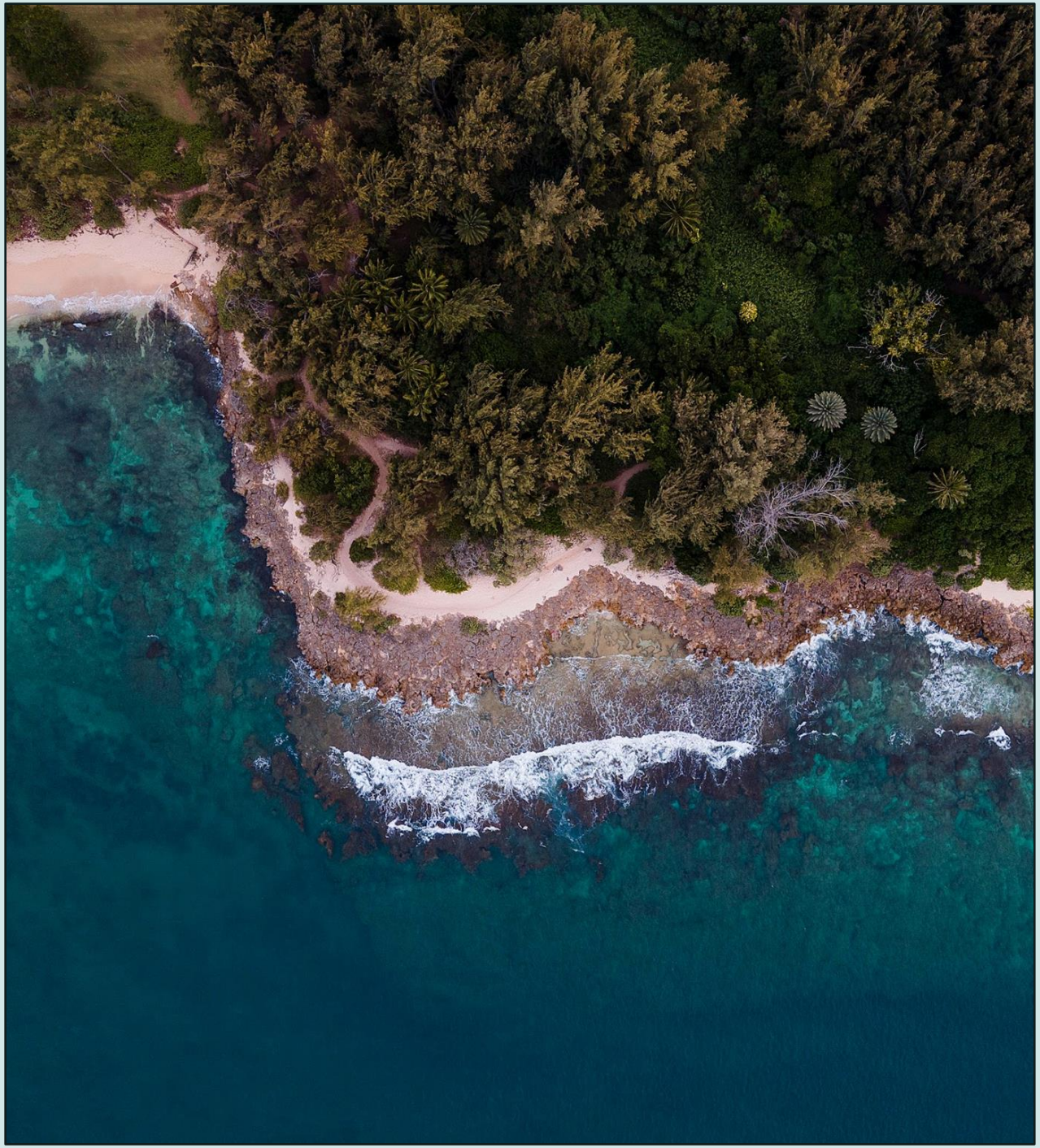
Digital Shoreline Analysis System

Geomorfologia do Litoral
2023/2024

Rui Fernandes
Alberto Gomes

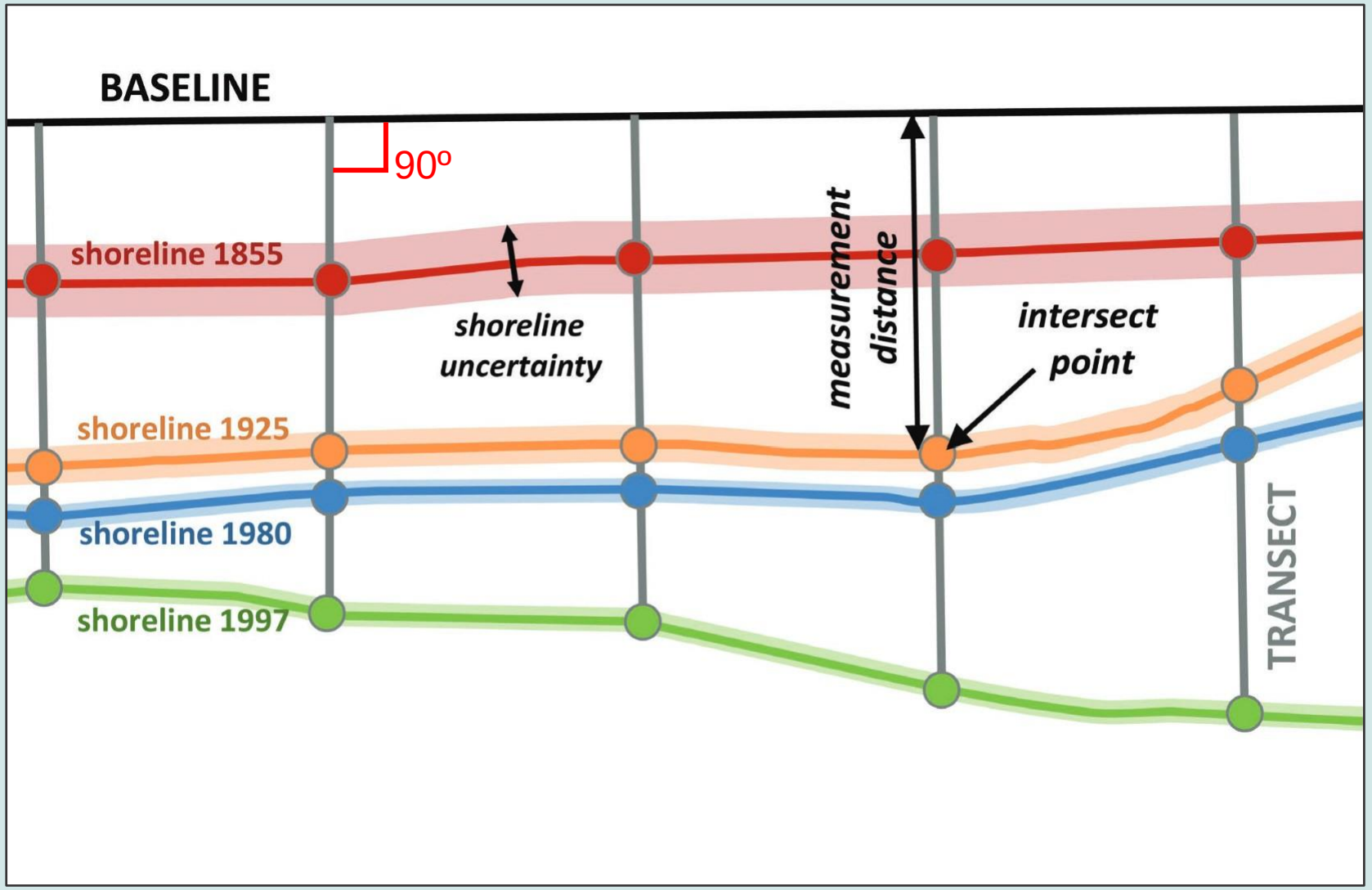


O que é e para que é utilizado

- *Software* desenvolvido pela *Unites States Geological Survey* (**USGS**);
- Toma a forma de um add-in para o **ArcMap** de instalação simples e rápida;
- Utilizado para medir a **variação** de linhas de costa ao longo do tempo;
- Devolve uma série de **indicadores métricos** para caracterizar a evolução;
- As operações funcionam totalmente em formato **vectorial**;
- Pode ser utilizado de forma criativa noutros **contextos**.

