IH cantabria
INSTITUTO DE HIDRÁULICA AMBIENTAL

SMC

USER MANUAL
SMC 2.5 - ENGLISH

FUNDACION INSTITUTO DE HIDRÁULICA AMBIENTAL DE CANTABRIA
UC UNIVERSIDAD DE CANTABRIA

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Chapter 1

INTRODUCTION

1. INTRODUCTION

1.1 What is SMC?

The SMC is an advanced software which integrates a series of numerical models for the implementation of a coastal research and design methodology. This software was developed by:

- The Ocean and Coastal Research Group from the University of Cantabria (UC)
- The Directorate General to the Coast in the Environmental Ministry of Spain (MMA)

within the Research Project : "Coastal Modelling Aid System".

1.2 What does SMC do?

The SMC is a tool which allows us to carry out a great number of tasks:

- Create or open work areas associated to a specific study area on the coast.
- With the BACO module, one can access a programme containing a data base with most of the nautical charts for the Spanish Coast along with their digitized bathymetric maps. With this information, a base work area is generated in which new data can be attached from other sources, such as a detailed bathymetry, new maps, and pictures. Once this first process is complete, the work area can be modified generating different alternatives or scenarios.
- Analyze different scenarios from images (photographs, maps, nautical charts, planes, etc.) to conduct a long term study of the beach plan forms.
- Conduct a historical approach using photographs and/or bathymetric maps from different time periods.
- Digitize and obtain the bathymetric charts and coast lines of an area from a nautical chart or referenced map.
- The ODIN module, allows us to access a visual wave data set obtained through commercial shipping measurements. This programme processes the information for a specific area of the Spanish coast while generating the necessary wave data to complete/execute the numerical models of the system.
- The ATLAS module allows us to obtain the information for the Coastal Flood Atlas of any location along the Spanish coast.

- Execute the different numerical models, carrying out the short, mid and long term analysis of the study area.

- The study of the long term behaviour of the beaches with different equilibrium formulations, morphodynamic states and beach models.

1.3 SMC structure

The Coastal Modelling System (SMC) integrates a series of applications and numerical models structured according to the space and time scale of the different dynamics affecting the littoral and beach morphology based on different thematic and reference documents.

All the applications of the Coastal Modelling System are integrated within the SMC but can also be executed autonomously. In this sense, the SMC can be seen as an independent application with a specific purpose.

The structure of the SMC and its relation with the theme and reference documents can be summarized in the following diagram:

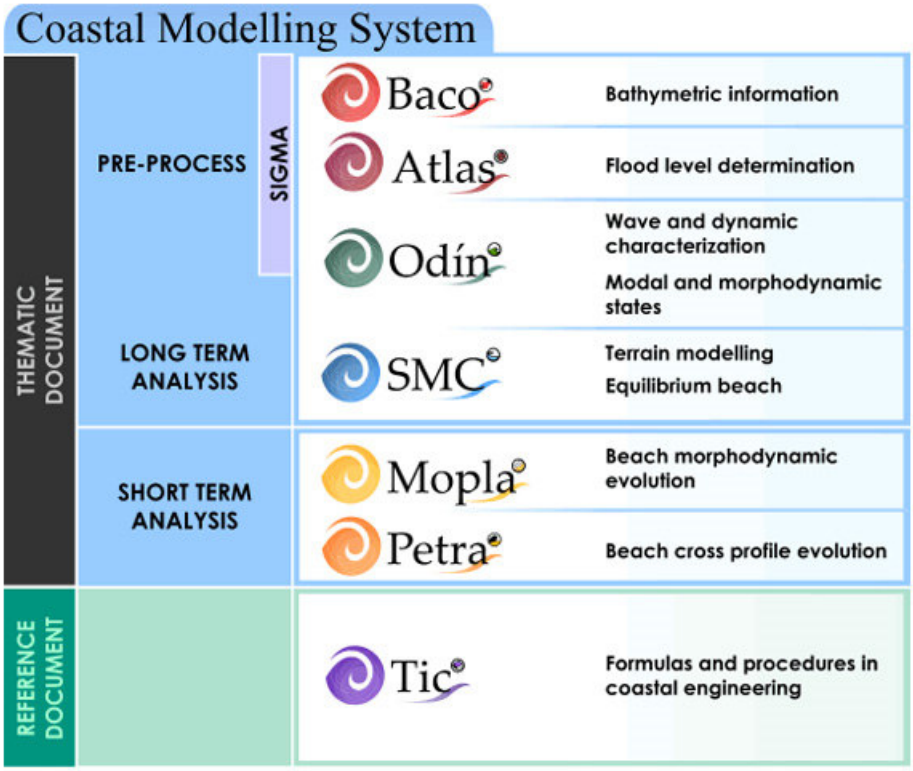

Figure 1.1

The SMC is structured in five modules:

