# 04\_Hierarchical\_clustering

March 27, 2020

## 1 Hierarchical agglomerative clustering of cases

Computational notebook 04 for NAME Dal Cin, Fleischmann.. - ADD Reference.

Contact: martin@martinfleischmann.net

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This notebooks standardize contextual characters and generates hierarchical clustering using Ward's method.

The only input required is summative\_data.csv generated by 03\_Calculate\_contextual\_characters.ipynb.

```
[3]: import matplotlib
import matplotlib.pyplot as plt
import pandas as pd
import sklearn
from sklearn import preprocessing
import scipy as sp
from scipy.cluster import hierarchy
```

```
[19]: sklearn.__version__, sp.__version__, pd.__version__, matplotlib.__version__
```

```
[19]: ('0.22.2.post1', '1.4.1', '1.0.3', '3.2.1')
```

```
[5]: path = 'data/summative_data.csv'
data = pd.read_csv(path, index_col=0)
```

```
[14]: data
```

```
sdbAre_rangeIQ
Γ14]:
                                                        sdbAre_TheilID
                                                                         sdbPer meanIQ
                        sdbAre meanIQ
      foz
                             0.145669
                                              0.074895
                                                               0.193100
                                                                               0.525362
      aguda
                            -0.690154
                                             -0.615406
                                                              -0.330468
                                                                              -0.622020
      esposende
                             1.115875
                                              0.587245
                                                              -0.074543
                                                                               1.378664
      espinho
                            -0.488655
                                             -0.837593
                                                              -1.292406
                                                                              -0.390449
      povoa
                             0.236331
                                             -0.456906
                                                              -1.022082
                                                                               0.668069
      vila_do_conde
                            -0.641281
                                             -0.900349
                                                              -0.805594
                                                                              -0.418497
```

vila_praia	-0.236344	-0.309269	-0.563741	-0.073743
costa_nova	-0.308560	-0.464835	-0.476125	-0.101839
praia_mira	-0.156279	-0.156343	-0.156052	-0.096126
palheiros1	0.901566	-0.200327	-1.192465	0.846955
palheiros2	-0.593671	-0.946392	-1.562552	-0.718485
palheiros3	-0.598359	-0.786099	-0.937243	-0.772217
figueira_foz1	-1.098891	-0.959705	-0.561010	-1.332771
figueira_foz2	-0.619773	-0.573249	0.031223	-0.646134
figueira_foz3	0.493904	0.614052	0.684350	0.564935
pedrogao	0.473856	0.596048	0.288538	0.477814
sao_martinho	1.139194	0.844062	0.246320	1.140482
ericeira	-0.646403	-0.776185	-0.811816	-0.660839
azenhas	-0.875571	-0.925823	-1.115090	-1.022967
quaios	0.133678	0.468040	0.606887	0.268789
vieira1	-0.901778	-0.933488	-0.923896	-1.109101
vieira2	0.476182	0.413256	0.350032	0.545655
foradouro	-0.164652	-0.269247	-0.527675	0.071673
nazare1	-0.872834	-1.048490	-1.377594	-1.123900
nazare2	2.932040	3.700397	1.741189	2.587010
cascais	-0.750294	-0.182028	1.516532	-0.824684
costa_caparica	-0.592074	0.072117	1.793385	-0.648654
praia_corvoeiro	-1.041269	-0.529299	0.742258	-1.237639
zambujeira	-0.600126	-0.485447	-0.090612	-0.740082
sesimbra	-0.867133	-0.897043	-0.682418	-1.035329
armacao	0.304595	1.462163	2.373260	0.332502
olhao	-0.003125	0.869389	1.797273	0.096579
monte_gordo	2.723822	1.277364	-0.296739	2.442285
albufeira	-0.638526	-0.269896	1.089003	-0.702064
faro	-0.104699	0.226760	0.994317	0.122445
quarteira	2.413738	2.317628	0.352456	2.208322
quarterra	2.410700	2.317020	0.332430	2.200522
	sdbPer_rangeIQ	sdbPer_TheilID	ssbCCo_meanIQ	\
foz	0.350970	0.224825	-1.582175	`
	-0.285571	0.065931	-1.052284	
aguda	0.714241	0.637960	-0.652857	
esposende	-0.837013	-1.101580	-0.588273	
espinho				
povoa	-0.988813	-1.366325	-2.686536	
vila_do_conde	-0.874376	-0.637180	-2.273327	
vila_praia	-0.406707	-0.725052	-0.558345	
costa_nova 	-0.228026	-0.358866	-1.124209	
praia_mira	0.027534	-0.099592	0.255449	
palheiros1	-0.757842	-1.256083	1.682114	
palheiros2	-1.226491	-1.438577	1.202416	
palheiros3	-1.024424	-1.023904	1.762862	
figueira_foz1	-0.970175	-0.523551	-0.291106	
figueira_foz2	-0.384762	-0.045132	-0.091578	
figueira_foz3	0.532740	0.613300	0.016107	

pedrogao	0.542392	0.219599	0.697154		
sao_martinho	0.848636	0.452623	0.025071		
ericeira	-0.846296	-0.686899	-0.001176		
azenhas	-1.045405	-1.040783	0.018076		
quaios	0.763578	0.709374	0.884984		
vieira1	-0.990776	-0.844770	1.284124		
vieira2	0.719786	0.450407	1.173539		
foradouro	-0.462550	-0.801038	-0.862021		
nazare1	-1.456273	-1.420101	1.414961		
nazare2	3.142604	1.970070	-0.530249		
cascais	0.193065	1.181609	-0.243466		
costa_caparica	0.595914	1.564967	0.438035		
praia_corvoeiro	-0.408792	0.393931	-0.095620		
zambujeira	-0.428670	-0.328774	1.030106		
sesimbra	-1.004221	-0.681124	0.306456		
armacao	1.654776	2.141651	0.624147		
olhao	1.520997	2.022318	-0.109315		
monte_gordo	0.272042	-0.690248	0.203878		
albufeira	0.079461	1.097082	-0.070199		
faro	0.804126	1.145030	-0.776799		
quarteira	1.864321	0.178903	0.570057		
	1·00				,
foz	ssbCCo_rangeIQ 1.289722	ssbCCo_TheilID 1.625614	ssbCor_meanIQ 1.418570	•••	\
aguda	0.651961	0.757708	0.178081		
esposende	1.004727	2.057803	3.159203		
espinho	0.393074	0.295110	-0.233439		
povoa	1.250063	1.949153	-0.219334		
vila_do_conde	1.609617	1.781211	-1.563553		
vila_praia	-0.296443	-0.394528	0.348525		
costa_nova	1.882528	2.021040	-0.371011	•••	
praia_mira	0.101699	-0.231061	-0.226495		
palheiros1	-2.462428	-1.518385	-0.612414		
palheiros2	-1.735955	-1.567289	-1.563553		
palheiros3	-2.239058	-1.561990	-1.563553		
figueira_foz1	-0.024027	-0.210634	0.157251		
figueira_foz2	0.318859	0.021771	-0.354524		
figueira_foz3	0.507669	0.293725	0.259799		
pedrogao		0.200.20			
sao_martinho	-0.798909	-0.824334	-0.063065		
ericeira	-0.798909	-0.824334	-0.063065		
ericeira azenhas	-0.798909 -0.003693	-0.824334 -0.331330	-0.063065 -0.097306		
	-0.798909 -0.003693 -0.077809	-0.824334 -0.331330 -0.542039	-0.063065 -0.097306 0.887174		
azenhas	-0.798909 -0.003693 -0.077809 0.165658	-0.824334 -0.331330 -0.542039 -0.068862	-0.063065 -0.097306 0.887174 -0.197032		
azenhas quaios	-0.798909 -0.003693 -0.077809 0.165658 -1.133161	-0.824334 -0.331330 -0.542039 -0.068862 -0.614224	-0.063065 -0.097306 0.887174 -0.197032 -0.533963		
azenhas quaios vieira1	-0.798909 -0.003693 -0.077809 0.165658 -1.133161 -1.117329	-0.824334 -0.331330 -0.542039 -0.068862 -0.614224 -1.099133	-0.063065 -0.097306 0.887174 -0.197032 -0.533963 -0.233782		
azenhas quaios vieira1 vieira2	-0.798909 -0.003693 -0.077809 0.165658 -1.133161 -1.117329 -0.491948	-0.824334 -0.331330 -0.542039 -0.068862 -0.614224 -1.099133 -0.465432	-0.063065 -0.097306 0.887174 -0.197032 -0.533963 -0.233782 -0.050995		