USGS
science for a changing world

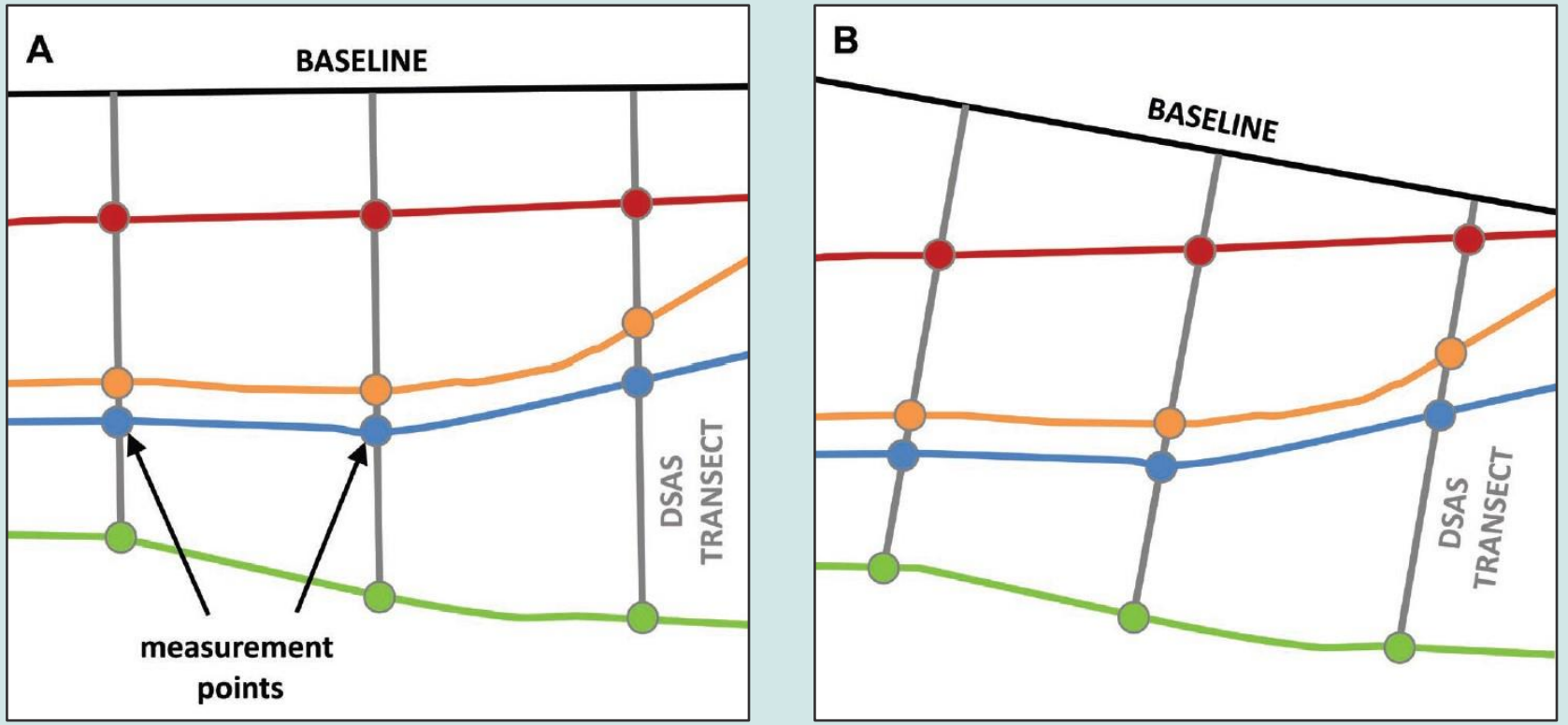
Como funciona



Como funciona

Atenção!

A *baseline* deve ser o mais **paralela** possivel às linhas de costa



Obrigatóriamente numa *Personal Geodatabase*

Linhas de costa

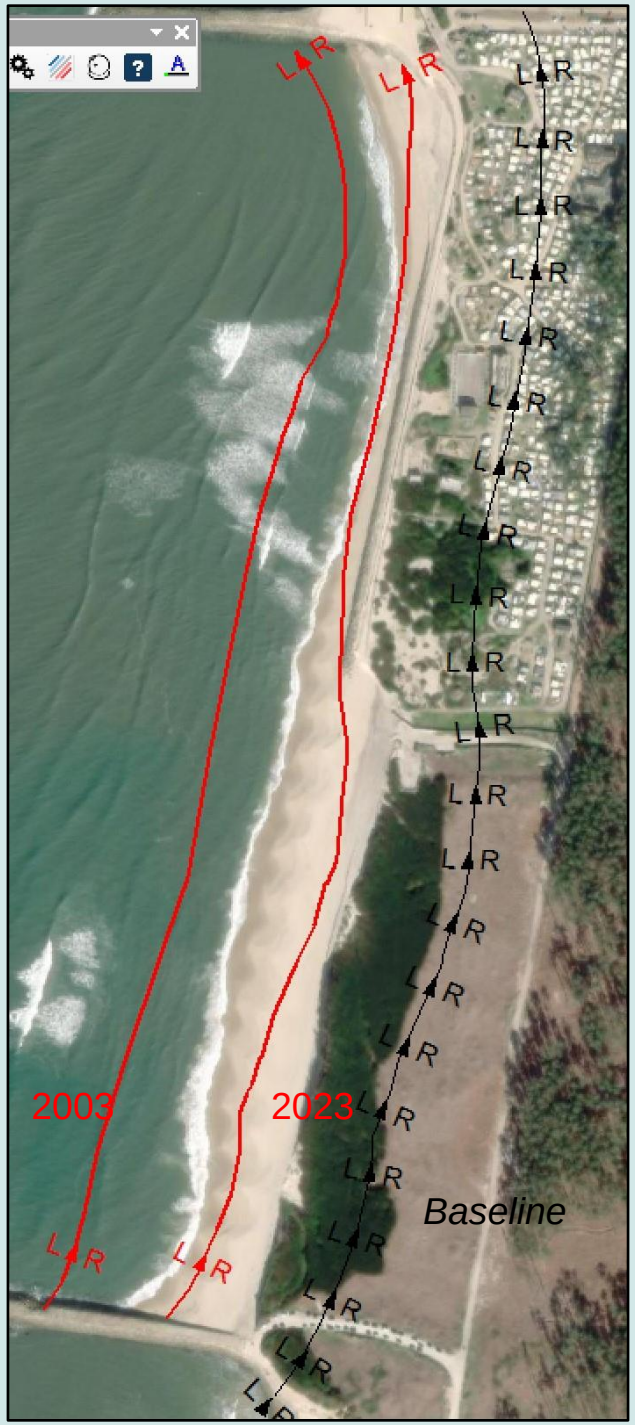
Field name	Data type	Attribute addition	DSAS requirement
OBJECTID	Object identifier	Autogenerated	Required
SHAPE	Geometry	Autogenerated	Required
SHAPE_Length	Double	Autogenerated	Required
DATE_(DSAS_date)[1]	Text (length=10 OR length=20)	User-created[1]	Required
UNCERTAINTY (DSAS_uncy)[1]	Any numeric field	User-created[1]	Required
SHORELINE_TYPE (DSAS_type)[1]	Text	User-created[1]	Optional (unless dataset includes the proxy-datum bias, in which case this field is required)

[1]These fields can be added using the Attribute Automator tool, described in **section 6.1**.

