Water Rennovation in Ukraine Project no. 22320101





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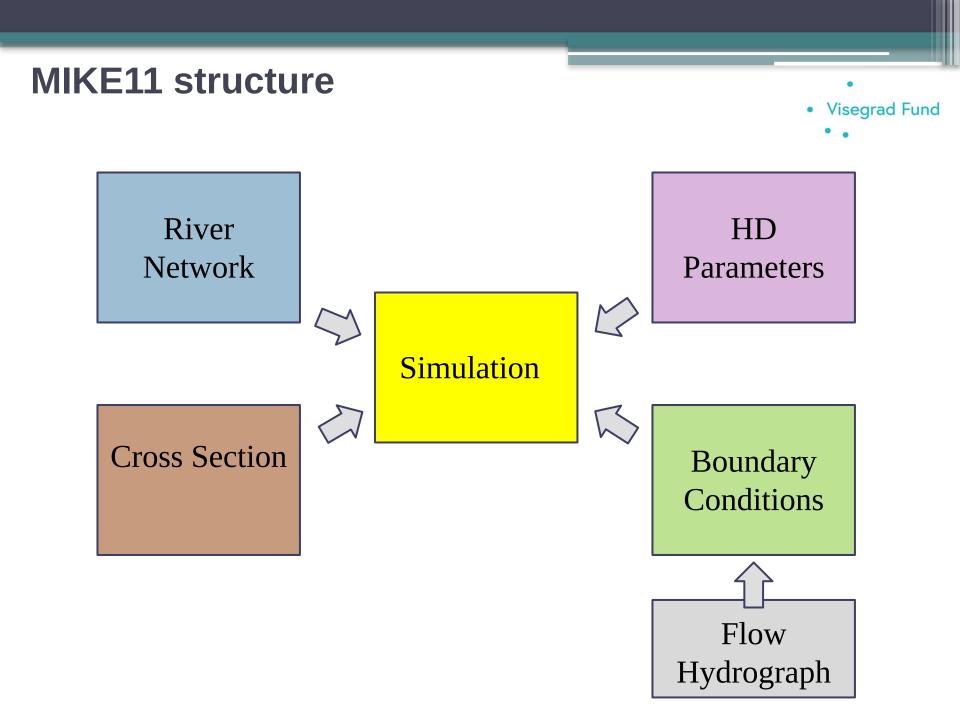
Modelling of water flow in rivers

1-st practical school (Event-Public), Krakow, PL 22/04/2024-28/04/2024

the "Implementation Period" 04/10/2023 to 15/03/2025

Dr inż. Maciej Wyrębek

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Models

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The simulation editor serves three purposes:

- 1. It contains the simulation and computation control parameter
- 2. It is used to start the simulation
- 3. It provides a link between the network editor and the other Mike11 editors. The editing of cross section is a typical example of this link, where the graphical view of the network editor is used to select cross section from the cross section editor.

Poniczanka_1%.sim11		
Models Input Simulation F	Results Start	
Models Mo	esuits Start	
Simulation Mode Unsteady Quasi steady		
0.9/	1	

Input

Here the user is required to specify a

range of input files:

□ Network

□ Cross-section

D Boundary data

□ HD Parameter

Poniczanka_1%	sim11				×
Models Input	Simulation Results Start				_
Input Files					
Network	zia_MW\MW\Z02_Poniczanka_W0\Poniczanka.nwk11		Edit		
Cross-sections	zia_MW\MW\Z02_Poniczanka_W0\Poniczanka.xns11	1 -	Edit		
Boundary data	czanka_W0\warunki_brzegowe\Poniczanka_1%.bnd11	1	Edit		
RR Parameters			Edit		
HD Parameters	ozia MW\MW\Z02 Poniczanka W0\Poniczanka.hd11	<u> </u>	Edit		
AD Parameters			Edit		
ECOLab Param			Edit		
ST Parameters			Edit		
FF Parameters			Edit		
DA Parameters		í —	Edit		
Ice Parameters			Edit		
ICC I didilicters)			
HD Results					
RR Results					
					_
0.07				 _	
0%					14

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Simulation

The simulation property page contains details of simulation time, time stepping specification and initial conditions for each of the chosen types of model.

