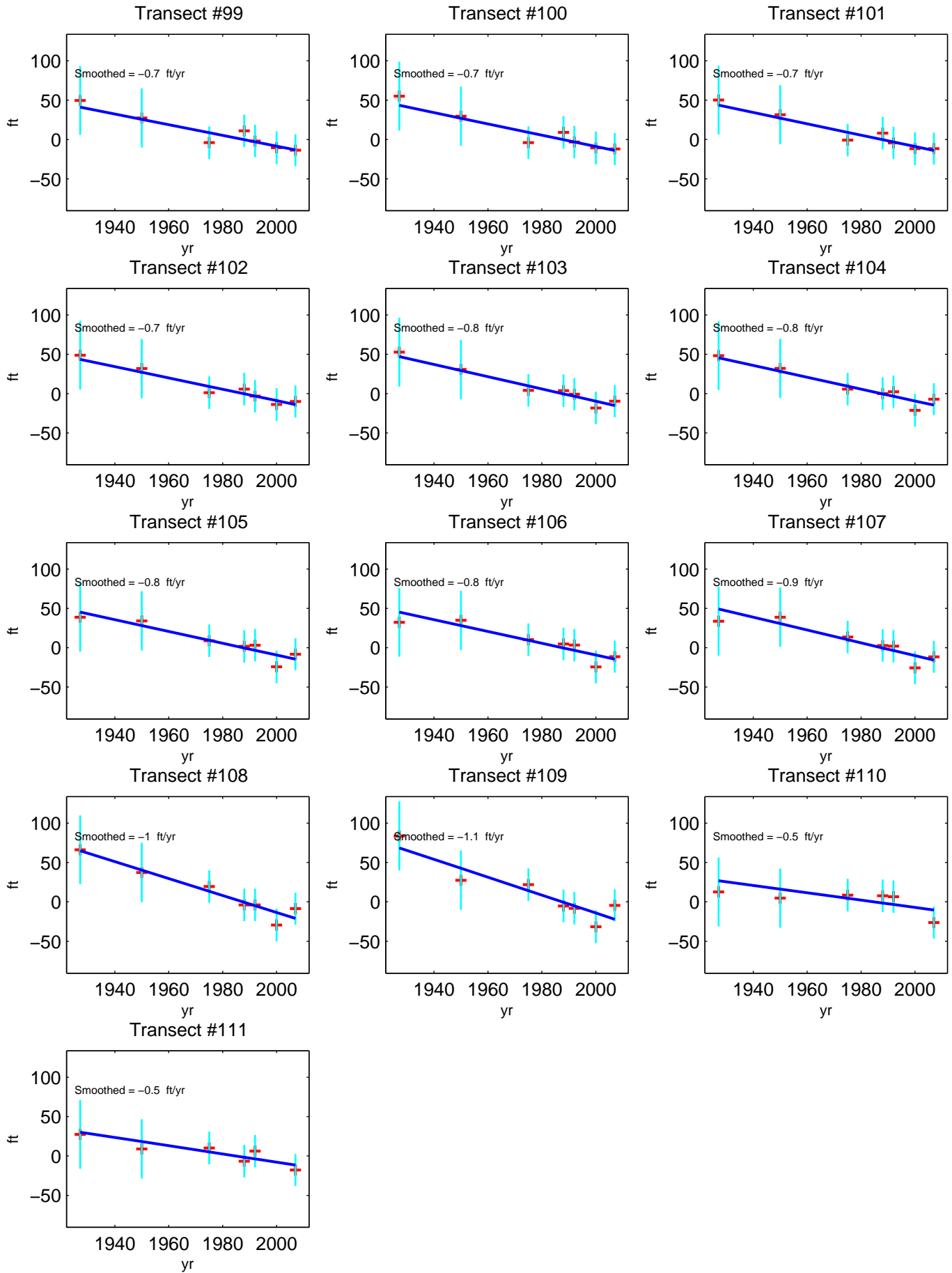
Positive Rate = Accretion  
Negative Rate = Erosion



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# Donkey - 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.

# Lae Lipoa, 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

- 1927 T-sheet
- Nov 1950
- Apr 1975
- Jul 1987
- May 1988
- May 1992
- Sept 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).

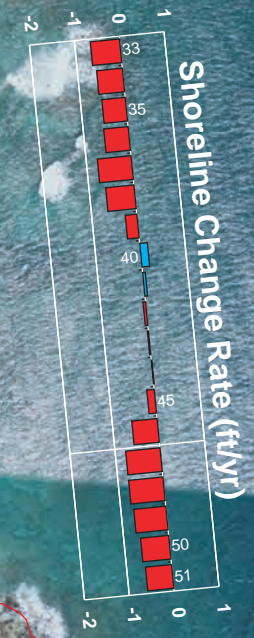
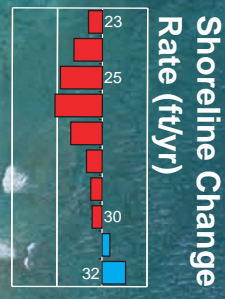
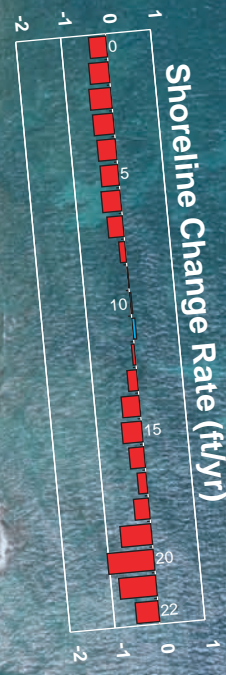
Movement of the SCRF along shore-normal transects (spaced every 66 ft) is used to calculate erosion rates.

## AREA DESCRIPTION

The Lae Lipoa study area (transects 0 - 51) is located on the east coast of Kauai. The area extends south from Kahala Point to Pohakuloa Point. The shoreline is composed of carbonate sand, basalt rock headlands, and exposed beach rock.

Overall, the area is experiencing erosion at an average rate of -0.4 ft/yr. The shoreline lends itself to division into four sections. The northern beach (transects 0 - 22) is eroding at an average rate of -0.4 ft/yr. South of Lae Lipoa Point (transects 23 - 32) the shoreline has experienced erosion at an average rate of -0.4 ft/yr. The section of beach at transects 33 - 46 is experiencing erosion at an average rate of -0.3 ft/yr. The southernmost beach (transects 47 - 51) is a small pocket beach that has experienced erosion at an average rate of -0.7 ft/yr. Previous studies<sup>1</sup> did not analyze the Lae Lipoa study area shoreline.

<sup>1</sup> 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.

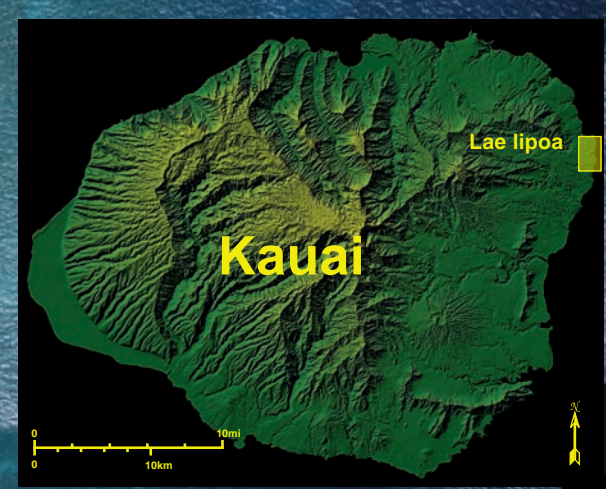
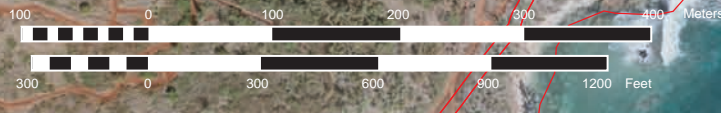


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 School of Ocean and Earth Sciences and Technology  
 1680 East West Road, Honolulu, HI 96822, U.S.A.