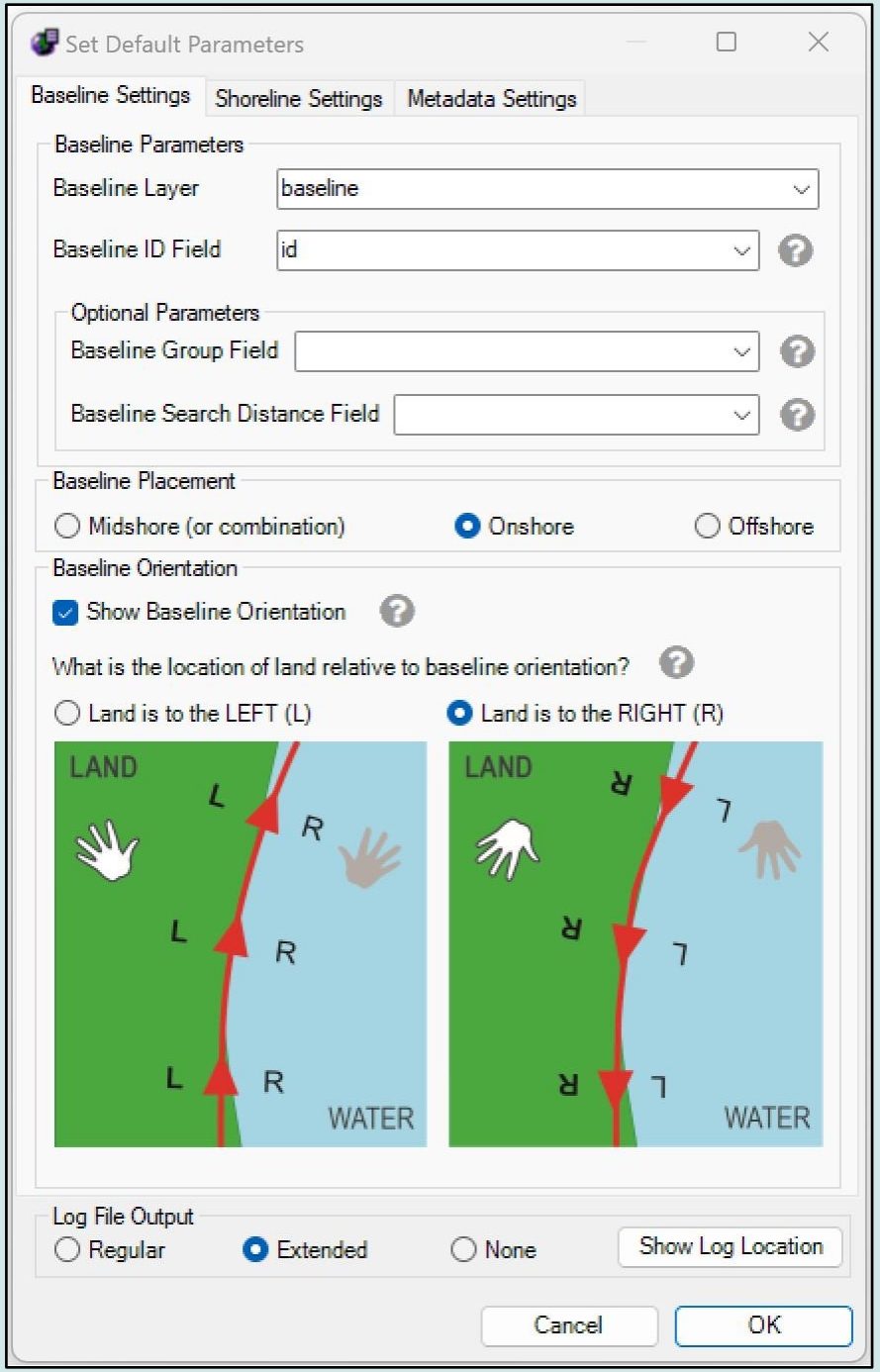
Baseline

Field name	Data type	Attribute addition	DSAS requirement
OBJECTID	Object identifier	Autogenerated	Required
SHAPE (alias: Shape)	Geometry	Autogenerated	Required
SHAPE_Length (alias: Shape_Leng)	Double	Autogenerated	Required
ID	Long integer	User-created	Required
Group (DSAS_group)	Long integer	User-created	Optional
Search_Distance (DSAS_search)	Double	User-created	Optional

