Final Report

Reference Coastline

Version 3

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July 2006

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TABLE OF CONTENTS

1. INTRODUCTION

Regarding the construction of a European Coastline based on storable data features it has been studied the best way to basically merge some information concerning the European Coastal Environment and to assign attributes of the coastal structures. This process was preceded from constant discussions on the spatial analysis team so we can reach a consensus. Mainly we concluded that it must be developed a natural coastline where all the countries involved have the same methodology, without considering any artificial infrastructure, as the coastal dynamics could be even more "stable" than the coastal and marine infrastructures along the European Coast. This coastline will also be the base coastline for the future works in this ETC-TE and also used as template by the EEA so it must contain some specific information.

1.1 GOALS

The purpose of this project was to provide a detailed reference coastline as a GIS dataset that contains the essential geometry and also meaningful attributes.

In order to obtain the best results implementing a valid European coastline, it has been selected the Corine Land Cover 2000, made from interpretation of IMAGE2000, in order to take advantage on its geometric accuracy. To characterize the coast it was used the coastline from EUROSION project; this coastline has a data model rich in attributes that describe coastline characteristics. The main strategy to obtain this coastline is the following: CORINE Land Cover is used to delineate the coastline geometry. Eurosion attributes are added to this coastline. This means that all the countries covered by CORINE Land Cover will have a coastline defined.

1.2 DISCUSSION

The very first step needed to start creating the coastline from CORINE Land Cover is defining how CORINE Land Cover classes delineate the coastline. In other words, a criteria must be fixed to classify each CORINE Land Cover in 'land' and 'sea' classes.

1.1.1 The Coastal Environment classes

First at all it should be presented the inconveniences to develop a coastline from the Corine Land Cover and the problems that can be some difficulties to develop a coastline from the Corine Land Cover 2000 (CLC2000) following the definition of the European Environment Agency (EEA) about this concept.

Coast line: The line that separates a land surface from an ocean or sea.

In this sense all kind of morphology or surface in the case of the CLC2000 legend not located in the "land" could be considered as "sea or ocean" morphology.

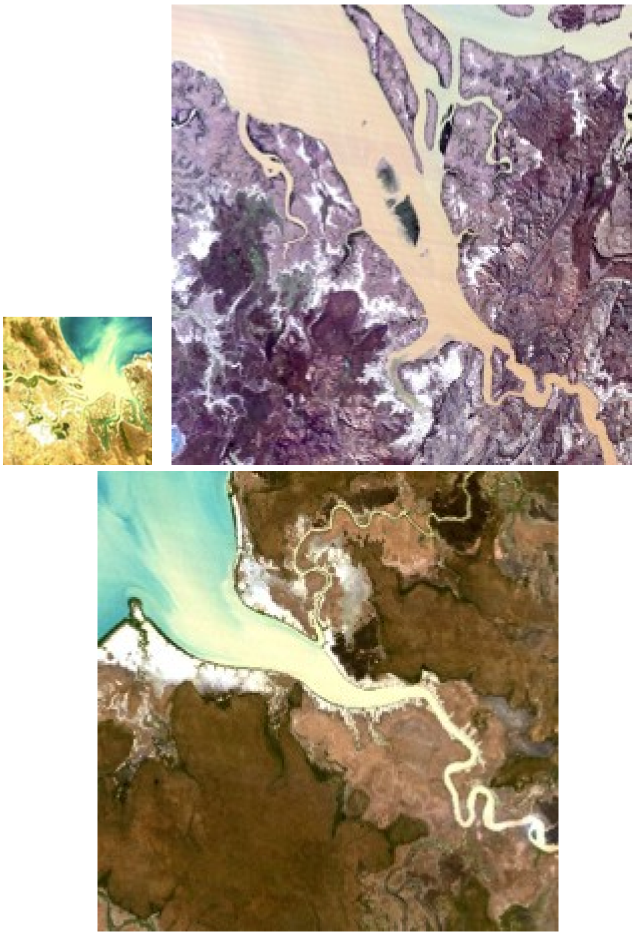
The first proposition was to do not include the intertidal flats, estuaries and the water bodies distributed as "sea and ocean" in the CLC2000 series.

- Analysing the different concepts morphologically:

Intertidal (mod) flats *are unvegetated, generally low gradient, and low energy environments, consisting of poorly- to moderately-sorted sandy mud and muddy sand. Gravel may be present in moderate concentrations at the base of shallow drainage channels, and coarser sediments typically occur closer to the low tide mark. Carbonate concentrations are moderate (reflecting shelly material in the sediments) and the concentration of organic material is variable, but generally high. Intertidal Flats are wider and more extensive in macrotidal systems. Surfaces tend to occur from mean low water spring to mean high water spring elevations and are usually flat and not vegetated, but may be dissected by shallow (and often vegetated by saltmarsh species) drainage channels. Biological activity consists of both high and low tide visitors, as well as permanent inhabitants. Burrowing infauna, crustaceans, molluscs, fish and birds are generally abundant*.

In this case, Intertidal flats should be considered like a non "land" morphology, and interpret all the intertidal flats as part of the marine environment.

Similar case with the **tide-dominated estuaries** *(see Examples below) represents a bedrock coastal embayment that* ***has been partially infilled by sediment derived from both the catchment and marine sources****, in which tidal currents, rather than waves, are the dominant force shaping the gross geomorphology. Tide-dominated estuaries generally consist of a landward-tapering funnel shaped valley, bounded by various intertidal sedimentary environments such as intertidal flats, mangroves, saltmarshes, and salt flats. Depending on the degree of sediment infilling, the boundaries of tide-dominated estuaries may follow the irregular outline of the drowned valley, or, in more mature cases are smooth and intersected by small tidal creek dendritic drainage networks. Major structural elements inside the estuary include elongate tidal sand banks, which occur in the wide entrance, oriented perpendicular to the coast and aligned parallel to the direction of dominant tidal currents. The tidal sand banks are usually dissected by deep channels containing strong tidal currents. Landward of the estuarine channels, the source river that feeds into tide-dominated estuaries often features a straight–meandering–straight river channel profile (see East Alligator River, below).* ***This represents the point at which the convergence of seaward-directed water and sediment transport by the river, and landward-directed water and sediment transport by tides occurs.*** *Due to strong tidal currents generated by large tidal ranges, tide-dominated estuaries are usually highly turbid.*



Examples of tide-dominated estuaries: the Fitzroy River (QLD), the Victoria River (NT), and the East Alligator River (NT).

In this case, we can consider the estuaries part of the marine waters, following the legend of the CLC2000 all the estuarine areas in Europe are part of the marine environment.

Coastal lagoons *and strand plain-associated coastal creeks are small, shallow basins that have very low (or negligible) freshwater input (see Examples below). The catchment for these systems is limited to the immediate hinterland. Due to the lack of significant freshwater input (and associated terrigenous sediment) and strong tidal currents, the entrances to these* ***coastal waterways*** *are often intermittently or permanently closed, resulting in isolation from marine influence for long periods. The geomorphology of coastal lagoons is similar to wave-dominated estuaries, however they lack a distinct fluvial bay-head delta. Strand plain-associated coastal creeks are narrow, generally shallow water bodies that occur on wave-dominated coasts. They are generally oriented parallel to the coast, and develop on prograding coastal sequences formed from beach ridges, dunes, and barriers. Coastal lagoons, and other small waterways associated with wave-dominated coastlines, tend to experience very low wave and tide energy within, as tidal waters are often unable to penetrate the closed (or very narrow and intermittent) entrances. Additionally, low or non-existent river flow is conducive to very low energy conditions, except during extreme flood conditions. The most significant physical energy source in many systems is internally generated wind-induced waves, however these usually remain quite small due to the limited size of the waterway.*

The last definition about coastal lagoons explain the evolution and also how contribute the coastal dynamic in it, in this case the evolution of this morphology depends directly on the coastal dynamics, then, coastal lagoons as non stable structure could be considered as part of the marine environment and also be defined as marine waters. (CLC2000 defines also the coastal lagoons like marine waters).

Examples of coastal lagoons

Despite intermittently experiencing significant variations in salinity, coastal lagoons and strand plain-associated coastal creeks are usually colonised by estuarine invertebrates and other 'euryhaline' aquatic organisms that can tolerate a wide range of salinity conditions The duration of water exchange between the ocean and the coastal lagoon is probably the most important factor influencing the recruitment of marine organisms.