	0 500000	0 004000	0 720700	
nazare2	0.589902	-0.004860	-0.738789	•••
cascais	0.274451	-0.000360	0.823353	•••
costa_caparica	0.427505	0.150223	-0.373019	•••
praia_corvoeiro	0.182786	-0.422794	0.126041	•••
zambujeira	-0.495271	-0.561681	-1.563553	•••
sesimbra	-0.358866	-0.746685	-0.346469	•••
armacao	-0.089550	-0.478580	1.316718	•••
olhao	0.131751	0.379221	0.207481	•••
monte_gordo	-0.118474	-0.320397	0.986175	•••
albufeira	-0.051202	-0.400535	0.123464	•••
faro	0.668719	0.956021	1.998350	•••
quarteira	0.268025	0.153340	1.011813	
-				
	lskElo_TheilID	likGra_meanIQ	likGra_rangeIQ	\
foz	-0.500558	-0.697226	-0.574718	
aguda	-0.646004	0.214105	0.671245	
esposende	-0.925142	-1.415258	-1.361038	
espinho	0.459406	0.392503	-0.281639	
povoa	0.831341	-0.326971	-0.628027	
vila_do_conde	-0.070472	-0.198830	-0.096624	
vila_do_conde vila_praia	0.939187	-0.260624	-0.311059	
<del>-</del>	-0.538544	-0.190119	-0.892778	
costa_nova				
praia_mira	0.443046	-0.254146	0.846564	
palheiros1	-1.134958	-1.130611	-1.233345	
palheiros2	-1.111674	0.451276	-1.219248	
palheiros3	0.420562	0.327512	1.565384	
figueira_foz1	-0.362172	2.800785	1.680444	
figueira_foz2	-0.867828	0.451542	0.806984	
figueira_foz3	-0.223815	-0.165446	0.422766	
pedrogao	0.410632	-0.797134	0.363970	
sao_martinho	1.690686	-1.079796	-0.891570	
ericeira	0.834854	0.976562	-0.733056	
azenhas	-1.307642	0.061480	-0.616883	
quaios	0.386376	-1.153721	-1.112917	
vieira1	0.404325	1.028746	0.578978	
vieira2	0.820905	-1.090640	-0.400422	
foradouro	-1.055496	-0.255042	-1.179590	
nazare1	3.521481	1.801182	1.051530	
nazare2	-0.431192	-1.463759	-1.199687	
cascais	-0.369707	1.307384	1.440742	
costa_caparica	-0.296671	-0.377394	-0.668649	
praia_corvoeiro	-0.140697	0.616143	-0.136710	
zambujeira	-0.593274	0.407838	1.463611	
sesimbra	-0.329867	2.168130	0.999789	
armacao	-0.526223	-0.455090	0.459516	
olhao	0.128509	0.893664	2.465878	
monte_gordo	2.307504	-1.259007	-0.643967	
	2.007004	1.200001	0.040001	