□ Time step type

- □ Simulation start and end
- □ Initial conditions

	Input Stion Period	Simulation	Res	ults	Start						
	tep type			Time :	atan	Unit					
	time step	•		10	step	Unit Sec. •					
Inco		imulation S				Simulation F					
Period	_	2009-07-01		0.00		2009-07-03		0.00	Apply Defaul	•	
1 Chiu				0.00		2000 07 0	0 12.0	0.00			
ST tim	e step mul	tiplier	1			RR time ste	p mul	tiplier	1		
Initial C	onditions										
	Type of o	condition		Hots	tart file	ename		Add to file	 Hotstart Date and Time 		
HD:	Hotstart		-	C:\I	/w\2	016_erozja\			2009-07-01 09:00		
AD:	Paramet	er File	-						1990-01-01 12:00	00	
ST:	Paramet	er File	-						1990-01-01 12:00	00	
RR:	Paramet	er File	-)		1990-01-01 12:00	00	

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Results

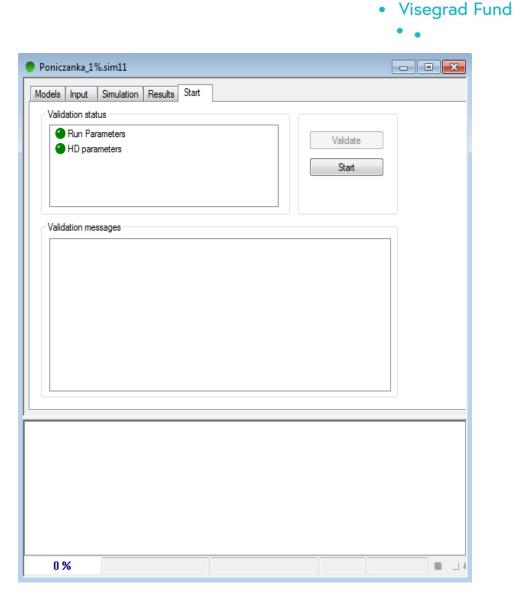
The user should specify a filename for saving of the simulation results..

Filename – name of the file and folder
 Storing Frequency: to limit the size of the results files the user can specify a save step interval.

Ponicz	anka_1	.%.sim11					
Models	Input	Simulation	Results	Start			
Resu	ılts						
		Filename		_	Storing Frequency	Unit:	
HD		Poniczanka_	1%.res11		1	Hours -	
AD)	1	Time step 🔍	
ST	:)	1	Time step 🔹	
RF	ł:)	1	Time step 🔹	
	~				1	1	
0 9	%						

Start

If all specified input files exist, the "Start" button can be pressed and the simulation will commence. The simulation will take place as a separate progress. Any error or warning message from the simulation will pop up in the Validation message window.



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River Network Editor

Graphical view

MIKE Zero - [Poniczanka.nwk11 - Modified] 🌹 File Edit View Network Layers Settings Window Help 8 × 💽 🧭 🐲 🚱 📼 🧕 🖉 😓 🖉 🖛 🙀 🗅 🚅 🖬 | 🍐 🖻 💼 | 🚑 🤋 📢 | 🔍 🔍 😓 🤠 | 🎬 Untitled j 195000 Project Explorer 194500 194000 193500 Zoom In Zoom Out Previous Zoom 193000 Next Zoom Pan (Shift) 192500 Refresh Grid 192000 Copy to Clipboard Save to Metafile. Save to Bitmap.. 191500 Font. 191000 190500 190000 189500 189000 188500 188000 568000 569000 570000 571000 572000 573000 574000 575000 576000

x = 572008.06 y = 188338.71

The graphical view is the default view and will be activated automatically when river а network file is opened or created. Editing of the river network (points and branches) is undertaken using the Graphical Editing Toolbar. Editing tools also find using Pop-Up are Menu (right mouse botton) these include insert, edit and delete

Ready

functions.

