INSTRUCTIONS FOR THE USE OF THE PROGRAM

DISCLAIMER

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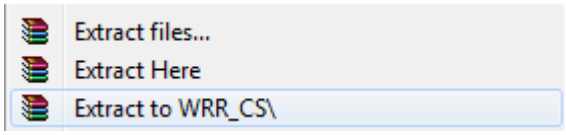
ACRONYMS

The acronyms in the following table are used throughout this document:

CS	cross section
SFDN	space filling drainage network, i.e., the connected set of steepest directions theoretically followed by runoff
CN	channel network: a subset of the *SFDN*
DEM	a data set (here a file in ASCII raster format) containing the "depitted" terrain elevation, from which the *SFDN* and the *CN* are computed.
CSP	the name of the program (Cross Section Processor)
DSVE	De Saint Venant Equations

PROGRAM INSTALLATION

The compressed file *WRR_CS.zip* contains the files needed for running the code in a *WINDOWS* environment, along with 4 *DEMs* (with extension.grd: see below), 2 of which are the test cases presented in the paper and 2 are provided as additional examples.
By using the command



the user should either uncompress the file at the root of a C disk or uncompress the file at any other location of a disk
In the first case, a directory called WRR_CS is created and the program is ready to use, by clicking on the *CSP.exe* icon.
In the second case, the user has to modify the path within the text file named "*list_of_directories*", as suggested in the following lines:

1	Let us suppose that the files have been uncompressed within the directory D:\programs\dummyname2\cross_section_extractor\WRR_CS\ We recommend not to use a path longer than 120 characters. In this directory you will find these data  	

	CSP.exe is the executable file and *list_of_directories* is an ASCII file with the names of two sub directories, necessary for the input-output operation of the program.	
2	Using a text editor, open the file *list_of_directories* and change the default paths C:\WRR_CS\in C:\WRR_CS\out with D:\programs\dummyname2\cross_section_extractor\WRR_CS\in D:\programs\dummyname2\cross_section_extractor\WRR_CS\out	

That's all. No other operation is needed for the installation. The program is now ready to use, by clicking on the *CSP.exe* icon.

FORMAT OF INPUT DEM FILES

The program works on ASCII DEM files, written according to the non-proprietary ARC/INFO ASCII GRID format, with *grd* extension. See the *.grd* files provided as test case or read http://en.wikipedia.org/wiki/Esri_grid.
It is fundamental that

1) the DEM has already been depitted, i.e., that a connected path with positive slopes already exists joining the cells of the DEM to the basin outlet.
2) the basin outlet must be located along the boundary of the basin (not necessarily of the DEM!).

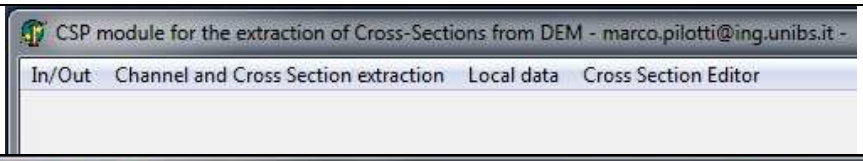
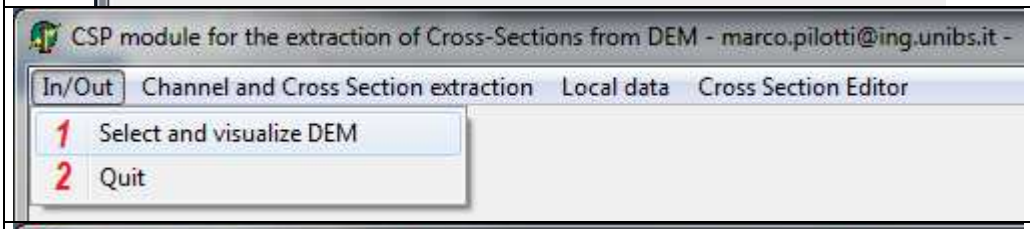
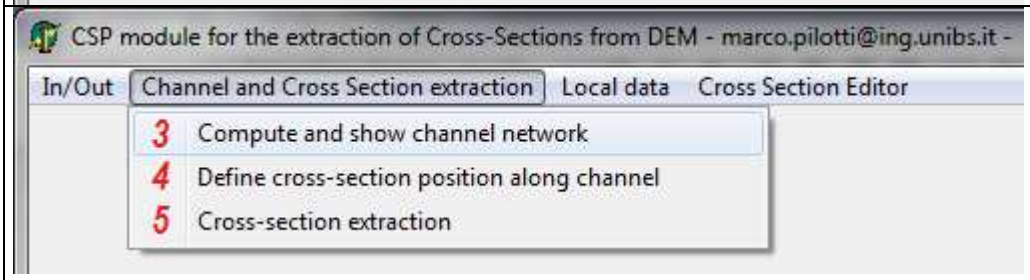
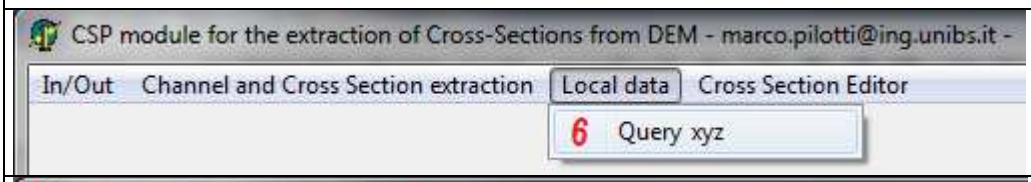
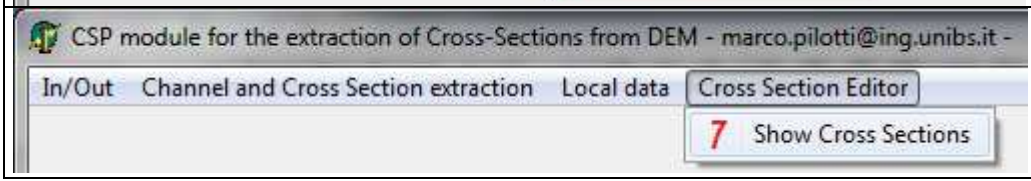
PROGRAM LIMITATIONS