albufeira 2.063143 -0.475239 0.570500 faro -0.494007 -1.505744 1.189653 quarteira -0.293754 -1.228314 0.129756 meshedness_TheilID sdsLen_meanIQ sdsLen_rangeIQ \	quarteira         -1.057200         -1.339946         -1.028204           foz         -0.106314         0.653276         1.034210           aguda         0.384864         3.105235         -0.506306           esposende         -0.732511         -0.493201         0.752514           espinho         -0.869100         1.332040         1.199922           povoa         -0.925107         0.984730         -1.043610           vila_do_conde         -0.492363         0.275276         -1.016189           vila_praia         -0.872127         0.670659         0.543844           costa_nova         -0.955551         1.154867         -0.38370           praia mira         0.523876         0.986359         0.08466           palheiros1         -1.014853         -1.174709         -0.805875           palheiros2         -1.325050         -1.045194         -0.638967           palheiros3         1.780842         -1.007964         -1.228614           figueira_foz1         -0.874055         0.008264         -0.295389           figueira_foz2         0.260599         -0.855275         0.288392           figueira_foz3         1.284578         0.516899         -0.656976           pedroga	albufeira	-0.114712	0.174255	0.945155	
	Toz	faro	-0.994964	-0.162346	-0.552422	
foz	foz         -0.106314         0.653276         1.034210           aguda         0.384864         3.105235         -0.506306           esposende         -0.732511         -0.493201         0.752514           espinho         -0.869100         1.332040         1.199922           povoa         -0.925107         0.984730         -1.043610           vila_praia         -0.872127         0.670659         0.543844           costa_nova         -0.955551         1.154867         -0.383700           praia_mira         0.523876         0.986359         0.098466           palheiros1         -1.014853         -1.174709         -0.805875           palheiros2         -1.325050         -1.045194         -0.639867           palheiros3         1.780842         -1.007964         -1.228614           figueira_foz1         -0.874055         0.008264         -0.295389           figueira_foz3         1.284578         0.516899         -0.855275         0.28392           figueira_foz3         1.284578         0.516899         -0.656976           pedrogao         1.059512         0.285272         0.28392           figueira_foz3         1.284578         0.516899         -0.556976 <tr< td=""><td>quarteira</td><td>-1.057200</td><td>-1.339946</td><td>-1.028204</td><td></td></tr<>	quarteira	-1.057200	-1.339946	-1.028204	
foz	foz         -0.106314         0.653276         1.034210           aguda         0.384864         3.105235         -0.506306           esposende         -0.732511         -0.493201         0.752514           espinho         -0.869100         1.332040         1.199922           povoa         -0.925107         0.984730         -1.043610           vila_praia         -0.872127         0.670659         0.543844           costa_nova         -0.955551         1.154867         -0.383700           praia_mira         0.523876         0.986359         0.098466           palheiros1         -1.014853         -1.174709         -0.805875           palheiros2         -1.325050         -1.045194         -0.639867           palheiros3         1.780842         -1.007964         -1.228614           figueira_foz1         -0.874055         0.008264         -0.295389           figueira_foz3         1.284578         0.516899         -0.855275         0.28392           figueira_foz3         1.284578         0.516899         -0.656976           pedrogao         1.059512         0.285272         0.28392           figueira_foz3         1.284578         0.516899         -0.556976 <tr< td=""><td></td><td></td><td></td><td></td><td></td></tr<>					
aguda 0.384864 3.105235 -0.506306 esposende -0.732511 -0.493201 0.752514 espinho -0.869100 1.332040 1.199922 povoa -0.925107 0.984730 -1.043610 vila_do_conde -0.492363 0.275276 -1.016189 vila_praia -0.872127 0.670659 0.543844 costa_nova -0.955551 1.154867 -0.383700 praia_mira 0.523876 0.986359 0.098466 palheiros1 -1.014853 -1.174709 -0.805875 palheiros2 -1.325050 -1.045194 -0.638967 palheiros3 1.780842 -1.007964 -1.228614 figueira_foz1 -0.874055 0.008264 -0.295389 figueira_foz2 0.260599 -0.855275 0.288392 figueira_foz2 1.284578 0.516899 -0.656976 pedrogao 1.059512 0.285523 1.497316 sao_martinho 0.740992 0.696023 -0.853814 ericeira -1.168394 0.016498 2.084130 azenhas -1.119369 -1.739709 -1.548973 quaios -0.715410 -0.571928 -1.107820 vieira1 -0.304447 0.989722 -0.151493 vieira2 0.448504 0.965242 -1.680004 foradouro -1.181150 0.517357 0.288544 nazare1 -0.777983 -1.115521 1.923833 nazare2 1.299911 -0.703578 -0.804982 cascais 0.624743 -0.072762 -0.500818 armacao 0.548043 -0.997355 2.411589 monte_gordo 1.032281 -0.999335 2.411589 monte_gordo 1.032281 -0.999335 2.411589 monte_gordo 0.478139 0.108114 -0.023688 albufeira 2.063143 -0.475239 0.570500 faro -0.494007 -1.505744 1.189653 quarteira -0.293754 -1.228314 0.129756	aguda 0.384864 3.105235		${\tt likGra\_TheilID}$	${\tt meshedness\_meanIQ}$	meshedness_rangeIQ	\
esposende	esposende	foz	-0.106314	0.653276	1.034210	
espinho	espinho         -0.869100         1.332040         1.199922           povoa         -0.925107         0.984730         -1.043610           vila_praia         -0.492363         0.275276         -1.016189           vila_praia         -0.872127         0.670659         0.543844           costa_nova         -0.955551         1.154867         -0.383700           praia_mira         0.523876         0.986359         0.098466           palheiros1         -1.014853         -1.174709         -0.805875           palheiros2         -1.325050         -1.045194         -0.638967           palheiros3         1.780842         -1.007964         -1.228614           figueira_foz1         -0.874055         0.008264         -0.295389           figueira_foz2         0.260599         -0.855275         0.288392           figueira_foz3         1.284578         0.516899         -0.656976           pedrogao         1.059512         0.285523         1.497316           sao_martinho         0.740992         0.696023         -0.853814           ericeira         -1.119369         -1.739709         -1.548973           quaios         -0.715410         -0.571928         -1.107820           v	aguda	0.384864	3.105235	-0.506306	
povoa	povoa         -0.925107         0.984730         -1.043610           vila_do_conde         -0.492363         0.275276         -1.016189           vila_praia         -0.872127         0.670659         0.543844           costa_nova         -0.955551         1.154867         -0.383700           praia_mira         0.523876         0.986359         0.098466           palheiros1         -1.014853         -1.174709         -0.805875           palheiros2         -1.325050         -1.045194         -0.638967           palheiros3         1.780842         -1.007964         -1.228614           figueira_foz1         -0.874055         0.008264         -0.295389           figueira_foz2         0.260599         -0.855275         0.288392           figueira_foz3         1.284578         0.516899         -0.656976           pedrogao         1.059512         0.285523         1.497316           ericeira         -1.168394         0.016498         2.084130           azenhas         -1.119369         -1.739709         -1.548973           quaios         -0.715410         -0.571928         -1.107820           vieira1         -0.304447         0.985242         -0.151493           vi	esposende	-0.732511	-0.493201	0.752514	
vila_do_conde	vila_do_conde	espinho	-0.869100	1.332040	1.199922	
vila_praia	vila_praia         -0.872127         0.670659         0.543844           costa_nova         -0.955551         1.154867         -0.383700           praia_mira         0.523876         0.986359         0.098466           palheiros1         -1.014853         -1.174709         -0.638967           palheiros2         -1.325050         -1.045194         -0.638967           palheiros3         1.780842         -1.007964         -1.228614           figueira_foz1         -0.874055         0.008264         -0.295389           figueira_foz2         0.260599         -0.855275         0.288392           figueira_foz3         1.284578         0.516899         -0.656976           pedroga         1.059512         0.285523         1.497316           sao_martinho         0.740992         0.696023         -0.853814           ericcira         -1.168394         0.016498         2.084130           azenhas         -1.119369         -1.739709         -1.548973           quaios         -0.715410         -0.571928         -1.107820           vieira1         -0.304447         0.989722         -0.151493           vieira2         0.448504         0.965242         -1.680004           fora	povoa	-0.925107	0.984730	-1.043610	
costa_nova         -0.955551         1.154867         -0.383700           praia_mira         0.523876         0.986359         0.098466           palheiros1         -1.014853         -1.174709         -0.805875           palheiros2         -1.325050         -1.045194         -0.638967           palheiros3         1.780842         -1.007964         -1.228614           figueira_foz1         -0.874055         0.008264         -0.295389           figueira_foz2         0.260599         -0.855275         0.288392           figueira_foz3         1.284578         0.516899         -0.656976           pedrogao         1.059512         0.285523         1.497316           sao_martinho         0.740992         0.696023         -0.85814           ericeira         -1.168394         0.016498         2.084130           azenhas         -1.119369         -1.739709         -1.548973           quaios         -0.715410         -0.571928         -1.107820           vieira1         -0.304447         0.985242         -0.151493           vieira2         0.448504         0.965242         -1.680004           foradouro         -1.181150         0.517357         0.288544           naza	costa_nova         -0.955551         1.154867         -0.383700           praia_mira         0.523876         0.986359         0.098466           palheiros1         -1.014853         -1.174709         -0.805875           palheiros2         -1.325050         -1.045194         -0.638967           palheiros3         1.780842         -1.007964         -1.228614           figueira_foz1         -0.874055         0.008264         -0.295389           figueira_foz2         0.260599         -0.855275         0.288392           figueira_foz3         1.284578         0.516899         -0.656976           pedrogao         1.059512         0.285523         1.497316           sao_martinho         0.740992         0.696023         -0.853814           ericeira         -1.168394         0.016498         2.084130           azenhas         -1.119369         -1.739709         -1.548973           quaios         -0.715410         -0.571928         -1.107820           vieira1         -0.304447         0.989722         -0.151493           vieira2         0.448504         0.965242         -1.680004           foradouro         -1.181150         0.517357         0.28854           nazar	vila_do_conde	-0.492363	0.275276	-1.016189	
praia_mira	praia_mira         0.523876         0.986359         0.098466           palheiros1         -1.014853         -1.174709         -0.805875           palheiros2         -1.325050         -1.045194         -0.638967           palheiros3         1.780842         -1.007964         -1.228614           figueira_foz1         -0.874055         0.008264         -0.295389           figueira_foz2         0.260599         -0.855275         0.288392           figueira_foz3         1.284578         0.516899         -0.656976           pedrogao         1.059512         0.285523         1.497316           sao_martinho         0.740992         0.696023         -0.853814           ericeira         -1.168394         0.016498         2.084130           azenhas         -1.119369         -1.739709         -1.548973           quaios         -0.715410         -0.571928         -1.107820           vieira1         -0.304447         0.989722         -0.151493           vieira2         0.448504         0.965242         -1.680004           foradouro         -1.181150         0.517357         0.288544           nazare1         -0.777983         -1.15321         1.32833           nazare2 </td <td>vila_praia</td> <td>-0.872127</td> <td>0.670659</td> <td>0.543844</td> <td></td>	vila_praia	-0.872127	0.670659	0.543844	
palheiros1	palheiros1         -1.014853         -1.174709         -0.805875           palheiros2         -1.325050         -1.045194         -0.638967           palheiros3         1.780842         -1.007964         -1.228614           figueira_foz1         -0.874055         0.008264         -0.295389           figueira_foz2         0.260599         -0.855275         0.288392           figueira_foz3         1.284578         0.516899         -0.656976           pedrogao         1.059512         0.285523         1.497316           sao_martinho         0.740992         0.696023         -0.853814           ericeira         -1.163394         0.016498         2.084130           azenhas         -1.119369         -1.739709         -1.548973           quaios         -0.715410         -0.571928         -1.107820           vieira1         -0.304447         0.989722         -0.151493           vieira2         0.448504         0.965242         -1.680004           foradouro         -1.181150         0.517357         0.288544           nazare1         -0.777983         -1.115321         1.923833           nazare2         1.299911         -0.703578         -0.804982           costa_ca	costa_nova	-0.955551	1.154867	-0.383700	
palheiros2	palheiros2         -1.325050         -1.045194         -0.638967           palheiros3         1.780842         -1.007964         -1.228614           figueira_foz1         -0.874055         0.008264         -0.295389           figueira_foz2         0.260599         -0.855275         0.288392           figueira_foz3         1.284578         0.516899         -0.656976           pedrogao         1.059512         0.285523         1.497316           sao_martinho         0.740992         0.696023         -0.853814           ericeira         -1.168394         0.016498         2.084130           azenhas         -1.119369         -1.739709         -1.548973           quaios         -0.715410         -0.571928         -1.107820           vieira1         -0.304447         0.989722         -0.151493           vieira2         0.448504         0.965242         -1.680004           foradouro         -1.181150         0.517357         0.288544           nazare1         -0.777983         -1.115321         1.923833           nazare2         1.299911         -0.703578         -0.804982           cascais         0.6224743         -0.072762         -0.500818           costa_capar	praia_mira	0.523876	0.986359	0.098466	
palheiros3	palheiros3         1.780842         -1.007964         -1.228614           figueira_foz1         -0.874055         0.008264         -0.295389           figueira_foz2         0.260599         -0.855275         0.288392           figueira_foz3         1.284578         0.516899         -0.656976           pedrogao         1.059512         0.285523         1.497316           sao_martinho         0.740992         0.696023         -0.853814           ericeira         -1.168394         0.016498         2.084130           azenhas         -1.119369         -1.739709         -1.548973           quaios         -0.715410         -0.571928         -1.107820           vieira1         -0.304447         0.989722         -0.151493           vieira2         0.448504         0.965242         -1.680004           foradouro         -1.181150         0.517357         0.288544           nazare1         -0.777983         -1.115321         1.923833           nazare2         1.299911         -0.703578         -0.804982           cascais         0.624743         -0.072762         -0.500818           costa_caparica         0.622603         0.632274         -0.042493           prais_corv	palheiros1	-1.014853	-1.174709	-0.805875	
figueira_foz1	figueira_foz1         -0.874055         0.008264         -0.295389           figueira_foz2         0.260599         -0.855275         0.288392           figueira_foz3         1.284578         0.516899         -0.656976           pedrogao         1.059512         0.285523         1.497316           sao_martinho         0.740992         0.696023         -0.853814           ericeira         -1.168394         0.016498         2.084130           azenhas         -1.119369         -1.739709         -1.548973           quaios         -0.715410         -0.571928         -1.107820           vieira1         -0.304447         0.989722         -0.151493           vieira2         0.448504         0.965242         -1.680004           foradouro         -1.181150         0.517357         0.288544           nazare1         -0.777983         -1.115321         1.923833           nazare2         1.299911         -0.703578         -0.804982           cascais         0.624743         -0.072762         -0.500818           costa_caparica         0.622603         0.632274         -0.042493           praia_corvoeiro         -0.975604         -1.285390         -0.220612           zamb	palheiros2	-1.325050	-1.045194	-0.638967	
figueira_foz2	figueira_foz2         0.260599         -0.855275         0.288392           figueira_foz3         1.284578         0.516899         -0.656976           pedrogao         1.059512         0.285523         1.497316           sao_martinho         0.740992         0.696023         -0.853814           ericeira         -1.168394         0.016498         2.084130           azenhas         -1.119369         -1.739709         -1.548973           quaios         -0.715410         -0.571928         -1.107820           vieira1         -0.304447         0.989722         -0.151493           vieira2         0.448504         0.965242         -1.680004           foradouro         -1.181150         0.517357         0.288544           nazare1         -0.7777983         -1.115321         1.923833           nazare2         1.299911         -0.703578         -0.804982           cascais         0.6224743         -0.072762         -0.500818           costa_caparica         0.622603         0.632274         -0.042493           praia_corvoeiro         -0.975604         -1.285390         -0.20612           zambujeira         0.314223         0.424661         -0.591777           sesimbr	palheiros3	1.780842	-1.007964	-1.228614	
figueira_foz3	figueira_foz3         1.284578         0.516899         -0.656976           pedrogao         1.059512         0.285523         1.497316           sao_martinho         0.740992         0.696023         -0.853814           ericeira         -1.168394         0.016498         2.084130           azenhas         -1.119369         -1.739709         -1.548973           quaios         -0.715410         -0.571928         -1.107820           vieira1         -0.304447         0.989722         -0.151493           vieira2         0.448504         0.965242         -1.680004           foradouro         -1.181150         0.517357         0.288544           nazare1         -0.777983         -1.115321         1.923833           nazare2         1.299911         -0.703578         -0.804982           cascais         0.624743         -0.072762         -0.500818           costa_caparica         0.622603         0.632274         -0.042493           praia_corvoeiro         -0.975604         -1.285390         -0.220612           zambujeira         0.314223         0.424661         -0.591777           sesimbra         -0.270193         0.492678         0.532565           armacao	figueira_foz1	-0.874055	0.008264	-0.295389	
pedrogao 1.059512 0.285523 1.497316 sao_martinho 0.740992 0.696023 -0.853814 ericeira -1.168394 0.016498 2.084130 azenhas -1.119369 -1.739709 -1.548973 quaios -0.715410 -0.571928 -1.107820 vieiral -0.304447 0.989722 -0.151493 vieira2 0.448504 0.965242 -1.680004 foradouro -1.181150 0.517357 0.288544 nazare1 -0.777983 -1.115321 1.923833 nazare2 1.299911 -0.703578 -0.804982 cascais 0.624743 -0.072762 -0.500818 costa_caparica 0.622603 0.632274 -0.042493 praia_corvoeiro -0.975604 -1.285390 -0.220612 zambujeira 0.314223 0.424661 -0.591777 sesimbra -0.270193 0.492678 0.532565 armacao 2.548534 -0.542030 -0.443133 olhao 1.032281 -0.999335 2.411589 monte_gordo 0.478139 0.108114 -0.023688 albufeira 2.063143 -0.475239 0.570500 faro -0.494007 -1.505744 1.189653 quarteira -0.293754 -1.228314 0.129756	pedrogao         1.059512         0.285523         1.497316           sao_martinho         0.740992         0.696023         -0.853814           ericeira         -1.168394         0.016498         2.084130           azenhas         -1.119369         -1.739709         -1.548973           quaios         -0.715410         -0.571928         -1.107820           vieira1         -0.304447         0.989722         -0.151493           vieira2         0.448504         0.965242         -1.680004           foradouro         -1.181150         0.517357         0.288544           nazare1         -0.777983         -1.115321         1.923833           nazare2         1.299911         -0.703578         -0.804982           cascais         0.624743         -0.072762         -0.500818           costa_caparica         0.622603         0.632274         -0.042493           praia_corvoeiro         -0.975604         -1.285390         -0.220612           zambujeira         0.314223         0.492678         0.532565           armacao         2.548534         -0.542030         -0.443133           olhao         1.032281         -0.999335         2.411589           monte_gordo	figueira_foz2	0.260599	-0.855275	0.288392	
