

Gutiérrez *et al.* (2015) - Long-term morphological evolution of urban pocket beaches in Montevideo (Uruguay): impacts of coastal interventions and links to climate forcing. *Journal of Integrated Coastal Zone Management / Revista de Gestão Costeira Integrada*, 15(4):467-484. DOI: 10.5894/rgci553 [Supporting Information]

Supporting Information

SI.I - Results of Anderson-Darling normality test performed on surface value series. Ramírez beach.

a) First aerial photographic series: 1927-2007 (15 records), PHTH-WL; **b)** First aerial photographic series: 1927-2007 (15 records), WDL-RM; **c)** Complete series: 1927-2008 (23 records), WDL-RM; **d)** Complete series (without 1927 and 1929 images), WDL-RM.

Ramírez				
	a)	b)	c)	d)
Alpha	0.05	0.05	0.05	0.05
P-value	0.05782	0.18740	0.41723	0.22106
Statistic	0.72761	0.51894	0.37371	0.48982
N	16	16	23	21
Conclusion	Probably normal	Probably normal	Probably normal	Probably normal

Supporting Information

SI.II - Results of Anderson-Darling normality test performed on surface value series. Pocitos beach.

L27: a) First aerial photographic series: 1927-2007 (15 records); **c)** Complete series: 1927-2008 (21 records); **e)** Complete series: (without 1927, 1945 and 1949 images). **L08: b)** First aerial photographic series: 1927-2007 (15 records); **d)** Complete series: 1927-2008 (21 records); **f)** Complete series: (without 1927, 1945 and 1949 images). For all series with WDL-RM.

Pocitos						
	a)	b)	c)	d)	e)	f)
Alpha	0.05	0.05	0.05	0.05	0.05	0.05
P-value	0.93844	0.55187	0.75839	0.59152	0.50749	0.73427
Statistic	0.16691	0.31155	0.24577	0.29691	0.33486	0.25315
N	15	15	21	21	18	18
Conclusion	Probably normal	Probably normal	Probably normal	Probably normal	Probably normal	Probably normal

Supporting Information

SI.III - Estimated model parameters from the regression model. Ramírez beach.

a) First aerial photographic series: 1927-2007 (15 records), PHTH-WL; **b)** First aerial photographic series: 1927-2007 (15 records), WDL-RM; **c)** Complete series: 1927-2008 (23 records), WDL-RM; **d)** Complete series (without 1927 and 1929 images), WDL-RM. Note the symbols for statistical significance values below the table.

a)

Residuals:						
Min	1Q	Median	3Q	Max		
-57.556	-6.749	2.255	15.672	32.064		
Coefficients:						
	Estimate	Std. Error	t value	Pr(> t)	Signif. code	
(Intercept)	2.042e+03	4.950e+01	41.258	5.05e-16	***	
SURF_Ramírez b	-2.259e-03	1.643e-03	-1.375	0.191		

Residual standard error: 22.95 on 14 degrees of freedom						
Multiple R-squared: 0.119, Adjusted R-squared: 0.05605						
F-statistic: 1.891 on 1 and 14 DF, p-value: 0.1907						

b)

Residuals:						
Min	1Q	Median	3Q	Max		
-53.190	-9.991	3.483	16.022	28.933		
Coefficients:						
	Estimate	Std. Error	t value	Pr(> t)	Signif. code	
(Intercept)	2.059e+03	6.153e+01	33.472	9.18e-15	***	
SURF_Ramírez b	-2.695e-03	1.948e-03	-1.383	0.188		

Residual standard error: 22.93 on 14 degrees of freedom						
Multiple R-squared: 0.1202, Adjusted R-squared: 0.05734						
F-statistic: 1.912 on 1 and 14 DF, p-value: 0.1884						

c)

Residuals:						
Min	1Q	Median	3Q	Max		
-54.812	-6.344	3.757	15.975	28.400		
Coefficients:						
	Estimate	Std. Error	t value	Pr(> t)	Signif. code	
(Intercept)	2.076e+03	3.922e+01	52.944	<2e-16	***	
SURF_Ramírez c	-3.214e-03	1.284e-03	-2.504	0.0206	*	

Residual standard error: 23.17 on 21 degrees of freedom						
Multiple R-squared: 0.2299, Adjusted R-squared: 0.1933						
F-statistic: 6.27 on 1 and 21 DF, p-value: 0.0206						

d)