1. **Pre-process (Sigma)**

   A pre-process module which generates all of the input data for the short- middle- and long-term numerical models. This module contains (for any location along the Spanish coast including the islands) all the Spanish bathymetry, wave directional regimes and the littoral flooding risk.

2. **Short-Term Analysis (Mopla, Petra)**

   The short-term module includes numerical evolution morphodynamic models for monochromatic and irregular input waves, in a process on a scale of hours to days.

3. **Long-Term Analysis**

   The middle- and long-term module allows the analysis of the middle-term processes (seasonal changes) and long-term response of the system on a scale of years

4. **Terrain Modelling (MMT)**

   The bathymetry renovation module permits easy updating of the actual bathymetry including different elements (sand fills in equilibrium beaches: plan and profile, coastal structures, etc.) in order to evaluate the different alternatives proposed using the numerical models.

5. **Coastal Engineering Tutoring (Tic)**

   The tutorial module includes the theoretical background in a numerical system and provides some data process systems for time series (e.g. buoys and tidal gauges). This module supports the science-based documents and it is sub-divided into four items: dynamics, coastal processes, coastal structures and environmental impact. This module is only available in Spanish.

Chapter 2

SMC INSTALLATION

2. SMC INSTALLATION

This chapter describes the requirements needed to install the SMC and the installation processes.

2.1 Hardware and software requirements

- Disk space: 150 MB + 700 MB for Baco program (bathymetric database, optional)
- Windows XP or earlier version (SMC does not work on Windows Vista and Windows 7)
- Internet connexion
- Surfer 7 or Surfer 8 (Golden Software). The version 2.5 of SMC does not work with Surfer 9. This will be improved in future versions.

2.2 Installation processes

The installation processes is in 4 steps:

1. Registration
2. Download the software
3. Install the program SMC
4. Request a license to finish the installation

Step 1. Registration

From our webpage:

http://www.smc.unican.es/en/,

Go to "Registration" and then to "User Registration"

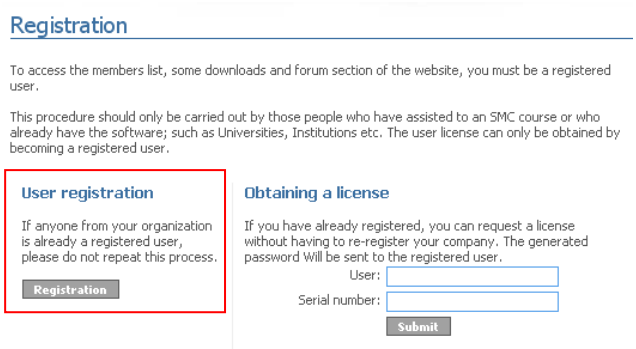

Figure 2.1

Then you must fill the questionnaire (Figure 2.2):

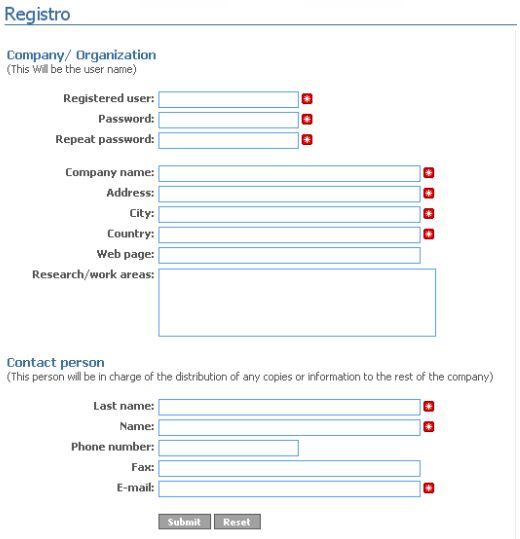

Figure 2.2

Usually the username ("Registered user") is the name of the institution (do not use space and special character). The username and password will be used later to download all SMC programs and documents and to the licence request. After your registration, you will receive a confirmation by email (the same e-mail that you indicate in the registration form).