468700mE UTM coordinates  
 159°18'00" W Latitude/Longitude coordinates



**Lae Lipoa - Smoothed Rates**

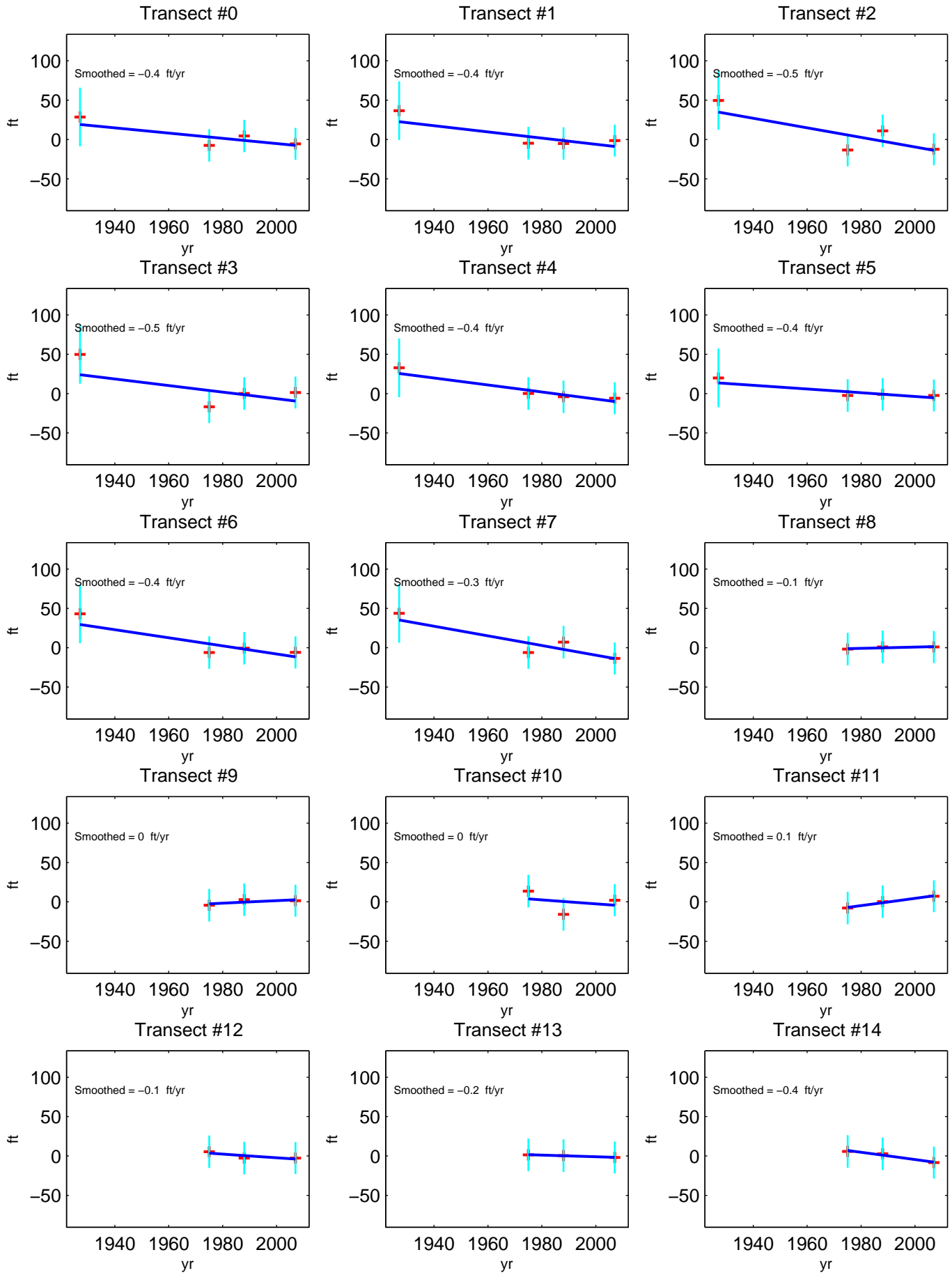
Positive Rate = Accretion  
 Negative Rate = Erosion

Transect	Smoothed Rate (ft/yr)	Transect	Smoothed Rate (ft/yr)
0	-0.4	46	-0.6
1	-0.4	47	-0.8
2	-0.5	48	-0.8
3	-0.5	49	-0.7
4	-0.4	50	-0.6
5	-0.4	51	-0.6
6	-0.4		
7	-0.3		
8	-0.1		
9	0.0		
10	0.0		
11	0.1		
12	-0.1		
13	-0.2		
14	-0.4		
15	-0.4		
16	-0.3		
17	-0.2		
18	-0.3		
19	-0.7		
20	-1.0		
21	-0.8		
22	-0.5		
23	-0.3		
24	-0.6		
25	-0.9		
26	-1.1		
27	-0.7		
28*	-0.3		
29	-0.3		
30	-0.2		
31	0.2		
32	0.5		
33	-0.6		
34	-0.6		
35	-0.5		
36	-0.5		
37	-0.8		
38	-0.6		
39	-0.3		
40	0.2		
41	0.1		
42	-0.1		
43	0.0		
44	0.0		
45	-0.2		

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

# Lae Lipoa - Smoothed Shoreline Change Rates

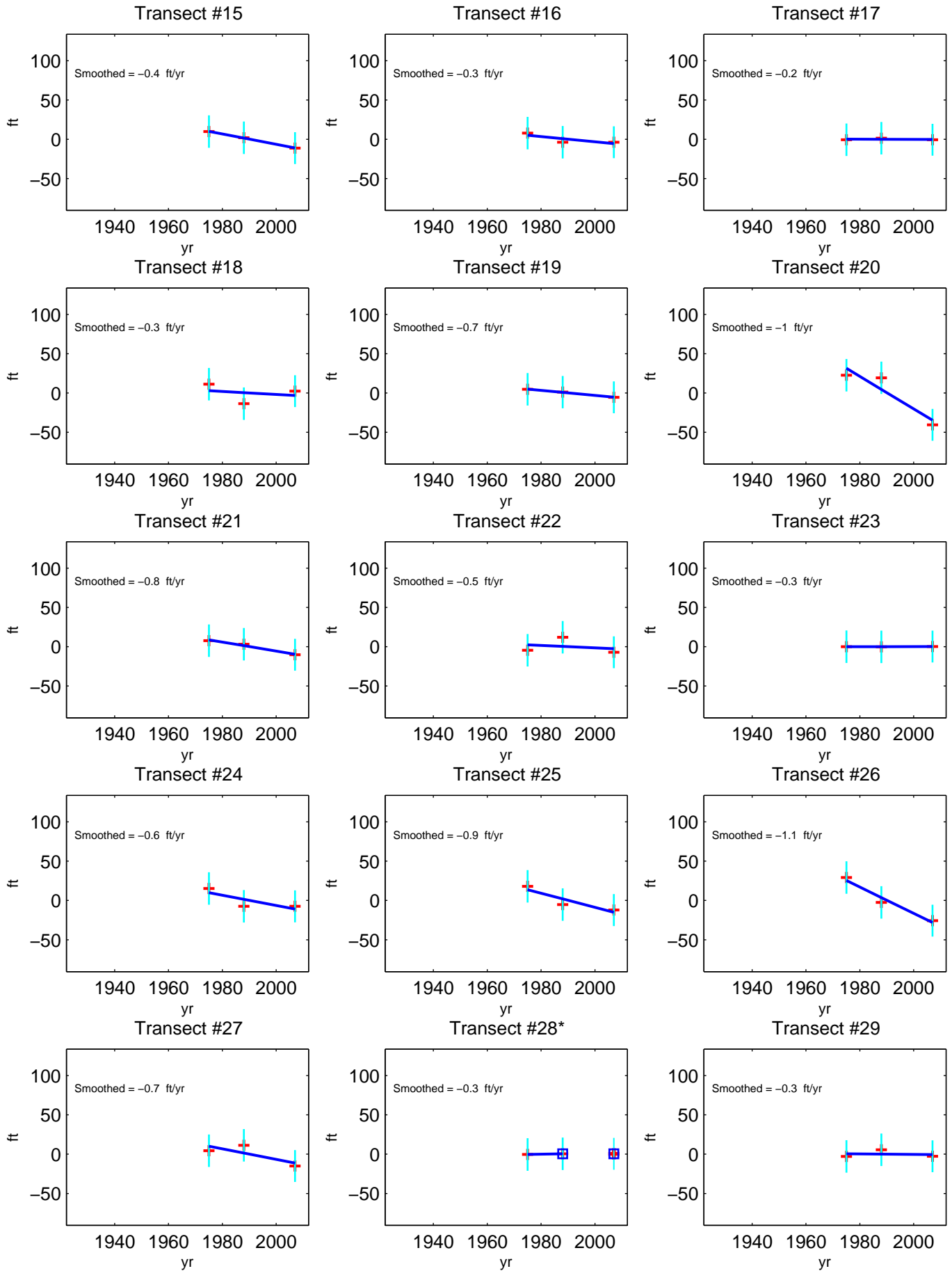
Positive Rate = Accretion  
Negative Rate = Erosion



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

# Lae Lipoa - Smoothed Shoreline Change Rates

Positive Rate = Accretion  
Negative Rate = Erosion

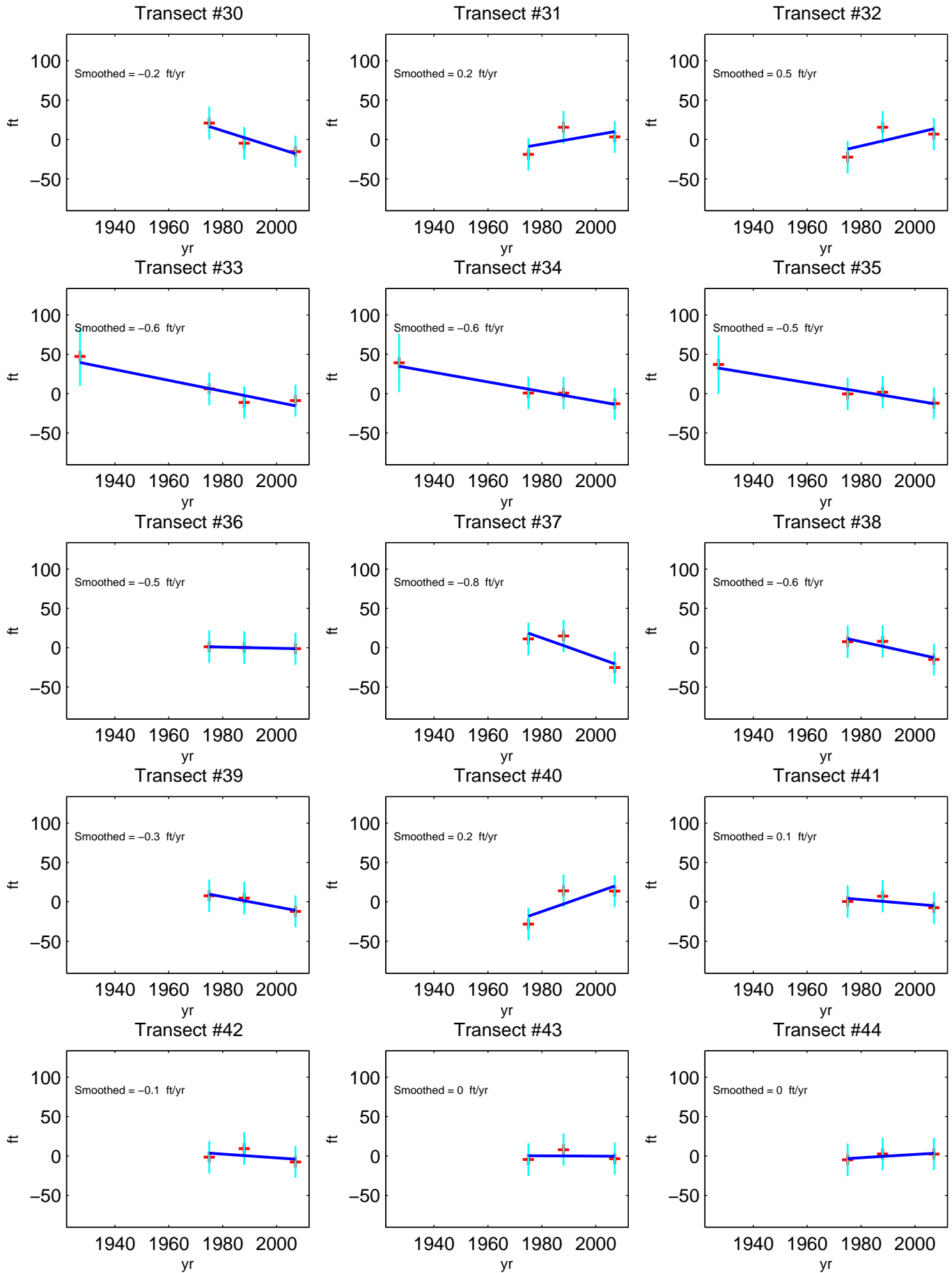


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# Lae Lipoa - Smoothed Shoreline Change Rates

