Tutorial on the use of Telemac-2D Hydrodynamics model and pre-/post-processing with BlueKenue

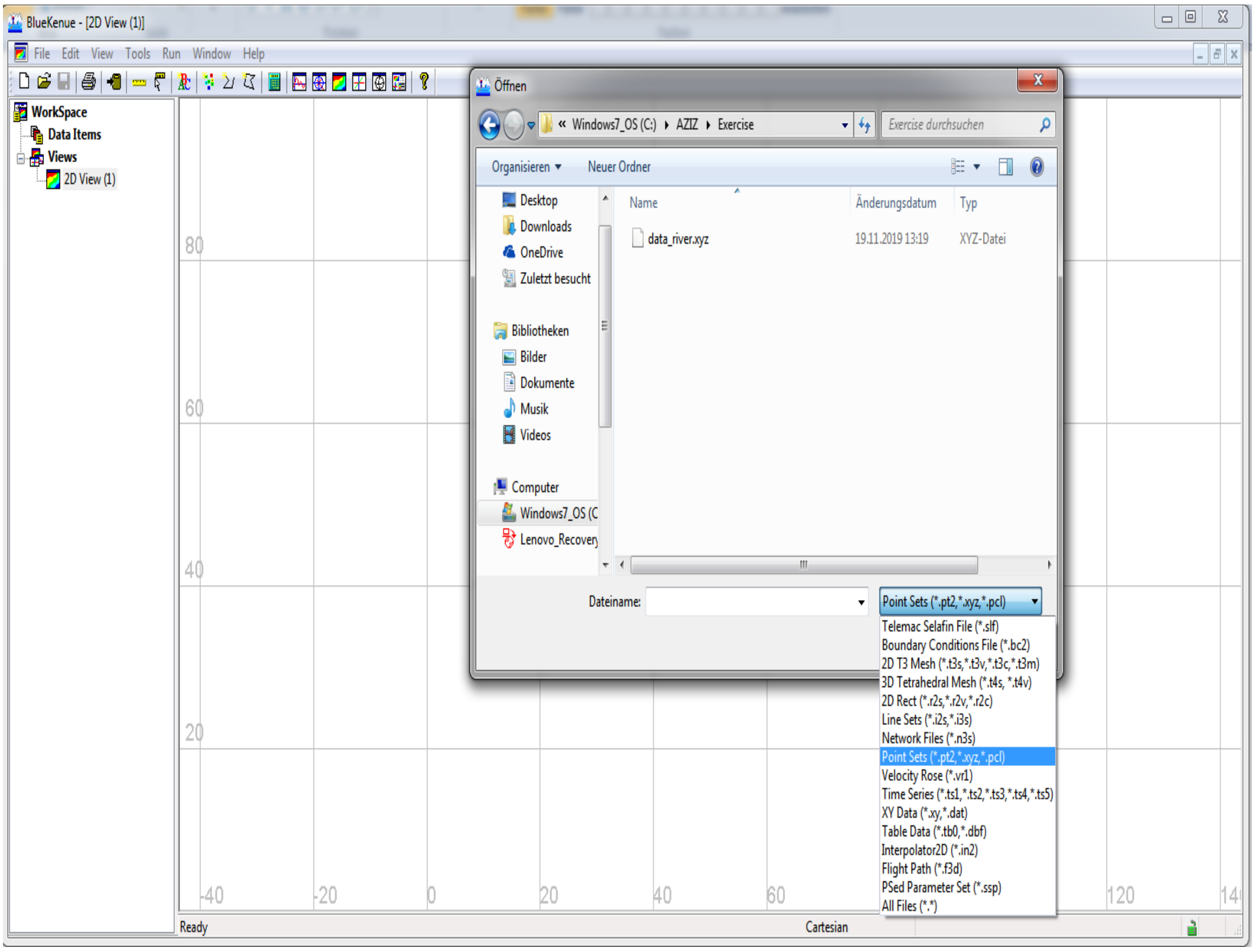
Pre-processing utilizing BlueKenue

BlueKenue is developed by the *Canadian Hydraulics Centre of the National Research Council* andis utilized in this tutorial to accomplish the following:

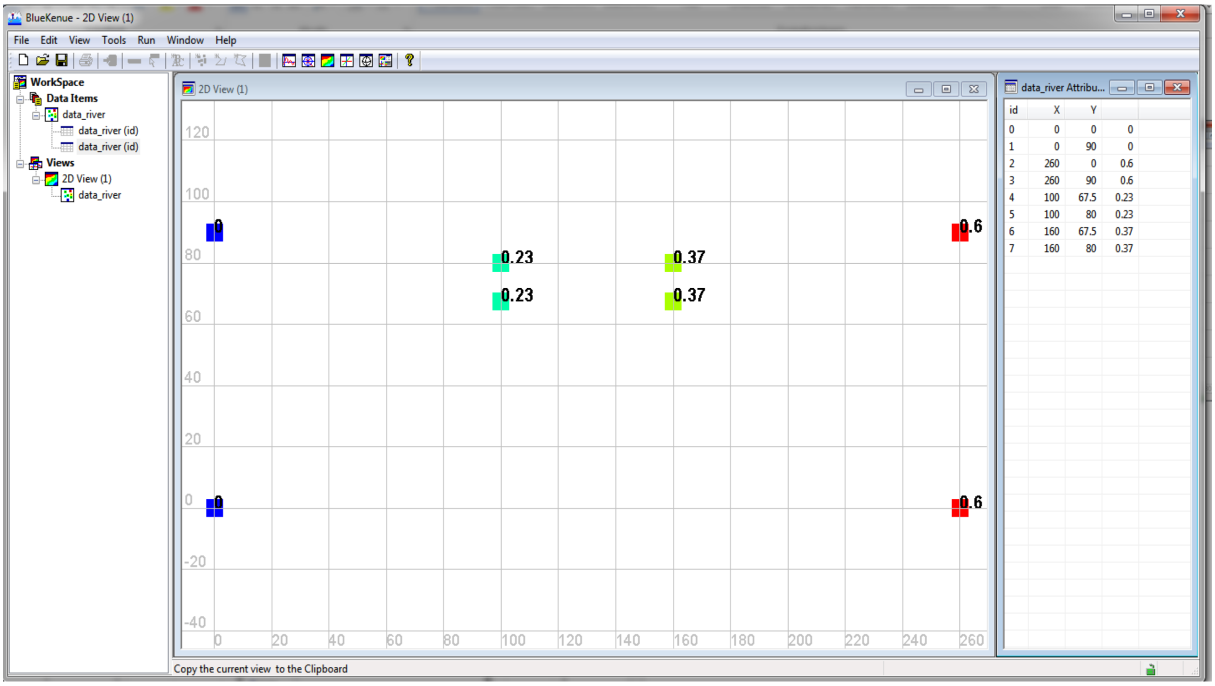
1. Generate the Finite-Element mesh
2. Create the boundary conditions influencing the system
3. Visualizing the TELEMAC-2D hydrodynamic results

Importing data to Bluekenue

Start BlueKenue and open the (.xyz) geometry date. In order to see your XYZ dataset, change the filetype drop-down menu from Selaphin to ALLfiles.