River Network Editor

Tabular view - Points

- • X MIKE Zero - [Poniczanka.nwk11:2 - Modified] 🍞 File Edit View Network Layers Settings Window Help _ 8 × D 🚅 🔲 | X 🖻 🛍 | 🍜 🤶 💔 Overview Definitions Attributes ---- Network j Points (188) Branch PONICZANKA Chainage 0 X-Coordinate Y-Coordinate Project Explorer Branches (1) 568328.74 194060.2 Chainage Type User Defined Routing Runoff/groundwater links Overview Grid points X Coord. Y Coord. Branch Chainage Type Chainage . 568328.74 194060.2 PONICZANKA User Defined 1 Ξ 568391.47 194038.19 PONICZANKA System Defined 66.578832 2 3 568503.68 193964.62 PONICZANKA System Defined 200.95739 4 568538.57 193929.93 PONICZANKA System Defined 250,23177 5 568642.05 193854.96 PONICZANKA System Defined 378.2066 6 568684.27 193811.65 PONICZANKA System Defined 438.78094 7 568727.95 193756.91 PONICZANKA System Defined 508.91732 8 568766.34 193729.84 PONICZANKA System Defined 555.96189 9 568833.65 193706.8 PONICZANKA System Defined 627.2125 10 647.03163 568853.41 193707.88 PONICZANKA System Defined 11 568968.16 193693.63 PONICZANKA 762.83623 System Defined 12 569005.08 193681.19 PONICZANKA 801.85404 System Defined 13 569096.85 193629.25 PONICZANKA System Defined 907.46099 14 193514.64 PONICZANKA 1084.1669 569231 System Defined 15 569353.31 193383.2 PONICZANKA System Defined 1263,9803 16 569472.87 193194.93 PONICZANKA System Defined 1487.3394 17 569487.35 193164.93 PONICZANKA System Defined 1520.701 18 569484.75 193112.74 PONICZANKA System Defined 1573.034 19 569476.48 193069.88 PONICZANKA 1616.7499 System Defined 20 569474.76 193001.86 PONICZANKA System Defined 1684.8936 21 569476.75 192947.46 PONICZANKA System Defined 1739.4115 22 569490.6 192855.58 PONICZANKA System Defined 1832.4687 23 569511.44 192820.95 PONICZANKA System Defined 1872.9463 24 569532.65 192756.08 PONICZANKA System Defined 1941.2979 Ready x = 571454.84 v = 191816.13Select Object

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The tabular view gives an overview of branches, structures, rainfall catchments etc.

River Network Editor

Tabular view - Branches

Definitions

Branch name: Name of the branch

□_{Topo} ID

Upstr. Ch: The chainage of the first point in the branch.

Downstr. Ch: The chainage of the last point in the branch.

□Flow Direction: If specified as positive, simulated discharge will be positive when the flow direction is from upstream chainage to downstream chainage. Vice versa if the flow direction is defined a as negative. □Maximum dx: Maximum distance between to adjacent h-pounts.

□Branch Type: Regular – minimum one cross section is required,

Link Channel – No cross are required.

🕨 File Edit View Network Layer D 🗃 🖵 🐰 🗈 🛍 🍰 🍞 K	-	/indow Help						-	8
Overview Network Points (188) Branches (1) Structures	Definitions Branch Nar PONICZAI	-	Upstr. Ch. 0				ranch Type Regular 🗸 🗸		and Project
Goodfallow The second secon	Connections	s Branch Name	Chainage			Edit Link (Channel Parameters		at Explorer
	Downstrear Overview	m						E	Ë
		Name	Topo ID	Upstr. Ch.	Downstr. Ch.	Flow Direct	tion Maximum da	_	, in the second se
			Topo ID PONICZANKA	Upstr. Ch.	Downstr. Ch.	Flow Direct	tion Maximum da 1000	_	
		Name PONICZANKA					1000	_	



The Cross Section Editor manages stores and displays all model cross section information.

There are two types of cross section data:

□ The raw data describes the shape of the cross section and the typically comes from a section survey of the river.

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□ The processed data is derived from the raw data and contains all information used by the computer model (e.g. level, cross section area, flow width, hydraulic/resistance radius). The processed data can be calculated by the cross section editor or entered manually.

Each cross section is uniquely identified by the following three keas:

□ River Name: The name given to the river branch.

□ Topo ID: Topographical identification name.

□ Chainade: River chainage of cross section.