Step 2. Download the software

Download the software from our webpage:

http://www.smc.unican.es/en/paginas/descargas.asp

To download, you will need your username and password. You should save the zip file on your computer.

Step 3. Install the program SMC

Unzip it and execute the Autorun.exe program.

Follow the instructions to install the program SMC.

- Notes:
- In some cases, a warning indicating an issue with the CTL3D32.DLL file. That is correct. Accept and keep going with installation.
- Installation program will ask for the directory to install the program in. Program\smc, that is, the default directory. It could be "only-lecture" In that case, choose another one
- After some programs installation, Windows reset is needed. This is made automatically after the completed installation.

Once is installed, a link should have been created in your Start menu.

You do not need the zip file and the corresponding uncompress directory anymore.

Step 4. License request

Run SMC

When you execute for the first time SMC, a window appears which ask your Company/Institute/University name. This is not the user name, and this requires **at least 5 characters and at least one space.**

The next window shows a **SERIAL NUMBER** and asks for a keyword.

Figure 2.3

To obtain the keyword, click on the webpage:
http://www.smc.unican.es/en/paginas/registro.asp

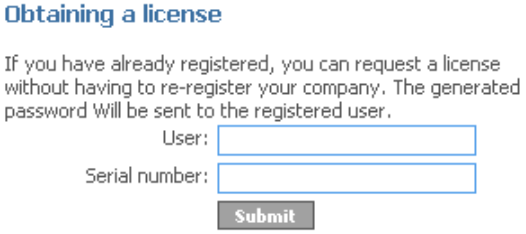

Figure 2.4

Write your username and your serial number.

Shortly after, you will receive the keyword by email. Now, you can finish the installation.

Note:
During the license request, you can close SMC, and run it again once you received the keyword.

2.3 Uninstall SMC

If you want to eliminate SMC, remove the SMC program directory and the links in the Start menu (Start\configuration\task bar).

Chapter 3

SMC MODULES

3. SMC MODULES

By using the graphical interface of the Coastal Monitoring System (SMC), the user has access to 5 modules: (1) the module "Pre-process" (Sigma), (2) the module of "Short-Term Analysis" (Mopla, Petra), (3) the module of "Long-Term Analysis", (4) the module of "Terrain Modelling" (MMT) and (5) the module "Coastal Engineering Tutoring" (Tic).

3.1 "Pre-process" (Sigma)

This module provides data that can be used as input for other modules. The data are available for the Spanish coast. It is divided in three programs.

1. Bathymetric information (Baco)

Baco provides the end-user with bathymetric information available for the study zone.

It provides:

- Image based and digitized, digital nautical charts (bathymetric data)
- The possibility to generate an SMC project