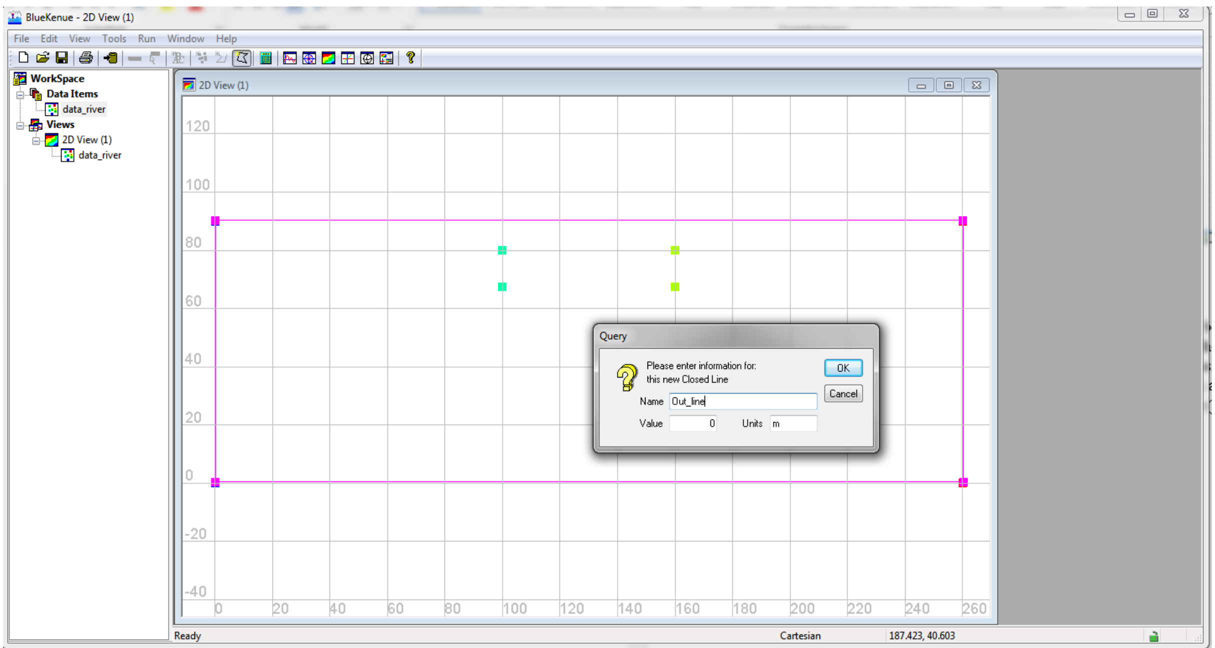
Viewing data in BlueKenue



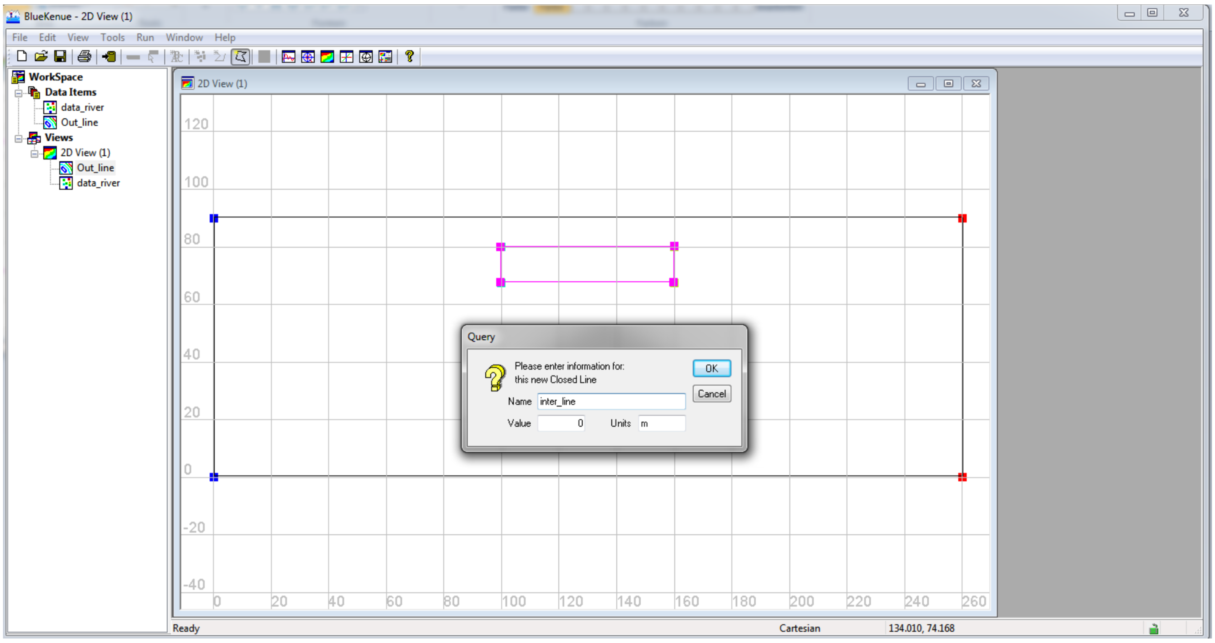
Mesh Generation

TELEMAC-2D solves the depth-averaged Navier-Stokes equation utilizing both Finite-Element (FE) and Finite-Volume (FV) formulations. All of these formulations require that a spatial representation of the domain be created using a compuatational mesh. BlueKenue has several tools for mesh generation and editing. Mesh types that BlueKenue can generate are unstructured and regular (via T3 Channel Mesher) triangular meshes.

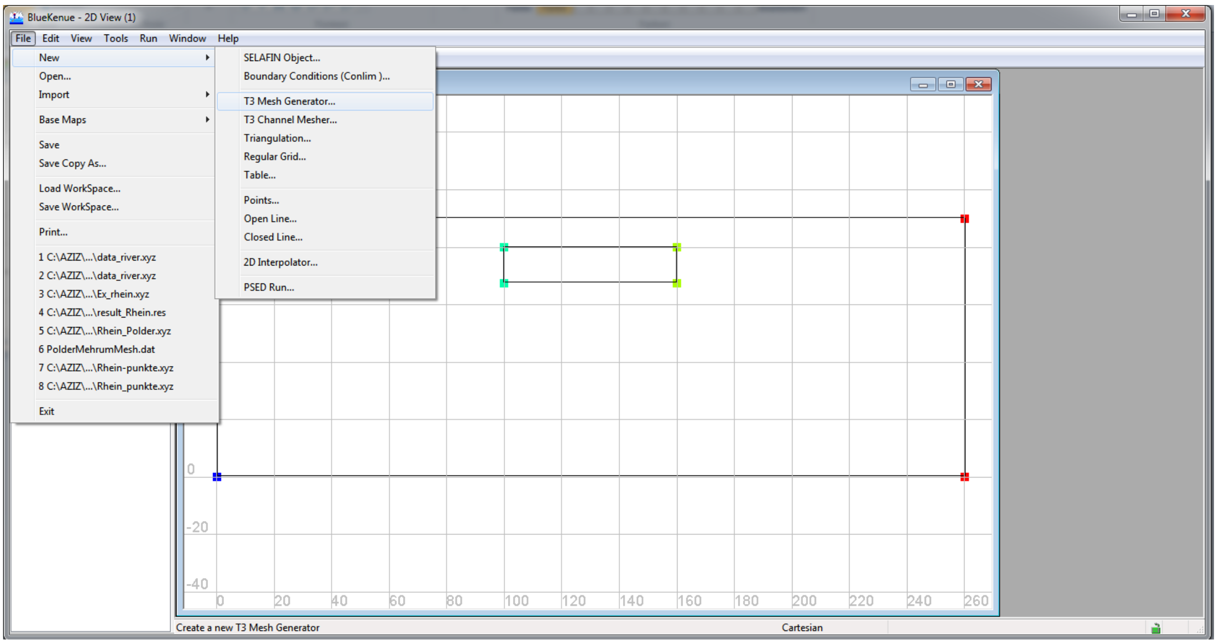
- Create new closed line between the exterior points



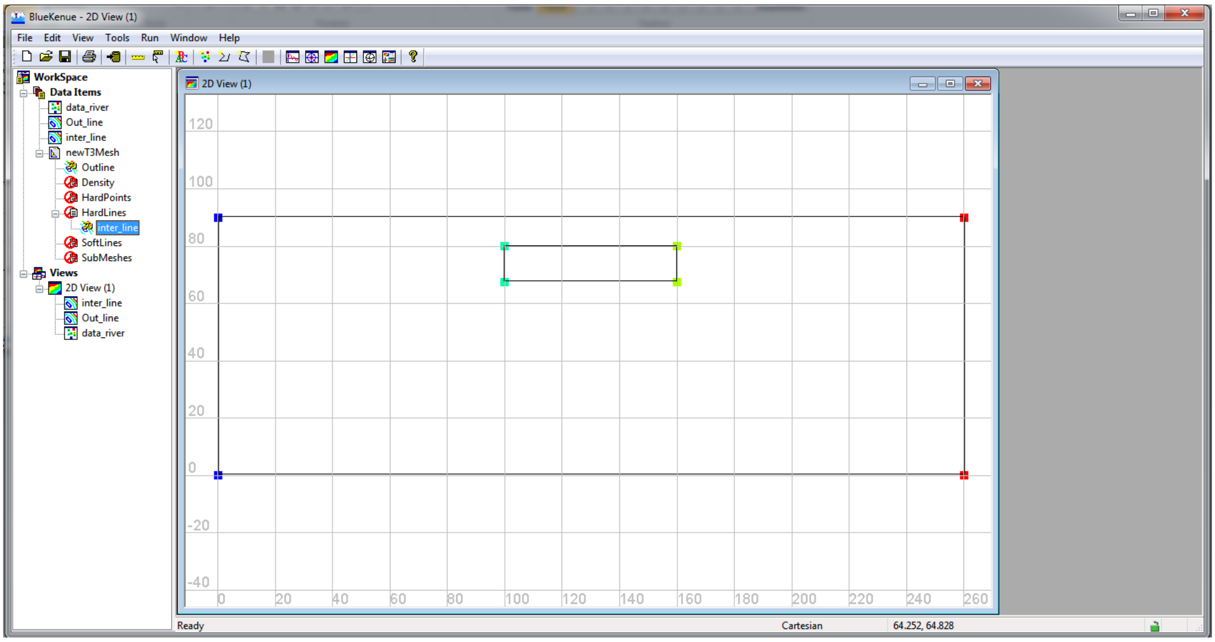
- Create new closed line between the interior points