Residuals:

Min	1Q	Median	3Q	Max
-35.527	-5.376	0.408	12.223	23.638

Coefficients:

	Estimate	Std. Error	t value	Pr(> t)	Signif. code
(Intercept)	2.091e+03	2.760e+01	75.756	< 2e-16	***
SURF_Ramírez d	-3.514e-03	9.002e-04	3.904	0.000955	***

Residual standard error: 16.21 on 19 degrees of freedom

Multiple R-squared: 0.4451, Adjusted R-squared: 0.4159

F-statistic: 15.24 on 1 and 19 DF, p-value: 0.0009549

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Supporting Information

SI.IV - Descriptive statistics of Ramírez beach.

a) First aerial photographic series: 1927-2007 (15 records), PHTH-WL; **b)** First aerial photographic series: 1927-2007 (15 records), WDL-RM; **c)** Complete series: 1927-2008 (23 records), WDL-RM; **d)** Complete series (without 1927 and 1929 images), WDL-RM.

	Ramírez			
	a)	b)	c)	d)
Mean	29923.8503	31439.0505	30321.9033	30400.9016
Std. error	901.5045	759.6913	802.3464	878.6000
Median	30757.9545	31676.0975	31288.3190	31477.5510
Mode	N/D	N/D	N/D	N/D
Std. deviation	3606.0181	3038.7653	3847.9179	4026.2512
Sample variance	13003366.88	9234094.28	14806472.35	16210698.62
Kurtosis	-0.019160	0.417413	-0.388472	-0.571760
Skewness	-0.492858	-0.346383	-0.428029	-0.478816
Range	13627.797	12294.295	14421.614	14421.614
Minimum	22913.96	25100.698	22973.444	22973.444
Maximum	36541.757	37394.993	37395.058	37395.058
Sum	478781.604	503024.808	697403.777	638418.933
Count	16	16	23	21
CV (%)	12.0506	9.6656	12.6902	13.2439

Supporting Information

SI.V - Estimated model parameters from the regression model. Pocitos beach.

L27: a) First aerial photographic series: 1927-2007 (15 records); **c)** Complete series: 1927-2008 (21 records); **e)** Complete series (without 1927, 1945 and 1949 images). **L08: b)** First aerial photographic series: 1927-2007 (15 records); **d)** Complete series: 1927-2008 (21 records); **f)** Complete series (without 1927, 1945 and 1949 images). Note the symbols for statistical significance values below the table.

a)

Residuals:

Min	1Q	Median	3Q	Max
-26.344	-19.127	-3.703	17.438	40.176

Coefficients:

	Estimate	Std. Error	t value	Pr(> t)	Signif. code
(Intercept)	2.047e+03	4.180e+01	48.977	3.92e-16	***
SURF_Pocitos a	-1.540e-03	8.584e-04	-1.794	0.0961	.

Residual standard error: 22.96 on 13 degrees of freedom

Multiple R-squared: 0.1984, Adjusted R-squared: 0.1367

F-statistic: 3.217 on 1 and 13 DF, p-value: 0.09614

b)

Residuals:

Min	1Q	Median	3Q	Max
-42.158	-21.170	3.809	20.786	34.484

Coefficients:

	Estimate	Std. Error	t value	Pr(> t)	Signif. code
(Intercept)	1.939e+03	6.675e+01	29.040	3.3e-13	***
SURF_Pocitos b	5.025e-04	9.628e-04	0.522	0.61	

Residual standard error: 25.38 on 13 degrees of freedom

Multiple R-squared: 0.02053, Adjusted R-squared: -0.05482

F-statistic: 0.2724 on 1 and 13 DF, p-value: 0.6105

c)

Residuals:

Min	1Q	Median	3Q	Max
-32.950	-18.961	3.381	16.879	34.832

Coefficients:

	Estimate	Std. Error	t value	Pr(> t)	Signif. code
(Intercept)	2.057e+03	3.436e+01	59.858	<2e-16	***
SURF_Pocitos c	-1.587e-03	7.228e-04	-2.19	0.0408	*

Residual standard error: 23.3 on 19 degrees of freedom

Multiple R-squared: 0.2023, Adjusted R-squared: 0.1603

F-statistic: 4.819 on 1 and 19 DF, p-value: 0.04078

d)