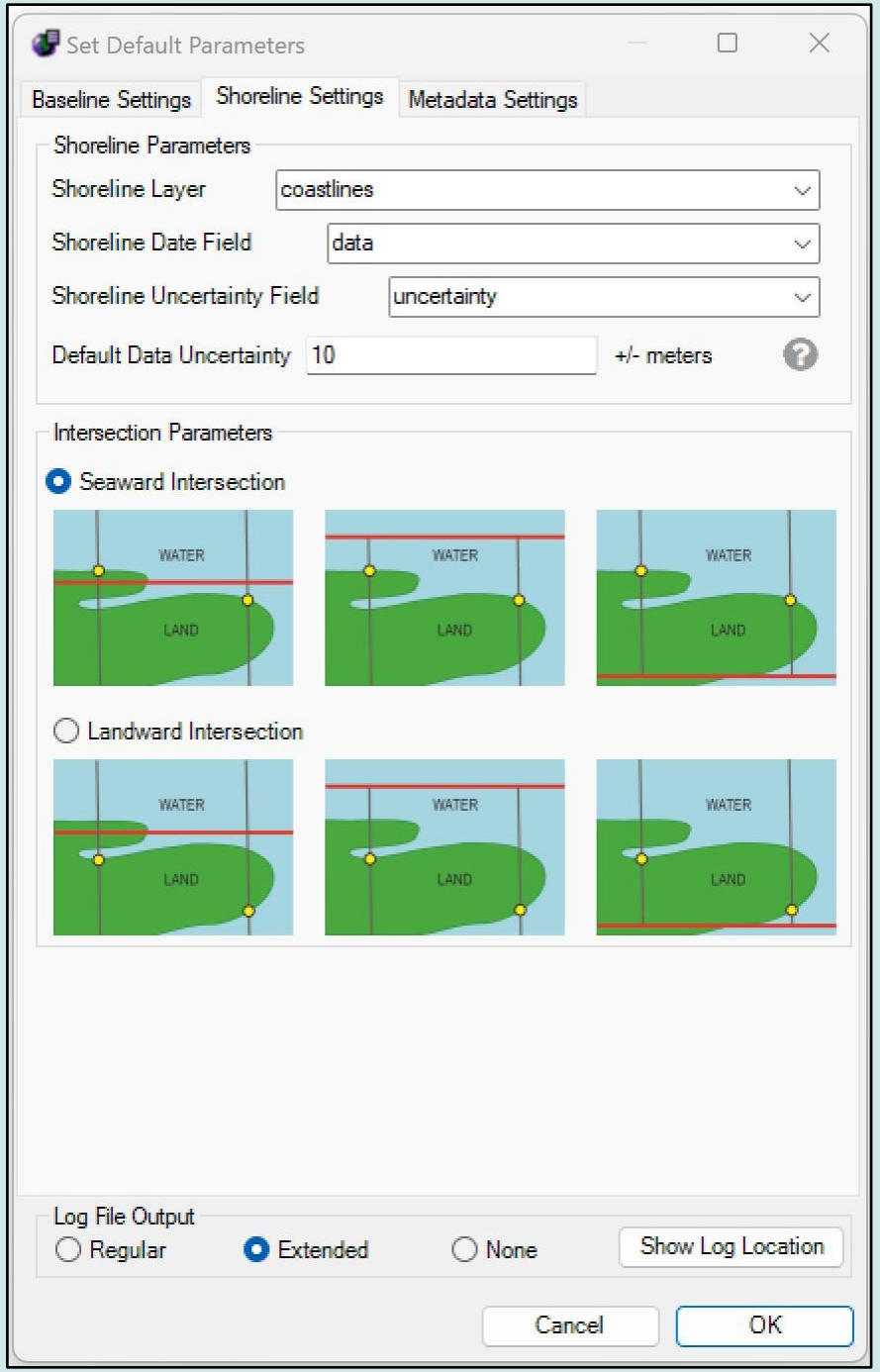
Linhas de costa
e *baseline*



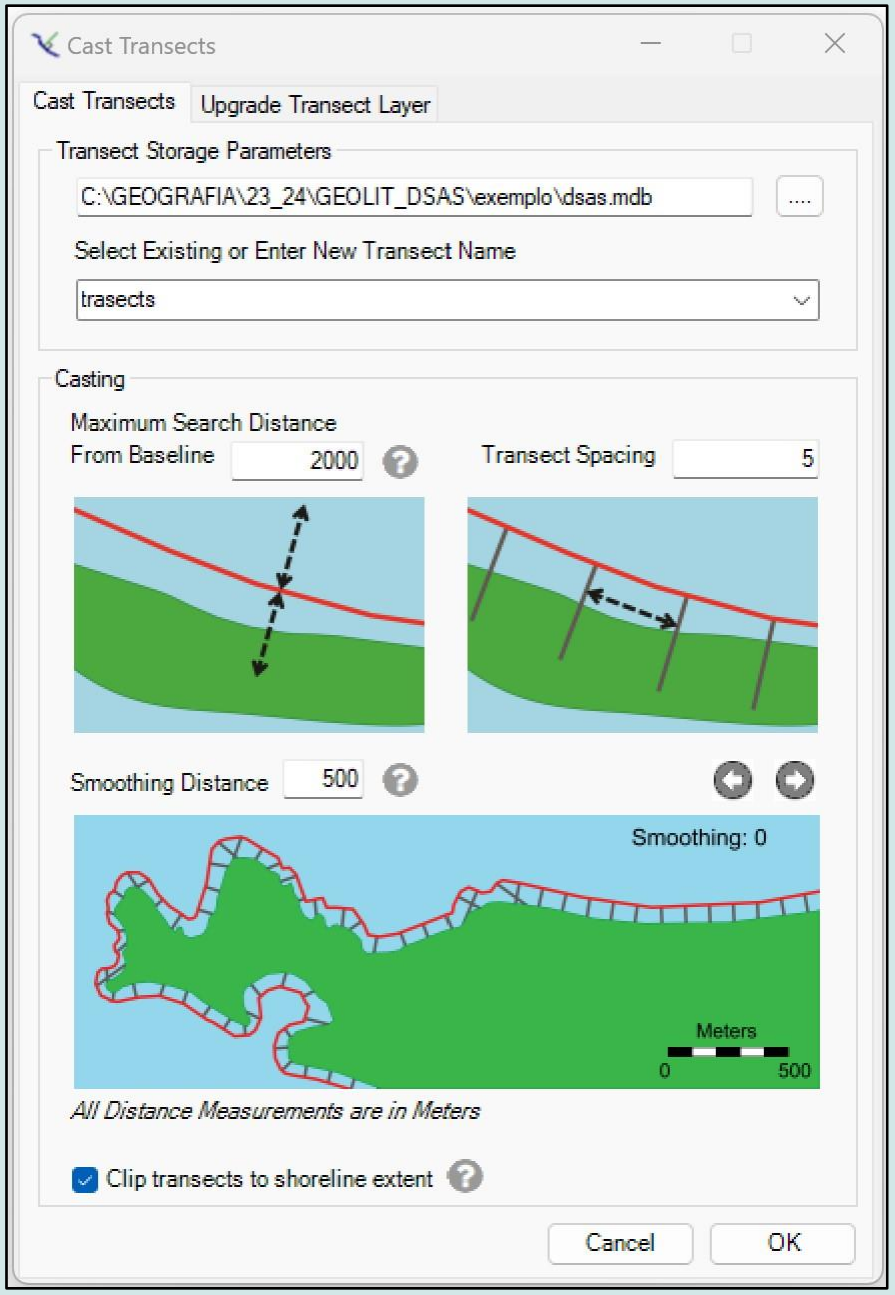
Linhas de costa

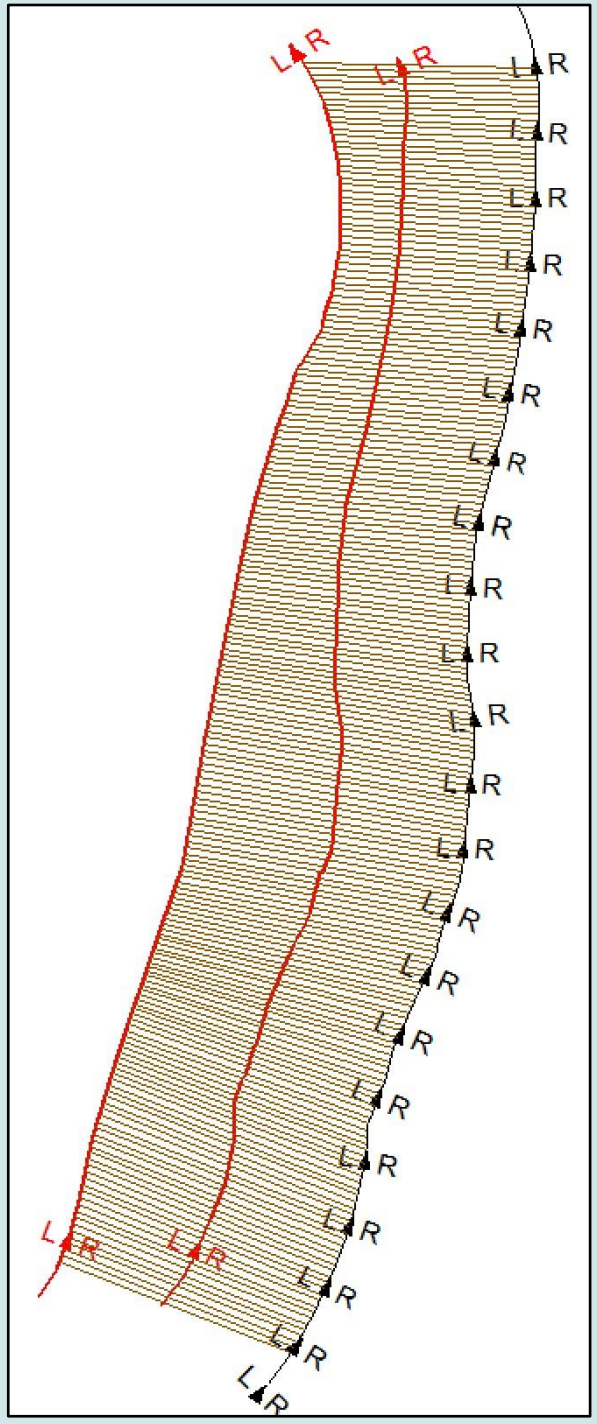


Baseline



Transects


Cast Transects
Cast Transects
Upgrade Transect Layer
Transect Storage Parameters
C:\GEOGRAFIA\23_24\GEOLIT_DSAS\exemplo\dsas.mdb
....
Select Existing or Enter New Transect Name
trasects
Casting
Maximum Search Distance
From Baseline
2000
Transect Spacing
5
Smoothing Distance
500
Smoothing: 0
Meters
0
500
All Distance Measurements are in Meters
Clip transects to shoreline extent