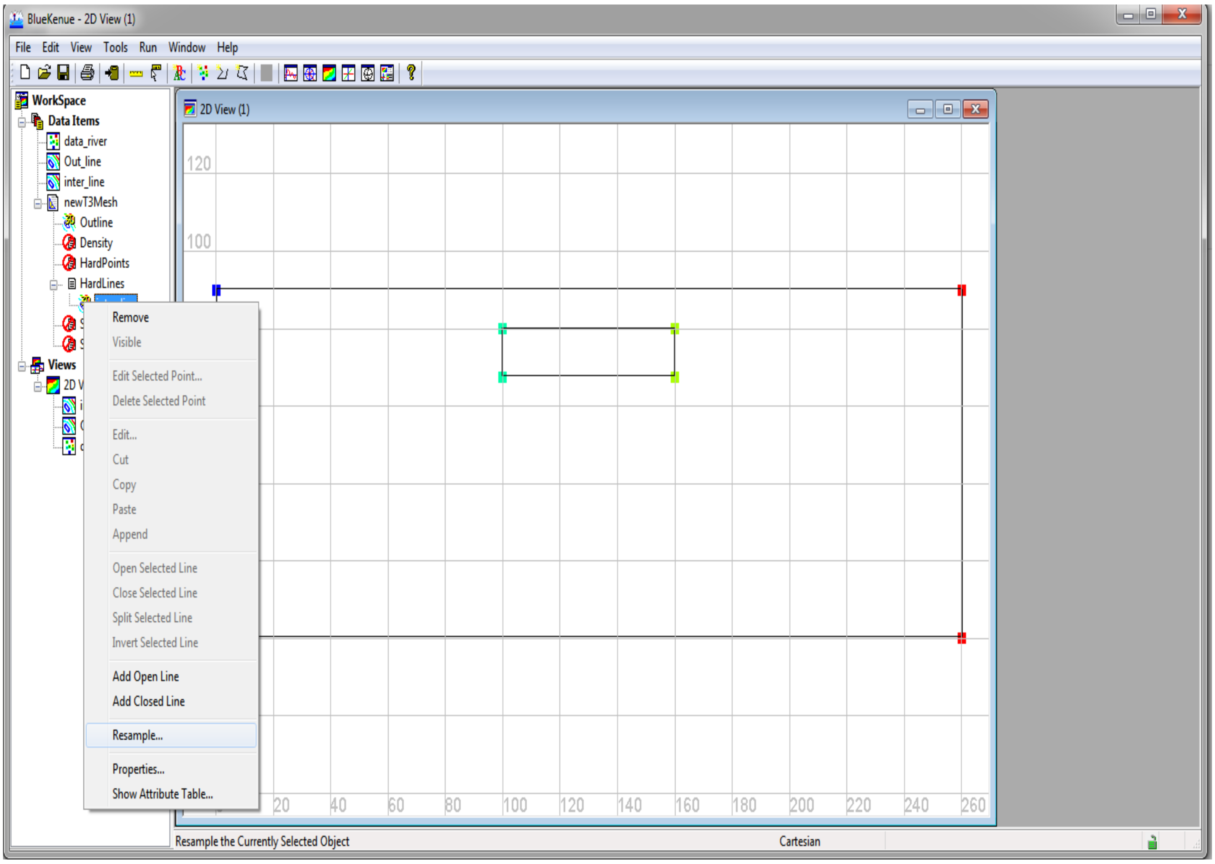
- Mesh generation



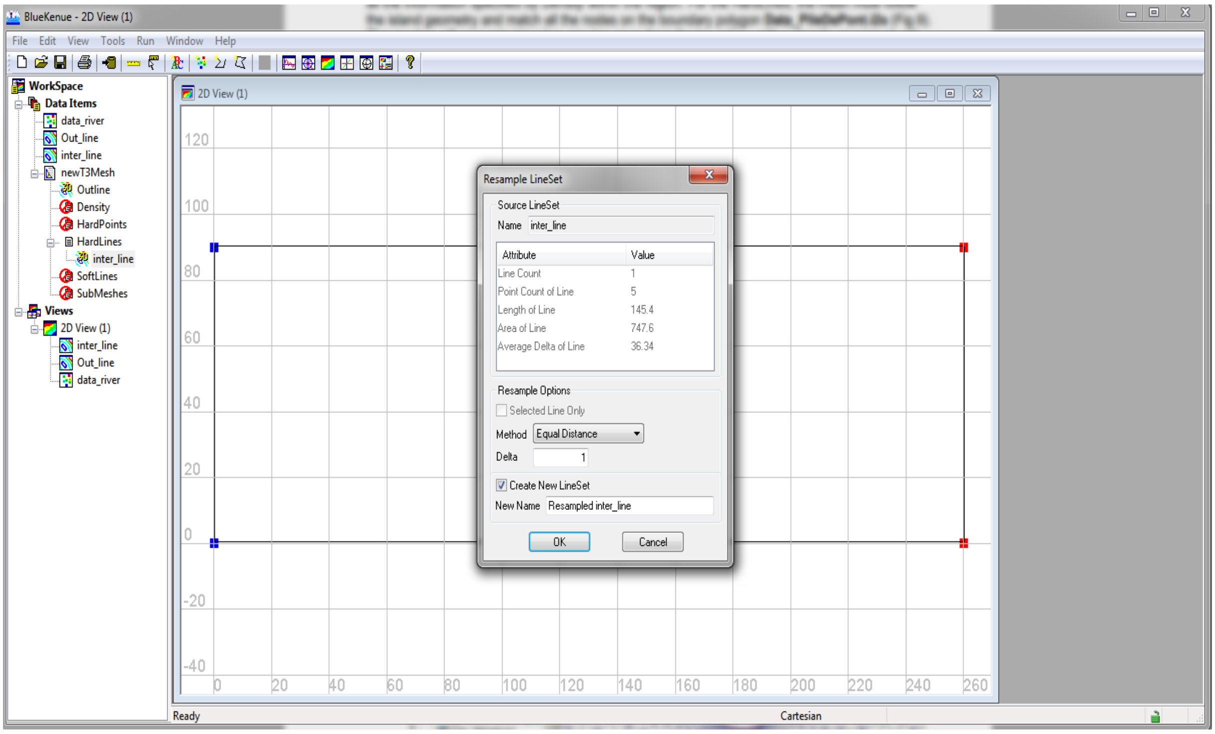
Drag and drop Out_line to Outline and inter_line to Hardlines