sao_martinho	sao_martinho         0.740992         0.696023         -0.853814           ericeira         -1.168394         0.016498         2.084130           azenhas         -1.119369         -1.739709         -1.548973           quaios         -0.715410         -0.571928         -1.107820           vieira1         -0.304447         0.989722         -0.151493           vieira2         0.448504         0.965242         -1.680004           foradouro         -1.181150         0.517357         0.288544           nazare1         -0.777983         -1.115321         1.923833           nazare2         1.299911         -0.703578         -0.804982           cascais         0.624743         -0.072762         -0.500818           costa_caparica         0.622603         0.632274         -0.042493           praia_corvoeiro         -0.975604         -1.285390         -0.220612           zambujeira         0.314223         0.424661         -0.591777           sesimbra         -0.270193         0.492678         0.532565           armacao         2.548534         -0.542030         -0.443133           olhao         1.032281         -0.999335         2.411589           monte_gordo	figueira_foz3	1.284578	0.516899	-0.656976	
ericeira	ericeira	pedrogao	1.059512	0.285523	1.497316	
azenhas	azenhas         -1.119369         -1.739709         -1.548973           quaios         -0.715410         -0.571928         -1.107820           vieira1         -0.304447         0.989722         -0.151493           vieira2         0.448504         0.965242         -1.680004           foradouro         -1.181150         0.517357         0.288544           nazare1         -0.777983         -1.115321         1.923833           nazare2         1.299911         -0.703578         -0.804982           cascais         0.624743         -0.072762         -0.500818           costa_caparica         0.622603         0.632274         -0.042493           praia_corvoeiro         -0.975604         -1.285390         -0.220612           zambujeira         0.314223         0.424661         -0.591777           sesimbra         -0.270193         0.492678         0.532565           armacao         2.548534         -0.542030         -0.443133           olhao         1.032281         -0.999335         2.411589           monte_gordo         0.478139         0.108114         -0.023688           albufeira         2.063143         -0.475239         0.570500           faro <t< td=""><td>sao_martinho</td><td>0.740992</td><td>0.696023</td><td>-0.853814</td><td></td></t<>	sao_martinho	0.740992	0.696023	-0.853814	
quaios	quaios         -0.715410         -0.571928         -1.107820           vieira1         -0.304447         0.989722         -0.151493           vieira2         0.448504         0.965242         -1.680004           foradouro         -1.181150         0.517357         0.288544           nazare1         -0.777983         -1.115321         1.923833           nazare2         1.299911         -0.703578         -0.804982           cascais         0.624743         -0.072762         -0.500818           costa_caparica         0.622603         0.632274         -0.042493           praia_corvoeiro         -0.975604         -1.285390         -0.220612           zambujeira         0.314223         0.424661         -0.591777           sesimbra         -0.270193         0.492678         0.532565           armacao         2.548534         -0.542030         -0.443133           olhao         1.032281         -0.999335         2.411589           monte_gordo         0.478139         0.108114         -0.023688           albufeira         2.063143         -0.475239         0.570500           faro         -0.494007         -1.505744         1.189653           quarteira	ericeira	-1.168394	0.016498	2.084130	
vieira1	vieira1         -0.304447         0.989722         -0.151493           vieira2         0.448504         0.965242         -1.680004           foradouro         -1.181150         0.517357         0.288544           nazare1         -0.777983         -1.115321         1.923833           nazare2         1.299911         -0.703578         -0.804982           cascais         0.624743         -0.072762         -0.500818           costa_caparica         0.622603         0.632274         -0.042493           praia_corvoeiro         -0.975604         -1.285390         -0.220612           zambujeira         0.314223         0.424661         -0.591777           sesimbra         -0.270193         0.492678         0.532565           armacao         2.548534         -0.542030         -0.443133           olhao         1.032281         -0.999335         2.411589           monte_gordo         0.478139         0.108114         -0.023688           albufeira         2.063143         -0.475239         0.570500           faro         -0.494007         -1.505744         1.189653           quarteira         -0.293754         -1.228314         0.129756    meshedness_TheilID  meshedness_Th	azenhas	-1.119369	-1.739709	-1.548973	
vieira2	vieira2         0.448504         0.965242         -1.680004           foradouro         -1.181150         0.517357         0.288544           nazare1         -0.777983         -1.115321         1.923833           nazare2         1.299911         -0.703578         -0.804982           cascais         0.624743         -0.072762         -0.500818           costa_caparica         0.622603         0.632274         -0.042493           praia_corvoeiro         -0.975604         -1.285390         -0.220612           zambujeira         0.314223         0.424661         -0.591777           sesimbra         -0.270193         0.492678         0.532565           armacao         2.548534         -0.542030         -0.443133           olhao         1.032281         -0.999335         2.411589           monte_gordo         0.478139         0.108114         -0.023688           albufeira         2.063143         -0.475239         0.570500           faro         -0.494007         -1.505744         1.189653           quarteira         -0.293754         -1.228314         0.129756    **Comparison of the comparison	quaios	-0.715410	-0.571928	-1.107820	
foradouro	foradouro         -1.181150         0.517357         0.288544           nazare1         -0.777983         -1.115321         1.923833           nazare2         1.299911         -0.703578         -0.804982           cascais         0.624743         -0.072762         -0.500818           costa_caparica         0.622603         0.632274         -0.042493           praia_corvoeiro         -0.975604         -1.285390         -0.220612           zambujeira         0.314223         0.424661         -0.591777           sesimbra         -0.270193         0.492678         0.532565           armacao         2.548534         -0.542030         -0.443133           olhao         1.032281         -0.999335         2.411589           monte_gordo         0.478139         0.108114         -0.023688           albufeira         2.063143         -0.475239         0.570500           faro         -0.494007         -1.505744         1.189653           quarteira         -0.293754         -1.228314         0.129756           foz         -0.241022         0.461052         0.724088           aguda         -0.406828         -0.615518         -0.818046           esposende	vieira1	-0.304447	0.989722	-0.151493	
nazare1	nazare1         -0.777983         -1.115321         1.923833           nazare2         1.299911         -0.703578         -0.804982           cascais         0.624743         -0.072762         -0.500818           costa_caparica         0.622603         0.632274         -0.042493           praia_corvoeiro         -0.975604         -1.285390         -0.220612           zambujeira         0.314223         0.424661         -0.591777           sesimbra         -0.270193         0.492678         0.532565           armacao         2.548534         -0.542030         -0.443133           olhao         1.032281         -0.999335         2.411589           monte_gordo         0.478139         0.108114         -0.023688           albufeira         2.063143         -0.475239         0.570500           faro         -0.494007         -1.505744         1.189653           quarteira         -0.293754         -1.228314         0.129756           meshedness_TheilID         sdsLen_meanIQ         sdsLen_rangeIQ         \           foz         -0.241022         0.461052         0.724088           aguda         -0.406828         -0.615518         -0.818046           esp	vieira2	0.448504	0.965242	-1.680004	
nazare2       1.299911       -0.703578       -0.804982         cascais       0.624743       -0.072762       -0.500818         costa_caparica       0.622603       0.632274       -0.042493         praia_corvoeiro       -0.975604       -1.285390       -0.220612         zambujeira       0.314223       0.424661       -0.591777         sesimbra       -0.270193       0.492678       0.532565         armacao       2.548534       -0.542030       -0.443133         olhao       1.032281       -0.999335       2.411589         monte_gordo       0.478139       0.108114       -0.023688         albufeira       2.063143       -0.475239       0.570500         faro       -0.494007       -1.505744       1.189653         quarteira       -0.293754       -1.228314       0.129756	nazare2         1.299911         -0.703578         -0.804982           cascais         0.624743         -0.072762         -0.500818           costa_caparica         0.622603         0.632274         -0.042493           praia_corvoeiro         -0.975604         -1.285390         -0.220612           zambujeira         0.314223         0.424661         -0.591777           sesimbra         -0.270193         0.492678         0.532565           armacao         2.548534         -0.542030         -0.443133           olhao         1.032281         -0.999335         2.411589           monte_gordo         0.478139         0.108114         -0.023688           albufeira         2.063143         -0.475239         0.570500           faro         -0.494007         -1.505744         1.189653           quarteira         -0.293754         -1.228314         0.129756           foz         -0.241022         0.461052         0.724088           aguda         -0.406828         -0.615518         -0.818046           esposende         -0.121131         1.705268         0.855035	foradouro	-1.181150	0.517357	0.288544	
cascais       0.624743       -0.072762       -0.500818         costa_caparica       0.622603       0.632274       -0.042493         praia_corvoeiro       -0.975604       -1.285390       -0.220612         zambujeira       0.314223       0.424661       -0.591777         sesimbra       -0.270193       0.492678       0.532565         armacao       2.548534       -0.542030       -0.443133         olhao       1.032281       -0.999335       2.411589         monte_gordo       0.478139       0.108114       -0.023688         albufeira       2.063143       -0.475239       0.570500         faro       -0.494007       -1.505744       1.189653         quarteira       -0.293754       -1.228314       0.129756	cascais         0.624743         -0.072762         -0.500818           costa_caparica         0.622603         0.632274         -0.042493           praia_corvoeiro         -0.975604         -1.285390         -0.220612           zambujeira         0.314223         0.424661         -0.591777           sesimbra         -0.270193         0.492678         0.532565           armacao         2.548534         -0.542030         -0.443133           olhao         1.032281         -0.999335         2.411589           monte_gordo         0.478139         0.108114         -0.023688           albufeira         2.063143         -0.475239         0.570500           faro         -0.494007         -1.505744         1.189653           quarteira         -0.293754         -1.228314         0.129756           meshedness_TheilID         sdsLen_meanIQ         sdsLen_rangeIQ         \           foz         -0.241022         0.461052         0.724088           aguda         -0.406828         -0.615518         -0.818046           esposende         -0.121131         1.705268         0.855035	nazare1	-0.777983	-1.115321	1.923833	
costa_caparica       0.622603       0.632274       -0.042493         praia_corvoeiro       -0.975604       -1.285390       -0.220612         zambujeira       0.314223       0.424661       -0.591777         sesimbra       -0.270193       0.492678       0.532565         armacao       2.548534       -0.542030       -0.443133         olhao       1.032281       -0.999335       2.411589         monte_gordo       0.478139       0.108114       -0.023688         albufeira       2.063143       -0.475239       0.570500         faro       -0.494007       -1.505744       1.189653         quarteira       -0.293754       -1.228314       0.129756     meshedness_TheilID sdsLen_meanIQ sdsLen_rangeIQ \	costa_caparica         0.622603         0.632274         -0.042493           praia_corvoeiro         -0.975604         -1.285390         -0.220612           zambujeira         0.314223         0.424661         -0.591777           sesimbra         -0.270193         0.492678         0.532565           armacao         2.548534         -0.542030         -0.443133           olhao         1.032281         -0.999335         2.411589           monte_gordo         0.478139         0.108114         -0.023688           albufeira         2.063143         -0.475239         0.570500           faro         -0.494007         -1.505744         1.189653           quarteira         -0.293754         -1.228314         0.129756           foz         -0.241022         0.461052         0.724088           aguda         -0.406828         -0.615518         -0.818046           esposende         -0.121131         1.705268         0.855035	nazare2	1.299911	-0.703578	-0.804982	
praia_corvoeiro	praia_corvoeiro	cascais	0.624743	-0.072762	-0.500818	
zambujeira 0.314223 0.424661 -0.591777 sesimbra -0.270193 0.492678 0.532565 armacao 2.548534 -0.542030 -0.443133 olhao 1.032281 -0.999335 2.411589 monte_gordo 0.478139 0.108114 -0.023688 albufeira 2.063143 -0.475239 0.570500 faro -0.494007 -1.505744 1.189653 quarteira -0.293754 -1.228314 0.129756  meshedness_TheilID sdsLen_meanIQ sdsLen_rangeIQ \	zambujeira         0.314223         0.424661         -0.591777           sesimbra         -0.270193         0.492678         0.532565           armacao         2.548534         -0.542030         -0.443133           olhao         1.032281         -0.999335         2.411589           monte_gordo         0.478139         0.108114         -0.023688           albufeira         2.063143         -0.475239         0.570500           faro         -0.494007         -1.505744         1.189653           quarteira         -0.293754         -1.228314         0.129756           foz         -0.241022         0.461052         0.724088           aguda         -0.406828         -0.615518         -0.818046           esposende         -0.121131         1.705268         0.855035	costa_caparica	0.622603	0.632274	-0.042493	
sesimbra       -0.270193       0.492678       0.532565         armacao       2.548534       -0.542030       -0.443133         olhao       1.032281       -0.999335       2.411589         monte_gordo       0.478139       0.108114       -0.023688         albufeira       2.063143       -0.475239       0.570500         faro       -0.494007       -1.505744       1.189653         quarteira       -0.293754       -1.228314       0.129756    meshedness_TheilID sdsLen_meanIQ sdsLen_rangeIQ \	sesimbra         -0.270193         0.492678         0.532565           armacao         2.548534         -0.542030         -0.443133           olhao         1.032281         -0.999335         2.411589           monte_gordo         0.478139         0.108114         -0.023688           albufeira         2.063143         -0.475239         0.570500           faro         -0.494007         -1.505744         1.189653           quarteira         -0.293754         -1.228314         0.129756           foz         -0.241022         0.461052         0.724088           aguda         -0.406828         -0.615518         -0.818046           esposende         -0.121131         1.705268         0.855035	praia_corvoeiro	-0.975604	-1.285390	-0.220612	
armacao 2.548534 -0.542030 -0.443133 olhao 1.032281 -0.999335 2.411589 monte_gordo 0.478139 0.108114 -0.023688 albufeira 2.063143 -0.475239 0.570500 faro -0.494007 -1.505744 1.189653 quarteira -0.293754 -1.228314 0.129756  meshedness_TheilID sdsLen_meanIQ sdsLen_rangeIQ \	armacao 2.548534 -0.542030 -0.443133 olhao 1.032281 -0.999335 2.411589 monte_gordo 0.478139 0.108114 -0.023688 albufeira 2.063143 -0.475239 0.570500 faro -0.494007 -1.505744 1.189653 quarteira -0.293754 -1.228314 0.129756  meshedness_TheilID sdsLen_meanIQ sdsLen_rangeIQ \ foz -0.241022 0.461052 0.724088 aguda -0.406828 -0.615518 -0.818046 esposende -0.121131 1.705268 0.855035	zambujeira	0.314223	0.424661	-0.591777	
olhao	olhao         1.032281         -0.999335         2.411589           monte_gordo         0.478139         0.108114         -0.023688           albufeira         2.063143         -0.475239         0.570500           faro         -0.494007         -1.505744         1.189653           quarteira         -0.293754         -1.228314         0.129756           foz         -0.241022         0.461052         0.724088           aguda         -0.406828         -0.615518         -0.818046           esposende         -0.121131         1.705268         0.855035	sesimbra	-0.270193	0.492678	0.532565	
monte_gordo 0.478139 0.108114 -0.023688 albufeira 2.063143 -0.475239 0.570500 faro -0.494007 -1.505744 1.189653 quarteira -0.293754 -1.228314 0.129756 meshedness_TheilID sdsLen_meanIQ sdsLen_rangeIQ \	monte_gordo         0.478139         0.108114         -0.023688           albufeira         2.063143         -0.475239         0.570500           faro         -0.494007         -1.505744         1.189653           quarteira         -0.293754         -1.228314         0.129756           foz         -0.241022         0.461052         0.724088           aguda         -0.406828         -0.615518         -0.818046           esposende         -0.121131         1.705268         0.855035	armacao	2.548534	-0.542030	-0.443133	
albufeira 2.063143 -0.475239 0.570500 faro -0.494007 -1.505744 1.189653 quarteira -0.293754 -1.228314 0.129756 meshedness_TheilID sdsLen_meanIQ sdsLen_rangeIQ \	albufeira 2.063143 -0.475239 0.570500 faro -0.494007 -1.505744 1.189653 quarteira -0.293754 -1.228314 0.129756 meshedness_TheilID sdsLen_meanIQ sdsLen_rangeIQ \ foz -0.241022 0.461052 0.724088 aguda -0.406828 -0.615518 -0.818046 esposende -0.121131 1.705268 0.855035	olhao	1.032281	-0.999335	2.411589	
faro	faro	monte_gordo	0.478139	0.108114	-0.023688	
quarteira -0.293754 -1.228314 0.129756  meshedness_TheilID sdsLen_meanIQ sdsLen_rangeIQ \	quarteira         -0.293754         -1.228314         0.129756           meshedness_TheilID         sdsLen_meanIQ         sdsLen_rangeIQ         \           foz         -0.241022         0.461052         0.724088           aguda         -0.406828         -0.615518         -0.818046           esposende         -0.121131         1.705268         0.855035	albufeira	2.063143	-0.475239	0.570500	
meshedness_TheilID sdsLen_meanIQ sdsLen_rangeIQ \	meshedness_TheilID sdsLen_meanIQ sdsLen_rangeIQ \ foz	faro	-0.494007	-1.505744	1.189653	
	foz       -0.241022       0.461052       0.724088         aguda       -0.406828       -0.615518       -0.818046         esposende       -0.121131       1.705268       0.855035	quarteira	-0.293754	-1.228314	0.129756	
	foz       -0.241022       0.461052       0.724088         aguda       -0.406828       -0.615518       -0.818046         esposende       -0.121131       1.705268       0.855035					
0.044000 0.464050 0.764000	aguda -0.406828 -0.615518 -0.818046 esposende -0.121131 1.705268 0.855035		<del>-</del>		_	
TOZ -0.241022 0.461052 0.724088	esposende -0.121131 1.705268 0.855035	foz	-0.241	0.461052	0.724088	
	•	aguda	-0.4068		-0.818046	
esposende -0.121131 1.705268 0.855035	0.007077 0.760360 0.206000	esposende	-0.121	131 1.705268	0.855035	
-0.27077 $-0.760260$ $-0.206000$	espinio -0.23/9// -0.760362 -0.396820	espinho	-0.2379	977 -0.760362	-0.396820	