Cancel
OK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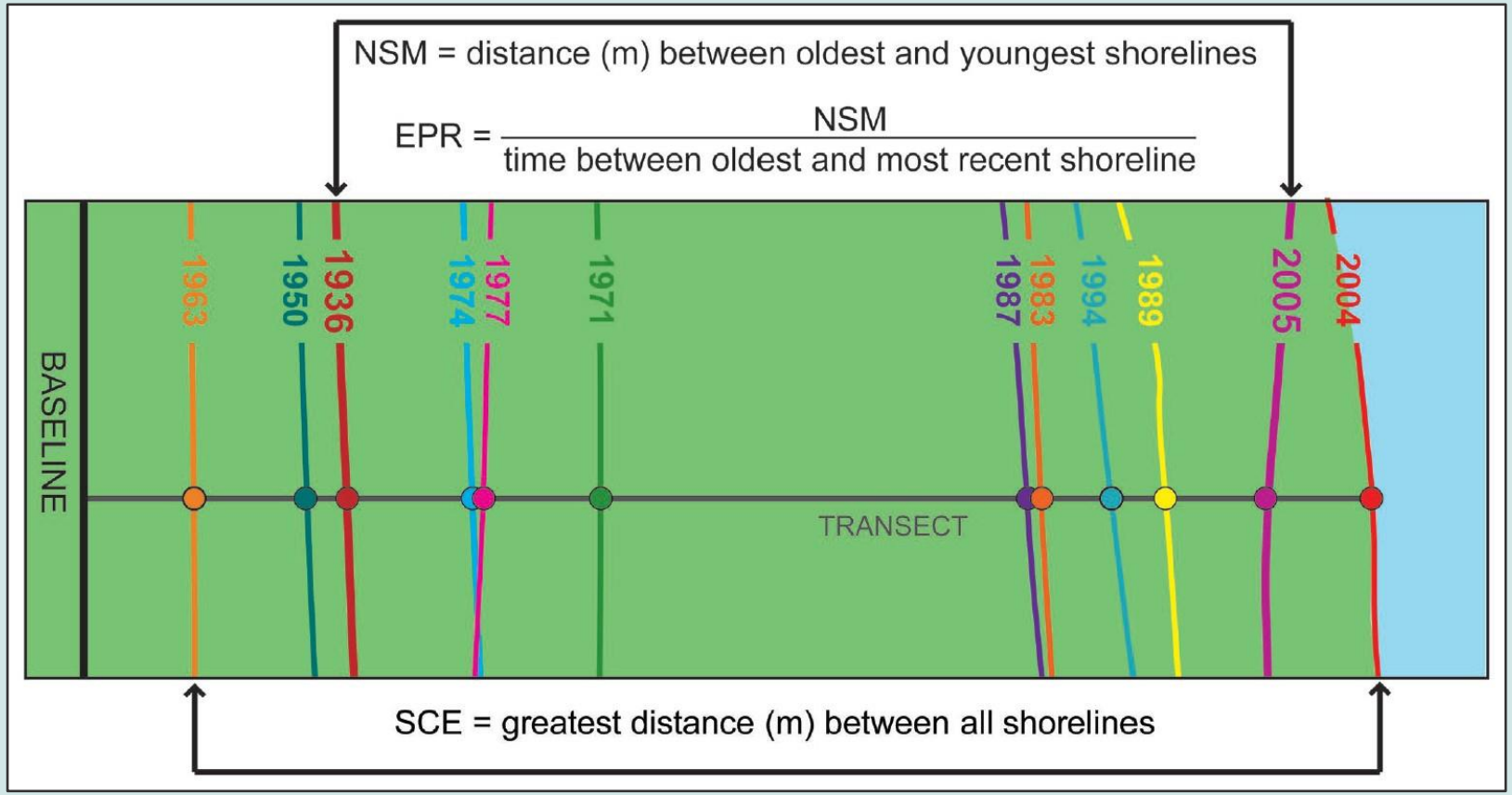
Índices

NSM – **Net Shoreline Movement**
Distância, em metros, entre a costa mais antiga e mais recente

SCE – **Shoreline Change Envolope**
Maior distância, em metros, entre duas linhas de costa

EPR – **End Point Rate**
Variação por ano. Obtido dividindo o NSM por número de anos.



Índices

NSM – **Net Shoreline Movement**
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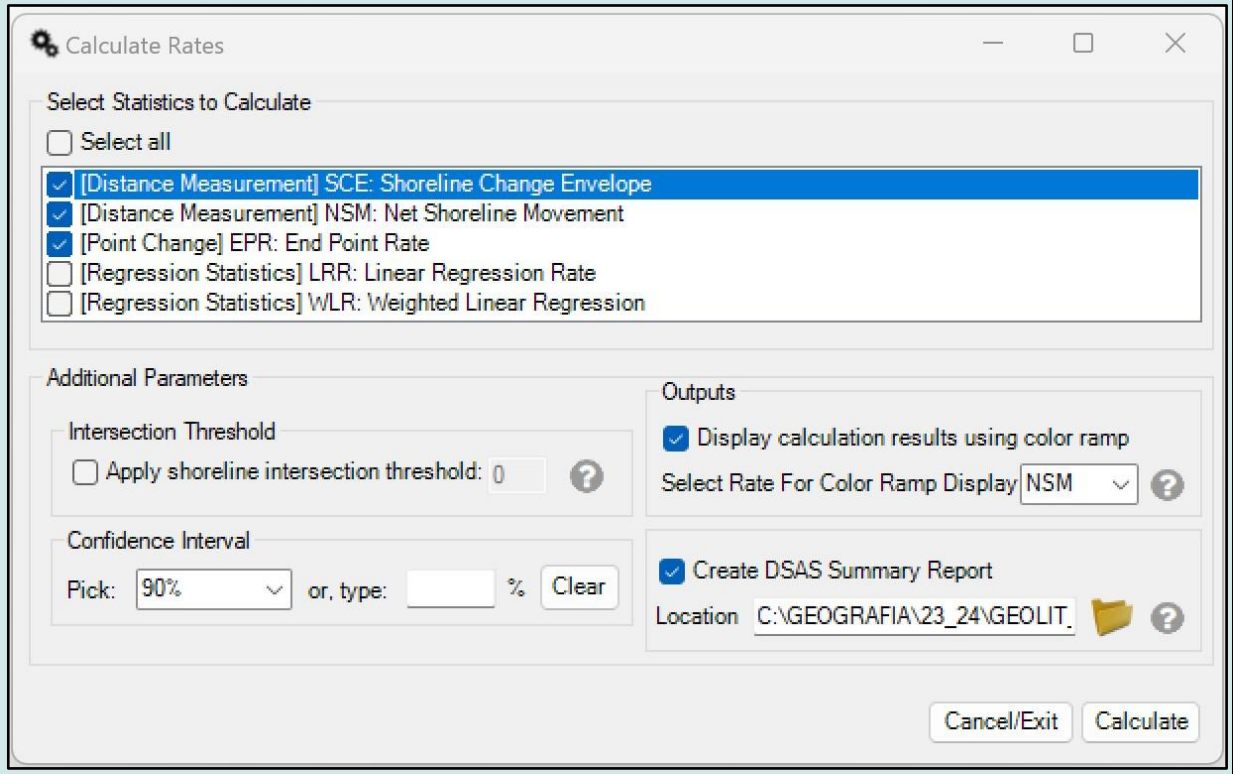
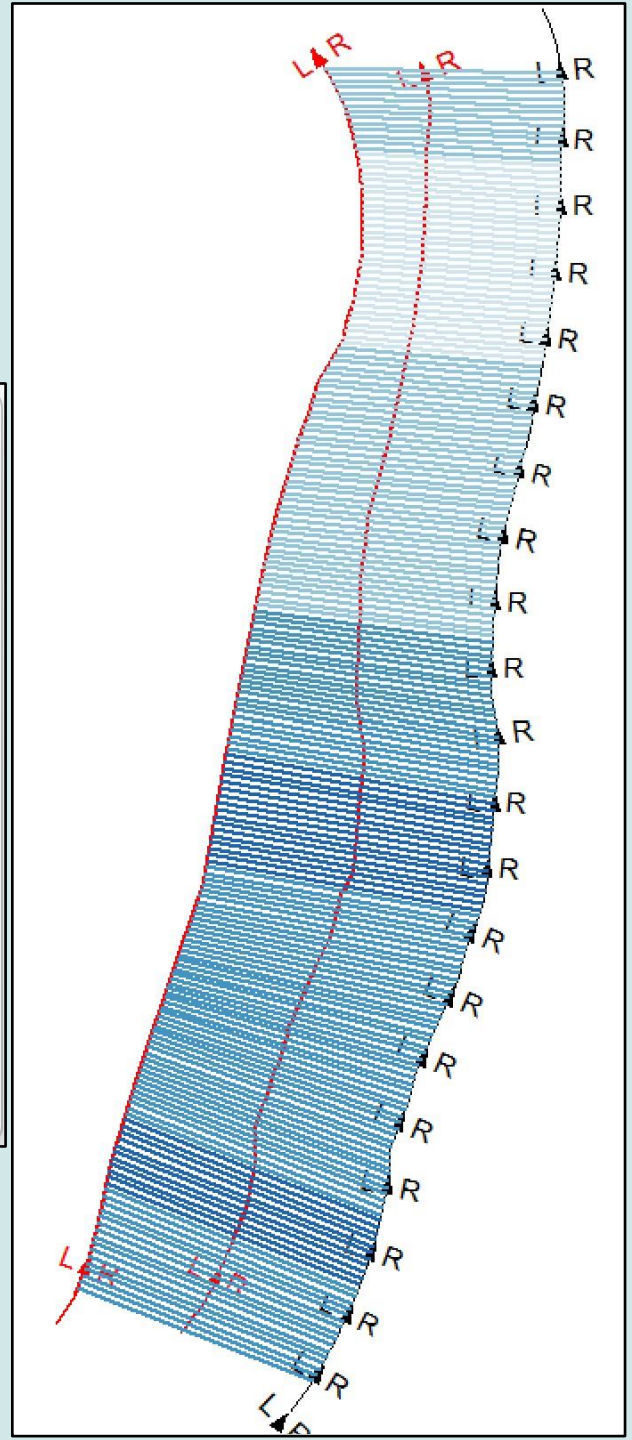