Select Resampled inter_line in Hardlines

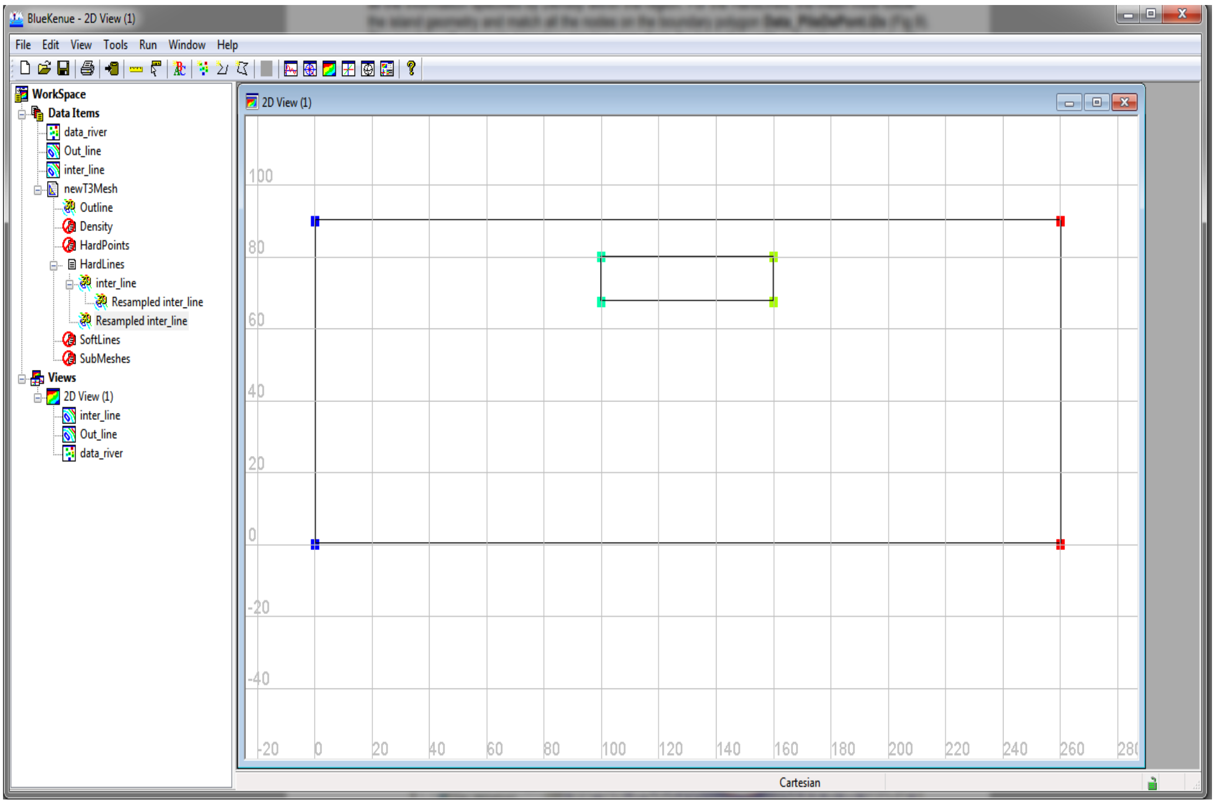


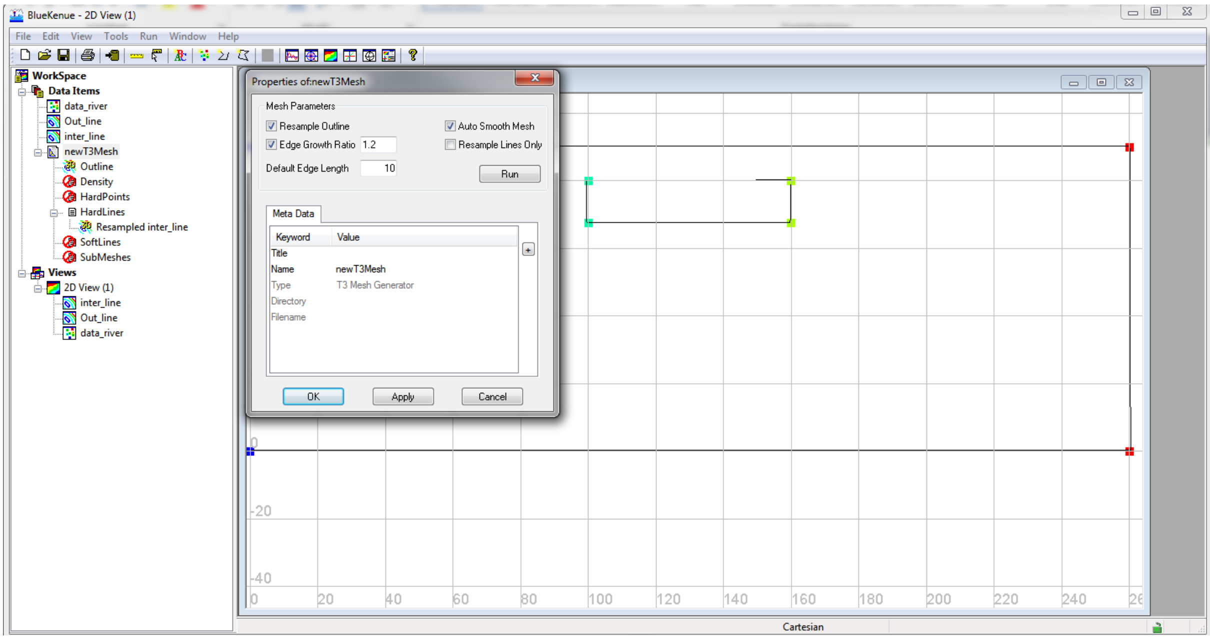
Change the method to Equal distance and



Select Resampled inter_line in Data Items, drag it into HardLines.

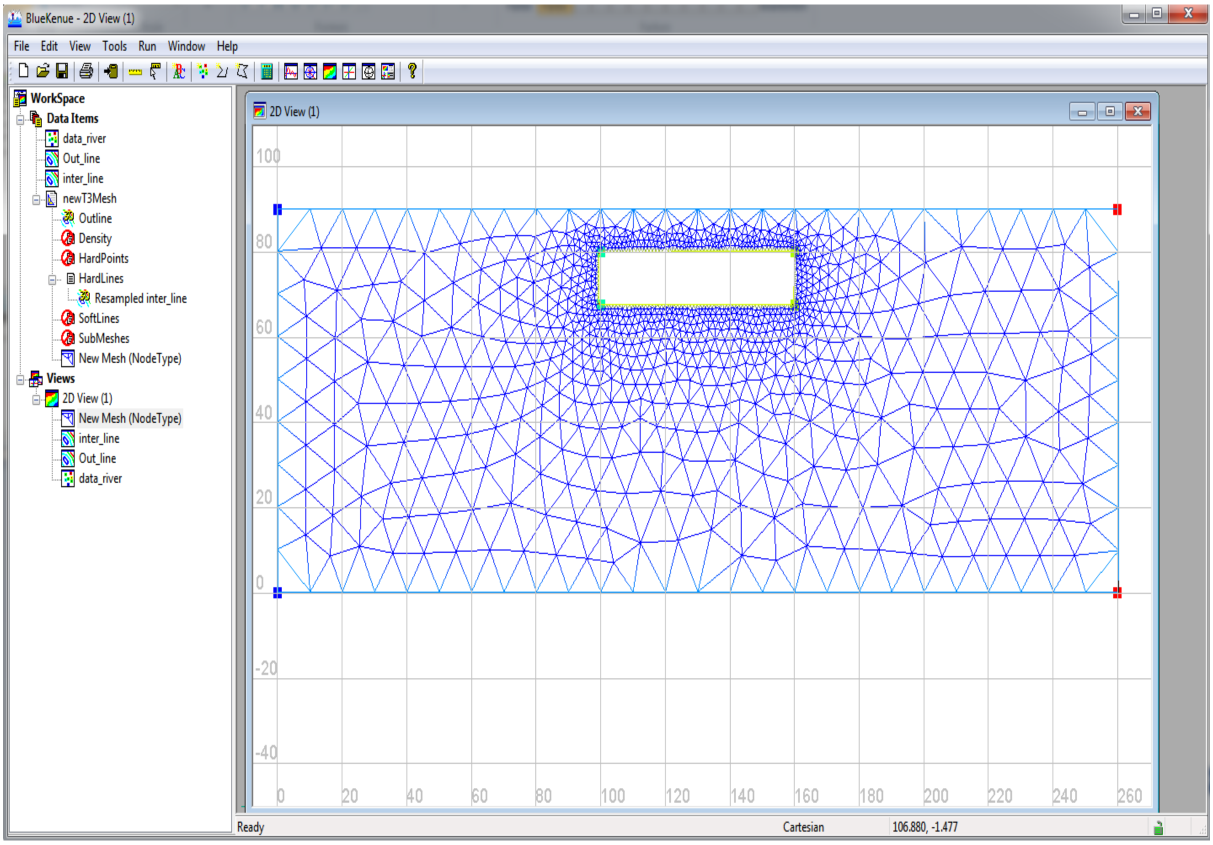
Remove the old boundary defining the inter_line from HardLines