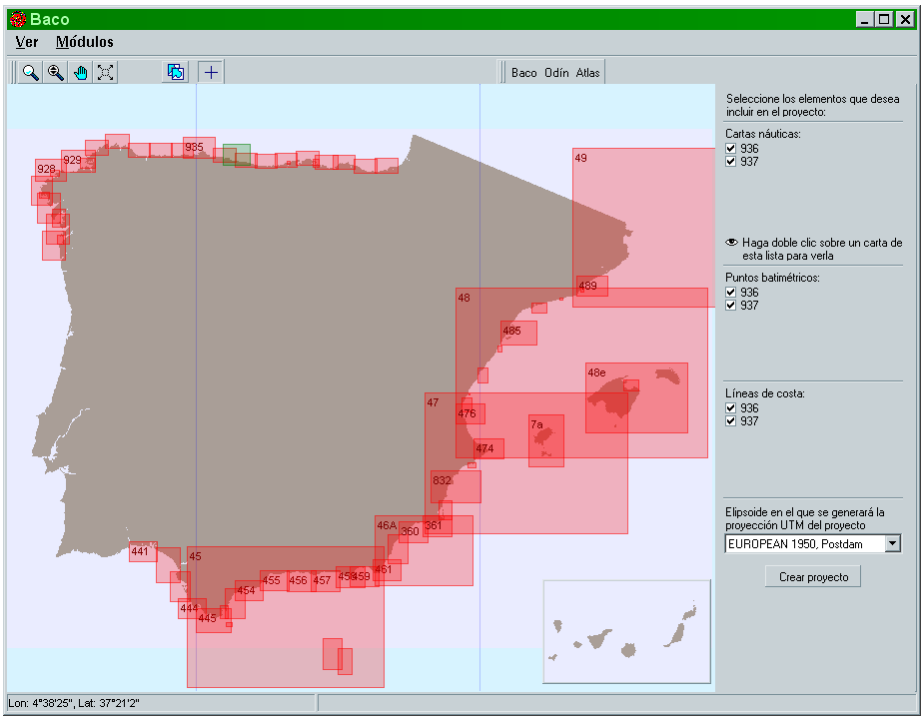

Figure 3.1. Baco

2. Wave and dynamics characterisation (Odín)

This software consists of a visually obtained data set (shipping routes). ODIN characterizes the waves commonly needed by the user, within the SMC programme.

The Odín program can determine the following information:

- The mean directional wave regimes (wave height and period) at indefinite and target depths.
- The wave characteristics associated to the mean energy flow.
- The waves which characterize the yearly averaged conditions.

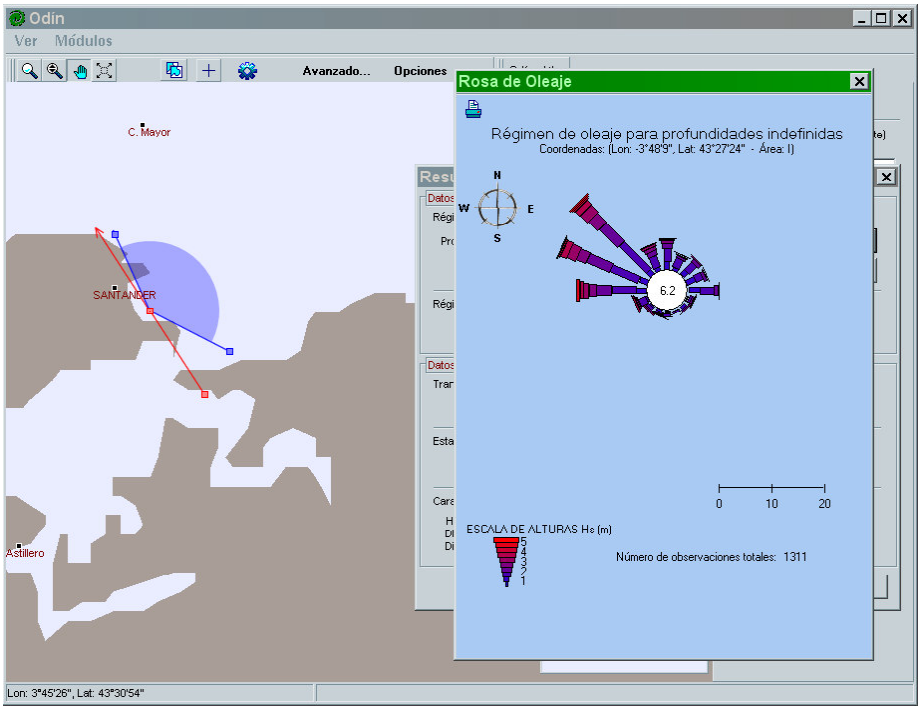

Figure 3.2. Odín

3. Flood level determination (Atlas)

Atlas is a software which presents the visualization of the results obtained in the thematic document on flood levels, designed within the framework of the "Coastal Modelling Aid System" project.

It allows us to obtain the mean and extreme tidal and flood regimes for the Spanish coast.

Some of the possible uses of the Atlas software are:

- Determination of the berm height associated to a beach planform.
- Determination of the level related to the tidal range.
- Definition of the freebord in the design of any marine structures (dikes, walls, etc.).

Figure 3.3. Atlas

3.2 "Short-Term Analysis" (Mopla, Petra)

The module "Short-Term Analysis" contains 2 programs that allow the user to analyse the coastal system at short time-scale and length-scale. Petra is a 2DV morphodynamic evolution model (2 dimensions in vertical). Mopla is a 2DH morphodynamic evolution model (2 dimensions in horizontal).