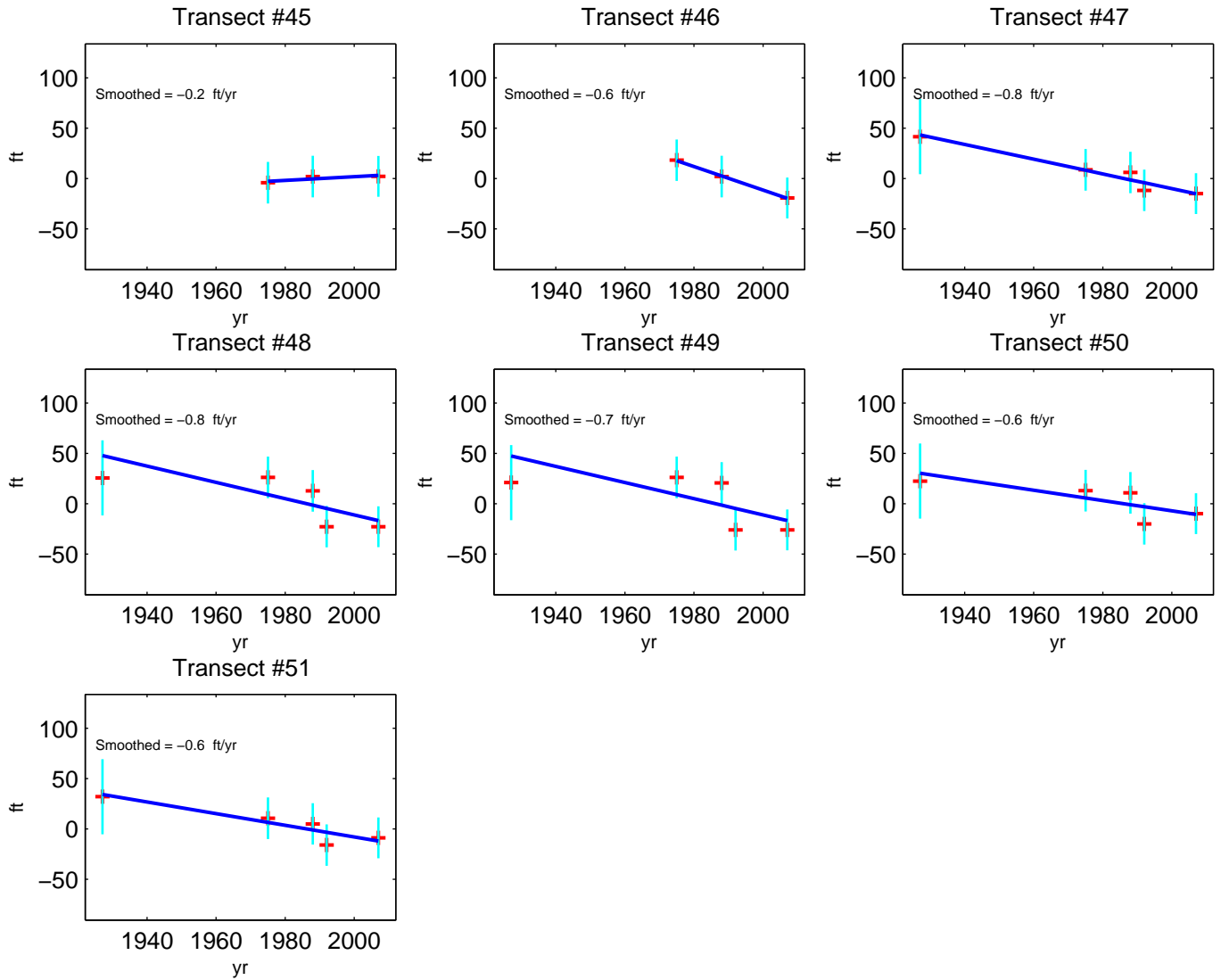
Positive Rate = Accretion  
Negative Rate = Erosion



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# Lae Lipoa - 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.

# Anahola, 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.

**AREA DESCRIPTION**

The Anahola study area (transects 45 - 174) is located on the east coast of Kauai. The area is bounded by Aliomanu Beach to the north and Kahala Point to the south. The shoreline is composed of calcareous sand beach interrupted by basalt headlands with a fringing reef offshore.

Overall, the area is eroding at an average rate of -0.4 ft/yr. The area lends itself to division into three portions. Aliomanu Beach (transects 45 - 88) is located to the north of Kuahau Point. This section of the study area is experiencing erosion at an average rate of -1.1 ft/yr. Anahola Beach (transects 89 - 128) to the north of Anahola River has experienced erosion at an average rate of -0.6 ft/yr. Anahola Beach Park (transects 129 - 174) to the south of Anahola River has experienced accretion at an average rate of 0.3 ft/yr. Previous studies<sup>1</sup> found similar trends in shoreline change for the Anahola study area shoreline.

<sup>1</sup> 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.

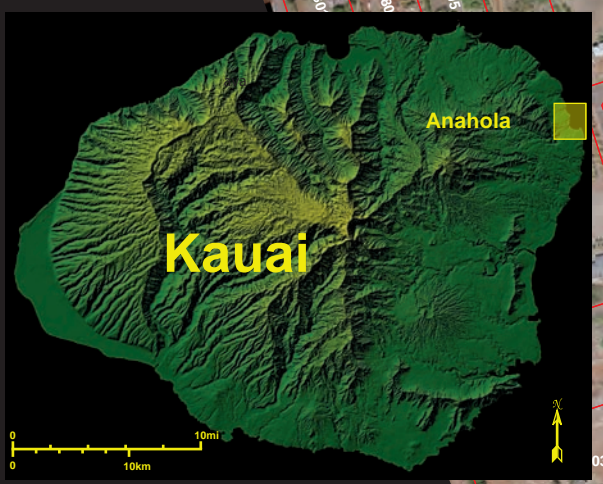
**HISTORICAL SHORELINES**

- █ 1927 T-sheet
- █ Apr 10 1975
- █ Apr 12 1975
- █ Jul 1987
- █ Mar 1988
- █ Sep 1992
- █ Nov 1996
- █ Sep 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.



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

Contract C25514    Contract 7249

467400mE    UTM coordinates  
 22°09'50" W    Latitude/Longitude coordinates

**Anahola - Smoothed Rates**

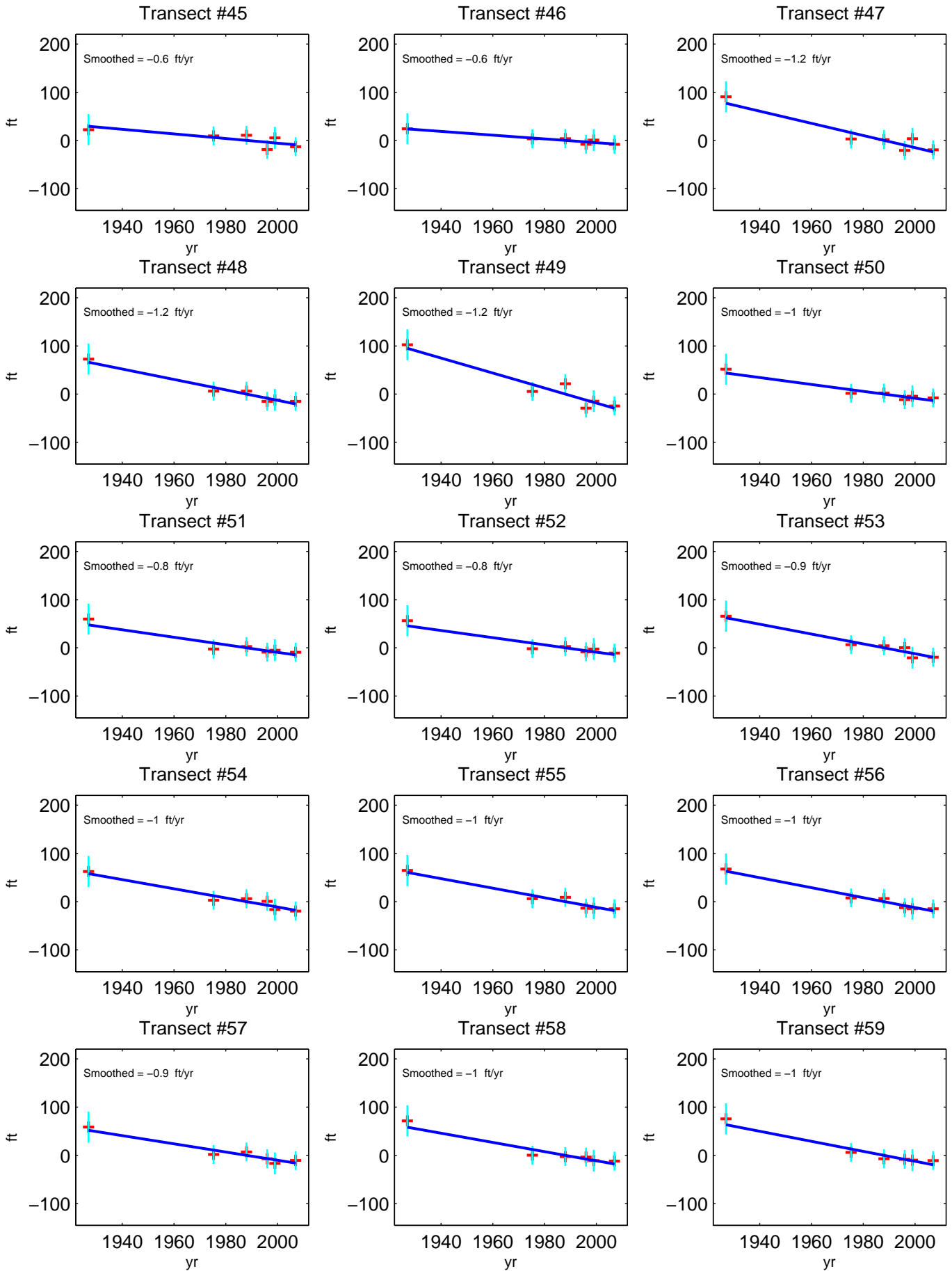
Positive Rate = Accretion  
Negative Rate = Erosion