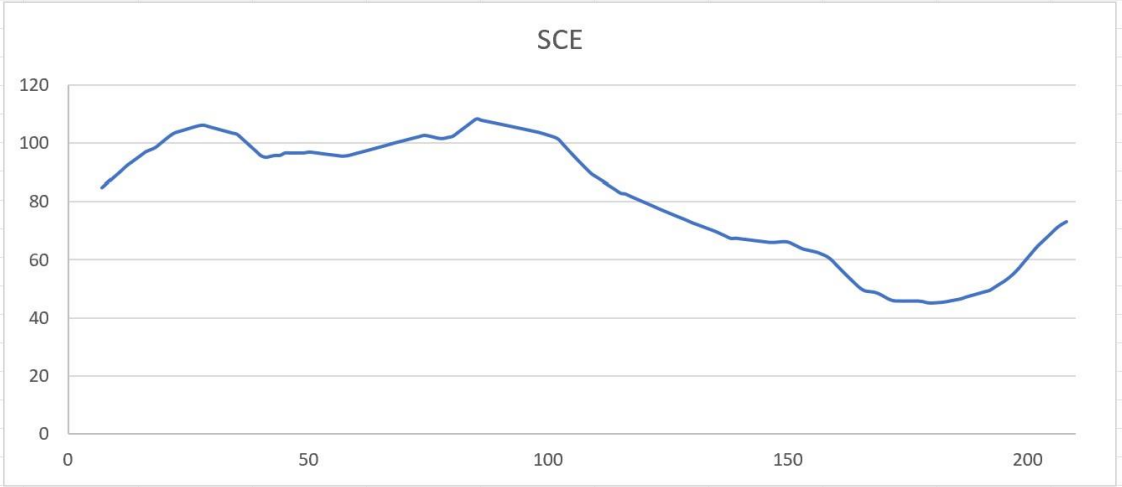


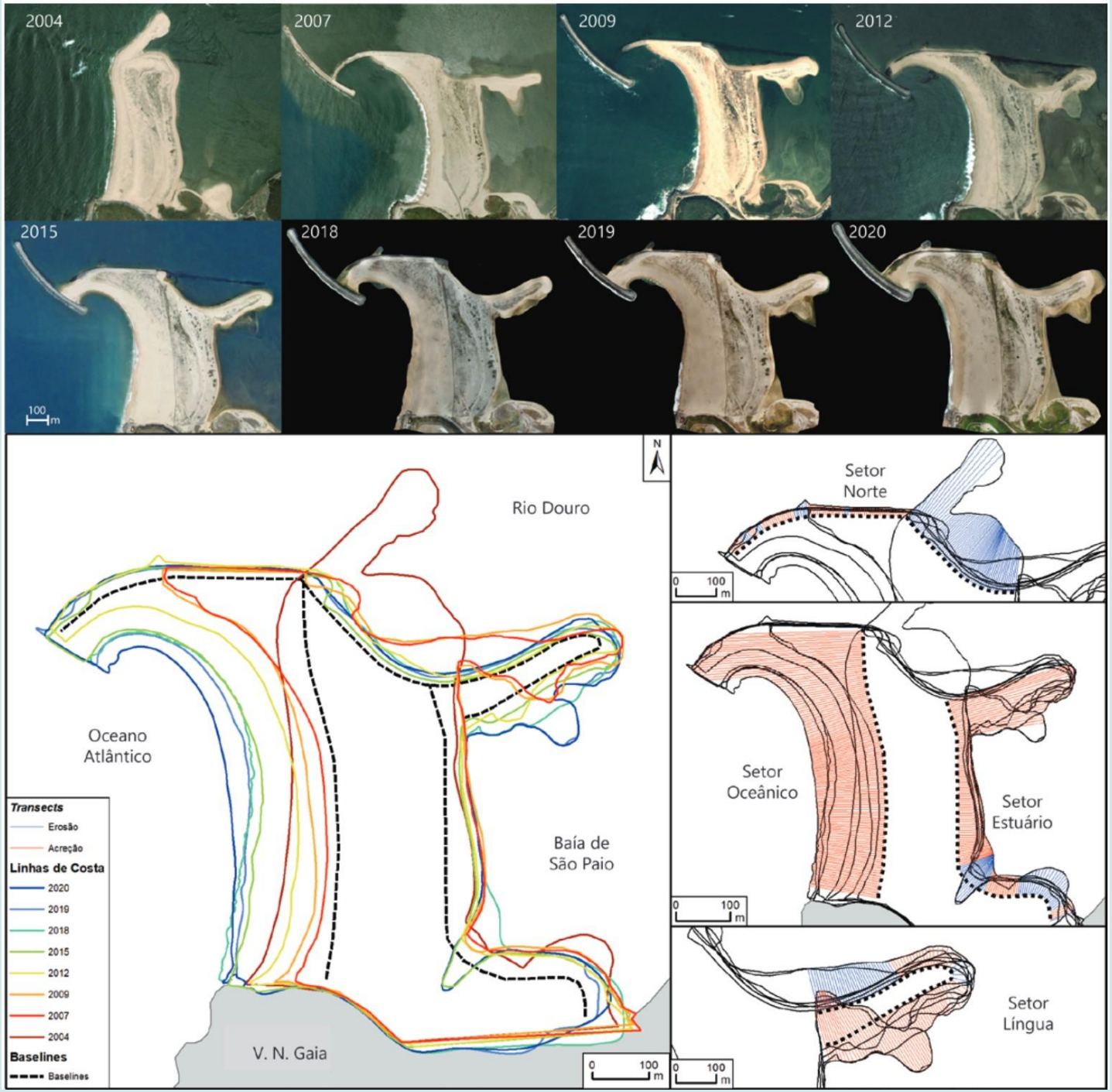
	geometry *	TransectID	BaselineID	GroupID	TransOrder	Azimuth	ShrCount	TCD	SHAPE_Length	SCE	NSM	EPR
▶	Polyline	7	1	<Null>	7	111.58	2	45	188.557019	84.91	-84.91	-4.29
	Polyline	8	1	<Null>	8	111.62	2	50	189.710737	86.35	-86.35	-4.37
	Polyline	9	1	<Null>	9	111.67	2	55	190.619834	87.8	-87.8	-4.44
	Polyline	10	1	<Null>	10	111.71	2	60	191.286424	89.25	-89.25	-4.51
	Polyline	11	1	<Null>	11	111.75	2	65	191.871125	90.71	-90.71	-4.59
	Polyline	12	1	<Null>	12	111.79	2	70	192.732163	92.25	-92.25	-4.67
	Polyline	13	1	<Null>	13	111.83	2	75	193.930103	93.46	-93.46	-4.73
	Polyline	14	1	<Null>	14	111.86	2	80	195.12768	94.66	-94.66	-4.79
	Polyline	15	1	<Null>	15	111.89	2	85	196.290464	95.86	-95.86	-4.85
	Polyline	16	1	<Null>	16	111.92	2	90	197.236625	97.06	-97.06	-4.91
	Polyline	17	1	<Null>	17	111.94	2	95	197.964571	97.74	-97.74	-4.94
	Polyline	18	1	<Null>	18	111.97	2	100	198.734822	98.51	-98.51	-4.98
	Polyline	19	1	<Null>	19	111.99	2	105	200.061934	99.84	-99.84	-5.05
	Polyline	20	1	<Null>	20	112.03	2	110	201.395819	101.18	-101.18	-5.12
	Polyline	21	1	<Null>	21	112.03	2	115	202.54746	102.49	-102.49	-5.18
	Polyline	22	1	<Null>	22	111.99	2	120	203.6075	103.52	-103.52	-5.24
	Polyline	23	1	<Null>	23	111.91	2	125	204.110141	104.03	-104.03	-5.26
	Polyline	24	1	<Null>	24	111.81	2	130	204.602507	104.53	-104.53	-5.29
	Polyline	25	1	<Null>	25	111.71	2	135	205.096489	105.03	-105.03	-5.31
	Polyline	26	1	<Null>	26	111.62	2	140	205.592085	105.53	-105.53	-5.34
	Polyline	27	1	<Null>	27	111.55	2	145	206.023822	105.97	-105.97	-5.36
	Polyline	28	1	<Null>	28	111.59	2	150	206.266115	106.17	-106.17	-5.37
	Polyline	29	1	<Null>	29	111.62	2	155	206.492624	105.72	-105.72	-5.35
	Polyline	30	1	<Null>	30	111.65	2	160	206.52048	105.26	-105.26	-5.32
	Polyline	31	1	<Null>	31	111.66	2	165	206.292351	104.81	-104.81	-5.3
	Polyline	32	1	<Null>	32	111.64	2	170	205.853387	104.36	-104.36	-5.28
	Polyline	33	1	<Null>	33	111.59	2	175	205.387744	103.91	-103.91	-5.26
	Polyline	34	1	<Null>	34	111.5	2	180	204.913004	103.46	-103.46	-5.23
	Polyline	35	1	<Null>	35	111.38	2	185	204.430434	103.02	-103.02	-5.21
	Polyline	36	1	<Null>	36	111.23	2	190	203.940844	101.62	-101.62	-5.14