1. Mopla

The Mopla application allows the numerical simulation of wave propagations from indefinite depths towards the coast line. With this data, the induced current in the break zone can be obtained; therefore the morphodynamic evolution of a beach can be simulated. The Mopla application includes the following models:

- **Oluca:** Mild slope parabolic model for wave propagation (both monochromatic and spectral wave) (See Oluca manual).
- **Copla:** Model for beach currents induced by the spectral wave breaking (See Copla manual).
- **Eros:** Erosion model-sedimentation and bathymetric evolution of the beaches (due to spectral waves) (see Eros manual).

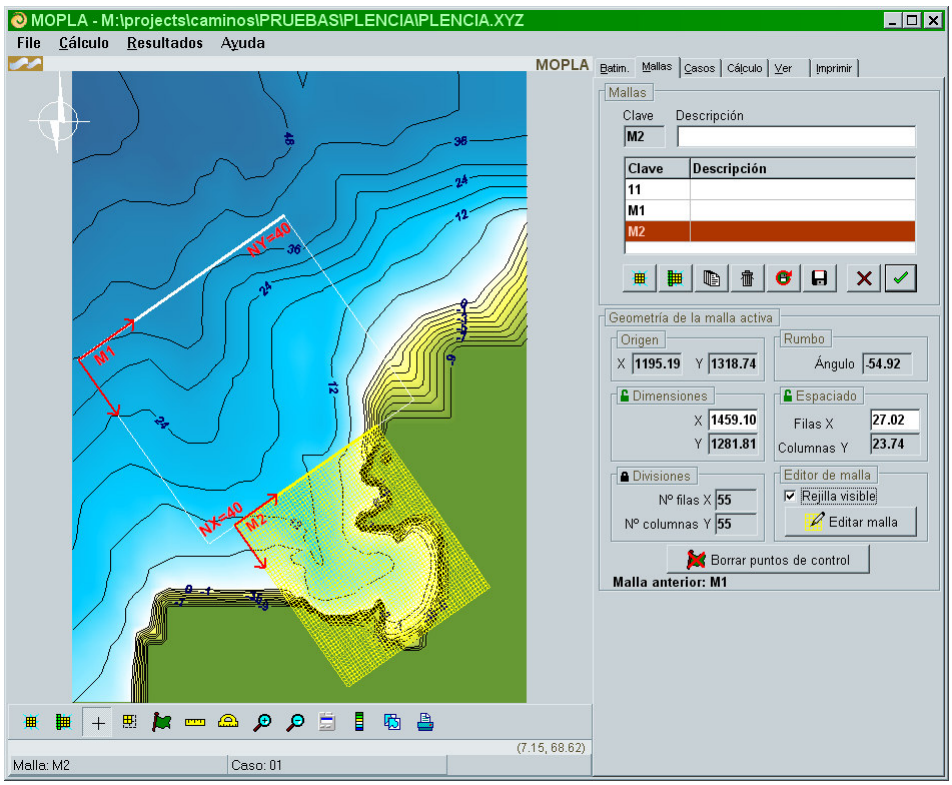

Figure 3.4. Mopla

The learning of Mopla can be done with the practice "Mopla" as well as the practice "Case Study of Suances (SPAIN)". More information about Mopla is given in its manual. For a full description, please refer to the Spanish manual.

2. Petra

Petra is a numerical model which studies the short term cross-profile evolution. The model solves the sediment flow equations within the break zone as well as the bathymetric changes associated to the spatial variation in the sediment transportation.

The magnitude of the sediment transport depends on the morphological characteristics of the environment (sedimentation and bathymetries) and the hydrodynamic conditions (induced waves and currents). Petra aims to study the response of the beach planform during a storm in regards to the coast line recession and the resulting beach profile.

A practical example is presented in the practice "Petra".