Transect	Smoothed Rate (ft/yr)	Transect	Smoothed Rate (ft/yr)	Transect	Smoothed Rate (ft/yr)
45	-0.6	91	-1.2	137	2.0
46	-0.6	92	-1.2	138	2.0
47	-1.2	93	-1.2	139	2.1
48	-1.2	94	-1.1	140	2.1
49	-1.2	95	-0.9	141	2.1
50	-1.0	96	-0.8	142	2.0
51	-0.8	97	-0.7	143	1.9
52	-0.8	98	-0.6	144	1.8
53	-0.9	99	-0.6	145	1.6
54	-1.0	100	-0.5	146	1.4
55	-1.0	101	-0.4	147	1.2
56	-1.0	102	-0.3	148	0.9
57	-0.9	103	-0.4	149	0.6
58	-1.0	104	-0.4	150	0.4
59	-1.0	105	-0.4	151	0.2
60	-1.1	106	-0.4	152	0.0
61	-1.0	107	-0.4	153	-0.4
62	-0.9	108	-0.4	154	-0.6
63	-0.9	109	-0.5	155	-0.8
64	-1.0	110	-0.6	156	-0.8
65	-1.1	111	-0.7	157	-0.9
66	-1.1	112	-0.7	158	-0.9
67	-1.1	113	-0.7	159	-0.9
68	-1.0	114	-0.7	160	-0.9
69	-1.0	115	-0.7	161	-0.8
70	-0.9	116	-0.7	162	-0.7
71	-0.9	117	-0.8	163	-0.7
72	-0.8	118	-0.8	164	-0.7
73	-0.8	119	-0.7	165	-0.8
74	-0.8	120	-0.6	166	-0.9
75	-0.9	121	-0.4	167	-0.9
76	-1.1	122	-0.2	168	-0.9
77	-1.3	123	0.0	169	-1.0
78	-1.4	124	0.1	170	-1.0
79	-1.5	125	0.2	171	-1.0
80	-1.5	126	0.1	172	-1.0
81	-1.5	127	0.1	173	-1.0
82	-1.7	128	0.0	174	-1.0
83	-1.8	129	1.2		
84	-1.8	130	1.2		
85	-1.8	131	1.3		
86	-1.6	132	1.3		
87	-1.5	133	1.4		
88	-1.3	134	1.6		
89	-1.2	135	1.7		
90	-1.2	136	1.8		

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

# Anahola - Smoothed Shoreline Change Rates

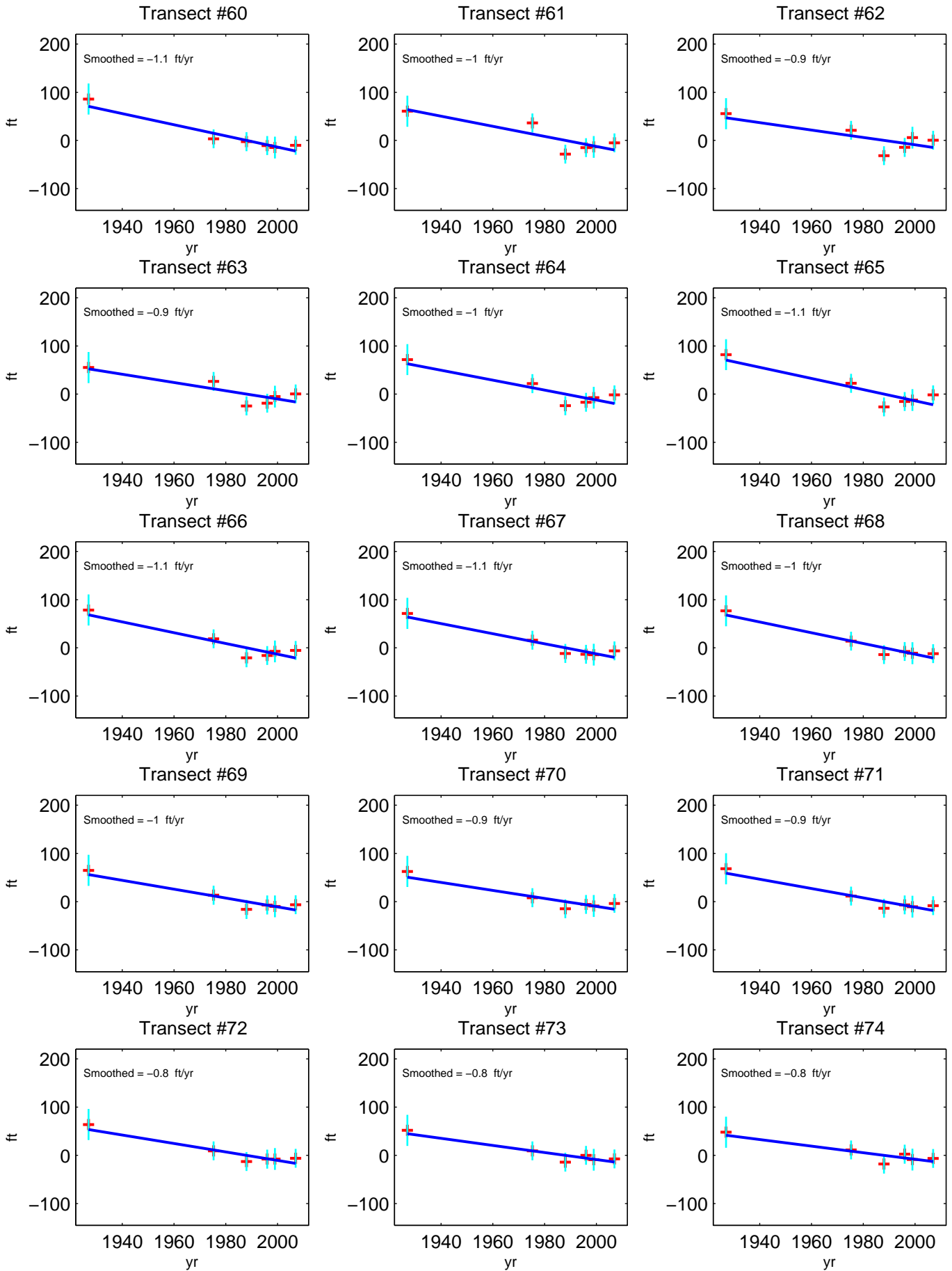
Positive Rate = Accretion  
Negative Rate = Erosion



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

# Anahola - Smoothed Shoreline Change Rates

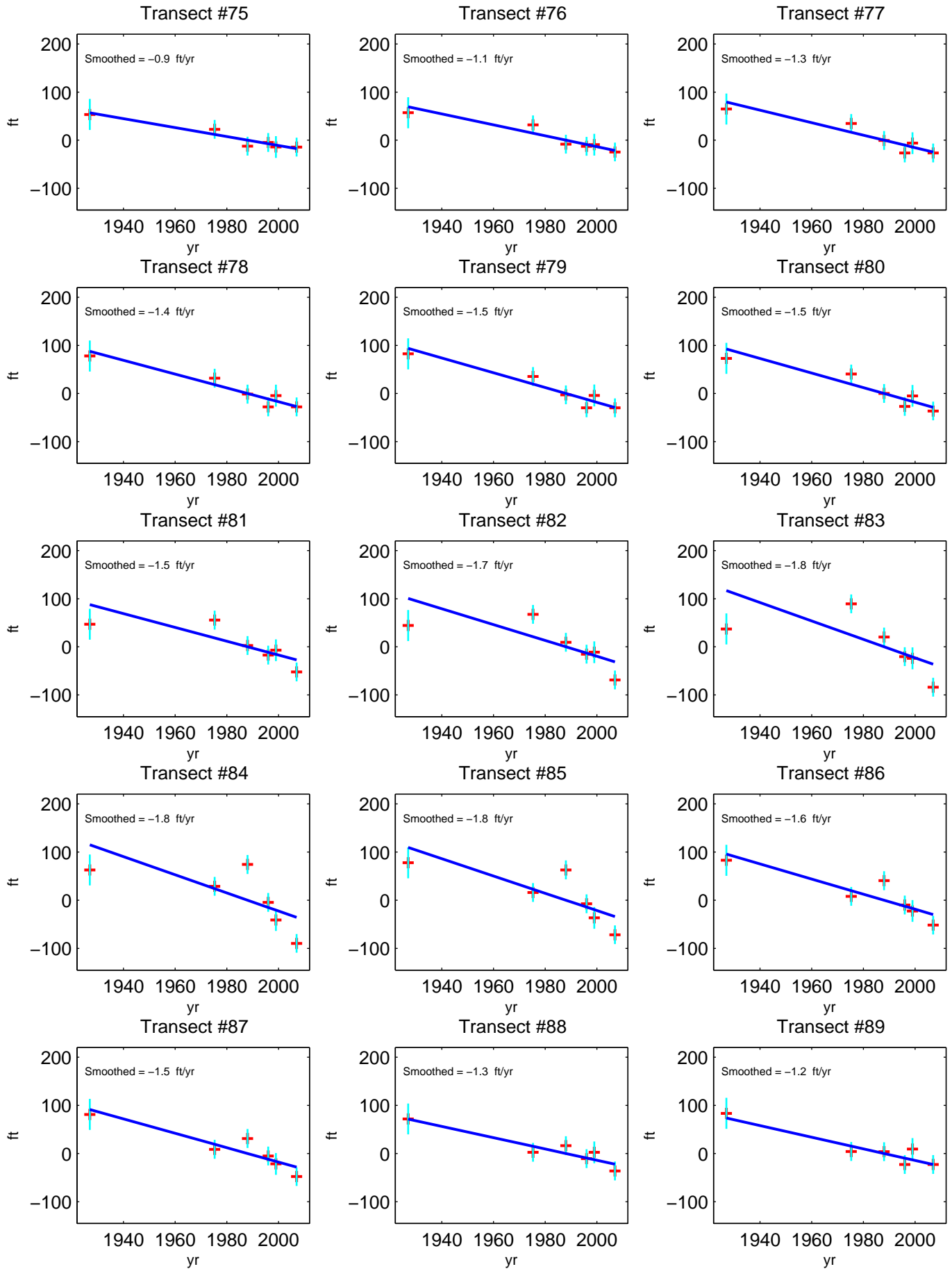
Positive Rate = Accretion  
Negative Rate = Erosion