🍞 Poniczanka.xns11											
	Topo ID	Chainage	Cross section ID	[meter]		PONICZA	ANKA - PON	ICZANKA - 368	0000		[s/m^(1/3)]
PONICZANKA	PONICZANKA	368.00	04HG] 🖡	~						0.090
	Radius Type		Datum	487	Sole-e-e-e-e-e-e-e-e-e-e-e-e-e-e-e-e-e-e-	1					
Open 🔻	Resistance Radius		• 0	400	an again						∮ - 0.080
Coordinates		ection of X coor	Morphological Mode	486		"ooo					¢ E
Apply X	T	Apply	Divide Section	485		~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~					0.070
	0	Calculate angle	Level of Divide			0	1990 B				A E
Right 0	0 Ang	jle 0	0	484		+	••••••••••••••••••••••••••••••••••••••				0.060 등
Resistance numbers				-						R d	gi
Transversal Distribution Hig	h/Low flow zones 🔻 🛛	eft high flow 0.055		483			Ĩ			A Berere	0.060 L 30 10 10 10 10 10 10 10 10 10 10 10 10 10
Resistance Type Ma	nning's n 🔻 🔻	Right high flow 0.055	Low flow 0.03	482						l	
				Š			۴ ا				esi 0.040
ID E PONICZANKA		Z Resist. 8 487.400 0.055	Mark	481		+	d			₿ <u>∲</u>	č
PONICZA		8 487.310 0.055								6-6-80 ⁶⁵	- 0.030
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14.00 0 24.00 0		8 487.110 0.055		479				1	S		
34.00 0	5 -461.2	8 487.040 0.055						l i i i i i i i i i i i i i i i i i i i	Ϋ́		
61.00 0	6 -455.2	0		478					⊦ <mark>/</mark>		
66.00 0	7 -453.2]+							0.010
214.00 0 219.00 0	8 -447.2	8 486.770 0.055 (8 486.680 0.055 (_	-500	-400 -3	300 -20)0 -1	00 0	10	200	····
< <u>213.00</u> 0	9 -437.2 	0 400.000 0.055	•				Cross sed			200	[meter]

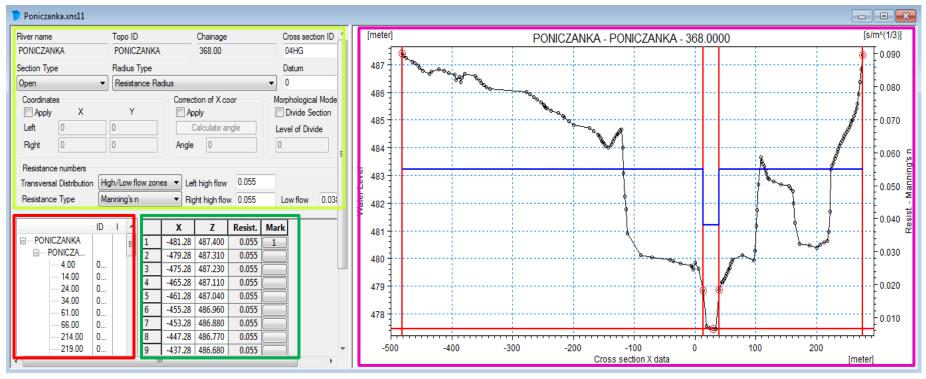
Raw data

The raw editor is made up by three views plus a number of additional dialog boxes.

☐ Tree view: Provides the list of all cross section file. The list is displayed using a tree structure with three levels. The upper level contains the river names, the second contains the Topo-IDs, and the thist contains cross section chainage.

□ Tabular view: Selecting cross section with the left mouse button will display the section information in the tabular view.

Graphical view: Anx-z-plot of the cross sectional data with markers and Resistance values.



Raw data – dialog box

□ River Name, Topo ID and Chainage: Non-editable information of the river name, the topographical identification tag and the chainage along the river. These values may be changed by selecting the appropriate level in the tree view using the rename facility

Cross section ID: An identification tag may be entered here. This tag is subsequently displayed in MIKE View and does not influence the calculations

□ Section Type: The type of section is set here. Four possibilities are listed:

Open section Closed irregular Closed circular Closed rectangular

Radius Type: The type of hydraulic radius formulation is set here
 Datum: We may change the elevation of the whole crossection by adding values in meters