-0.412517	0.349350	0.067833
-0.397444	0.581370	1.509812
-0.272933	0.270958	1.681556
-0.307469	-0.042163	-0.185388
-0.339244	-0.583534	0.030992
-0.347904	-0.333674	-0.206665
-0.333396	-0.661535	-0.931967
-0.361537	-0.760099	-0.170349
-0.345735	-0.660135	-0.237054
-0.175278	1.479505	-1.007637
-0.378479	0.721040	1.869536
-0.074206	0.054505	2.748589
-0.385081	1.032168	-0.413419
-0.060756	-0.907482	-0.441773
-0.343724	-1.011384	-0.260812
-0.390973	-0.038813	-0.753850
-0.368978	-0.896935	-0.915641
-0.418167	3.837869	-1.007637
-0.323453	-1.043737	-0.953351
0.938362	-1.149868	-1.007637
3.889488	0.601193	1.778987
-0.376870	0.007725	0.209764
-0.161275	1.101844	-1.007637
-0.242353	0.728317	-0.250074
-0.378906	-0.837457	-0.577571
-0.311015	-0.815989	-0.803208
-0.340535	-0.694528	0.263037
0.701410	-0.810422	-1.007637
-0.329474	-0.031411	0.217406
-0.185788	-0.605530	0.207218
4.040527	0.827500	1.969977
-0.199338	-0.499090	-0.779655
	-0.397444 -0.272933 -0.307469 -0.339244 -0.347904 -0.333396 -0.361537 -0.345735 -0.175278 -0.378479 -0.074206 -0.385081 -0.060756 -0.343724 -0.390973 -0.368978 -0.418167 -0.323453 0.938362 3.889488 -0.376870 -0.161275 -0.242353 -0.378906 -0.311015 -0.340535 0.701410 -0.329474 -0.185788 4.040527	-0.397444       0.581370         -0.272933       0.270958         -0.307469       -0.042163         -0.339244       -0.583534         -0.347904       -0.333674         -0.333396       -0.661535         -0.361537       -0.760099         -0.345735       -0.660135         -0.175278       1.479505         -0.378479       0.721040         -0.074206       0.054505         -0.385081       1.032168         -0.060756       -0.907482         -0.343724       -1.011384         -0.390973       -0.038813         -0.368978       -0.896935         -0.418167       3.837869         -0.323453       -1.043737         0.938362       -1.149868         3.889488       0.601193         -0.376870       0.007725         -0.161275       1.101844         -0.242353       0.728317         -0.378906       -0.837457         -0.311015       -0.815989         -0.340535       -0.694528         0.701410       -0.810422         -0.329474       -0.031411         -0.185788       -0.605530         4.040527       0.82