Tide-dominated deltas *(see Examples below) are comprised of a river that is directly connected to the sea via channels, that are typically flanked by low-lying vegetated floodplains and swamp areas. Because of the dominance of tidal processes, the geomorphology of tide-dominated deltas features a landward tapering funnel-shaped valley, and the river is connected to the sea via a series of distributary channels. Channels may be separated by large expanses of low-gradient vegetated swamps.*

Because net bedload transport is offshore, tide-dominated deltas do not exhibit the 'straight-meandering-straight' channel morphology seen in many tide-dominated estuaries . Due to the degree of sediment infilling, the gross geomorphology of tide-dominated deltas may not exhibit the morphology of the antecedent valley (if present). Tidal sand banks are a major structural element within the entrances of tide-dominated deltas, and are oriented perpendicular to the coast, and aligned parallel to the direction of dominant tidal currents. The tidal sand banks are usually dissected by deep channels containing strong tidal currents. The dominance of offshore sediment transport and generally low wave-energy at the coast means that tide-dominated deltas usually construct lobate shoreline 'protuberance', which extends onto the inner continental shelf. Due to strong tidal currents generated by large tidal ranges, tide-dominated deltas are usually highly turbid.

Examples of tide-dominated deltas

During the latter stages of deltaic evolution (or sediment infilling), the connectivity between the river channels and tidal inlet increases. This results in more efficient transmission of fluvial sediment directly to the ocean, as much of the system is comprised of a floodplain area that is above the influence of most tides. The distribution of environments such as intertidal flats, mangroves and saltmarshes is not significantly different from tide-dominated estuaries, except for the formation of tidal sand banks seaward of the mouth due to the net offshore bedload transport. Tide-dominated deltas have reached a point in their development where further evolution involves progradation of the coastline onto the inner continental shelf, although this process can be limited by sediment supply and the effects of sediment redistribution by tidal (and other) currents, in this case we can consider the deltas as part of the land morphology, and not as marine environment to delimitate the coastline of Europe.

Following the showed examples and considering the intertidal flats, the coastal lagoons and estuaries as part of the marine waters or environments with the sea and ocean type from the CLC2000, there is possibility to develop an European coastline that could be valid and useful only if we explain and justify our methodology. Although the consideration of these morphologies as non “land” covers is totally appropriate.

The CLC classes that have been selected as non-land or part of the sea should be merged, in this case using the proximity tool to obtain the sea area around the European countries selecting the bordering polygons.

The countries selected are the EU25, RO, BG, TR, HK, BH, CS, AL, and MK.

The resultant file must be converted into polygons and apply the Spatial Analysis tool “allocation” assigning arcs or nodes in a network to the closest facility, until the facility or each arc's limit of impedance is reached. For example, extending the SABE Polygons to the nearest CLC2000 limit with the same coordinate system. The output raster will be which it will start the comparing work to analyse the differences and the “non common” circumstances.

After the allocation assigning it should be introduced the IMAGE2000 to have the main base to check the possible gaps or referenced mistakes.

1.1.2 Specific Problems to define the Coastline

In order to define a natural and homogeneous European coastline it is obviously necessary to congregate some important information like aerial imagery, specific definitions of country areas (Corine Land Cover) and also some explicit data versioning the coastal subject as the Eurosion Project Coastline. After the first phase of collecting data it has to be organized in a GIS database where there had possibility to analyse it and find the best way to define the correct coastline.

This analysis process consists in covering the entire coastline and reporting some situations where are found some case problems in the definition process. For example the differences in the length of the Corine Land Cover coastline in relation with the aerial imagery must be reported and analysed in order to find the best method to define the respective coastline.

The process starts with the analysis of the representation of the Coastline of Netherlands viewing the Corine Land Cover 2000, the Eurosion Coastline and the aerial photos of LandSat from Netherlands, with the correspondent legend data.

In the coastline of the Netherlands there are some places where it can be got more accuracy in its definition, in using Eurosion Project Coastline. In the case of the Reference Database of Netherlands from Corine Land Cover the represented coastline is not always so similar as the images from LandSat, existing in some areas a few differences of 50 metres to 250 metres. These cases should be analysed to define what kind of adjust must be done. The purpose is to get a maximum variation of more or less 50 metres.

In Netherlands it has been noticed some problems with non-represented thin transport structures, port areas with large amounts of marine waters perhaps, and some cases of little adjusts of less than 100 metres, that should be done in the main coastline, due to its very angular line edges. This line edges are normally pieces of land like peninsulas and cables that are too thins and hard to identify. These ones are usually identify very well by the Eurosion Coastline Database, by the way it don't have always a good and steady representation of the coastline.

Estuary closed by little piece of landform in Suffolk, (NUTS3-UKH14), in the southeast of United Kingdom.

Other country that it has been analysed is the United Kingdom, where the main country coastline are well defined, only in some areas and in specific nature sub-systems the line is sometimes trembled, being that in another locale, with the same natural environment, the line stays straight or rounded all the way. This kind of problem occurs in almost all the countries so that should be solved using Corine Land Cover background, and in other cases the Eurosion Coastline Database. It has been found as well an estuary not connected to the sea, blocked by an area of beaches, so we acquire that it was a simple inaccuracy in which a little part of the beach should be included in the estuary. It has been also found a closed estuary by a port area where the result has been the same.

In Estonia the coastline as it has been seen by the LandSat images, is very sinuous with a natural environment especially homogeneous. In some areas is hard to define where the land ends and where the marine waters begin, so we have in several cases to use like the good one the official information. The point is that some local waters are full of vegetable and fungus species, which appear with green colour in the aerial imagery, and obviously not seems to be marine water and it is confused with land. In general all the information are in good shape and the Corine Land Cover will be enough to build the coastline in Estonia.

Estuary closed by a port area in Suffolk (NUTS3 UKH14), in the southeast of United Kingdom.

In Spain, the last country to be analysed, has a problem in order to define the land used by port areas. It can be distinguished three kinds of diverse port areas classification. One is oval, a line that go around the port including all the waters that involves the port zone. The second one considers only the artificial structures of support of the traffic, where any water is included. The last one comprises the artificial structures and also the waters between then, it considers a part of the water as artificial surface as the area as been reconstructed by humans. Of course that in this kind of difficulty in a definition is hard to get total consensus in one of then, but it should be chosen only one with a strong natural argument, for example.

In the north of Spain it has been located imprecision in intertidal flat. This kind of areas must have always a simple connection with the sea or marine space, so they can be invaded by water in a part of the day, in order to make possible its definition of marine area. The imprecision consists in one intertidal flat that don't have any link with the sea, it has a beach zone that isolates the intertidal in the middle of the land. The solution that has been found is to join the two intertidals by the beach area that should be wrong defined. To finish the Spanish analysis it comes a strange situation that is the obligation to mark a coastline in the edge of a coastal lagoon. A thin piece of land is dividing a coastal lagoon from the sea, what suggest one simple and homogeneous area. But the point is that it should be drown a coastline stuck between two water bodies, a coastal lagoon and an intertidal flat.

This is an example of a closed intertidal flat area in the north of Spain, in La Coruña, (NUTS3 – ES111). Normally this kind of areas must have at least a simple connection with the marine zone, like the ocean for example, but in this case it can be seen that there is a intertidal flat next to the sea, and the other one, in blue colour, that does not have any link with the sea not even with the closest intertidal flat in the north.

A coastal lagoon separated from the sea by a little corridor of terrain (albufera), in the Region de Murcia, (NUTS3 – ES620), in the southeast of the Spanish coast. It has been marked in the area of an intertidal flat that could be a problem because the coastline has to be marked by the left hand of the intertidal area, that in this case keep in touch with an watered zone, the coastal lagoon. This seems to be incongruent, marking a line that should distinct sea from country fields being that in this case it divides water areas.

In this other example it can be seen a little failure in a Corine Land Cover 2000 discontinuous urban fabric area in Overig Zeeland, (NUTS3 – NL342), in Netherlands. The urban zone in the centre should cover the red marked region that is now considered as sea and ocean.

The port areas question is for sure the most difficult example to resolve. In those three pictures it can be seen a variety of port areas in the east and south of Spain, that have different characteristics as well as diverse structures, so that it's easy to observe that they have not similar classifications for the same typology. In the first picture located in Granada, (NUTS3-ES614) the port area covers all the facilities and also the water that is between then. It is supposedly the best definition. The second case next to Barcelona, (NUTS3-ES511), shows four port areas with the same structure in general, circular or oval around the sea port area, that consider a significant water zone rounding all the ports. Finally the last definition is placed in Almería, (NUTS3-ES611), that covers only the artificial platforms that support the traffic sea-land.

In this case the Corine Land Cover 2000 considers a large watered area as port structure. It can be found that the biggest part of it should be classified as sea and ocean, for the reason that it is not an artificial zone. Only the two structures in the right side may be included in the port areas nomenclature, the other parts of the territory should be classified as sea and ocean area. This case is located in Zeeuwsch-Vlaanderen, (NUTS3-NL341), in the Netherlands.

In this case we have a water body area close to the sea. It is strange to perceive that there is nothing in the middle of the two areas. This case is located in Overig Zeeland, (NUTS3 – NL342), in the Netherlands.