Residuals:

Min	1Q	Median	3Q	Max
-54.749	-21.286	9.258	22.597	26.893

Coefficients:

	Estimate	Std. Error	t value	Pr(> t)	Signif. code
(Intercept)	1.978e+03	5.362e+01	36.887	<2e-16	***
SURF_Pocitos d	6.679e-05	7.798e-04	0.086	0.933	

Residual standard error: 26.08 on 19 degrees of freedom
 Multiple R-squared: 0.0003859, Adjusted R-squared: -0.05223
 F-statistic: 0.007335 on 1 and 19 DF, p-value: 0.9326

e)

Residuals:

Min	1Q	Median	3Q	Max
-33.90	17.52	8.70	15.63	21.42

Coefficients:

	Estimate	Std. Error	t value	Pr(> t)	Signif. code
(Intercept)	2.014e+03	3.298e+01	61.071	<2e-16	***
SURF_Pocitos e	-5.396e-04	7.133e-04	-0.757	0.46	

Residual standard error: 19.88 on 16 degrees of freedom
 Multiple R-squared: 0.03454, Adjusted R-squared: -0.0258
 F-statistic: 0.5724 on 1 and 16 DF, p-value: 0.4603

f)

Residuals:

Min	1Q	Median	3Q	Max
-34.687	-17.695	8.645	16.287	21.424

Coefficients:

	Estimate	Std. Error	t value	Pr(> t)	Signif. code
(Intercept)	2.014e+03	4.251e+01	47.376	<2e-16	***
SURF_Pocitos f	-3.601e-04	6.143e-04	-0.586	0.566	

Residual standard error: 20.02 on 16 degrees of freedom
 Multiple R-squared: 0.02102, Adjusted R-squared: -0.04017
 F-statistic: 0.3435 on 1 and 16 DF, p-value: 0.566

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Supporting Information

SI.VI - Descriptive statistics of Pocitos beach.

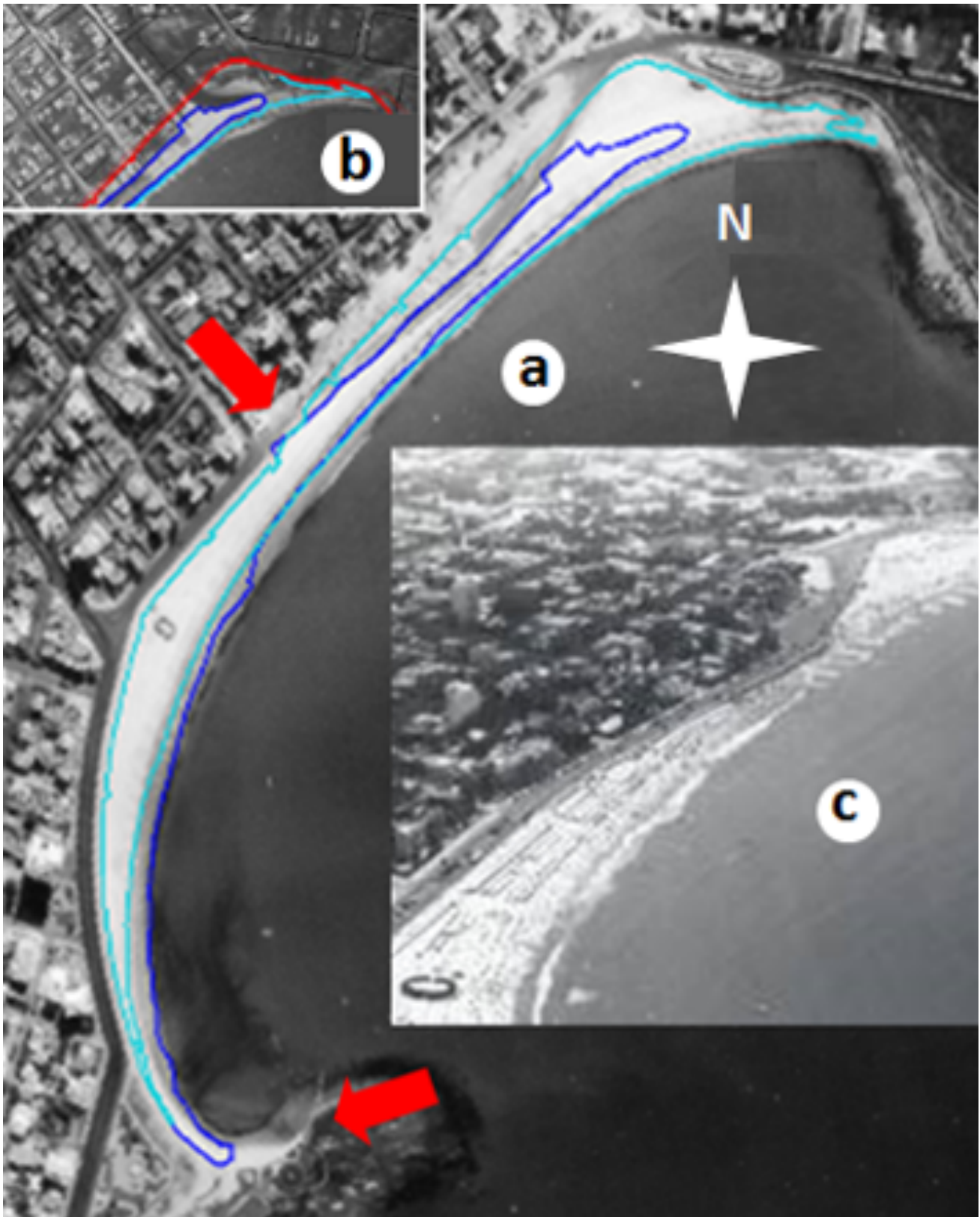
L27: **a)** First aerial photographic series: 1927-2007 (15 records); **c)** Complete series: 1927-2008 (21 records); **e)** Complete series (without 1927, 1945 and 1949 images). **L08:** **b)** First aerial photographic series: 1927-2007 (15 records); **d)** Complete series: 1927-2008 (21 records); **f)** Complete series (without 1927, 1945 and 1949 images).