#### $sdsLen\_TheilID$ foz 0.028703 aguda -0.171664 esposende -0.215043 espinho -0.561585 povoa -0.482178

vila\_praia costa\_nova 0.377693 praia\_mira -0.248484 palheiros1 -0.623030

0.174819

1.100864

vila\_do\_conde

palheiros2 -1.028346 palheiros3 -0.007962

figueira\_foz1 -0.073076

figueira_foz2	-1.034646
figueira_foz3	0.457077
pedrogao	3.612789
sao_martinho	-0.288137
ericeira	-0.349702
azenhas	0.249238
quaios	-0.639641
vieira1	-0.869967
vieira2	-1.034646
foradouro	-0.953459
nazare1	-1.034646
nazare2	0.745924
cascais	0.442356
costa_caparica	-0.834119
praia_corvoeiro	-0.927245
zambujeira	-0.604882
sesimbra	1.262271
armacao	0.507301
olhao	-1.034646
monte_gordo	1.628755
albufeira	1.283601
faro	1.820061
quarteira	-0.674349

[36 rows x 96 columns]

### 1.1 Standardize

```
[15]: x = data.values
    scaler = preprocessing.StandardScaler()
    cols = list(data.columns)
    data[cols] = scaler.fit_transform(data[cols])
    data
```

E 2						
[15]:		${\tt sdbAre\_meanIQ}$	${\tt sdbAre\_rangeIQ}$	${\tt sdbAre\_TheilID}$	sdbPer_meanIQ	\
	foz	0.145669	0.074895	0.193100	0.525362	
	aguda	-0.690154	-0.615406	-0.330468	-0.622020	
	esposende	1.115875	0.587245	-0.074543	1.378664	
	espinho	-0.488655	-0.837593	-1.292406	-0.390449	
	povoa	0.236331	-0.456906	-1.022082	0.668069	
	vila_do_conde	-0.641281	-0.900349	-0.805594	-0.418497	
	vila_praia	-0.236344	-0.309269	-0.563741	-0.073743	
	costa_nova	-0.308560	-0.464835	-0.476125	-0.101839	
	praia_mira	-0.156279	-0.156343	-0.156052	-0.096126	
	palheiros1	0.901566	-0.200327	-1.192465	0.846955	
	palheiros2	-0.593671	-0.946392	-1.562552	-0.718485	
	palheiros3	-0.598359	-0.786099	-0.937243	-0.772217	