1.3 CONCLUSIONS

The previous discussions concerning the environmental and coastal questions came into the consensus that to build a coastline it must be defined first the Corine Land Cover zones that should be included in the marine environment, and the ones that are considered as land form. So analysing the CLC2000 features the conclusion was that all the classes of Estuaries and Intertidal Flats that connects to the Sea should be considered as marine environment and in the end part of the Sea.

2. METHODOLOGY

2.1 GENERAL RESUME AND WORKFLOW

The methodology to obtain the European reference coastline comprises two main steps: **Main process workflow:**

- **Coastline geometry creation**: this geometry is created selecting the CORINE Land Cover polygons that touch the sea, and deleting from this selection the estuaries and intertidal flats that are connected to the sea as well (so they are considered as sea). From this selection, the coastline is created. This coastline inherits CORINE attributes; this means that each coast segment will have a CORINE class associated touching the sea.
- **Eurosion attributes inheritance**: as long as Eurosion has associated many attributes to the coast, such as erosion patterns, geomorphology, typology, and so on, these attributes are assigned to this coastline derived from CORINE. It's done by proximity (allocation first, identity afterwards).

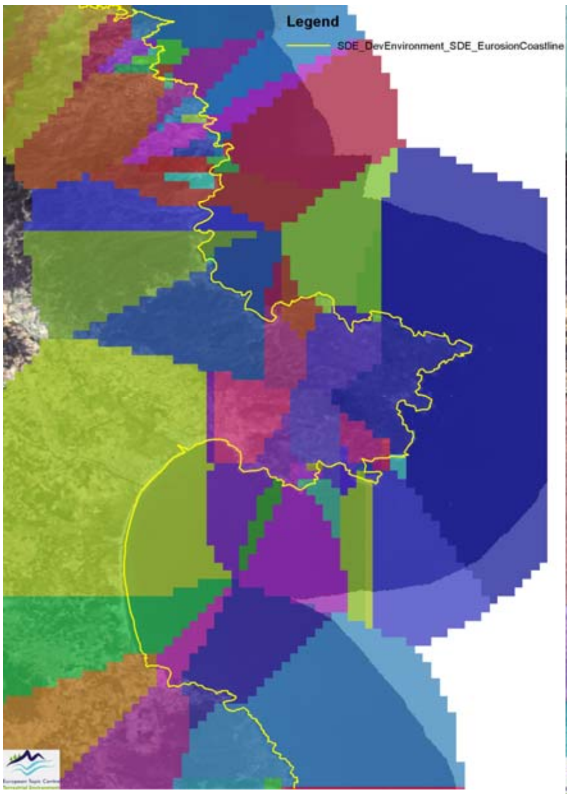
Geometry Definition

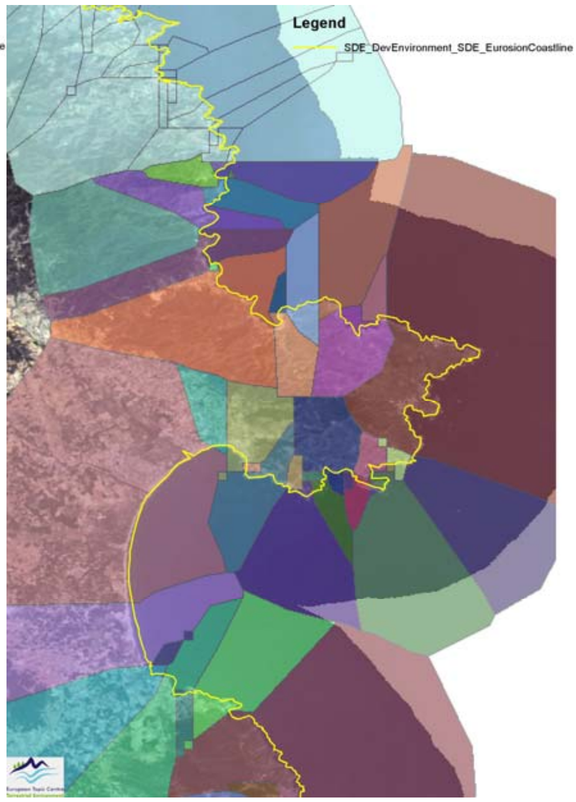
The first step on the methodology consisted in convert the raster of the Corine Land Cover 2000 into two parts, one representing the land features and other as the sea with a reclassification of the corine raster. As we have the new raster reclassified we could create a line that divides the two zones. This process makes possible a selection of the coastal zones of Corine Land Cover by overlapping. As we have this CLC 2000 coastal zones exported to a new workspace we should remove the Intertidal Flats and Estuaries zones that are part of the Sea. In the end this areas from Corine composes the land edges that touch the Sea and from this ones we could obtain the geometry line that touches the Sea. Mainly to create this coastline we had to find a way to select and extract the line edges from Corine Land Cover 2000 that touches the Sea, removing the Intertidal Flats and Estuaries zones. Because of some problems in the selection from the Corine Land Cover Seamless vector file, we have to use first the raster file to create a line from it separating the land from the sea, and then use it to select fixtures in the Seamless file. The problems to select directly from CLC2000 vector file are in small waterways that connect to inland marine waters, these ones by a definition error are not considered as Sea in CLC2000, and in that way it is hard to locate automatically the line that touches this zones.

Attributes inheritance

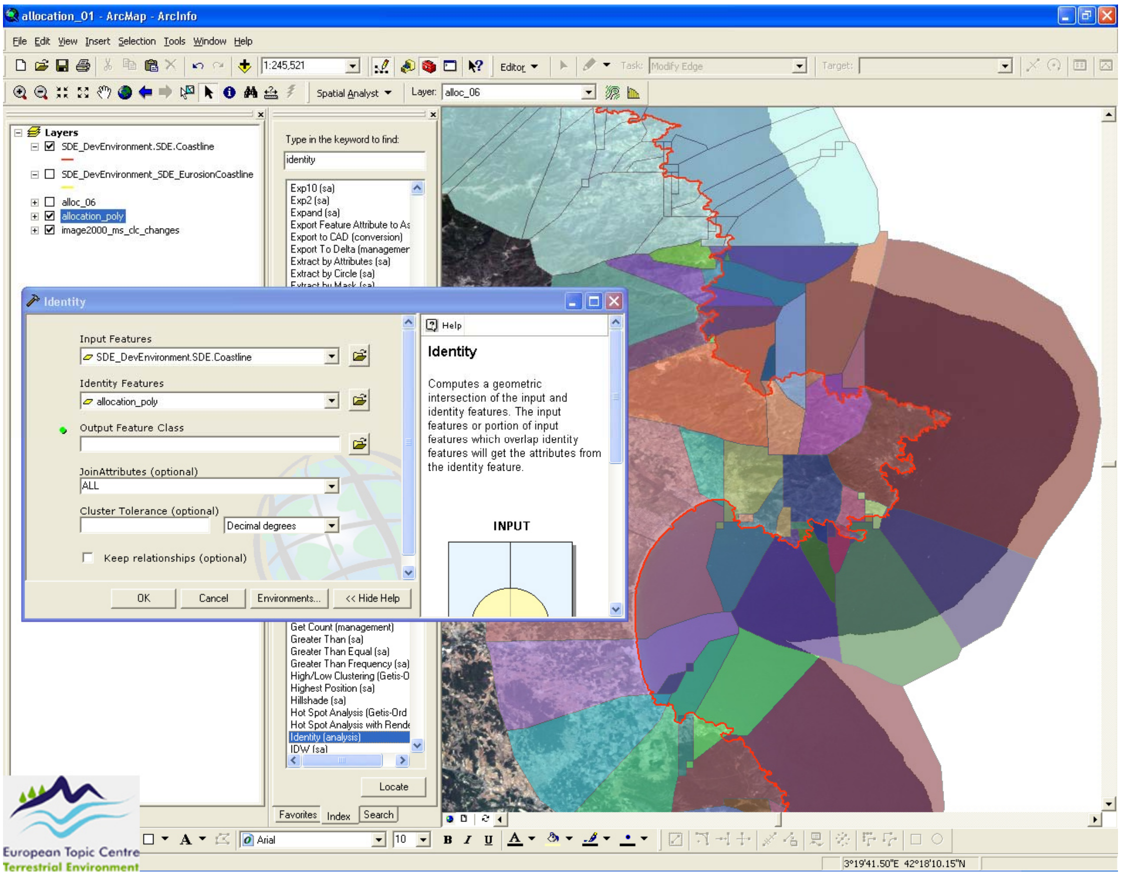
The inclusion of the attributes of Eurosion on the Coastline is based on the requirement of a good coastal characterization with good attribute data. This process was done through an allocation of the features from Eurosion. The allocation creates a raster file from the attributes of one specific shape at one defined distance. To add the attributes to the Coastline we should convert the raster to polygon features and then with the identity tool push the aim data to the Coastline. Here we can see examples of the process:

In the left image is represented the Eurosion Coastline at yellow colour, in the other one is overlapped the new coastline creation. This example is from Catalonia, Spain.