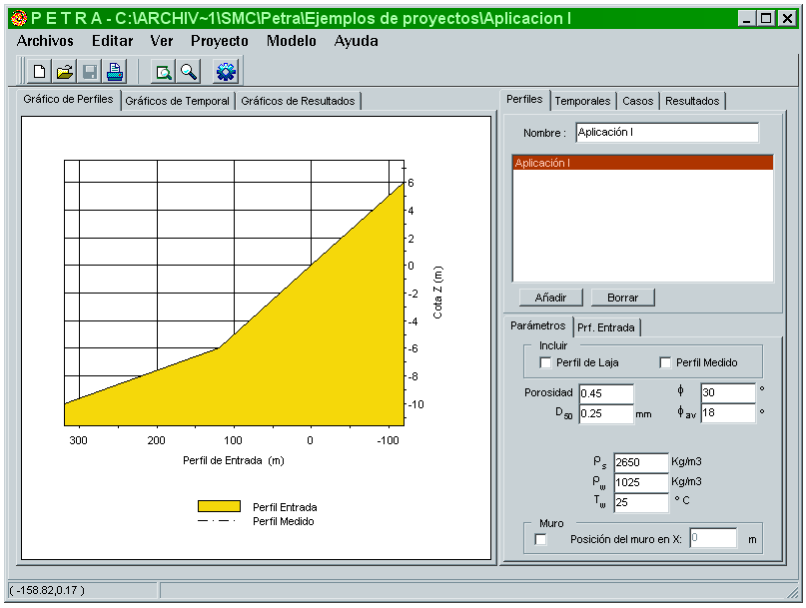

Figure 3.5. Petra

3.3 "Long-Term Analysis"

This module contains a program to analyse the morphodynamic evolution of a coastal system at large time and length scale, by giving the equilibrium of a beach. It is base on formulations of planform and profile equilibrium.

This module is part of the "Terrain Modelling" module (MMT) and using instructions are given in a practical study (practice "Equilibrium Beach Regeneration").

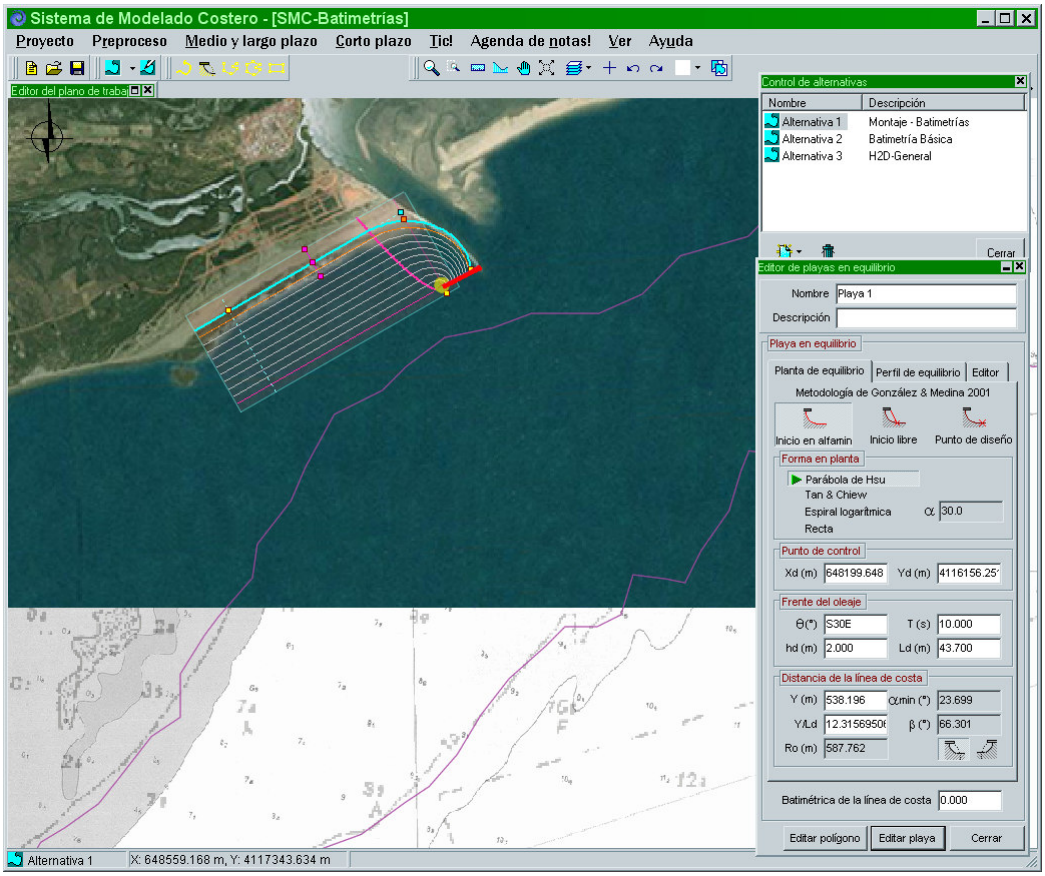

Figure 3.6. Long-Term Analysis

3.4 "Terrain Modelling" (MMT)

This module allows us to change a bathymetry by including it rigid structures such as dikes, breakwater, wall, etc... as well as erodible structures such as sand import, dredging, etc...