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# Anahola - Smoothed Shoreline Change Rates

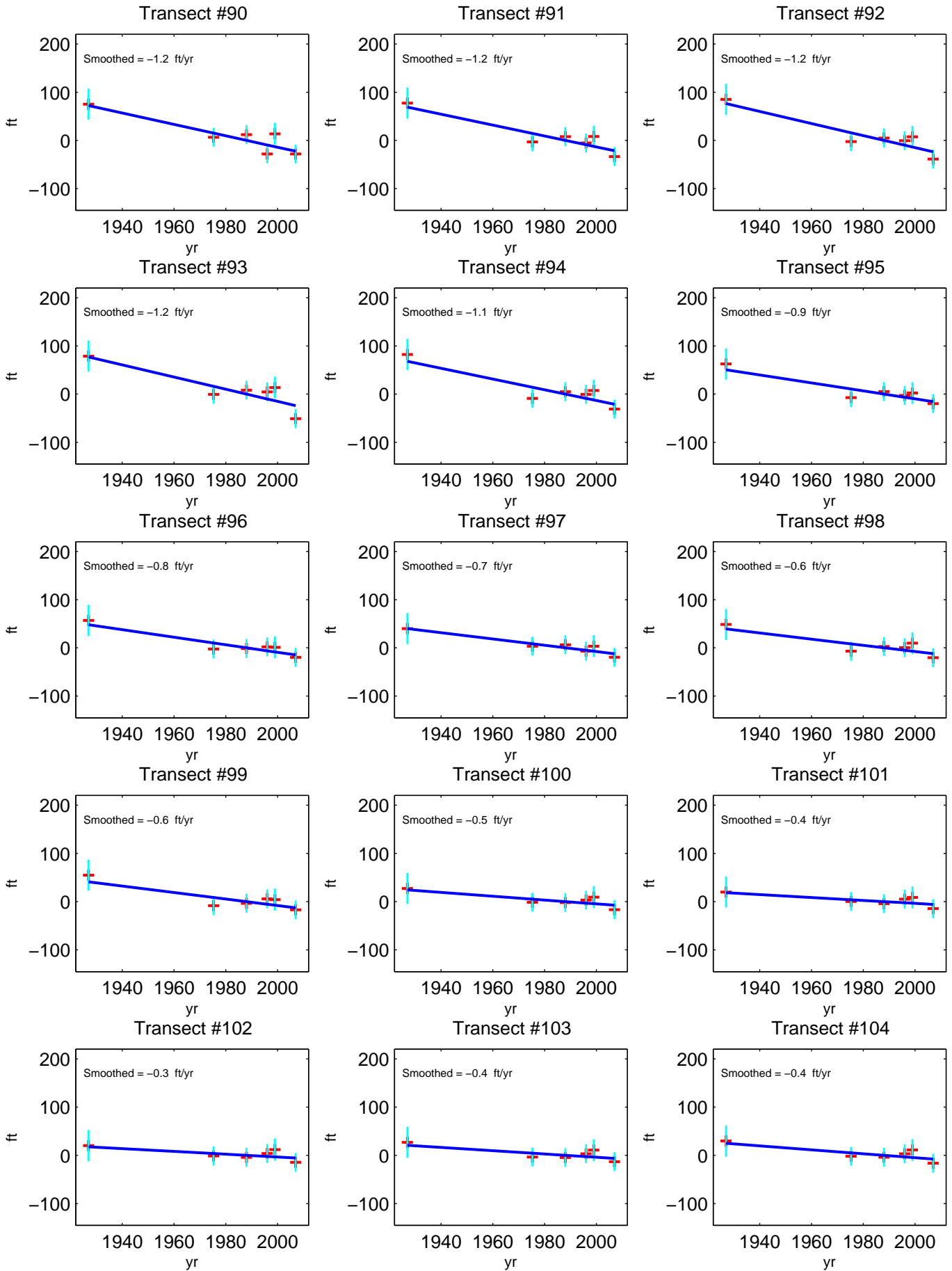
Positive Rate = Accretion  
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# Anahola - Smoothed Shoreline Change Rates

Positive Rate = Accretion  
Negative Rate = Erosion

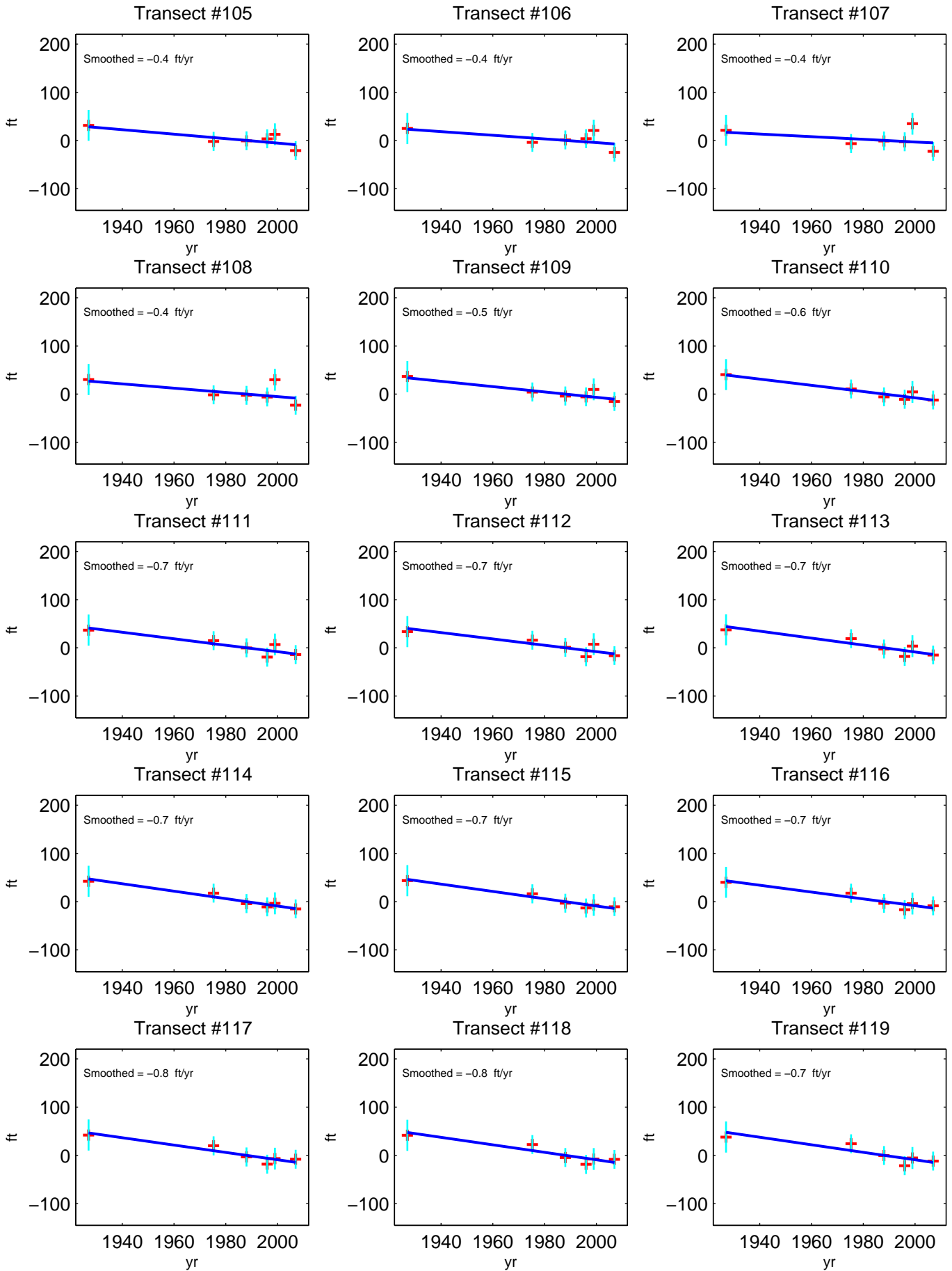


\*Hardened Shorelines with no beach are shown with a blue square. The analysis stops at the first hardened shoreline.