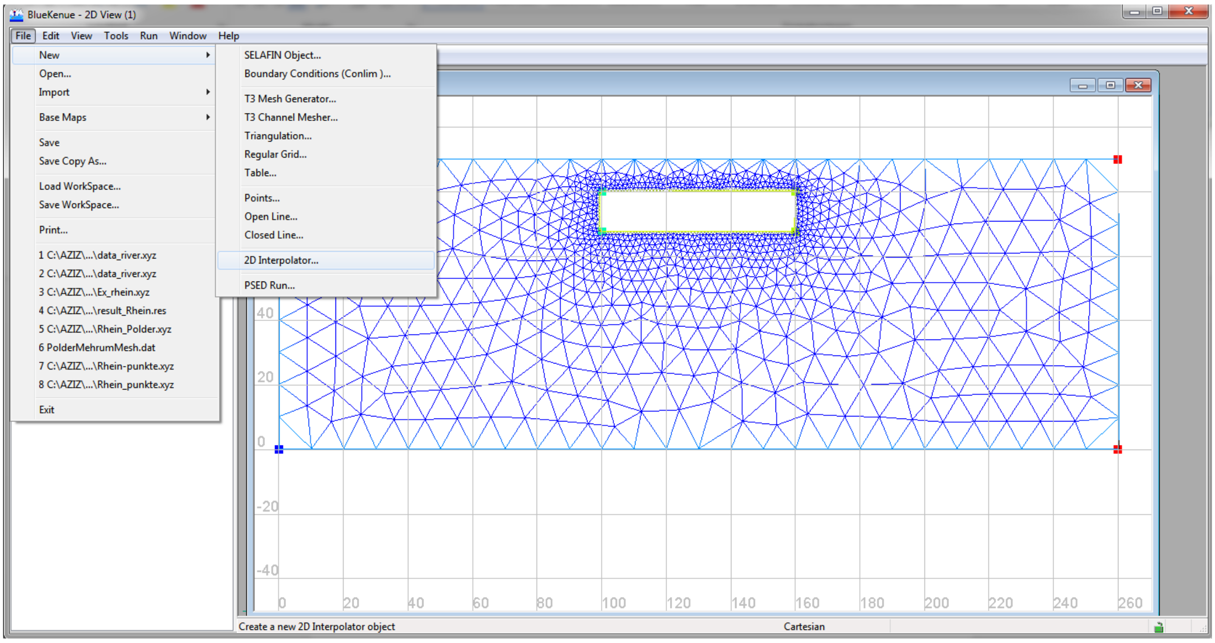
- Generate a new mesh

Drag and drop it to 2D View



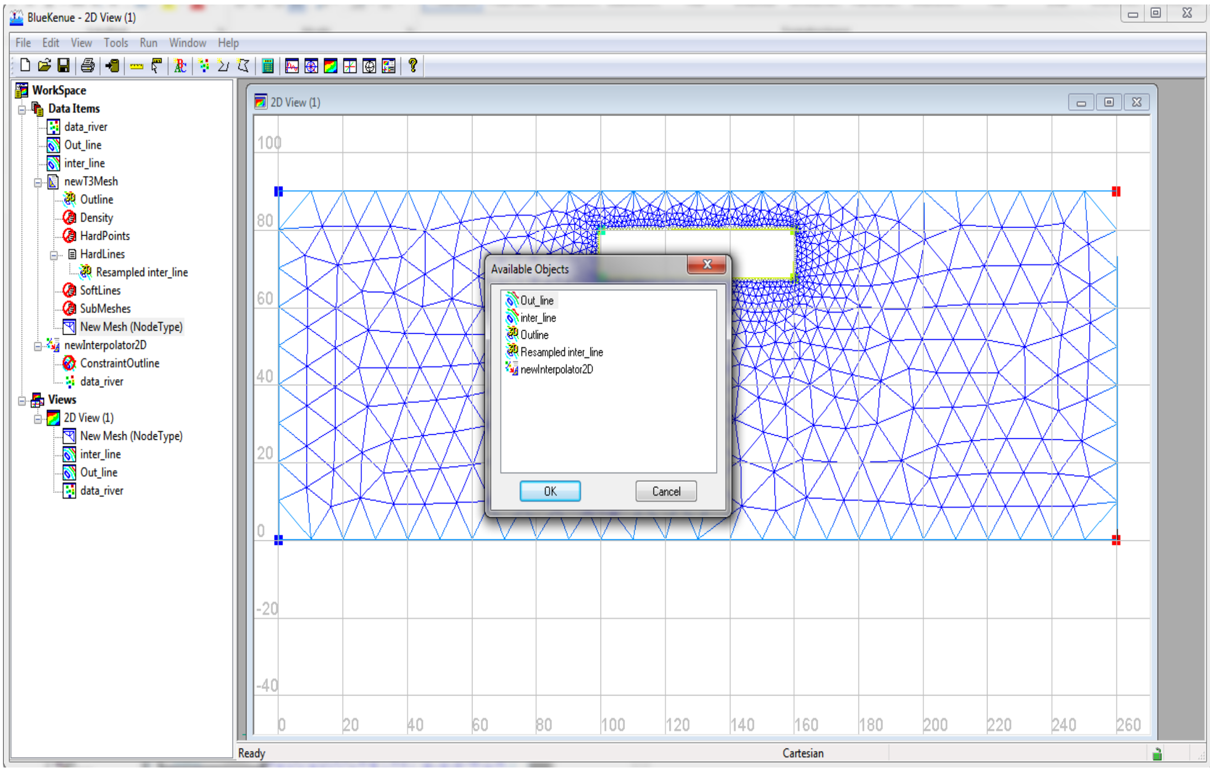
- Applying the bathymetry to the mesh

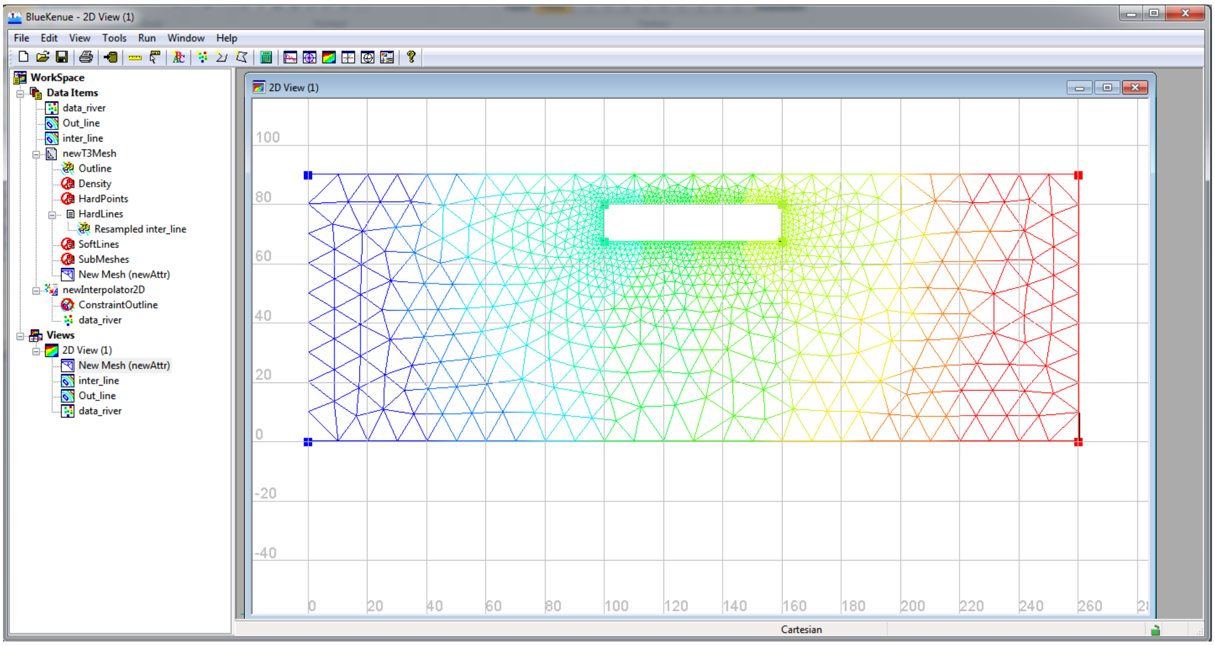
Click on File – New – 2D Interpolator.