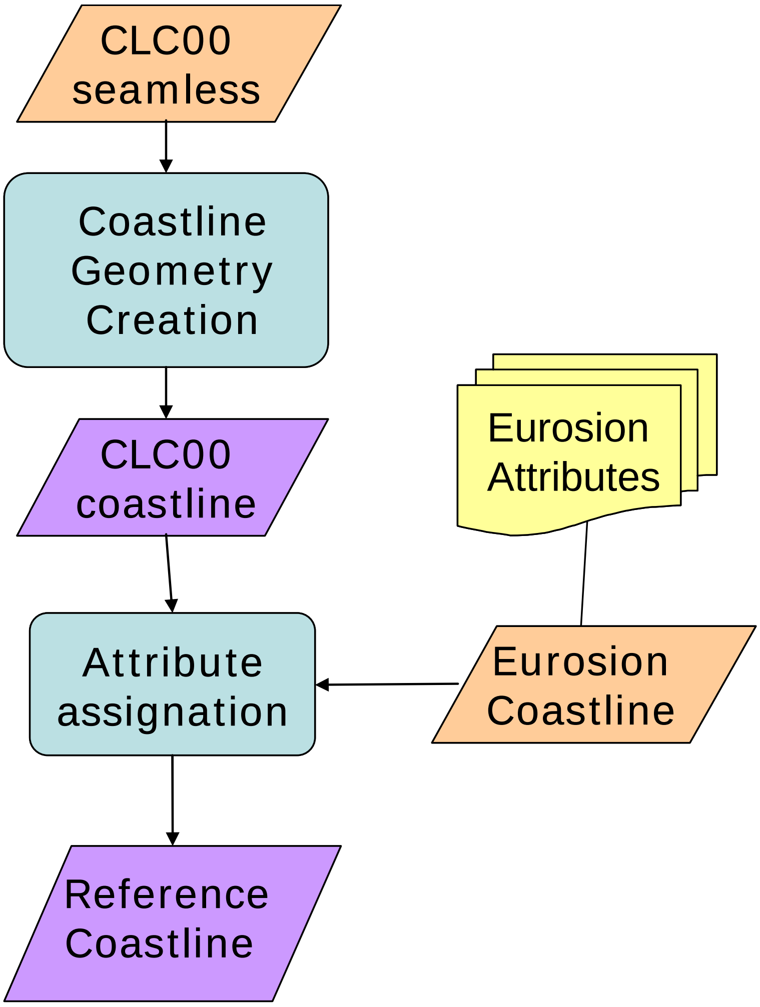


In the left image we can see the allocation of the Eurosion Coastline at different colours by means of is attribute, in the other one is shown the polygon shapefile of the allocation. This example is from Catalonia, Spain.



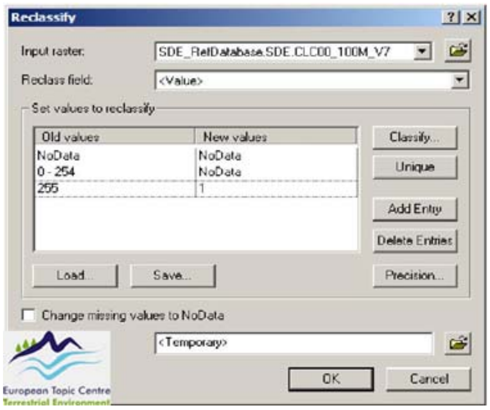
In this image the polygon with the wanted attributes from Eurosion overlap the Coastline geometry. By now we can see what type of attribute of Eurosion will correspond to each zone in the new Coastline. In the last step we use the Identity tool that assigns to the output shapefile the attributes that intersect with the input features. This example is from Catalonia, Spain.

WORKFLOW:


CLC00
seamless
Coastline
Geometry
Creation
CLC00
coastline
Eurosion
Attributes
Attribute
assignation
Eurosion
Coastline
Reference
Coastline

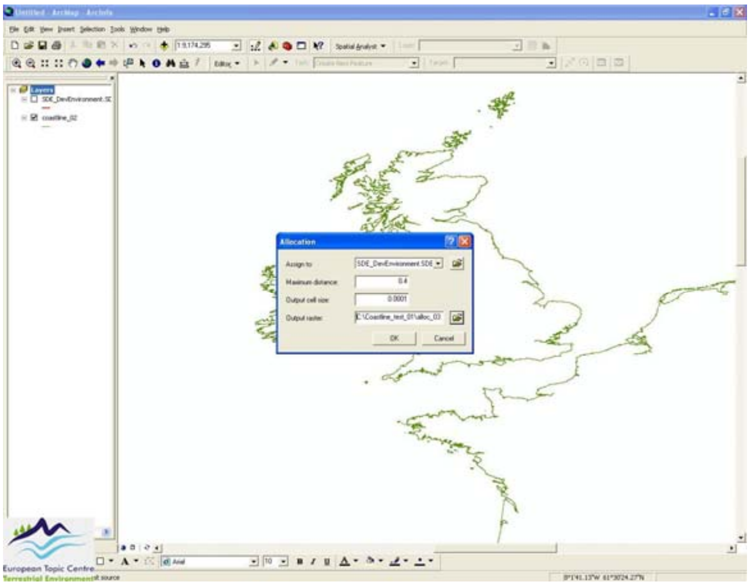
2.2 Detailed Resume

The European coastline as we can see in the Corine Land Cover coastal areas, are defined through many different classifications due to diverse types of environment and country explicit way of classify it. In this way we will find always a few differences of delimitation in many coastal areas that in the main appears to be equals. We opt to maintain the country classification from CLC 2000 that has been done by the most competent and expert institutions of the specific nations in cause, that supposedly it is the strongest information that we can use.



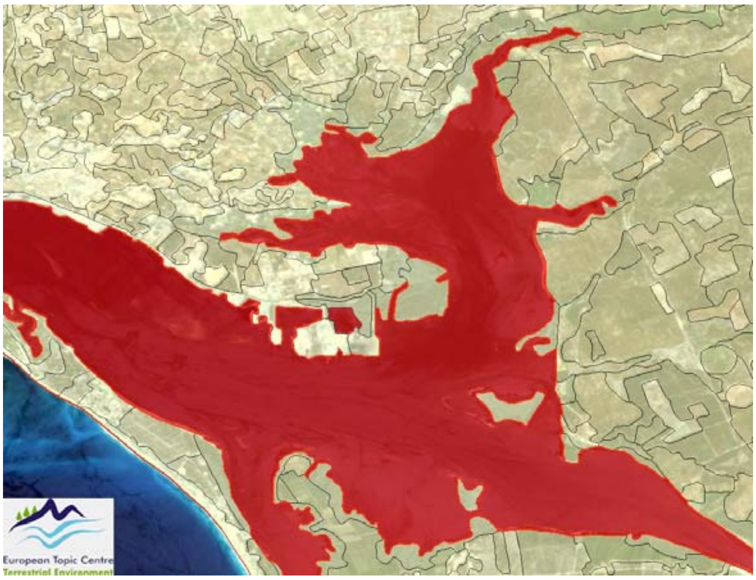
Example of Reclassify

In the other hand we begin to choose the CLC 2000 raster file of 100 metres definition named 'sde_refdatabase.sde.clc00_100m_v7', in order to make a reclassify of it. This operation consists in make that all the raster classes that are considered land assumes the No Data value, this values goes from 0 to 254 in the pixels value table, the marine areas are marked by the 255 value, and assumes the 1 value, the No Data features stays intact. With that we can distinguish the non-land areas (1 value) from the land (0 value), to get the line edges that compound the coast. It was the best way we find to begin to construct the coastline. After the creation of the raster we should convert it to coverage file in the Arc Info with the command Gridpoly adapting it to polygon coverage. It will be necessary in Arc Info also make a build or a clean of the coverage, it depends of the results, in order to have the topology completely ready to display and operate.