# Anahola - Smoothed Shoreline Change Rates

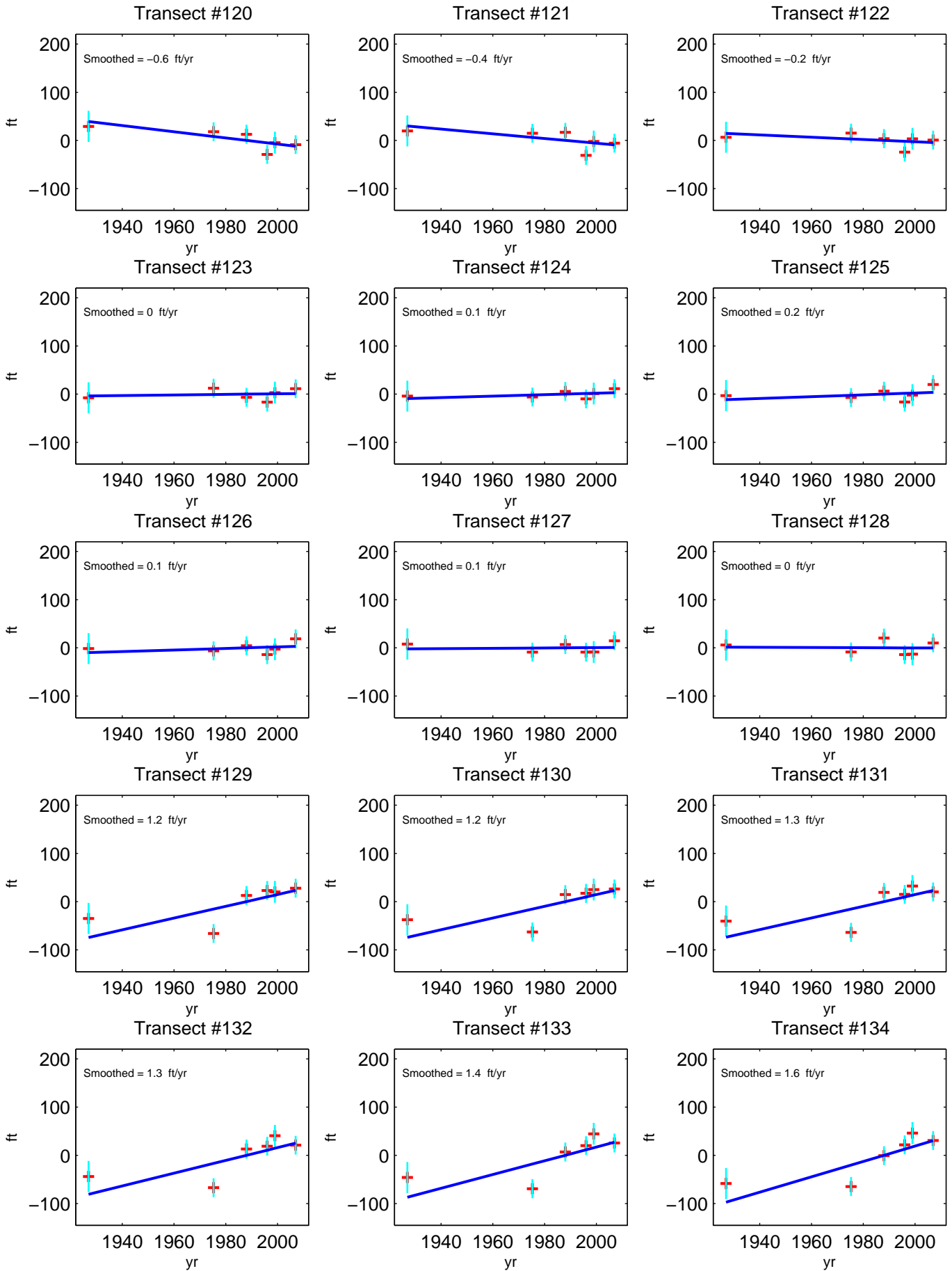
Positive Rate = Accretion  
Negative Rate = Erosion



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

# Anahola - Smoothed Shoreline Change Rates

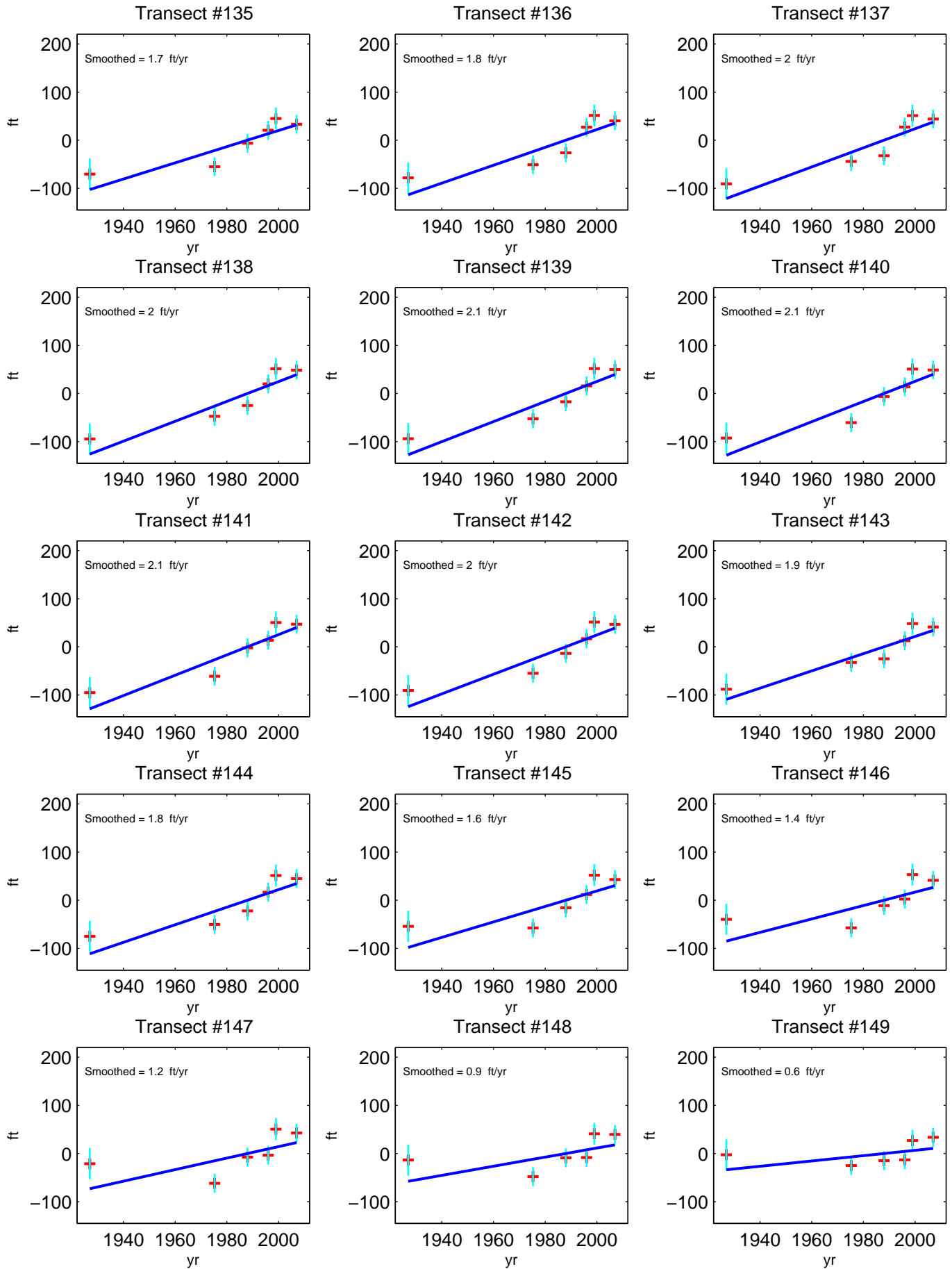
Positive Rate = Accretion  
Negative Rate = Erosion



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# Anahola - Smoothed Shoreline Change Rates