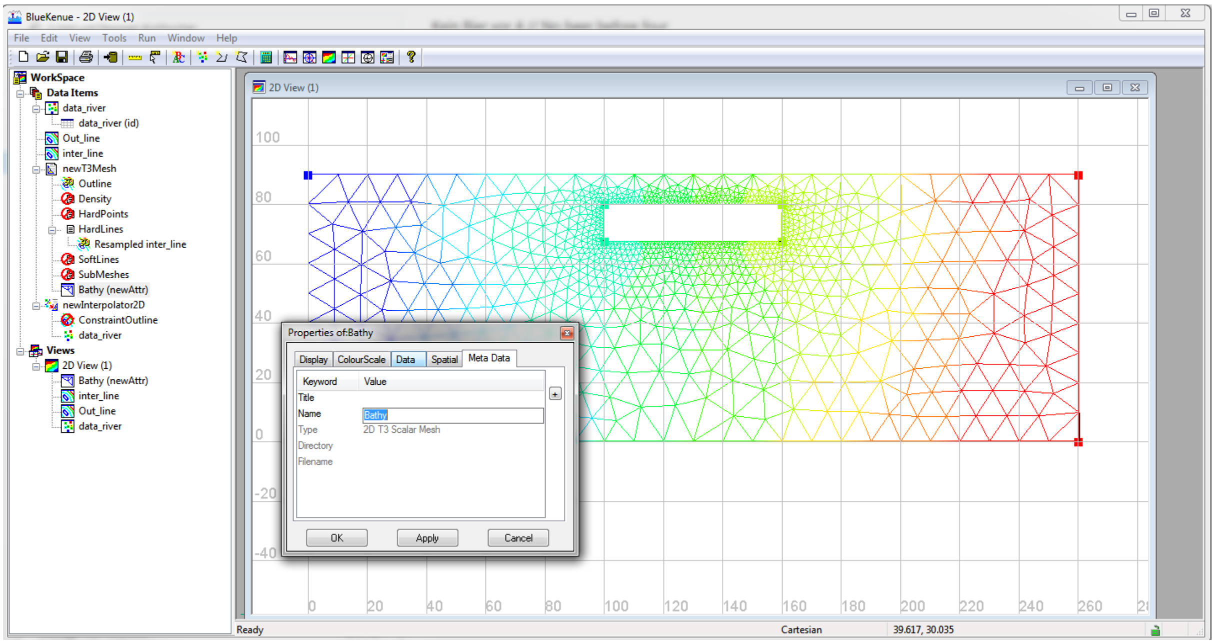
Drag Data_river into NewInterpolator2D.

Select New Mesh (NodeType), check that it displays the attribute (NodeType), Tools – Map Object. Select NewInterpolator2D in the new window, OK.





Rename it Bathy.

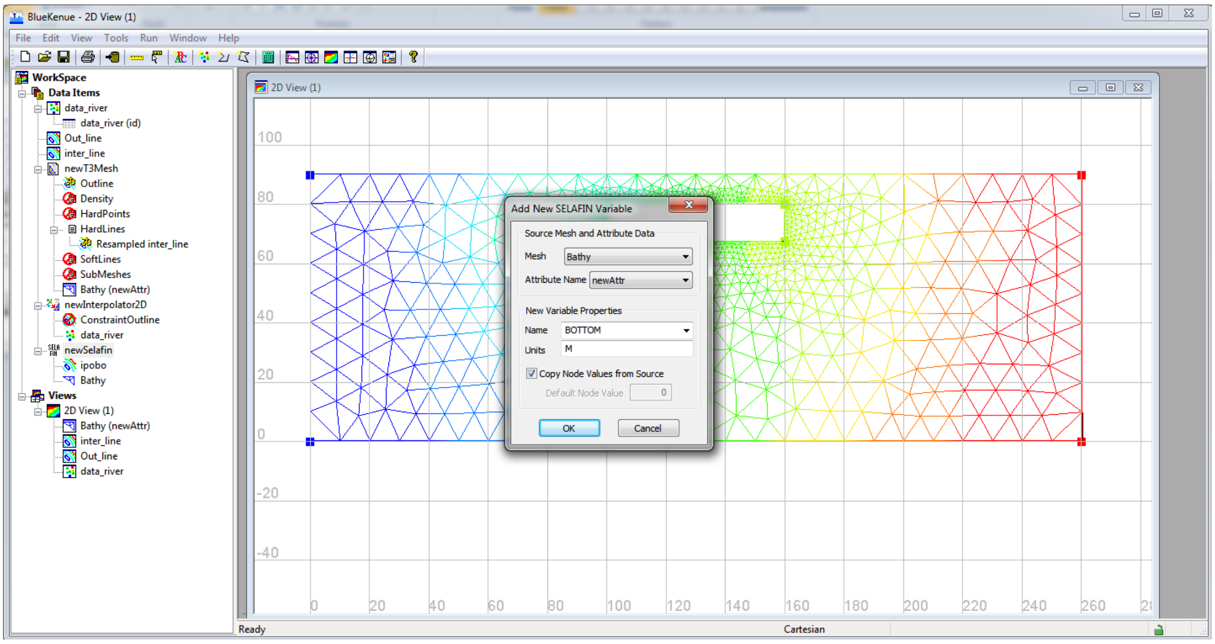


Preparation of the TELEMAC input files

- Preparation of the Geometry File:

File - New – SELAFIN Object. A new object, newSelafin, is created in Data Items

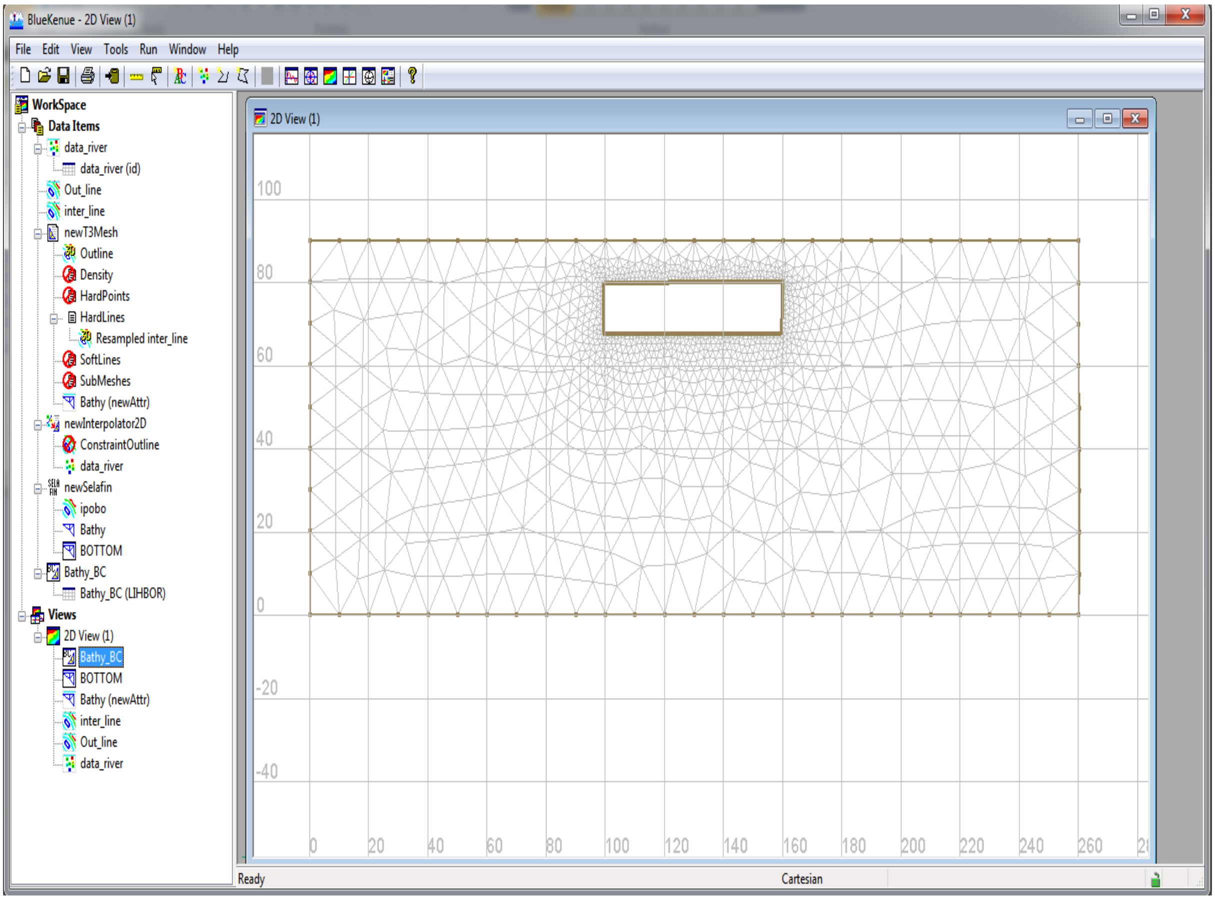
Drag NewMesh (newAttr) into newSelafin.