River name		Topo ID	Chainage		Cross sect	ion ID
PONICZAN	KA	PONICZANKA	368.00		04HG	
Section Type	e	Radius Type			Datum	
Open		▼ Resistance Rad	dius	• 0		
Coordinate Apply Left Right	x 0 0	Y 0 0	Correction of X coo Apply Calculate and Angle		Morphologica Divide Se Level of Divid	ection
Resistance	e numbers				_	
Transversa	l Distribution	High/Low flow zone	es ▼ Left high flow	0.055		
Resistance	е Туре	Manning's n	 Right high flow 	0.055	Low flow	0.038

Raw data – Dialog box – Resistance number

ſ	Resistance numbers					
	Transversal Distribution	High/Low flow zones 🔻	Left high flow	0.055		
	Resistance Type	Manning's n 🛛 🔻	Right high flow	0.055	Low flow	0.038

Transversal distribution: The distribution of resistance number is set here. We have three options: Uniform, High/Low flow zones, Disributed

Resistance type:

Relative resistance

Manning's n

Manning's N

Chezy number

Dercy Weisbach

Values of resistance number when Uniform or High/Low flow zones were selected.

For distributed option resistance values are put in Tabular view window

	X	Z	Resist.	Mark
52	-137.30	484.120	0.055	
53	-135.30	484.220	0.055	
54	-133.30	484.320	0.055	
55	-129.30	484.440	0.055	
56	-127.30	484.500	0.055	
57	-125.30	484.560	0.055	
58	-123.30	484.620	0.055	
59	-121.30	484.670	0.055	
60	-119.30	484.000	0.055	
61	-117.30	483.090	0.055	

Processed data

The processed data view is similar to the raw data display. A tree view exists on the left where the required cross section can be selected. A tabular view provides all processed data and a graphical view displays the processed data graphically.

🍞 Poniczanka.xns11:2 - Modi	fied														×
								F	ladius	•					
River name : PONICZANKA	То	po ID : PON			ge : 368.00				^{[me} P	ONICZAN	IKA - PO	DNICZ	ANKA	- 368. /	0 0 ,]
	🔳 Pr	otect data	Data st		ot updated	Edited by	user /		486 -					ø	-
ID ▲ □ PONICZANKA □ □ PONICZ □ □ 4.00 0		Level	Cross section area	Radius	Storage width	Add. storage area	Re ^ n fa		484			/	8		-
14.00 0	1	477.460	0.000	0.000	0.000	0.000	(-			æ			
24.00 0	2	477.480	0.141	0.017	9.658	0.000	E		482 -				ø	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	-
34.00 0 61.00 0	3 4	479.740 479.840	63.542 70.722	1.693 1.686	59.390 84.204	0.000		5	5 -						
66.00 0	4 5	479.840	80.063	1.648	101.384	0.000		Mater Level	480 -	6	, 9	/			-
214.00 0	6	479.950	81.090	1.645	103.888	0.000	- d	t l			۳				
219.00 0	7	480.120	105.884	1.490	186.797	0.000									
347.00 0	8	480.380	155.562	1.407	195.148	0.000	Ċ		478 -		f				-
368.00 0 438.00 0	9	480.470	173.965	1.419	213.800	0.000	C		-	e la	1	6			
438.00 0	10	480.540	189.685	1.426	236.027	0.000	C		-						
448.00 0	11	480.640	213.939	1.440	249.393	0.000	C		476 -		/	/			-
453.00 0	12	482.610	748.965	2.898	288.413	0.000	C		-						
479.00 0	13	482.680	769.647	2.955	302.509	0.000	(-		474 -		<u> </u>				_
Synchronize raw data Recompute Delet	e All	View Ra	w Data	Levels			4		472 -	0.0	2.0		4.0		
•			111				•				Ra	dius		[meter	1

Boundary Data Editor

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The boundary editor is used to specify boundary conditions to a Mike11 Model. The Boundary File window consists of three split windows.

The top split window is used to specify the overall boundary conditions. Each boundary condition appears as a row in a Boundary Table in this window. The table lists all boundaries included in a model set up. There is no limit to the number of rows (boundaries) that can be included in the table.

The contents of the second and third split windows depend on the specifications of the active row (row number highlighted) in the Boundary Table. Additional information needed in order to specify the boundary conditions are in the are entered in the second and third split windows.