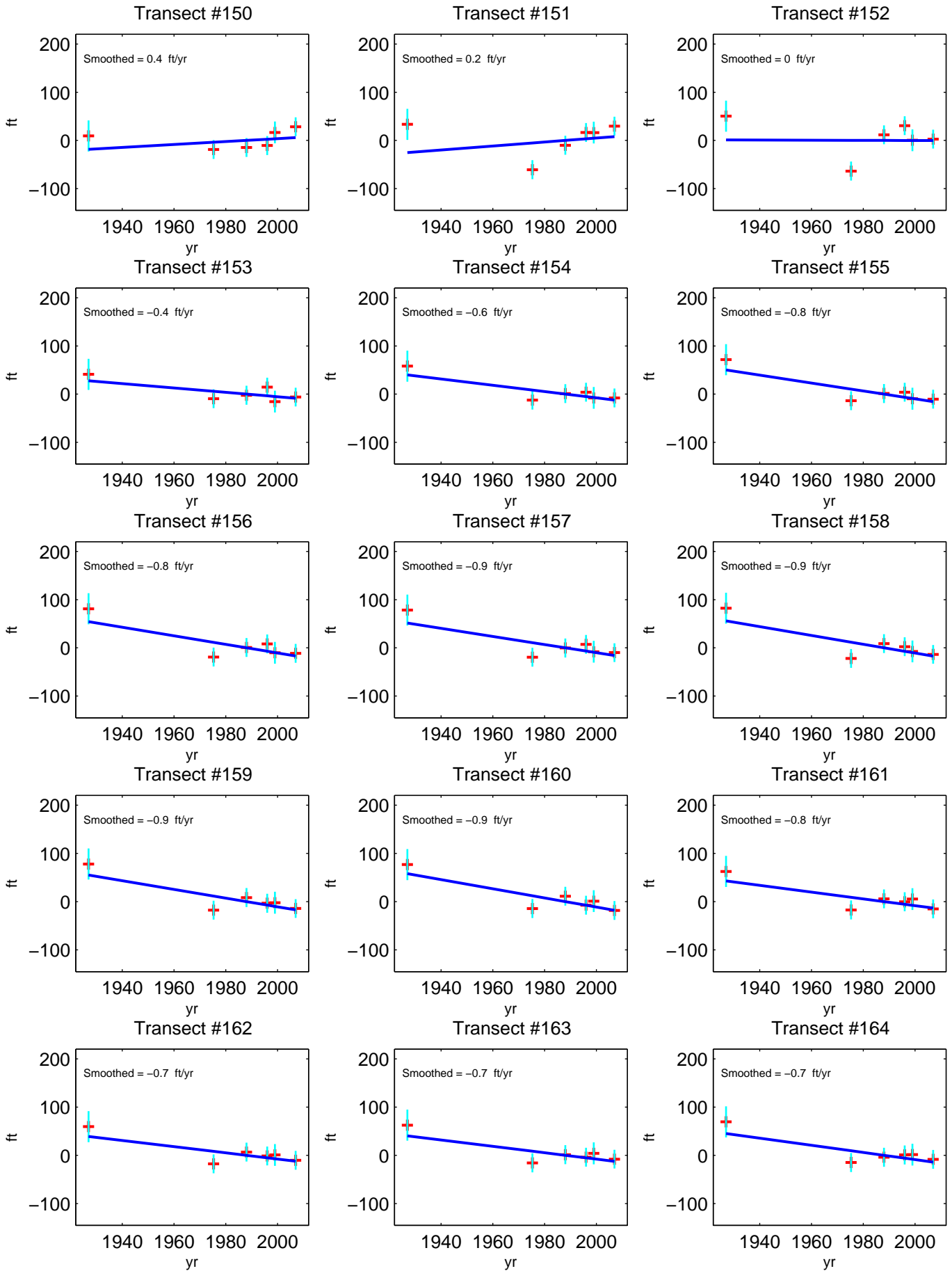
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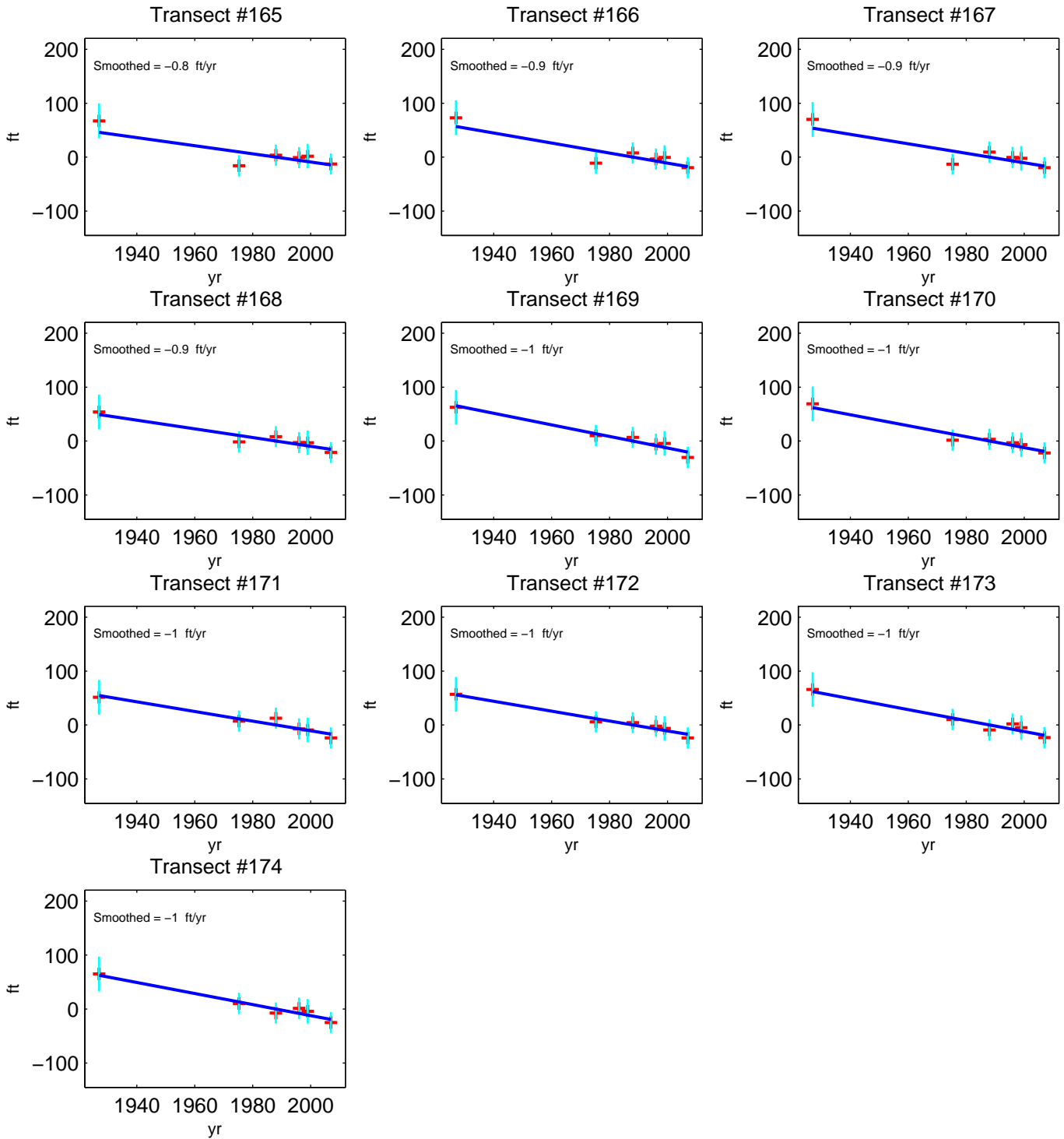
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# Anahola - Smoothed Shoreline Change Rates

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# Papaa Bay, 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

- █ 1927 T-sheet
- █ Apr 1975
- █ Jul 1987
- █ Mar 1988
- █ Sep 1992
- █ Nov 1996
- █ Sep 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 Papaa Bay study area (transects 0 - 44) is located on the east coast of Kauai. The area is bounded by Papaa Bay to the north and Aliomanu Beach to the south. The shoreline is composed of calcareous sand beach interrupted by basalt headlands with a fringing reef offshore.

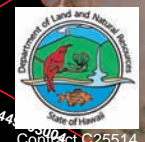
Overall, the area is eroding at an average rate of -0.5 ft/yr. The area lends itself to division into two portions. Papaa Bay (transects 0 – 12) is a small pocket beach located to the north of the study area. This section of the study area is experiencing erosion at an average rate of -1.0 ft/yr. The next beach (transects 13 – 44) to the south of Aliomanu Beach has experienced erosion at an average rate of -0.4 ft/yr. Previous studies<sup>1</sup> found both beaches in this study area are stable or slightly accreting. These diverging results might be due to the use of different methodologies and the extended time series of shoreline positions used in this study.

<sup>1</sup> 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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 1680 East West Road, Honolulu, HI 96822, U.S.A.



2451100mN UTM coordinates  
 159°19'10" W Latitude/Longitude coordinates

**Papaa Bay - Smoothed Rates**

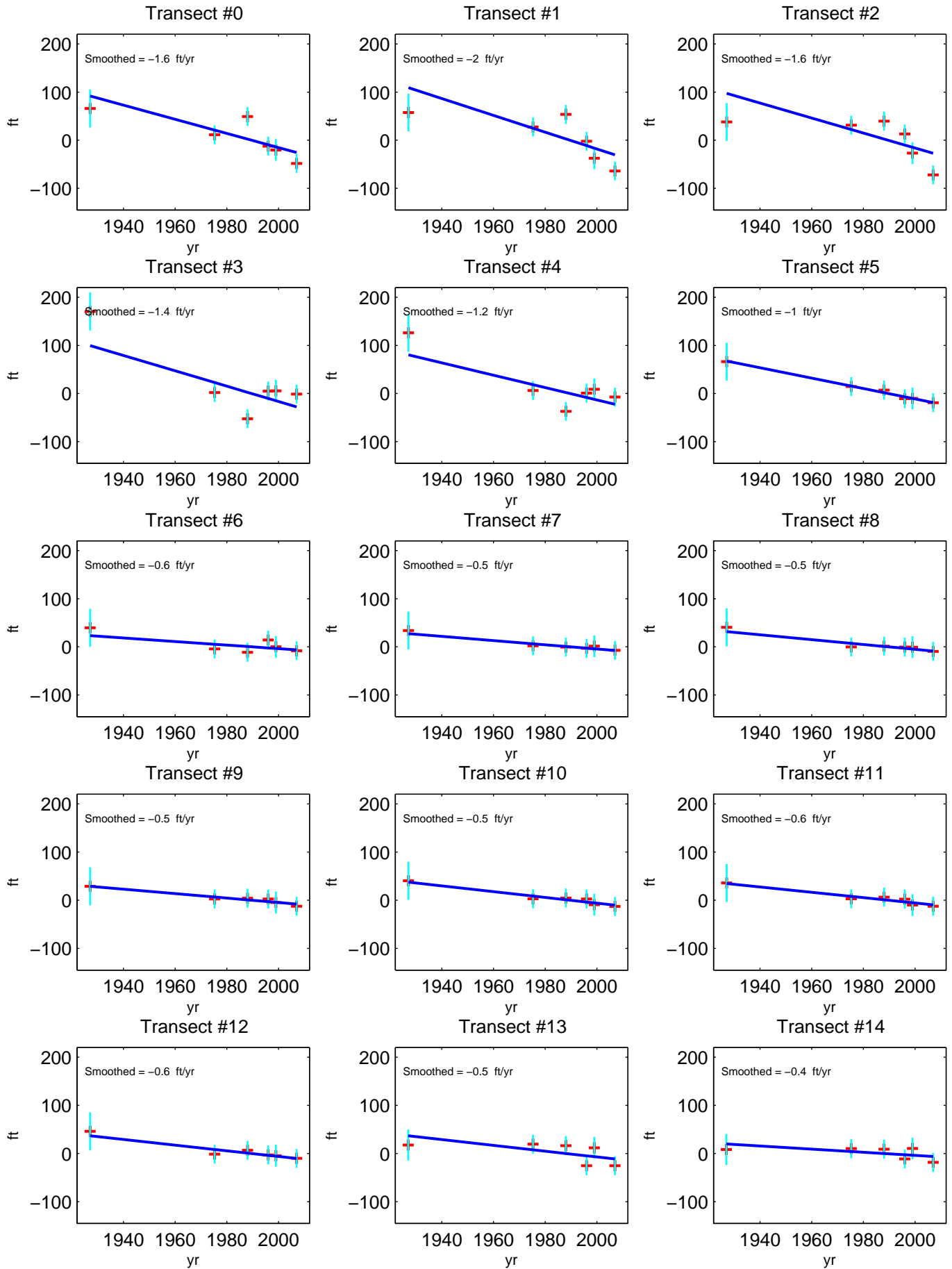
Positive Rate = Accretion  
Negative Rate = Erosion