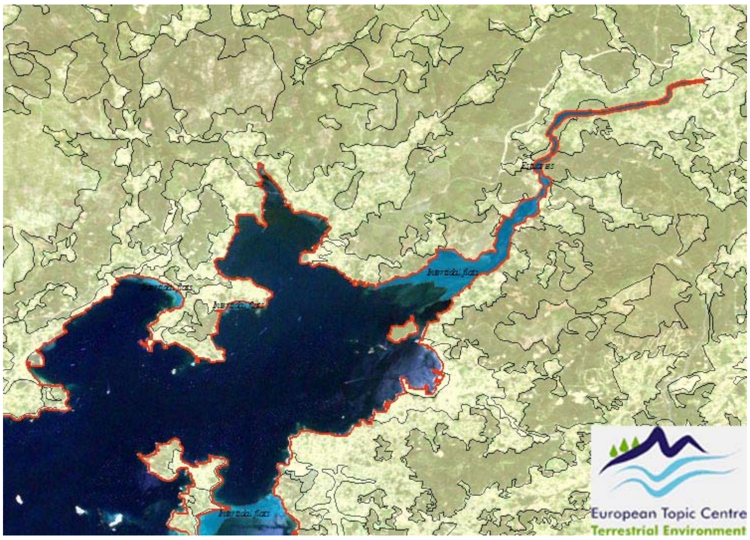


Allocation process that calculates for each cell its nearest source based on the least accumulative cost over a cost surface.

The next step includes a specific selection of two fields in the attribute table of the line coverage features. We should select by attributes the Lpoly and Rpoly that are equal to one (1) so we can have the arcs that form the exterior delimitation of the coast. Those ones must be exported to line shapefile to start the selection by location tasks. This shapefile containing a simplified coastline should be overlaid with the Corine Land Cover 2000 Seamless SDE features so we could make a selection of all the coastal areas by location. This operation deals with a huge quantity of features that turns the processing extremely slow. In some cases we had to break the process in parts to ensure that the information are well disposed. Consequently the coastline shapefile should be overlaid to the Corine Land Cover 2000 Seamless to pick up the areas in CLC2000 that intersect the coastline shapefile. This task should be done by three times more or less, adding to the previous selection the current one. As the information that was treated has to many features it will be required to divide the process in various steps, exporting the intermediate results to shapefile.



Here we can see marine waters (estuary) rounded by land that represents the Corine Land Cover 2000 areas.



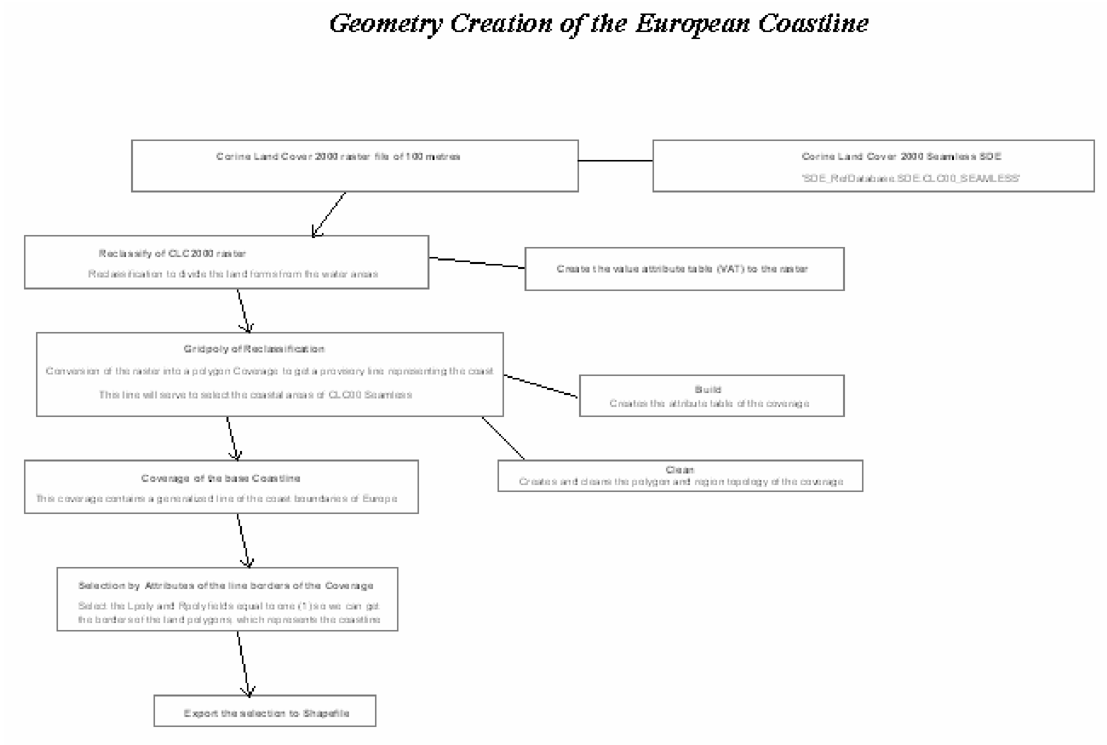
Example of various intertidal flats that makes part of the marine environment, the final coastline marked with red color and also the Corine Land Cover 2000 specific areas.

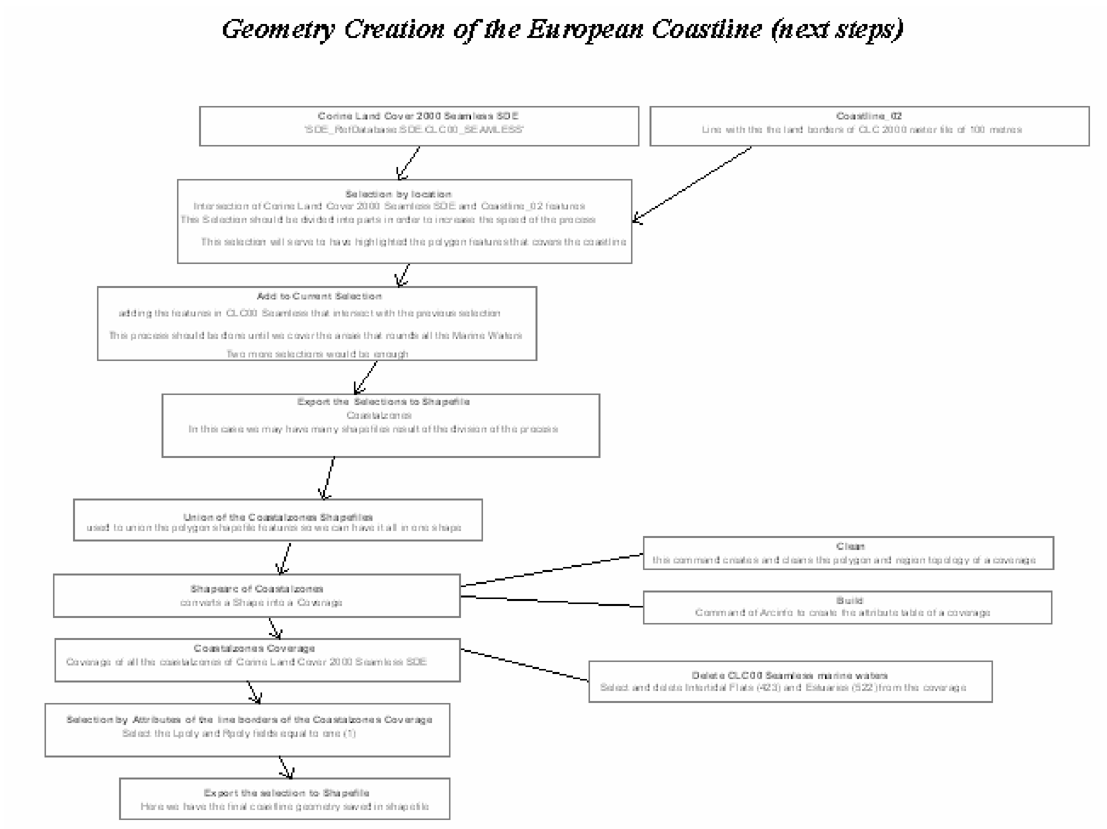
When we have the coastal zones exported to shapefile, certifying that they cover around all the marine zones and that the Intertidal Flats (423) and the Estuaries (522) are not included in this sum of features, a Shapearc Arcinfo command should be done. This tool converts the specified shape into a coverage file, with POLY option. Also as the procedure after the Gridpoly we have to select the arcs that compose the coastline selecting by attributes the Lpoly and Rpoly equal to one (1), and export then to shapefile line type. With that we may have accomplish the Coastline production in the matter of the topology and displacement as a detailed line demarcation of the contrast Sea-Land.

The final step consisted in a creation of an allocation of the Eurosion Coastline attribute features. This command makes a topic grid with the wanted distance and the attributes required by the user. In this case we opt to choose a distance that cover the most part of the large internal marine waters, in the most Estuaries. The cell size was set to 0.004 because that was the maximum definition we can get without occurring any errors. The grid file has all the codes and attributes of the Eurosion Coastline in large coastal zones that make possible assign the attributes of the aim features to the previous coastline shapefile. To do that we have to convert the raster to features so we can have a polygon shapefile with the codes of Eurosion. To pass the attributes fixed in the polygon shape to the coastline an Identity tool as to be done. The intersection tool only works with the common geometries so in the end some parts of the coast will be un-represented. The Identity tool keeps all the values and features of the shapefile including those that do not have attributes of Eurosion.