Ponicz	zanka_1%.bnd11						
	Boundary Description	Boundary Type	Branch Name	Chainage	Chainage	Gate ID	Boundary ID
1	Open 🚽	Inflow	PONICZAN	10158	0		górny warunek
2	Distributed Source	Inflow	PONICZAN	10158	4030		Qg_Rdzawka
3	Point Source	Inflow	PONICZAN	4030	0		Rdzawka
4	Distributed Source	Inflow	PONICZAN	4030	24		Rdzawka_ujscie
5	Open	Water Level	PONICZAN	0	0		rzędna z Raby w km 110725
		1					^
	de HD calculation de AD boundaries						E
	Data Type TS Type	File / Value	TS Info				
1	Discharge: TS Fil	\dfs0\Poniczanka	Edit p=1%				-

Boundary Data Editor

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The Boundary Table shown in the split windows gives an overview of the boundaries included in

the model set up. The information required is the Boundary Description, the Boundary Type and the Location of the Boundary.

Ponicz	zanka_1%.bnd11						
	Boundary Description	Boundary Type	Branch Name	Chainage	Chainage	Gate ID	Boundary ID
1	Open	Inflow	PONICZAN	10158	0		górny warunek
2	Distributed Source	Inflow	PONICZAN	10158	4030		Qg_Rdzawka
3	Point Source	Inflow	PONICZAN	4030	0		Rdzawka
4	Distributed Source	Inflow	PONICZAN	4030	24		Rdzawka_ujscie
5	Open	Water Level	PONICZAN	0	0		rzędna z Raby w km 110725

In the third table Data Type and Input Files are loaded. Loaded files may be changeded by using Edit botton.

	Data Type	TS Type	File / Value	TS Info
1	Discharge:	TS Fil	\dfs0\Rdzawka.dfs Edit	p=1%

Time series

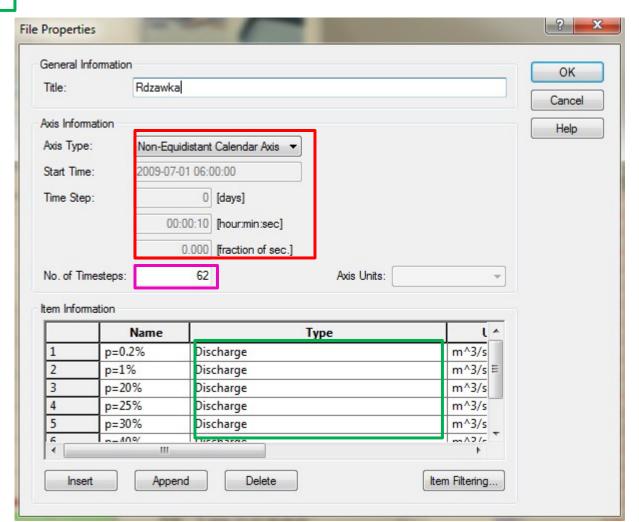
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The Time Series window is useded to define:

<u>type of boundary condition</u>,

perion of time,
 nuber time step

In the Item Information Table the numer of flow hydrograph may by define.



Time series

The Flow Hydrograph window is made up by two views :

u table view window with values of flow

u graphical view window displays the table view data graphically,

Rdzawka.dfs0							
Rdzawka		Time	1:p=0.2% [m^3/s]	2:p=1% [m^3/s]	3:p=20% [m^3/s]		
	0	2009-07-01 06:00:00	0	0	6.09		
24	1	2009-07-01 07:00:00	0.49	0.36	6.09		
-+ p=1% [m^3/s]	2	2009-07-01 08:00:00	4.22	3.08	6.09		
22 -=-p=20% [m^3/s] →-p=25% [m^3/s]	3	2009-07-01 09:00:00	10.16	7.41	6.09		
20	4	2009-07-01 10:00:00	15.88	11.59	6.09		
	5	2009-07-01 11:00:00	20.26	14.79	6.09		
18	6	2009-07-01 12:00:00	23.09	16.85	6.09		
	7	2009-07-01 13:00:00	24.56	17.93	6.09		
16 - +++++++++++++++++++++++++++++++++++	8	2009-07-01 14:00:00	24.98	18.23	6.09		
	9	2009-07-01 15:00:00	24.65	17.99	6.09		
14 =	10	2009-07-01 16:00:00	23.81	17.38	6.09		
	11	2009-07-01 17:00:00	22.65	16.53	6.09		
12	12	2009-07-01 18:00:00	21.3	15.55	6.09		
10 -	13	2009-07-01 19:00:00	19.86	14.5	6.09		
	14	2009-07-01 20:00:00	18.41	13.44	6.09		
8	15	2009-07-01 21:00:00	16.99	12.4	6.09		
	16	2009-07-01 22:00:00	15.62	11.4	6.09		
6	17	2009-07-01 23:00:00	14.32	10.45	6.09		
	18	2009-07-02 00:00:00	13.1	9.57	6.09		
4 1	19	2009-07-02 01:00:00	11.98	8.74	6.09		
	20	2009-07-02 02:00:00	10.94	7.98	6.09		
2	21	2009-07-02 03:00:00	9.98	7.28	6.09		
	22	2009-07-02 04:00:00	9.1	6.65	6.09		
06:00 06:00 06:00	23	2009-07-02 05:00:00	8.3	6.06	6.09		
2009-07-01 07-02 07-03	< □		i	i	4		