Transect	Smoothed Rate (ft/yr)
0	-1.6
1	-2.0
2	-1.6
3	-1.4
4	-1.2
5	-1.0
6	-0.6
7	-0.5
8	-0.5
9	-0.5
10	-0.5
11	-0.6
12	-0.6
13	-0.5
14	-0.4
15	-0.3
16	-0.3
17	-0.3
18	-0.4
19	-0.5
20	-0.5
21	-0.4
22	-0.4
23	-0.4
24	-0.5
25	-0.6
26	-0.6
27	-0.4
28	-0.2
29	0.0
30	0.1
31	0.0
32	0.0
33	-0.1
34	-0.3
35	-0.4
36	-0.4
37	-0.2
38	-0.2
39	-0.3
40	-0.5
41	-0.7
42	-0.7
43	-0.7
44	-0.7

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

# Papaa Bay - Smoothed Shoreline Change Rates

Positive Rate = Accretion  
Negative Rate = Erosion

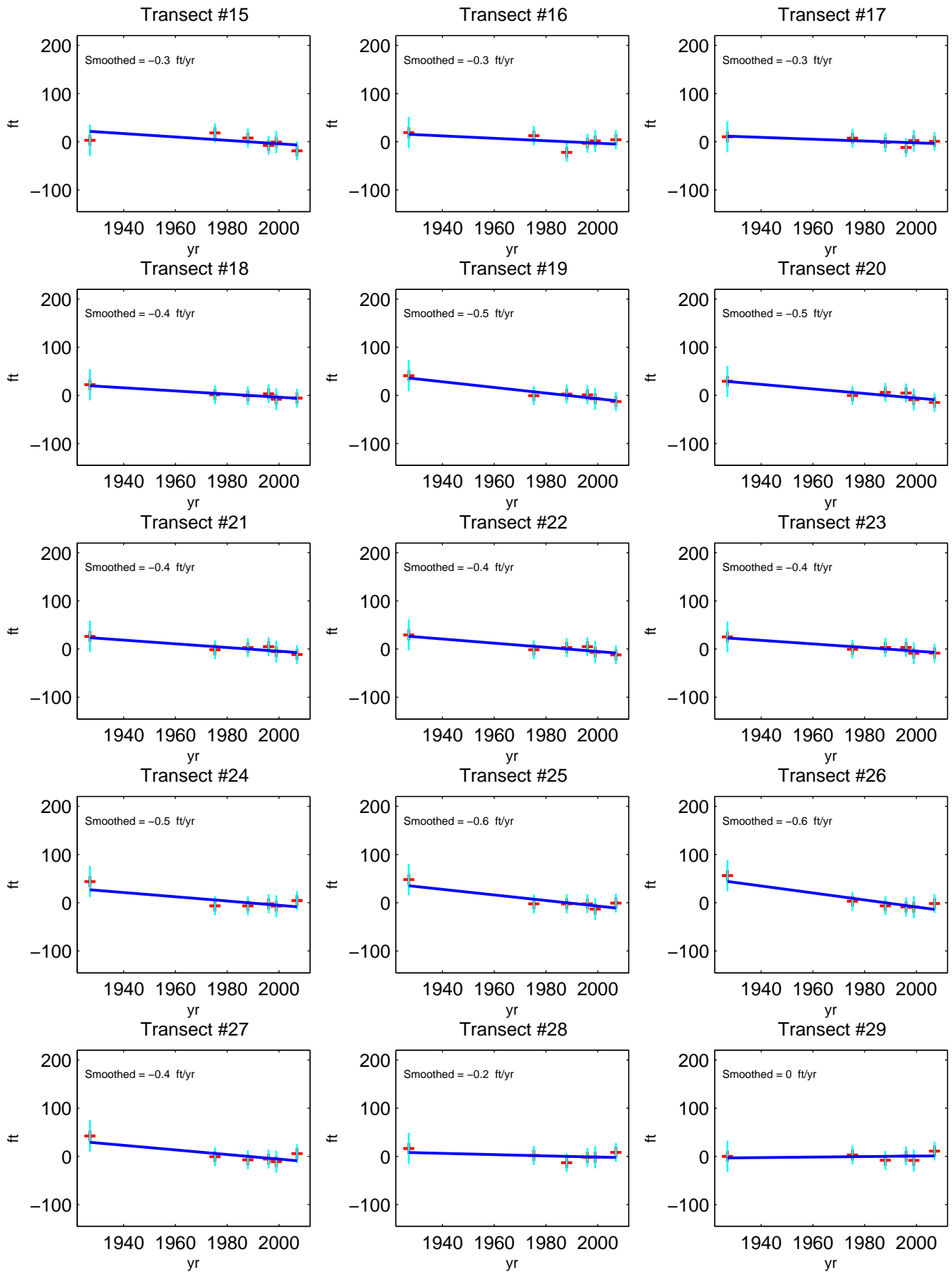


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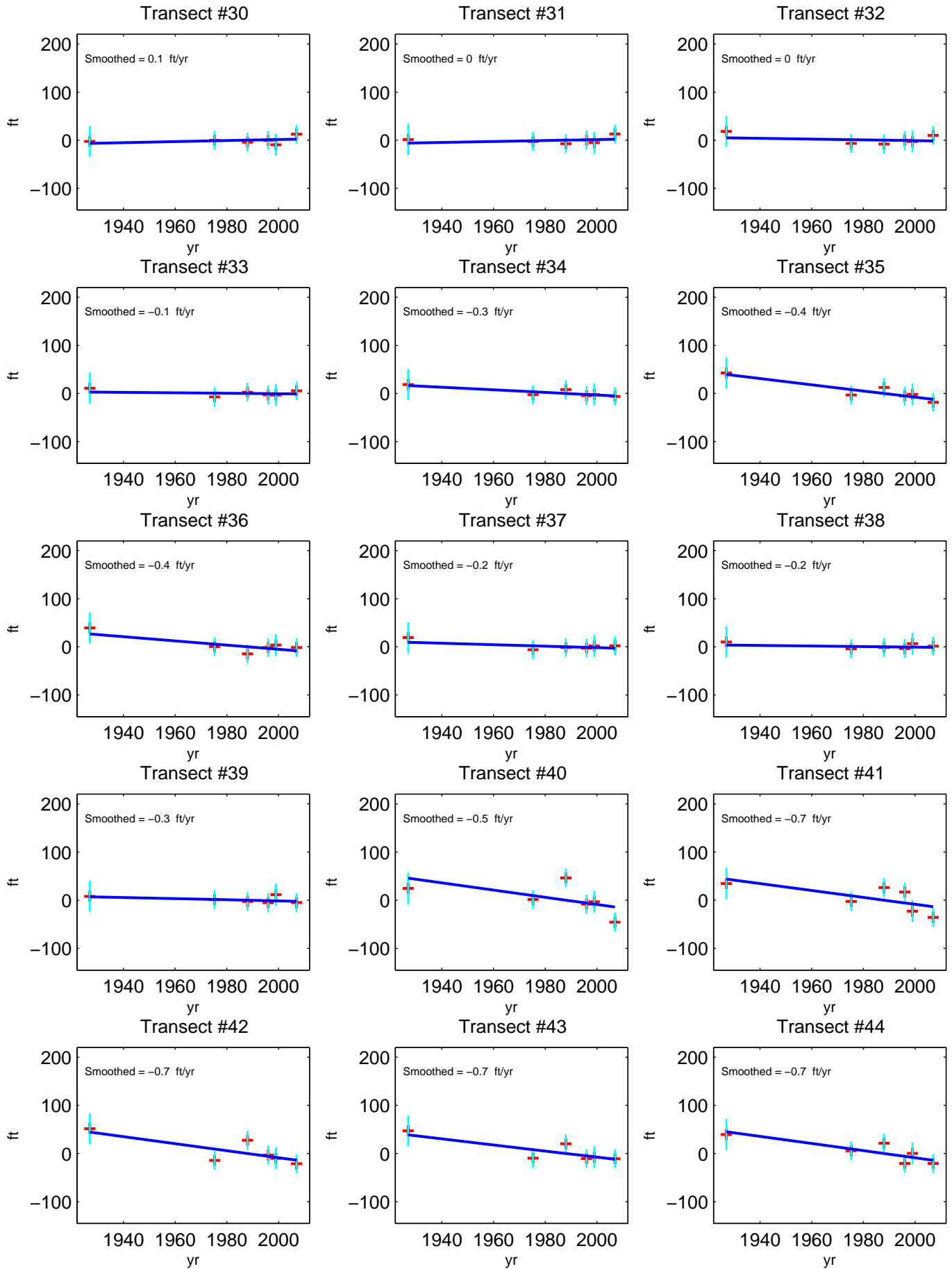
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