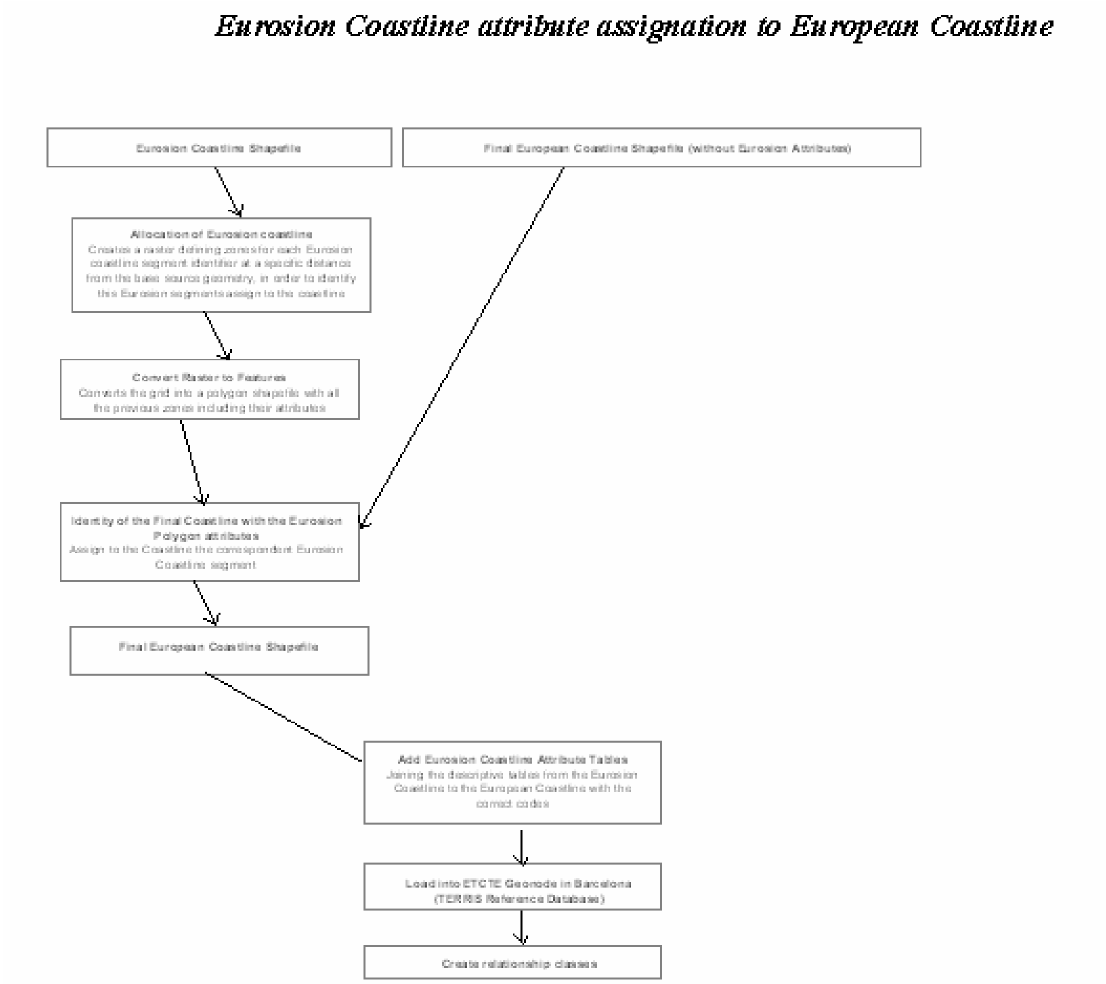
As we accomplish this task the coastline shapefile needs to be updated with the attributes description and some codes too. For that a join data will be the solution, assigning the correct feature tables, so the Coastline could have topology data and also backup descriptive information. As the Eurosion Coastline only covers specific coastal areas we have to aggregate the coastal areas that lacks in the final coastline. To do that an Identity must be done, this tool computes a geometric intersection of the input features and identity features where the input features or portions there of that overlap identity features will get the attributes of those identity features.

Detailed workflow for geometry creation:





Detailed workflow for attribute inheritance



3. RESULTS

The final result from the GIS procedure seems to be more or less homogeneous in its representation, and comparing with the Landsat images the features completely fits the coastal extremity. The data is saved on polyline shapefile. Here it is displayed the European countries in Corine Land Cover 2000 covered by the Coastline. CLC00 DB refers to mostly to year 2000 in most countries; in some parts interpretation is based on year 1999 or year 2001 data, exceptionally on year 2002 data. See the table below for reference.

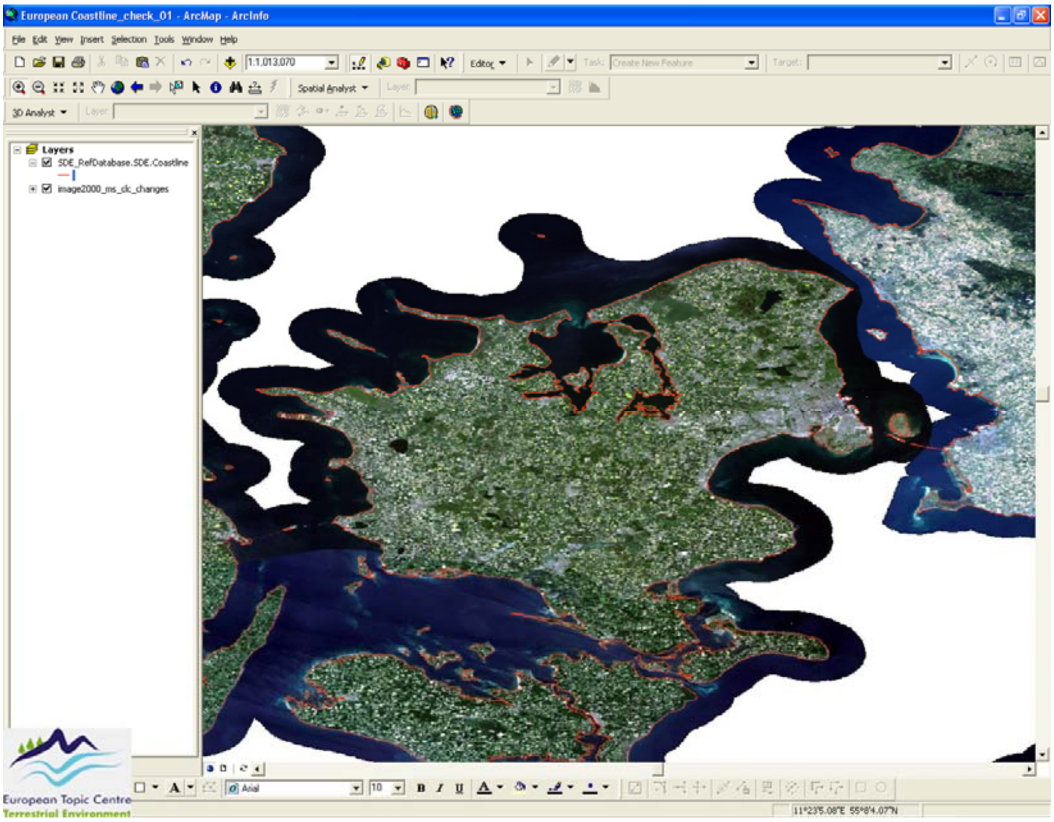
Time reference			
Albania	1995	1996	considered as CLC2000
Austria	1999	2001	
Belgium	1999	2000	
Bosnia and Herzegovina	1998	1998	considered as CLC2000
Bulgaria	2000	2001	
Croatia	1999	2000	
Cyprus	2000	2000	
Czech Republic	1999	2001	
Denmark	1999	2001	
Estonia	1999	2001	
Finland	1999	2002	
France	1999	2001	
Germany	1999	2001	
Greece	2000	2001	
Hungary	2000	2000	
Ireland	2000	2001	
Italy	1999	2002	
Latvia	1999	2001	
Liechtenstein	2000	2000	
Lithuania	1999	2001	
Luxembourg	2000	2000	
Malta	2001	2001	
Macedonia	1995	1996	considered as CLC2000
The Netherlands	1999	2000	
Poland	1999	2001	
Portugal	1999	2002	
Romania	2000	2001	
Slovak Republic	2000	2001	
Slovenia	1999	2000	
Spain	1999	2002	
Sweden	1999	2002	
United Kingdom	1999	2002	

The Coastline includes a conjunct of tables with attribute data like CLC2000 and Eurosion codes and description to complement the geometry features. The next table reveal the classes from Corine Land Cover 2000 in the coastline features and each complete length in meters.