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Hydrodynamic Editor

The Hydrodynamic parameters editor (HD-editor) is used for setting sub-plementary data used for the simulation. The Editor has a number of tabs. In our model we will used only two from those tabs: Add. Output

Initial	

each Lengths	Add. Outpu	t Flood Pla	ain Resist.	User	Def. Marl	cs	Encroachm	ent
eat Balance	Stratification		ries Output				water Leaka	
al Wind	1	Bed Resist. Tool	-	Approx	_	t Values	-	
nitial conditions								
-Global Values								
Water Depth	0.5		Water Le	vel				
Discharge:	1		Water De	pth				
-Local Values								
	River Name	Chainage	Initial y	Ini	itial Q	1		
					1	1		
1			0.5		1			
1			0.:)	1			
1			0.:		1]		
1			0.:		1]		
1			0.2		1]		
1			0.:		1]		
1			0.:	2]		
1			0.:	2]		
1			0.:	2	1]		
1			0.:		1			
1			0.:	2	1]		
1			0.:		1]		
1			0.:		1]		
1			0.:		1]		
1			0.3		1]		
1			0.2		1			

Hydrodynamic Editor

Add. Output

The number of simulated parameters can be selected for storage in the additional output results file (with the file name extension 'Ress11').

The parameters are saved for each save step at each h/q point of the river system. Time series and longitudinal profiles of the parameters can be viewed in the same same way as normal MIKE11 result file in MIKE VIEW.

Heat Balance	Stratification	Time Series O	utput Ma	aps Grou	undwater Leakage
Initial Wind E	Bed Resist. Be	d Resist. Toolbox	Wave Approx	Default Val	ues Quasi Steady
Reach Lengths	Add. Output	Flood Plain Re	esist. Use	r Def. Marks	Encroachment
	HorQpoints H	l and Q points Tot	al Structure	s	
Velocity					
Discharge					
Cross Section Area	\checkmark				
Flow Width	\checkmark				
Radius	\checkmark				
Resistance					
Conveyance					
Froude Number	V				
Volume			1		
Flood Area					
Mass Error					
Accumulated Mass I	Error				
Lateral Inflows					
Water level slope					
Energy level slope					
Energy level	\checkmark				
Bed shear stress					
Groundwater head					
Time Step					

Hydrodynamic Editor

Initial

Initial conditions for the hydrodynamic model are specified on this page. The initial values may be specified as discharge and as either water level or water depth.. The global values are applied over the entire network at the start of the computation. Specific local values can be specified by entering river name, chainage and initial values. Local values will override the global specification.

					• V	'isegrad F	-un
Poniczanka.hd11						•	
Heat Balance	Stratification	Time Serie	o Output	Maps	Groups	dwater Leakage	
Reach Lengths	Add. Output	Flood Plain			f. Marks	Encroachment	_
Initial Wind			d Resist. Toolbox Wave Approx Defau				_
TVIII G	Ded Healat.	ed nesist. Toolbe	M 110/07	ppiox			-17
Initial conditions							h I
Global Values							
Water Depth	0.5		O Water Lev	vel			
Discharge:	1	Ξ.	Water Dep	oth			
Discritigo.	•		• Water Dep				
Less 11/shares							
- Local Values -							
	River Name	Chainage	Initial y	Initi	al Q		
1			0.5		1		
							///