The learning of this module can be made in the practical study presented in the practice "Equilibrium Beach Regeneration".

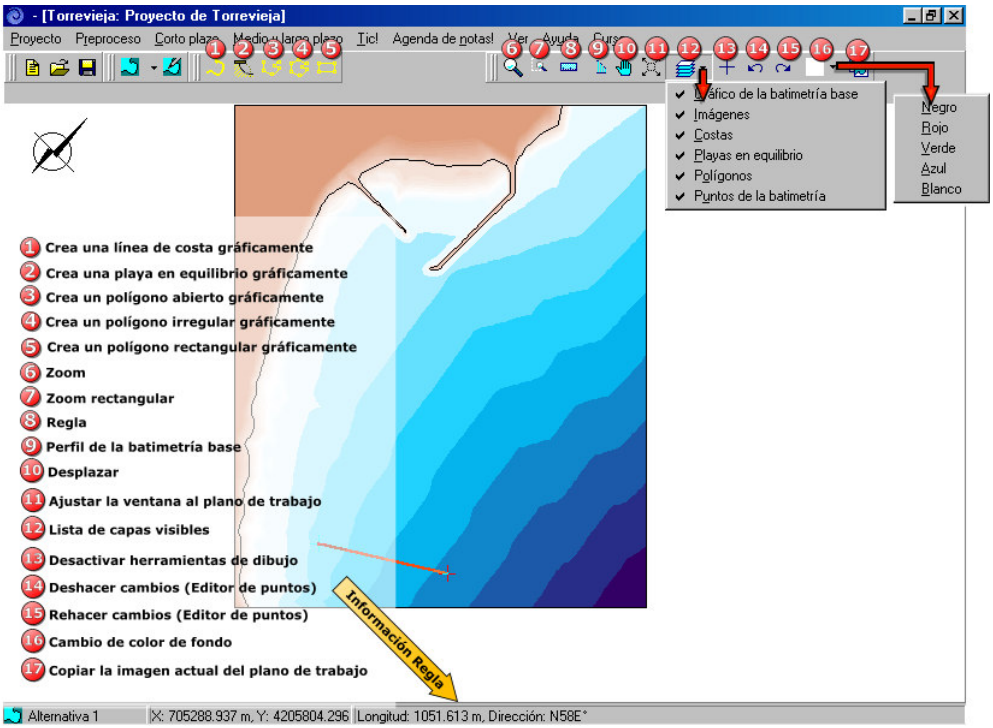

Figure 3.7. MMT

3.5 "Coastal Engineering Tutoring" (Tic)

The main objective of the Tic is to compile into one interactive document the most useful formulas and procedures used in coastal engineering.

The program is made up of a series of basic units for each particular issue. Each unit is separated into four subject groups: dynamics, sedimentary processes, marine works and environmental impacts.

This module is only available in Spanish.