	Polyline	37	1	<Null>	37	111.06	2	195	203.445587	100.12	-100.12	-5.06
	Polyline	38	1	<Null>	38	110.87	2	200	202.949843	98.63	-98.63	-4.99
	Polyline	39	1	<Null>	39	110.7	2	205	202.427311	97.14	-97.14	-4.91
	Polyline	40	1	<Null>	40	110.54	2	210	201.68699	95.66	-95.66	-4.84
	Polyline	41	1	<Null>	41	110.39	2	215	200.613466	95.12	-95.12	-4.81
	Polyline	42	1	<Null>	42	110.23	2	220	199.22916	95.45	-95.45	-4.83
	Polyline	43	1	<Null>	43	110.08	2	225	197.619008	95.77	-95.77	-4.84
	Polyline	44	1	<Null>	44	109.93	2	230	196.47343	95.79	-95.79	-4.85
	Polyline	45	1	<Null>	45	109.79	2	235	196.603237	96.6	-96.6	-4.89
	Polyline	46	1	<Null>	46	109.65	2	240	196.606413	96.6	-96.6	-4.89

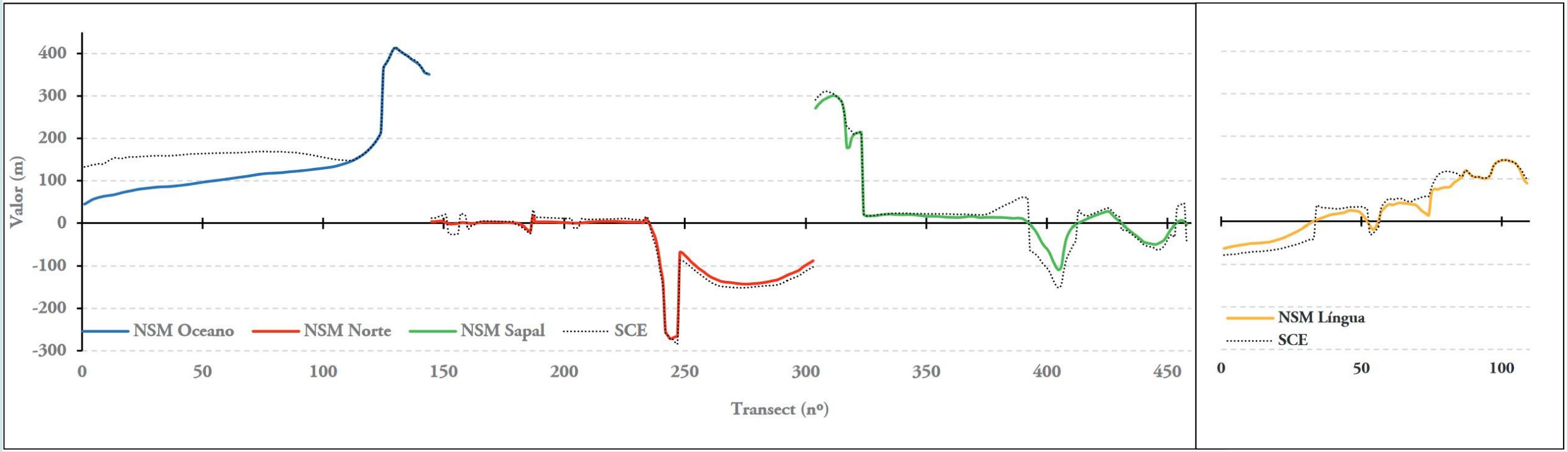
```
DISTANCE: SCE (Shoreline Change Envelope, m)

SCE OVERALL AVERAGES:
total number of transects: 202
average distance: 81.53
maximum distance: 108.33
maximum distance transect ID: 85
minimum distance: 45.27
minimum distance transect ID: 180


DISTANCE: NSM (Net Shoreline Movement, m)

NSM OVERALL AVERAGES:
total number of transects: 202
average distance: -81.53
number of transects with negative distance: 202
percent of all transects that have a negative distance: 100%
maximum negative distance: -108.33
maximum negative distance transect ID: 85
average of all negative distances: -81.53
number of transects with positive distance: 0
percent of all transects that have a positive distance: 0%
maximum positive distance:
maximum positive distance transect ID:
average of all positive distances:


RATE: EPR (End Point Rate, m/yr)

EPR OVERALL AVERAGES:
total number of transects: 202
average rate: -4.12
average of the confidence intervals associated with rates: 0.72
reduced n (number of independent transects): 1
uncertainty of the average rate using reduced n: 0.72
average rate with reduced n uncertainty: -4.12 +/- 0.72

number of erosional transects: 202
percent of all transects that are erosional: 100%
percent of all transects that have statistically significant erosion: 100%
maximum value erosion: -5.48
maximum value erosion transect ID: 85
average of all erosional rates: -4.12

number of accretional transects: 0
percent of all transects that are accretional: 0%
percent of all transects that have statistically significant accretion: 0%
```