The program can operate on DEM with dimensions up to 1500 x 1500.
The program was written in DELPHI and was tested under WINDOWS 7 and WINDOWS 8 OS.
Please, note that the program under revision works only with the files provided as samples files.
basin1.grd, basin2.grd, aviolo.grd, bagnadore.grd
However, this restriction will be eliminated at the end of the revision process.

Please, note that this program has been written for scientific and technical use only. Starting from an original version, this program has been painstakingly tested and made as much user-friendly as possible. However, since the author is not a professional object programmer, the visual interface could certainly be improved. For instance, I couldn't program the dynamic zooming of the panels, but I don't think this is a real limitation.

PROGRAM USE AND TUTORIALS

The program is provided along with 4 separate short stand-alone tutorials, by which the user can understand how the program works and what are its options. Tutorials 1 and 3 make reference to the test cases discussed in the paper.
The use of the code is straightforward. In the following, the '.' is used to indicate the decimal place and groups of thousands are not separated. There are 7 main options that are here presented in a visual way and explored in the tutorials.

	*The main panel of the program shows 4 set of commands*
	*1 is used for the selection and the visualization of the DEM on the screen 2 is used to quit the program*
	*Command 3 is used to compute the Channel Network on the basis of a fixed threshold area. Command 4 allows the manual selection of the stations of CS along the Channel Network Command 5 computes the CS, either on the basis of a user provided file with CS location (created with Command 4) or automatically.*
	*Command 6 is used to browse through the DEM elevations*
	*Command 7 is the CS visualizer, used to show the computed CS*

LIST OF OUTPUT FILES

During the pre-processing of the DEM, several ASCII files are written on disk. These files allow a complete description of the SFDN and CN of the watershed (files with extension *1sf*, *2sf*, *1dr* and *2dr*). Finally, during the CS extraction process, the files to be used as an input to the DSVE solver are written (files with extension *xyz, in, out*).

directory	*name and extension*	*content*
out	***namefile*.1sf, *namefile*.2sf**	complete topological description of the SFDN
out	***namefile*.1dr, *namefile*.2dr**	complete topological description of the CN

out	***namefile*_path1.xyz**	description of the selected stretch of the CN, with number of CS, location, thalweg elevation, distance from upstream, drained area and local slope.
out	***namefile*_path3.xyz**	as above, with information reorganised in a different way
out	***namefile*_CS_1.xyz**	description of the selected stretch of the *CN*. Row *i* (for i>=6) of this file contains the description of *CS* number (*i*-5), with its location, thalweg elevation, distance from upstream, local slope and number of points *n* where the *CS* has been sampled. Along the same row, there is a sequence of *n* (*x,y,z,d*) values, where *d* is the planimetric distance of each value in the plane that contains the *CS*.
out	***inviluppo1.prm*** ***inviluppo1.prm***	list of leftmost and righmost stations in the set of CSs. These two lines are shown on the screen at the end of the CS extraction process.
For each CS, the following files are written		
out	***namefile*sez_i.in** i= 1..number of CS	Within this file the geometry of each CS is described. The first line contains the following information: number of CS, distance of CS from upstream end-point of the selected CN, local slope, *N* (i.e., number of transversal stations used to discretize this CS), thalweg elevation, drained area at CS location, x,y of thalweg. In the following lines, the geometry of the CS is described FOR j = 1 TO *N* [x,y,(z-z_thalweg), K_s]$_j$
out	***namefile*sez_i.out** i= 1..number of CS	Within this file the hydraulic tables of the CS are provided. The third line of the file contains number of CS, distance of CS from upstream end-point of the selected CN, local slope, *dummyvalue,* thalweg elevation, *dummyvalue, dummyvalue*. From the seventh line onward the following variables are provided by lines: the water stage with respect to the thalweg, the corresponding wetted area, wetted perimeter, free surface width, hydraulic radius, ks,ks,ks, elevation of CS centroid, alfa,beta, average bed stress
out	***namefile* _UNIF_i.out** i= 1..number of CS	Within this file the normal flow stage-discharge relationship is provided The third line of this file contains the CS number, the distance of CS from upstream end-point of the selected CN, the local slope, the local Gauckler-Strickler coefficient From the seventh line onward the following variables are provided by lines: Water stage with respect to the thalweg, the corresponding wetted area and the discharge computed according to the Chezy equations.