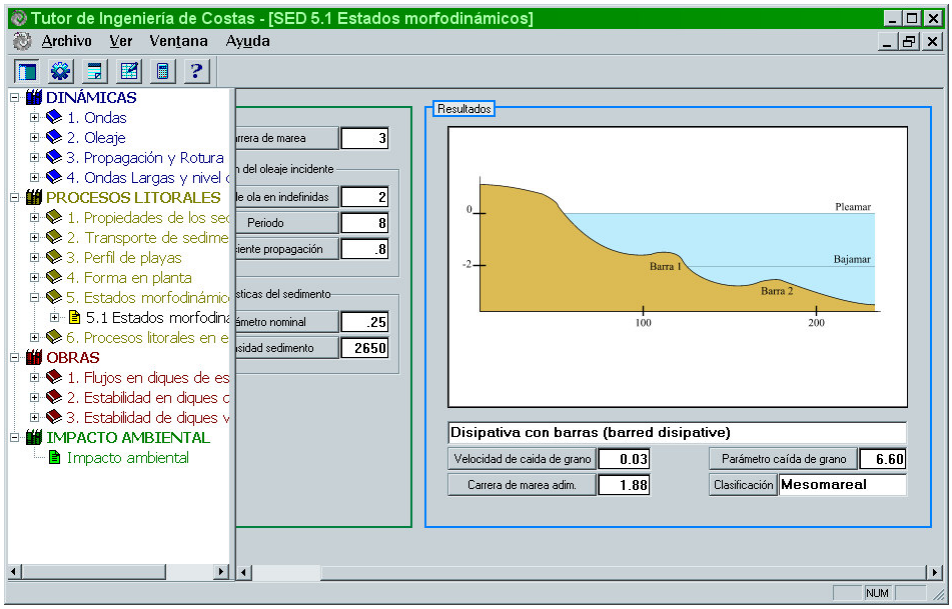

Figure 3.8. Tic

Appendix I

SMC INPUT FILES

SMC INPUT FILES

Bathymetric file XYZ

This is an ASCII-type file with 3 columns containing real numbers that are space-separated. **Files containing commas or tabulations give errors**.

X_1 Y_1 Z_1

X_2 Y_2 Z_2

X_3 Y_3 Z_3

.

.

.

.

.

X_n Y_n Z_n

These files are stored in the subdirectory “batimetrías” in the project directory.

Coastline file

File *.BLN

This ASCII-type file includes the (x,y) point coordinates of a contour line that delimits the coastline. The file format is as follows:

P		Type
X_1	Y_1	
X_2	Y_2	
X_3	Y_3	
X_4	Y_4	
.		
.		
.		
.		
X_p	Y_p	

where:

- P = integer indicating the number of points defining the contour line
- Type = integer indicating if the contour line is open or close (0 = open, 1 = close). For a closed contour line, SMC joints the first and the last points.

Notice that numbers in the file are space-separated; **commas or tabulations give errors**.

File *.Dxf

This is an AutoCad-type file (from version 12 or later version).

Coastline files are stored in the subdirectory "costas" in the project directory.

Big files may slow down the SMC. Files with **more than one contour line (i.e. discontinuous coastline) in the same coastline file** often give coastline graphical representation problems that sometimes can be solved by restarting SMC. Thus it is recommended to use one contour line only per file.

Picture files

SMC works with the following file formats:

- *.BMP
- *.JPG
- *.PNG ("True color")

Internally, SMC works with PNG files. However, the other formats are converted. Picture files are stored in the subdirectory “imágines” in the project directory.

Appendix II

MOPLA OUTPUT FILES

Monochromatic Oluca (TOT)

	1	2	3	4	5	6	7	8	9	10
Column	A	B	C	D	E	F	G	H	I	J
Meaning	x	y	x	y	Bathymetry	Amplitude	Free srfce.	Direction	Phase	Direction
Reference	Grid		Bathymetry					Grid		Bathymetry

Spectral Oluca (TOT)

	1	2	3	4	5	6	7	8	9	10	11	12	13
Column	A	B	C	D	E	F	G	H	I	J	K	L	M
Meaning	x	y	x	y	Bathymetry	Amplitude	Free srfce.	Direction	Phase	Direction	Hs	Direction	Direction
Reference	Grid		Bathymetry					Grid		Bathymetry		Grid	Bathymetry
						Component					Spetrum		

Copla (TC)

	1	2	3	4	5	6	7	8	9
Column	A	B	C	D	E	F	G	H	I
Meaning	x	y	x	y	Velocity	Direction	Direction	3D Height*	2D Height
Reference	Grid		Bathymetry			Grid	Bathymetry		

*It is used for 3D graphics. The only difference with 2D Height is the value for points in the coast.

Eros (TM)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Column	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
Meaning	x	y	x	y	H?	Direction	Direction	Velocity	Velocity direction	Velocity direction	?	Initial depth	Transport	Transport direction	Transport direction	Depth change rate	Final depth	Depth change
Reference	Grid		Bathymetry			Grid	Bathymetry		Grid	Bathymetry				Grid	Bathymetry			

Figure AII.1. MOPLA output files