Preparation of the Boundary Conditions File

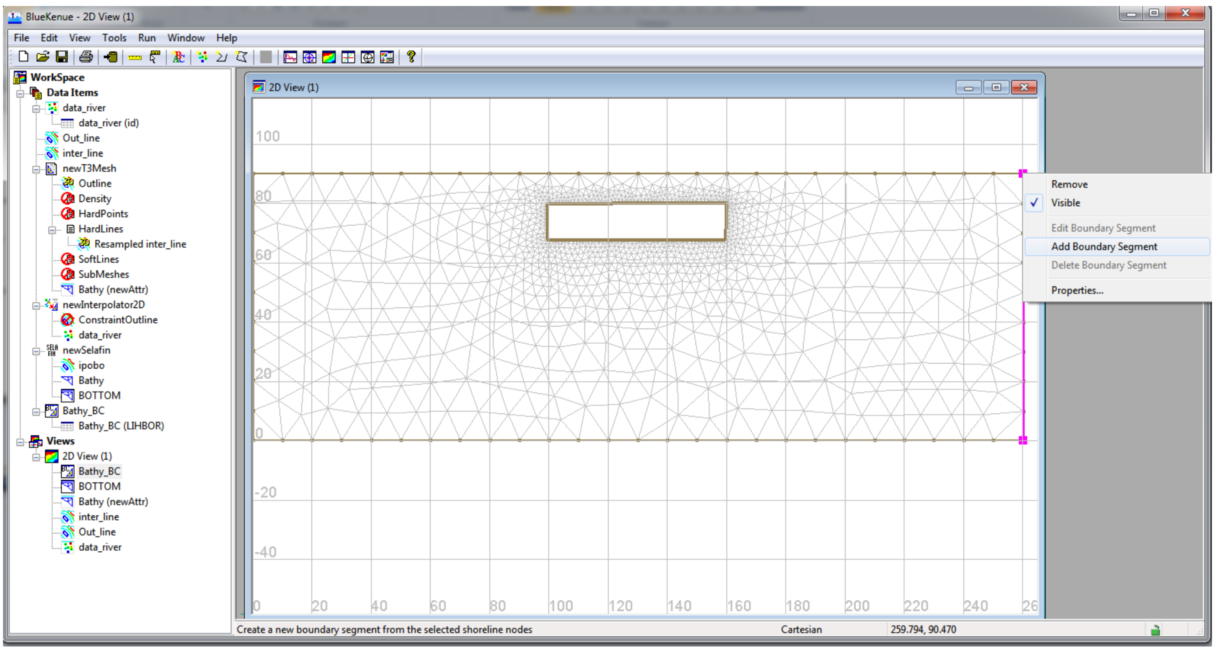
File – New – Boundary Conditions. In the new window, select Bathy. A new object called Bathy_BC is created under Data Items.

Select Bathy_BC and drag it into the 2D view.



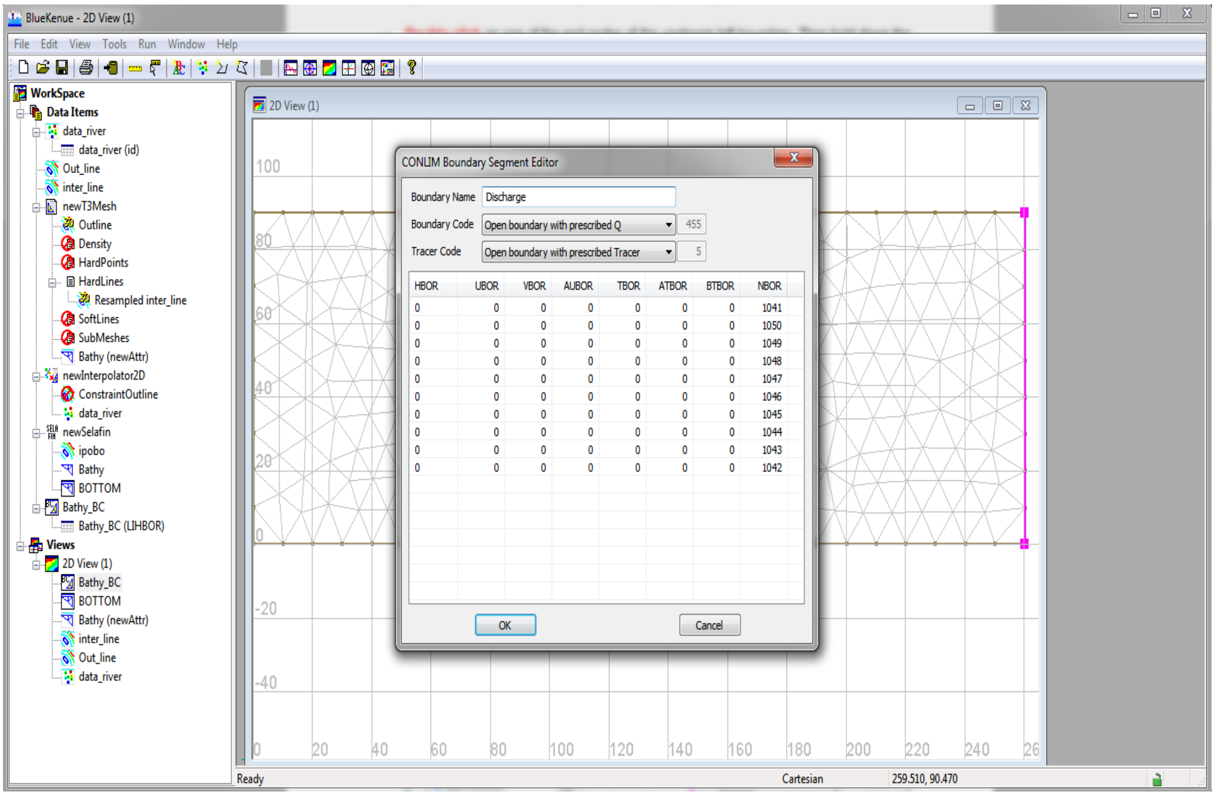
Double-click on one of the end nodes of the river right boundary. Then hold down the Shift key and double-click on the other end node of the same boundary. The boundary becomes magenta between the 2 selected nodes:

Right-click and select Add Boundary Segmen.