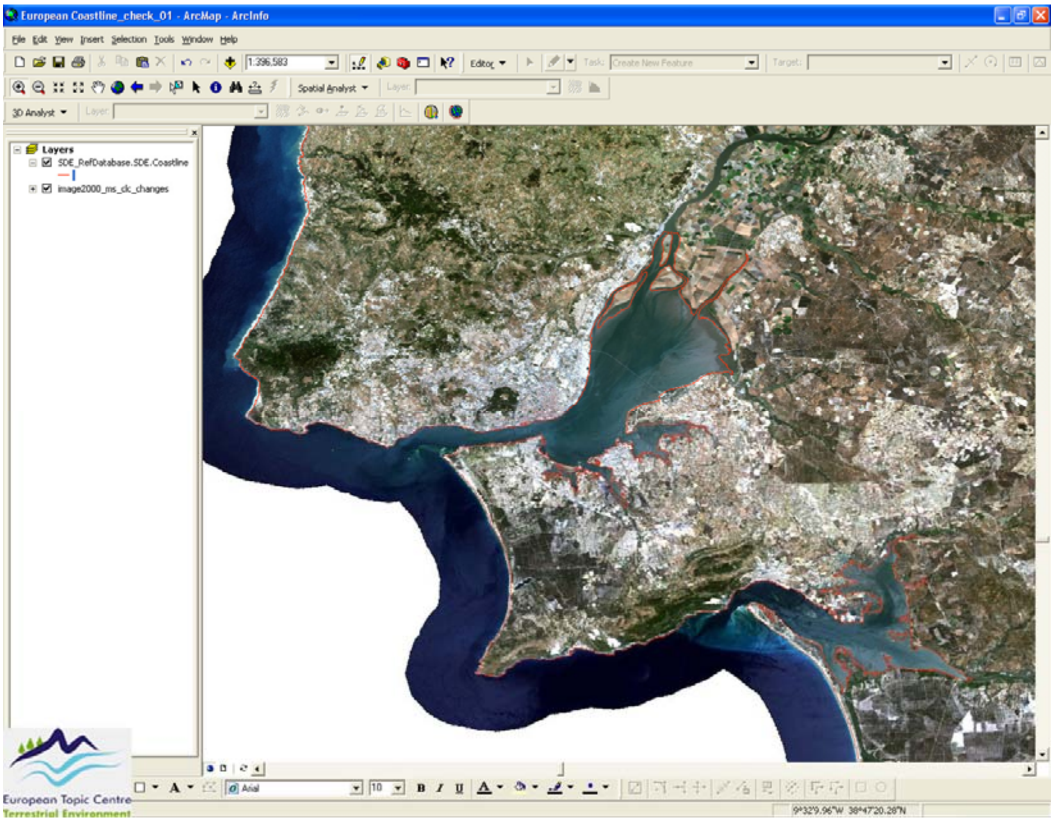
Attributes of CLCclasses_lenght

DESCRIPTION	LENGTH
Continuous urban fabric	1151731.7379
Discontinuous urban fabric	8354011.8238
Industrial or commercial units	1483878.0131
Road and rail networks and associated land	122514.0741
Port areas	2569573.2623
Airports	117588.2696
Mineral extraction sites	116585.5465
Dump sites	33233.8918
Construction sites	138486.0773
Green urban areas	263047.0147
Sport and leisure facilities	2018121.5672
Non-irrigated arable land	5727327.9804
Permanently irrigated land	170349.1259
Rice fields	49932.5621
Vineyards	157819.314
Fruit trees and berry plantations	367845.1365
Olive groves	743118.0546
Pastures	10953338.9551
Annual crops associated with permanent crops	137854.264
Complex cultivation patterns	4813690.7805
Land principally occupied by agriculture, with significant areas of natural vegetation	6311266.508
Agro-forestry areas	1489.5337
Broad-leaved forest	3309864.7449
Coniferous forest	19610262.108
Mixed forest	7176540.7299
Natural grasslands	7008767.2974
Moors and heathland	5147074.7484
Sclerophyllous vegetation	8665965.428
Transitional woodland-shrub	6315981.6618
Beaches, dunes, sands	8299872.5343
Bare rocks	2888912.5022
Sparsely vegetated areas	2431769.381
Burnt areas	25854.4976
Inland marshes	845997.4125
Peat bogs	1139027.8355
Salt marshes	4127876.9077
Salines	319877.8849
Water courses	117476.7924
Water bodies	68432.873
Coastal lagoons	218803.791
Sea and Ocean	43110.2809

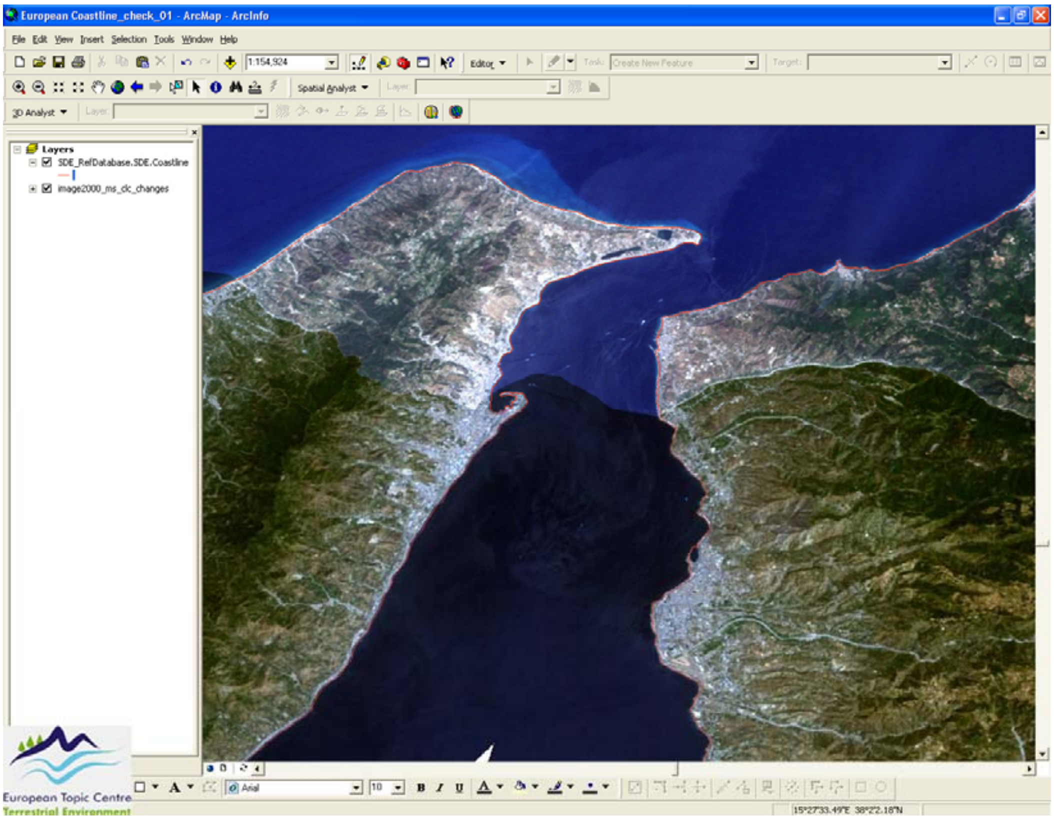
Record: 0 Show: All Selected Records (0 out of 41 Selected.) Options



This image is from the Copenhagen isle, in Denmark.



Here we can see the region of the Great Lisbon, in Portugal.



This example is from Messina, Italy.

ANNEX 1: DATA SOURCES DESCRIPTION

CORINE LAND COVER 2000:

The Corine Land Cover is a consistent and homogeneous database throughout Europe with a good spatial resolution. Standardised and tested methodology and follows the INSPIRE standarts. The data is available for all the European coastal countries (except CS and TR) and the most important thing to develop the coastline is that CLC2000 is accessible at the highest level of detail.