figueira_foz1	-1.098891	-0.959705	-0.561010	-1.332771
figueira_foz2	-0.619773	-0.573249	0.031223	-0.646134
figueira_foz3	0.493904	0.614052	0.684350	0.564935
pedrogao	0.473856	0.596048	0.288538	0.477814
sao_martinho	1.139194	0.844062	0.246320	1.140482
ericeira	-0.646403	-0.776185	-0.811816	-0.660839
azenhas	-0.875571	-0.925823	-1.115090	-1.022967
quaios	0.133678	0.468040	0.606887	0.268789
vieira1	-0.901778	-0.933488	-0.923896	-1.109101
vieira2	0.476182	0.413256	0.350032	0.545655
foradouro	-0.164652	-0.269247	-0.527675	0.071673
nazare1	-0.872834	-1.048490	-1.377594	-1.123900
nazare2	2.932040	3.700397	1.741189	2.587010
cascais	-0.750294	-0.182028	1.516532	-0.824684
costa_caparica	-0.592074	0.072117	1.793385	-0.648654
praia_corvoeiro	-1.041269	-0.529299	0.742258	-1.237639
zambujeira	-0.600126	-0.485447	-0.090612	-0.740082
sesimbra	-0.867133	-0.897043	-0.682418	-1.035329
armacao	0.304595	1.462163	2.373260	0.332502
olhao	-0.003125	0.869389	1.797273	0.096579
monte_gordo	2.723822	1.277364	-0.296739	2.442285
albufeira	-0.638526	-0.269896	1.089003	-0.702064
faro	-0.104699	0.226760	0.994317	0.122445
quarteira	2.413738	2.317628	0.352456	2.208322
	sdbPer_rangeIQ	sdbPer_TheilID	ssbCCo_meanIQ	\
foz	sdbPer_rangeIQ 0.350970	sdbPer_TheilID 0.224825	ssbCCo_meanIQ -1.582175	\
foz aguda	~			\
	0.350970	0.224825	-1.582175	\
aguda	0.350970 -0.285571	0.224825 0.065931	-1.582175 -1.052284	\
aguda esposende	0.350970 -0.285571 0.714241	0.224825 0.065931 0.637960	-1.582175 -1.052284 -0.652857	\
aguda esposende espinho	0.350970 -0.285571 0.714241 -0.837013	0.224825 0.065931 0.637960 -1.101580	-1.582175 -1.052284 -0.652857 -0.588273	
aguda esposende espinho povoa	0.350970 -0.285571 0.714241 -0.837013 -0.988813	0.224825 0.065931 0.637960 -1.101580 -1.366325	-1.582175 -1.052284 -0.652857 -0.588273 -2.686536	
aguda esposende espinho povoa vila_do_conde	0.350970 -0.285571 0.714241 -0.837013 -0.988813 -0.874376	0.224825 0.065931 0.637960 -1.101580 -1.366325 -0.637180	-1.582175 -1.052284 -0.652857 -0.588273 -2.686536 -2.273327	
aguda esposende espinho povoa vila_do_conde vila_praia	0.350970 -0.285571 0.714241 -0.837013 -0.988813 -0.874376 -0.406707	0.224825 0.065931 0.637960 -1.101580 -1.366325 -0.637180 -0.725052	-1.582175 -1.052284 -0.652857 -0.588273 -2.686536 -2.273327 -0.558345	
aguda esposende espinho povoa vila_do_conde vila_praia costa_nova	0.350970 -0.285571 0.714241 -0.837013 -0.988813 -0.874376 -0.406707 -0.228026	0.224825 0.065931 0.637960 -1.101580 -1.366325 -0.637180 -0.725052 -0.358866	-1.582175 -1.052284 -0.652857 -0.588273 -2.686536 -2.273327 -0.558345 -1.124209	
aguda esposende espinho povoa vila_do_conde vila_praia costa_nova praia_mira	0.350970 -0.285571 0.714241 -0.837013 -0.988813 -0.874376 -0.406707 -0.228026 0.027534	0.224825 0.065931 0.637960 -1.101580 -1.366325 -0.637180 -0.725052 -0.358866 -0.099592	-1.582175 -1.052284 -0.652857 -0.588273 -2.686536 -2.273327 -0.558345 -1.124209 0.255449	
aguda esposende espinho povoa vila_do_conde vila_praia costa_nova praia_mira palheiros1	0.350970 -0.285571 0.714241 -0.837013 -0.988813 -0.874376 -0.406707 -0.228026 0.027534 -0.757842	0.224825 0.065931 0.637960 -1.101580 -1.366325 -0.637180 -0.725052 -0.358866 -0.099592 -1.256083	-1.582175 -1.052284 -0.652857 -0.588273 -2.686536 -2.273327 -0.558345 -1.124209 0.255449 1.682114	
aguda esposende espinho povoa vila_do_conde vila_praia costa_nova praia_mira palheiros1 palheiros2	0.350970 -0.285571 0.714241 -0.837013 -0.988813 -0.874376 -0.406707 -0.228026 0.027534 -0.757842 -1.226491	0.224825 0.065931 0.637960 -1.101580 -1.366325 -0.637180 -0.725052 -0.358866 -0.099592 -1.256083 -1.438577	-1.582175 -1.052284 -0.652857 -0.588273 -2.686536 -2.273327 -0.558345 -1.124209 0.255449 1.682114 1.202416	
aguda esposende espinho povoa vila_do_conde vila_praia costa_nova praia_mira palheiros1 palheiros2 palheiros3	0.350970 -0.285571 0.714241 -0.837013 -0.988813 -0.874376 -0.406707 -0.228026 0.027534 -0.757842 -1.226491 -1.024424	0.224825 0.065931 0.637960 -1.101580 -1.366325 -0.637180 -0.725052 -0.358866 -0.099592 -1.256083 -1.438577 -1.023904	-1.582175 -1.052284 -0.652857 -0.588273 -2.686536 -2.273327 -0.558345 -1.124209 0.255449 1.682114 1.202416 1.762862	
aguda esposende espinho povoa vila_do_conde vila_praia costa_nova praia_mira palheiros1 palheiros2 palheiros3 figueira_foz1	0.350970 -0.285571 0.714241 -0.837013 -0.988813 -0.874376 -0.406707 -0.228026 0.027534 -0.757842 -1.226491 -1.024424 -0.970175	0.224825 0.065931 0.637960 -1.101580 -1.366325 -0.637180 -0.725052 -0.358866 -0.099592 -1.256083 -1.438577 -1.023904 -0.523551	-1.582175 -1.052284 -0.652857 -0.588273 -2.686536 -2.273327 -0.558345 -1.124209 0.255449 1.682114 1.202416 1.762862 -0.291106	
aguda esposende espinho povoa vila_do_conde vila_praia costa_nova praia_mira palheiros1 palheiros2 palheiros3 figueira_foz1 figueira_foz2	0.350970 -0.285571 0.714241 -0.837013 -0.988813 -0.874376 -0.406707 -0.228026 0.027534 -0.757842 -1.226491 -1.024424 -0.970175 -0.384762	0.224825 0.065931 0.637960 -1.101580 -1.366325 -0.637180 -0.725052 -0.358866 -0.099592 -1.256083 -1.438577 -1.023904 -0.523551 -0.045132	-1.582175 -1.052284 -0.652857 -0.588273 -2.686536 -2.273327 -0.558345 -1.124209 0.255449 1.682114 1.202416 1.762862 -0.291106 -0.091578	
aguda esposende espinho povoa vila_do_conde vila_praia costa_nova praia_mira palheiros1 palheiros2 palheiros3 figueira_foz1 figueira_foz2 figueira_foz3	0.350970 -0.285571 0.714241 -0.837013 -0.988813 -0.874376 -0.406707 -0.228026 0.027534 -0.757842 -1.226491 -1.024424 -0.970175 -0.384762 0.532740	0.224825 0.065931 0.637960 -1.101580 -1.366325 -0.637180 -0.725052 -0.358866 -0.099592 -1.256083 -1.438577 -1.023904 -0.523551 -0.045132 0.613300	-1.582175 -1.052284 -0.652857 -0.588273 -2.686536 -2.273327 -0.558345 -1.124209 0.255449 1.682114 1.202416 1.762862 -0.291106 -0.091578 0.016107	
aguda esposende espinho povoa vila_do_conde vila_praia costa_nova praia_mira palheiros1 palheiros2 palheiros3 figueira_foz1 figueira_foz2 figueira_foz3 pedrogao	0.350970 -0.285571 0.714241 -0.837013 -0.988813 -0.874376 -0.406707 -0.228026 0.027534 -0.757842 -1.226491 -1.024424 -0.970175 -0.384762 0.532740 0.542392	0.224825 0.065931 0.637960 -1.101580 -1.366325 -0.637180 -0.725052 -0.358866 -0.099592 -1.256083 -1.438577 -1.023904 -0.523551 -0.045132 0.613300 0.219599	-1.582175 -1.052284 -0.652857 -0.588273 -2.686536 -2.273327 -0.558345 -1.124209 0.255449 1.682114 1.202416 1.762862 -0.291106 -0.091578 0.016107 0.697154	
aguda esposende espinho povoa vila_do_conde vila_praia costa_nova praia_mira palheiros1 palheiros2 palheiros3 figueira_foz1 figueira_foz2 figueira_foz3 pedrogao sao_martinho	0.350970 -0.285571 0.714241 -0.837013 -0.988813 -0.874376 -0.406707 -0.228026 0.027534 -0.757842 -1.226491 -1.024424 -0.970175 -0.384762 0.532740 0.542392 0.848636	0.224825 0.065931 0.637960 -1.101580 -1.366325 -0.637180 -0.725052 -0.358866 -0.099592 -1.256083 -1.438577 -1.023904 -0.523551 -0.045132 0.613300 0.219599 0.452623	-1.582175 -1.052284 -0.652857 -0.588273 -2.686536 -2.273327 -0.558345 -1.124209 0.255449 1.682114 1.202416 1.762862 -0.291106 -0.091578 0.016107 0.697154 0.025071	
aguda esposende espinho povoa vila_do_conde vila_praia costa_nova praia_mira palheiros1 palheiros2 palheiros3 figueira_foz1 figueira_foz2 figueira_foz3 pedrogao sao_martinho ericeira	0.350970 -0.285571 0.714241 -0.837013 -0.988813 -0.874376 -0.406707 -0.228026 0.027534 -0.757842 -1.226491 -1.024424 -0.970175 -0.384762 0.532740 0.542392 0.848636 -0.846296	0.224825 0.065931 0.637960 -1.101580 -1.366325 -0.637180 -0.725052 -0.358866 -0.099592 -1.256083 -1.438577 -1.023904 -0.523551 -0.045132 0.613300 0.219599 0.452623 -0.686899	-1.582175 -1.052284 -0.652857 -0.588273 -2.686536 -2.273327 -0.558345 -1.124209 0.255449 1.682114 1.202416 1.762862 -0.291106 -0.091578 0.016107 0.697154 0.025071 -0.001176	
aguda esposende espinho povoa vila_do_conde vila_praia costa_nova praia_mira palheiros1 palheiros2 palheiros3 figueira_foz1 figueira_foz2 figueira_foz3 pedrogao sao_martinho ericeira azenhas	0.350970 -0.285571 0.714241 -0.837013 -0.988813 -0.874376 -0.406707 -0.228026 0.027534 -0.757842 -1.226491 -1.024424 -0.970175 -0.384762 0.532740 0.542392 0.848636 -0.846296 -1.045405	0.224825 0.065931 0.637960 -1.101580 -1.366325 -0.637180 -0.725052 -0.358866 -0.099592 -1.256083 -1.438577 -1.023904 -0.523551 -0.045132 0.613300 0.219599 0.452623 -0.686899 -1.040783	-1.582175 -1.052284 -0.652857 -0.588273 -2.686536 -2.273327 -0.558345 -1.124209 0.255449 1.682114 1.202416 1.762862 -0.291106 -0.091578 0.016107 0.697154 0.025071 -0.001176 0.018076	

vieira2	0.719786	0.450407	1.173539		
foradouro	-0.462550	-0.801038	-0.862021		
nazare1	-1.456273	-1.420101	1.414961		
nazare2	3.142604	1.970070	-0.530249		
cascais	0.193065	1.181609	-0.243466		
costa_caparica	0.595914	1.564967	0.438035		
praia_corvoeiro	-0.408792	0.393931	-0.095620		
zambujeira	-0.428670	-0.328774	1.030106		
sesimbra	-1.004221	-0.681124	0.306456		
armacao	1.654776	2.141651	0.624147		
olhao	1.520997	2.022318	-0.109315		
monte_gordo	0.272042	-0.690248	0.203878		
albufeira	0.079461	1.097082	-0.070199		
faro	0.804126	1.145030	-0.776799		
quarteira	1.864321	0.178903	0.570057		
	${\tt ssbCCo\_rangeIQ}$	${\tt ssbCCo\_TheilID}$	${\tt ssbCor\_meanIQ}$		\
foz	1.289722	1.625614	1.418570		
aguda	0.651961	0.757708	0.178081		
esposende	1.004727	2.057803	3.159203		
espinho	0.393074	0.295110	-0.233439		
povoa	1.250063	1.949153	-0.219334		
vila_do_conde	1.609617	1.781211	-1.563553		
vila_praia	-0.296443	-0.394528	0.348525	•••	
costa_nova	1.882528	2.021040	-0.371011	•••	
praia_mira	0.101699	-0.231061	-0.226495	•••	
palheiros1	-2.462428	-1.518385	-0.612414	•••	
palheiros2	-1.735955	-1.567289	-1.563553	•••	
palheiros3	-2.239058	-1.561990	-1.563553	•••	
figueira_foz1	-0.024027	-0.210634	0.157251	•••	
figueira_foz2	0.318859	0.021771	-0.354524	•••	
figueira_foz3	0.507669	0.293725	0.259799	•••	
pedrogao	-0.798909	-0.824334	-0.063065	•••	
sao_martinho	-0.003693	-0.331330	-0.097306	•••	
ericeira	-0.077809	-0.542039	0.887174	•••	
azenhas	0.165658	-0.068862	-0.197032	•••	
quaios	-1.133161	-0.614224	-0.533963	•••	
vieira1	-1.117329	-1.099133	-0.233782	•••	
vieira2	-0.491948	-0.465432	-0.050995	•••	
foradouro	1.539276	1.431744	-0.532598	•••	
nazare1	-1.763870	-1.508549	-1.563553	•••	
nazare2	0.589902	-0.004860	-0.738789	•••	
cascais	0.274451	-0.000360	0.823353	•••	
costa_caparica	0.427505	0.150223	-0.373019	•••	
praia_corvoeiro	0.182786	-0.422794	0.126041	•••	
zambujeira	-0.495271	-0.561681	-1.563553	•••	
sesimbra	-0.358866	-0.746685	-0.346469	•••	