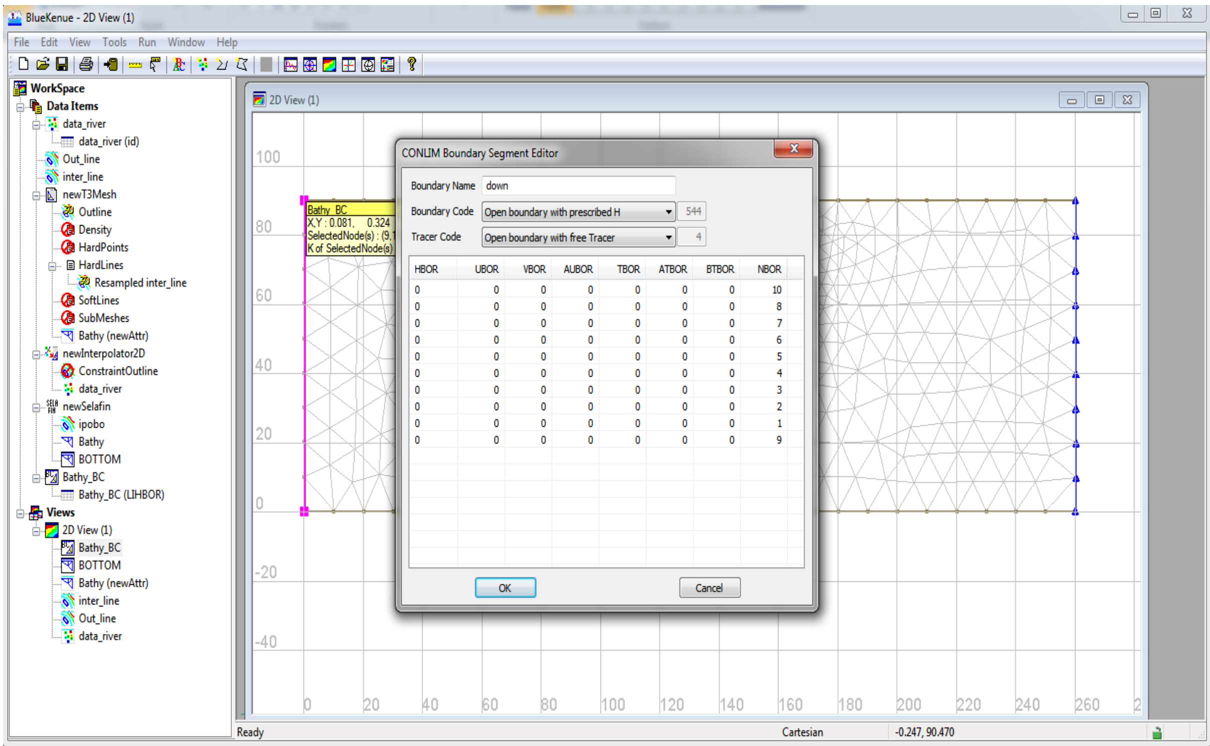


In the box Boundary Code, select Open boundary with prescribed Q

In the box Tracer code select Open boundary with prescribed Tracer



Repeat the same specification for the downstream boundary segment: In Boundary Name, insert down, in Boundary Code select Open boundary with prescribed H, and in Tracer code select Open boundary with free Tracer



To save the boundary conditions file for Telemac:

- Select File Bathy (LIHBOR)
- Save and give a new name for instance mesh.cli

To save the boundary definition file:

- Select Bathy_BC
- File – Save and give a new name such as Bathy_BC.bc2

<u>Processor: **Telemac-2D**</u>

(TELEMAC-MASCARET is an integrated suite of solvers for use in the field of free-surface flow, open source; to consult the website: http://www.opentelemac.org/)

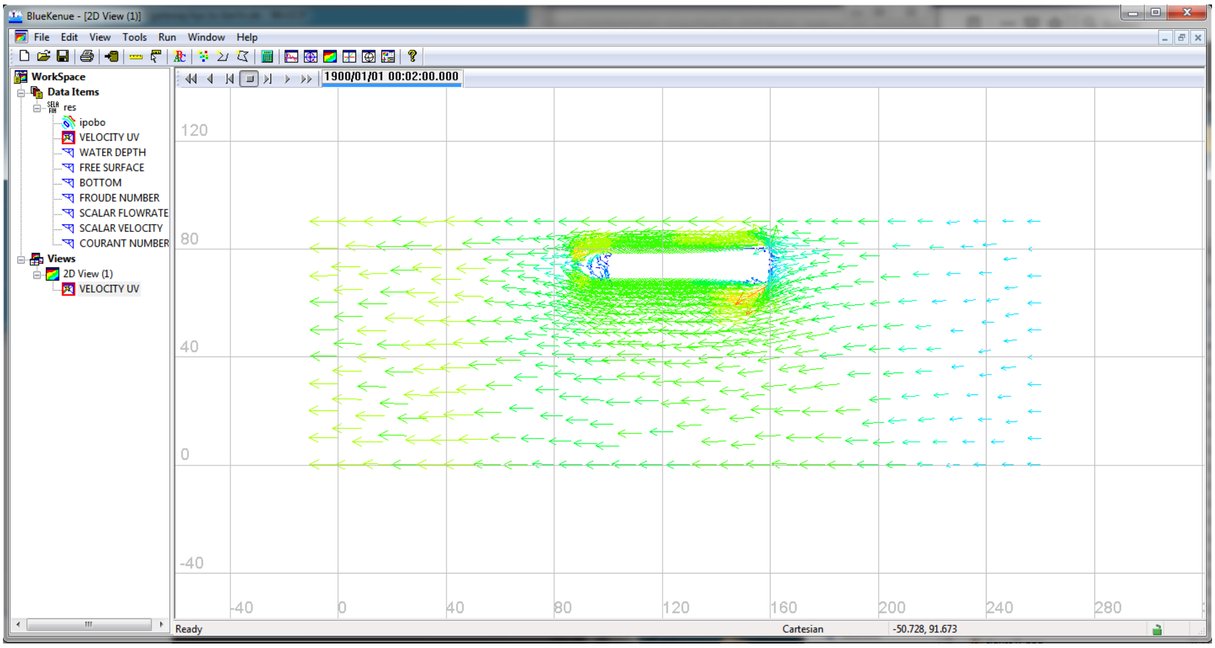
- Create a folder (e.g. Exercise_1) and save together:
  - "River.sel": mesh file created in Bluekenue
  - "Bathy_BC.cli": boundary condition file created inBluekenue
  - "cas.txt": steering file where all commands are given, as the following:

```
/-------------------------------------------/
/ TELEMAC-2D                                /
/-------------------------------------------/
/---------------------------------------------
/  COMPUTER INFORMATIONS
/---------------------------------------------
/
STEERING FILE              :cas.txt
BOUNDARY CONDITIONS FILE   :Bathy_BC.cli
GEOMETRY FILE              :River.sel
RESULTS FILE               :res.slf
/
/---------------------------------------------
/  GENERAL INFORMATIONS - OUTPUTS
/---------------------------------------------
/
TITLE                      = 'Exercise 1'
VARIABLES FOR GRAPHIC PRINTOUTS = 'U,V,S,B,H,Q,M,F,L'
GRAPHIC PRINTOUT PERIOD        = 750
LISTING PRINTOUT PERIOD        = 750
TIME STEP                  = 0.04
DURATION : 120
MASS-BALANCE               = YES
INFORMATION ABOUT SOLVER       = YES
/---------------------------------------------
```

```
/  INITIAL CONDITIONS
/---------------------------------------------
/
INITIAL CONDITIONS : 'CONSTANT ELEVATION'
INITIAL ELEVATION : 2.60
/OUTPUT OF INITIAL CONDITIONS = YES
PRESCRIBED ELEVATIONS : 0.; 2.66
PRESCRIBED FLOWRATES : 30.0; 0.
/
/---------------------------------------------
/  PHYSICAL PARAMETERS
/---------------------------------------------
/
TURBULENCE MODEL            = 1
/VELOCITY DIFFUSIVITY       = 1.E-4
LAW OF BOTTOM FRICTION : 3
FRICTION COEFFICIENT : 40.0
/
/---------------------------------------------
/  NUMERICAL PARAMETERS
/---------------------------------------------
/
/EQUATIONS                  = 'SAINT-VENANT EF'
TIDAL FLATS                 = NO
/OPTION FOR THE TREATMENT OF TIDAL FLATS : 1
/TYPE OF ADVECTION          = 1;5
/DISCRETIZATIONS IN SPACE   = 11;11
/SOLVER                     = 3
SOLVER ACCURACY             = 1.E-6
/
&FIN
```

Post_processing utilizing BlueKenue

BlueKenue as a post-processing tool serves as an intuitive and capable platform for viewing and analyzing 2D- and 3D-results


BlueKenue - [2D View (1)]
File
Edit
View
Tools
Run
Window
Help
1900/01/01 00:02:00.000
WorkSpace
Data Items
res
ipobo
VELOCITY UV
WATER DEPTH
FREE SURFACE
BOTTOM
FROUDE NUMBER
SCALAR FLOWRATE
SCALAR VELOCITY
COURANT NUMBER
Views
2D View (1)
VELOCITY UV
120
80
40
0
-40
-40
0
40
80
120
160
200
240
280
Ready
Cartesian
-50.728, 91.673