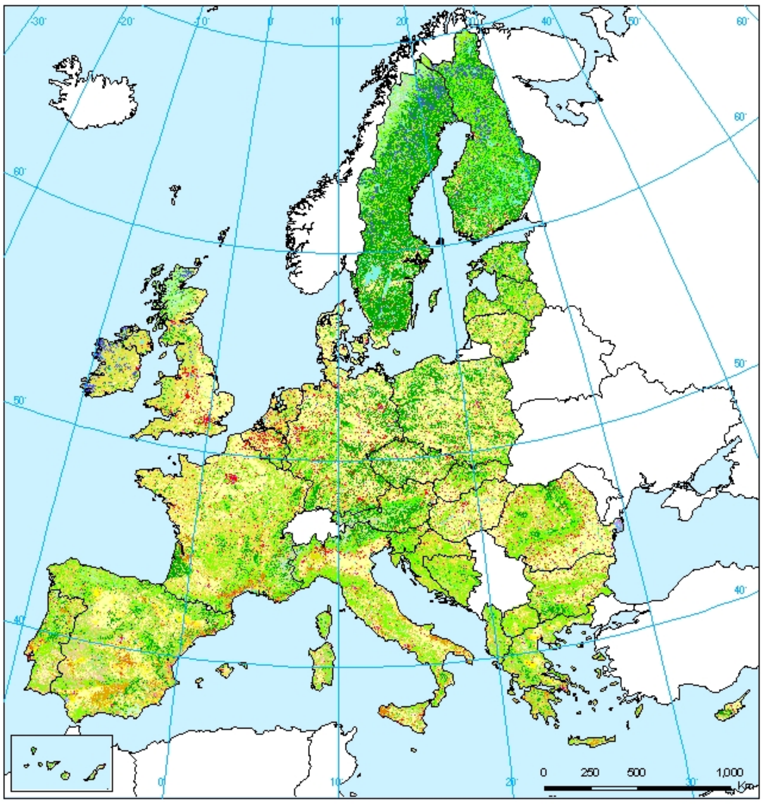
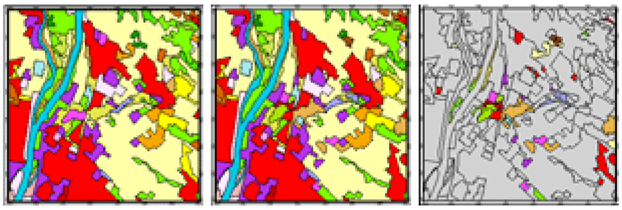


IMAGE 2000 Project:

The satellite image "snap shot" of the EU territory (IMAGE2000) is be the basic material to undertake the up-date of CLC database for the year 2000 (CLC2000) and identify main land cover changes in Europe during the period 1990-2000. The project is also extended to the ten Phare Accession Countries (also new EEA member countries from January 2002). In this case has been useful to compare the CLC2000 polygons with the reality that the IMAGE2000 shows.



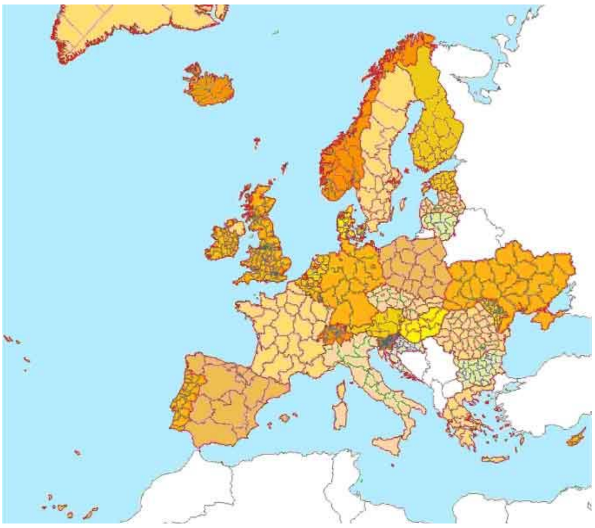
CLC 1990 CLC 2000 Changes

SABE:

SABE2004 represents the status of the administrative data of July 2003 for the former EU15 and May 2004 for the 'new' EU10 and other European countries.

Seamless Administrative Boundaries of Europe (SABE) dataset has been compiled from source data provided by 35 National Mapping and Cadastral Agencies (NMCAs), members of EuroGeographics. It contains all administrative units from country down to commune level. The term "seamless" means that there are no gaps or overlaps between polygons initially derived from different sources.

The source data are of the best available semantic quality. The contributions have been transformed into a uniform structure and positional reference system, line-filtered to a uniform resolution and are edge matched at international boundaries. The main reason because it has been selected as base for the checking process of the coastline in Europe.



3.1 First Revision

After sending the provisory Coastline to the project manager of the spatial data in the EEA, some problems on the geometry were detected. The features appear in some cases generalized when zoomed, in Spain for example; where it should be like a curved line it comes out a straight line. After some attempts to find the origin of the error we concluded that it was a problem of tolerance. In the step of cleaning the coastal zones coverage file we had not selected the appropriate tolerance of processing, so in some points with particular definition and irregularity of the coast the final representation became generalized. The solution was to change the fuzzy tolerance of the analysis, made in Arcinfo, from 0.0001 to 0.00000139, and in the end we obtained more precision.

3.2 Second Revision

The data was sent to the EEA for a second revision, where geometric errors were detected as dangling nodes. The following errors were found:

Tests applied:

1) **Check Geometries** (ArcToolbox):
   Results:
   - CLC00_Coastline_CheckGeometry.dbf, with 11 features with problems of "Self intersections" (The interior of each part must not intersect itself or other parts. For a multipoint geometry, this means two of the points in the multipoint are in the same location (same x and y coordinate))

   Join: FEATURE_ID (dbf) with Objectid (coastline), to check the errors

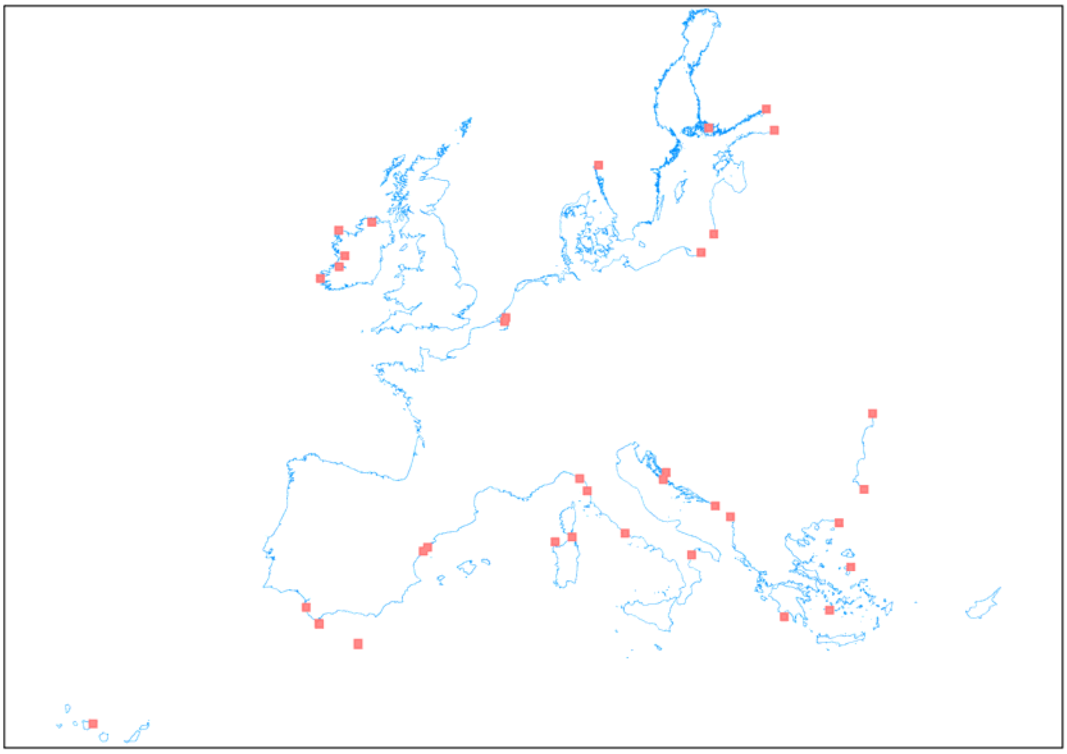
   found.
2) **Create New Topology** (ArcCatalog):

   Rules applied:
   - Must Not Overlap: A line from one layer must not overlap lines from the same layer
   - Must Not Intersect: A line must not intersect or overlap other lines from the same layer

- Must Not Have Dangles: A line from one layer must touch lines from the same layer at both endpoints
- Must Not Self-Overlap: A line feature from one layer must not intersect or overlap itself
- Must Not Self-Intersect: A line feature from one layer must not intersect itself

Results:

- Coastline_Topology (Personal Geodatabase Topology)
- Topology_Errors.txt



Fixes applied

These errors were investigated and corrected when applied.

First case, 'self intersecting geometries', based on check geometry from ArcGIS: it should not be corrected; the geometries are correct, and are not self intersecting. The error seems to appear because the geometries have only one point of intersection. But they are correct as long as they are derived from Corine. Any change should be manual, and will have a line different than Corine at the end.

Second case, dangling nodes: the lines that had dangles were removed or corrected manually. Some of them couldn't be fixed, because they must be dangles (for example, where the coastline is cut because there is no more Corine data). There are two dangles that we couldn't remove because they appeared as dangles, but we could find no end of line.