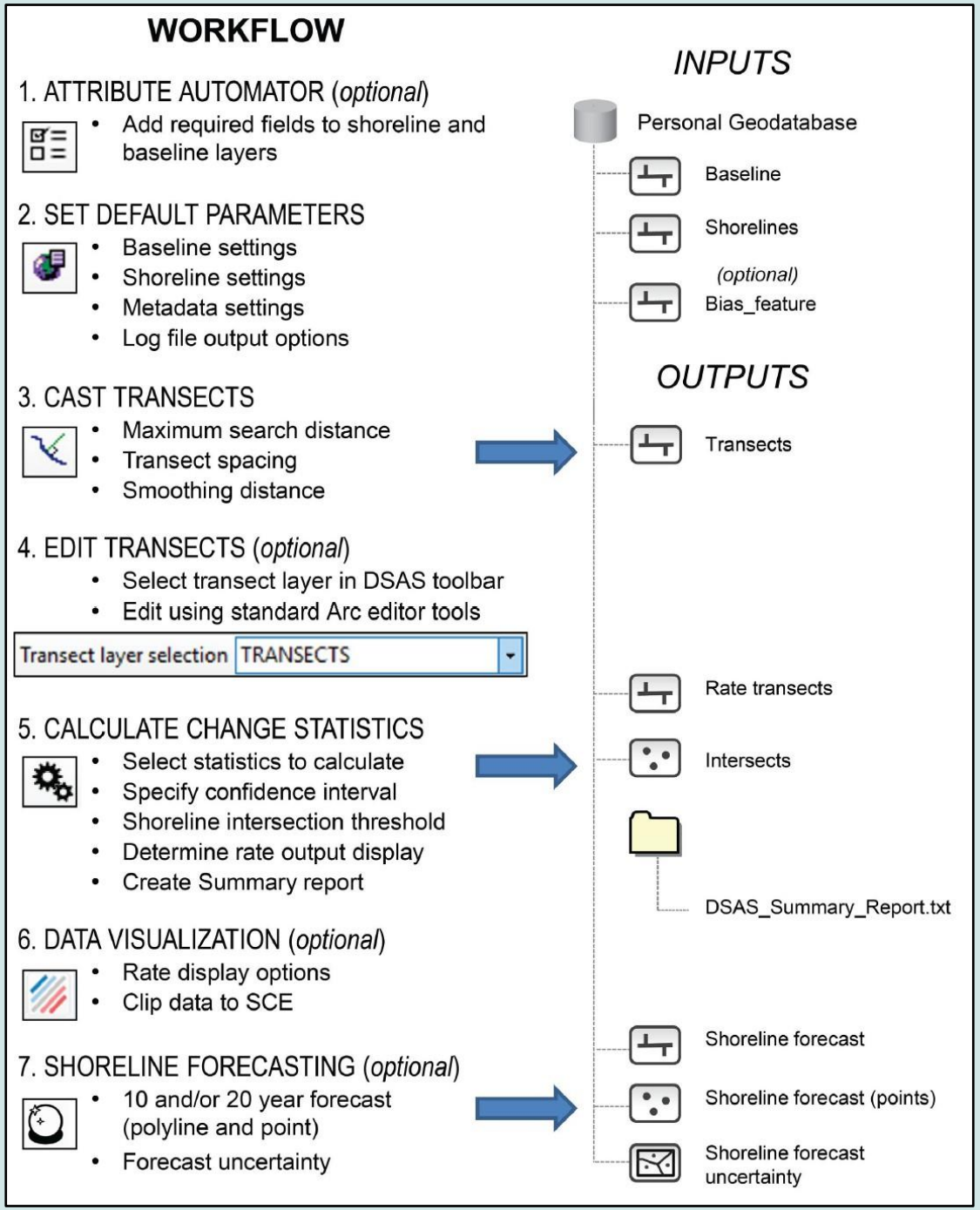
Podemos exportar a tabela para construir gráficos

TransectID	SCE	NSM	EPR
7	84.91	-84.91	-4.29
8	86.35	-86.35	-4.37
9	87.8	-87.8	-4.44
10	89.25	-89.25	-4.51
11	90.71	-90.71	-4.59
12	92.25	-92.25	-4.67
13	93.46	-93.46	-4.73
14	94.66	-94.66	-4.79
15	95.86	-95.86	-4.85
16	97.06	-97.06	-4.91
17	97.74	-97.74	-4.94
18	98.51	-98.51	-4.98
19	99.84	-99.84	-5.05
20	101.18	-101.18	-5.12
21	102.49	-102.49	-5.18
22	103.52	-103.52	-5.24
23	104.03	-104.03	-5.26
24	104.53	-104.53	-5.29
25	105.03	-105.03	-5.31
26	105.53	-105.53	-5.34
27	105.97	-105.97	-5.36
28	106.17	-106.17	-5.37
29	105.72	-105.72	-5.35
30	105.26	-105.26	-5.32
31	104.81	-104.81	-5.3
32	104.36	-104.36	-5.28
33	103.91	-103.91	-5.26
34	103.46	-103.46	-5.23
35	103.02	-103.02	-5.21
36	101.62	-101.62	-5.14
37	100.12	-100.12	-5.06
38	98.63	-98.63	-4.99
39	97.14	-97.14	-4.91
40	95.66	-95.66	-4.84
41	95.12	-95.12	-4.81




2004
2007
2009
2012
2015
2018
2019
2020
100 m
N
Rio Douro
Oceano Atlântico
Baía de São Paio
V. N. Gaia
Transects
Erosão
Acreção
Linhas de Costa
2020
2019
2018
2015
2012
2009
2007
2004
Baselines
Baselines
0 100 m
Setor Norte
Setor Oceânico
Setor Estuário
Setor Língua


400
300
200
100
0
-100
-200
-300
Valor (m)
NSM Oceano
NSM Norte
NSM Sapal
SCE
0
50
100
150
200
250
300
350
400
450
Transect (nº)
NSM Língua
SCE
0
50
100


WORKFLOW
1. ATTRIBUTE AUTOMATOR (optional)
• Add required fields to shoreline and baseline layers
2. SET DEFAULT PARAMETERS
• Baseline settings
• Shoreline settings
• Metadata settings
• Log file output options
3. CAST TRANSECTS
• Maximum search distance
• Transect spacing
• Smoothing distance
4. EDIT TRANSECTS (optional)
• Select transect layer in DSAS toolbar
• Edit using standard Arc editor tools
Transect layer selection
TRANSECTS
5. CALCULATE CHANGE STATISTICS
• Select statistics to calculate
• Specify confidence interval
• Shoreline intersection threshold
• Determine rate output display
• Create Summary report
6. DATA VISUALIZATION (optional)
• Rate display options
• Clip data to SCE
7. SHORELINE FORECASTING (optional)
• 10 and/or 20 year forecast (polyline and point)
• Forecast uncertainty
INPUTS
Personal Geodatabase
Baseline
Shorelines
(optional)
Bias_feature
OUTPUTS
Transects
Rate transects
Intersects
DSAS_Summary_Report.txt
Shoreline forecast
Shoreline forecast (points)
Shoreline forecast uncertainty