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-0.089550
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armacao
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olhao
monte_gordo
                       -0.118474
                                        -0.320397
                                                         0.986175
albufeira
                       -0.051202
                                        -0.400535
                                                         0.123464
faro
                        0.668719
                                         0.956021
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quarteira
                        0.268025
                                         0.153340
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                                                   likGra_rangeIQ
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foz
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aguda
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esposende
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espinho
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povoa
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vila_do_conde
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vila_praia
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costa_nova
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praia_mira
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palheiros1
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palheiros2
palheiros3
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figueira_foz1
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figueira_foz2
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figueira_foz3
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pedrogao
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sao martinho
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ericeira
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azenhas
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vieira2
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foradouro
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nazare1
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nazare2
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cascais
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costa_caparica
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praia_corvoeiro
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zambujeira
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sesimbra
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armacao
                       -0.526223
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olhao
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monte gordo
                        2.307504
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albufeira
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                                        0.174255
                                                         0.945155
faro
                       -0.994964
                                       -0.162346
                                                        -0.552422
quarteira
                       -1.057200
                                       -1.339946
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                  likGra_TheilID
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foz
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esposende	-0.732511	-0.493201	0.752514
espinho	-0.869100	1.332040	1.199922
povoa	-0.925107	0.984730	-1.043610
vila_do_conde	-0.492363	0.275276	-1.016189
vila_praia	-0.872127	0.670659	0.543844
costa_nova 	-0.955551	1.154867	-0.383700
praia_mira	0.523876	0.986359	0.098466
palheiros1	-1.014853	-1.174709	-0.805875
palheiros2	-1.325050	-1.045194	-0.638967
palheiros3	1.780842	-1.007964	-1.228614
figueira_foz1	-0.874055	0.008264	-0.295389
figueira_foz2	0.260599	-0.855275	0.288392
figueira_foz3	1.284578	0.516899	-0.656976
pedrogao	1.059512	0.285523	1.497316
sao_martinho	0.740992	0.696023	-0.853814
ericeira	-1.168394	0.016498	2.084130
azenhas	-1.119369	-1.739709	-1.548973
quaios	-0.715410	-0.571928	-1.107820
vieira1	-0.304447	0.989722	-0.151493
vieira2	0.448504	0.965242	-1.680004
foradouro	-1.181150	0.517357	0.288544
nazare1	-0.777983	-1.115321	1.923833
nazare2	1.299911	-0.703578	-0.804982
cascais	0.624743	-0.072762	-0.500818
costa_caparica	0.622603	0.632274	-0.042493
praia_corvoeiro	-0.975604	-1.285390	-0.220612
zambujeira	0.314223	0.424661	-0.591777
sesimbra	-0.270193	0.492678	0.532565
armacao	2.548534	-0.542030	-0.443133
olhao	1.032281	-0.999335	2.411589
monte_gordo	0.478139	0.108114	-0.023688
albufeira	2.063143	-0.475239	0.570500
faro	-0.494007	-1.505744	1.189653
quarteira	-0.293754	-1.228314	0.129756
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foz	-0.241022	0.461052	0.724088
aguda .	-0.406828	-0.615518	-0.818046
esposende	-0.121131	1.705268	0.855035
espinho	-0.237977	-0.760362	-0.396820
povoa	-0.412517	0.349350	0.067833
vila_do_conde	-0.397444	0.581370	1.509812
vila_praia	-0.272933	0.270958	1.681556
costa_nova	-0.307469	-0.042163	-0.185388
praia_mira	-0.339244	-0.583534	0.030992
palheiros1	-0.347904	-0.333674	-0.206665

palheiros2	-0.333396	-0.661535	-0.931967
palheiros3	-0.361537	-0.760099	-0.170349
figueira_foz1	-0.345735	-0.660135	-0.237054
figueira_foz2	-0.175278	1.479505	-1.007637
figueira_foz3	-0.378479	0.721040	1.869536
pedrogao	-0.074206	0.054505	2.748589
sao_martinho	-0.385081	1.032168	-0.413419
ericeira	-0.060756	-0.907482	-0.441773
azenhas	-0.343724	-1.011384	-0.260812
quaios	-0.390973	-0.038813	-0.753850
vieira1	-0.368978	-0.896935	-0.915641
vieira2	-0.418167	3.837869	-1.007637
foradouro	-0.323453	-1.043737	-0.953351
nazare1	0.938362	-1.149868	-1.007637
nazare2	3.889488	0.601193	1.778987
cascais	-0.376870	0.007725	0.209764
costa_caparica	-0.161275	1.101844	-1.007637
praia_corvoeiro	-0.242353	0.728317	-0.250074
zambujeira	-0.378906	-0.837457	-0.577571
sesimbra	-0.311015	-0.815989	-0.803208
armacao	-0.340535	-0.694528	0.263037
olhao	0.701410	-0.810422	-1.007637
monte_gordo	-0.329474	-0.031411	0.217406
albufeira	-0.185788	-0.605530	0.207218
faro	4.040527	0.827500	1.969977
quarteira	-0.199338	-0.499090	-0.779655

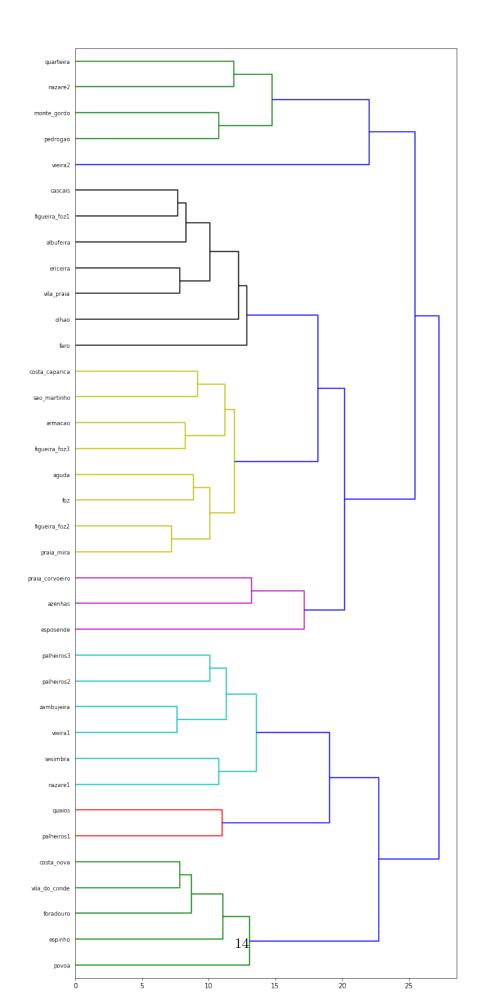
	sdsLen_TheilID
foz	0.028703
aguda	-0.171664
esposende	-0.215043
espinho	-0.561585
povoa	-0.482178
vila_do_conde	0.174819
vila_praia	1.100864
costa_nova	0.377693
praia_mira	-0.248484
palheiros1	-0.623030
palheiros2	-1.028346
palheiros3	-0.007962
figueira_foz1	-0.073076
figueira_foz2	-1.034646
figueira_foz3	0.457077
pedrogao	3.612789
sao_martinho	-0.288137
ericeira	-0.349702
azenhas	0.249238

```
quaios
                      -0.639641
                      -0.869967
vieira1
vieira2
                      -1.034646
foradouro
                      -0.953459
nazare1
                      -1.034646
nazare2
                       0.745924
cascais
                       0.442356
costa_caparica
                      -0.834119
praia_corvoeiro
                      -0.927245
zambujeira
                      -0.604882
sesimbra
                       1.262271
armacao
                       0.507301
olhao
                      -1.034646
monte_gordo
                       1.628755
albufeira
                       1.283601
faro
                       1.820061
quarteira
                      -0.674349
```

[36 rows x 96 columns]

```
[16]: data.to_csv('data/summative_data_norm.csv')
```

### 1.2 Clustering



### 1.3 Assing to places

```
[]: folder = 'data/'
     parts = ['atlantic', 'preatl', 'premed', 'med']
     c_parts = []
     geoms = []
     for part in parts:
         path = folder + part + '.gpkg'
         layers = [x[:-4] for x in fiona.listlayers(path) if 'blg' in x]
         for 1 in layers:
            buildings = gpd.read_file(path, layer=l + '_blg')
             if 'part' in buildings.columns:
                 for bpart in set(buildings.part):
                     subset = buildings.loc[buildings.part == bpart]
                     geoms.append(subset.geometry.unary_union.centroid)
                     c_parts.append(part)
             else:
                 geoms.append(buildings.geometry.unary_union.centroid)
                 c_parts.append(part)
[]: gdf = gpd.GeoDataFrame(data, geometry=geoms)
     gdf['part'] = c_parts
[]: gdf['cl'] = hierarchy.fcluster(Z, 18, criterion='distance')
     gdf['cl'] = gdf.cl.replace(8, 7)
     gdf['cl'] = gdf.cl.replace(2, 3)
[]: gdf.reset_index().to_file('data/points.gpkg', driver='GPKG', layer='ward')
```