Pocitos						
	a)	b)	c)	d)	e)	f)
Mean	48205.7503	68995.1681	47018.3665	68364.7280	45764.4267	68772.8796
Std. error	1845.5540	1818.8923	1573.0627	1632.1420	1593.6541	1863.2827
Median	47730.6080	68623.6140	47526.8270	68059.5450	45587.2070	68180.0690
Mode	N/D	N/D	N/D	N/D	N/D	N/D
Std. deviation	7147.8000	7044.5396	7208.6790	7479.4142	6761.3018	7905.2391
Sample variance	51091045.10	49625538.87	51965052.73	55941636.96	45715201.47	62492805.57
Kurtosis	-0.482737	-0.052939	-0.796489	-0.637048	-1.049300	-0.878239
Skewness	-0.062148	0.408702	0.067662	0.263071	0.104681	0.144512
Range	25824.295	25811.213	25824.295	26935.155	21581.824	26935.155
Minimum	35240.001	56930.821	35240.001	55806.879	35240.001	55806.879
Maximum	61064.296	82742.034	61064.296	82742.034	56821.825	82742.034
Sum	723086.255	1034927.522	987385.697	1435659.287	823759.681	1237911.832
Count	15	15	21	21	18	18
CV (%)	14.8277	10.2102	15.3316	10.9405	14.7741	11.4947

Supporting Information

SI.1 - Pocitos Beach

a) Picture of 1945 showing the path of the waterfront (“La Rambla”) of Pocitos beach. The blue line indicates the beach area in 1927 (L27). The turquoise thick line indicates the location of the waterfront in its current path (2008). Red arrows indicate the ends of the stretch of boulevard that has remained unchanged in its location for the entire series of photos (Source: Image-1945, SSRFAU). Photo inderts detail (Source: Image CMDF-IdeM); **b)** The mouth of the Pocitos creek in 1927. **c)** The 1930 panoramic view shows the original waterfront protruded into a section of the beach and divided it into two sections, which was maintained in 1945.



Supporting Information

SI.2 - Pocitos Beach

Left: Previous high tide high water (PHTH-WL)-2007 (Turquoise) and 1927 (blue). Present location of the waterfront (red line). Right: The polygons on the beach indicate net gains and losses in area that have occurred over 80 years. Photo: File DINAMA, 1927; IdeM File, 2007.

