

Morpho2DH

Tutorial

- Bed Material Load -

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I. Outline

I.1 Morpho2DH

Morpho2DH is a calculation solver that a debris/mud flow model is added to Morpho2D.

Morpho2D is the unsteady horizontal two dimensional bed deformation analysis solver which is developed by Hiroshi Takebayashi, Kyoto University. The governing equations are written in boundary fitted general coordinate system. In 2009, the solver was installed to RIC-Nays Version 1.0 which is the free software developed by RIC. Some functions are added to the original version and the improved version is installed into iRIC Version2.0 on March 2011. Morpho2D was unified with Nays2D and Nays2DH was developed. Hence, the development of Morpho2D was stopped on March 2014.

Morpho2DH is the horizontal two dimensional debris/mud flow analysis solver which can reproduce the transport and deposition process of debris/mud flow due to the landslides. Structures (ex. sabo dam, weir, house and so on) and horizontal distribution of erosion depth can be considered in the analysis.

Additionally, the unsteady horizontal two dimensional bed deformation analysis which can be performed using Morpho2D can be performed as it used to be.

I.2 Morpho2DH Tutorial - Bed Material Load -

The purpose of the tutorial is to show the detailed procedure of the analysis from the beginning to end. Tutorials has enough explanations to perform analysis. However, if you cannot understand the tutorials, please refer iRIC user manual and Morpho2DH manual.

[Contents of Tutorial]

- Chapter II Bed deformation analysis on bed composed of non-uniform sediment (Mekong River)
- Chapter III Bed deformation analysis with vegetation (Mekong River)
- Chapter IV Bed deformation analysis with river regulation works (Mekong River)

I.3 Open Morpho2DH

1. Startup iRIC and Select [Create New Project] from [iRIC Start Page] window.

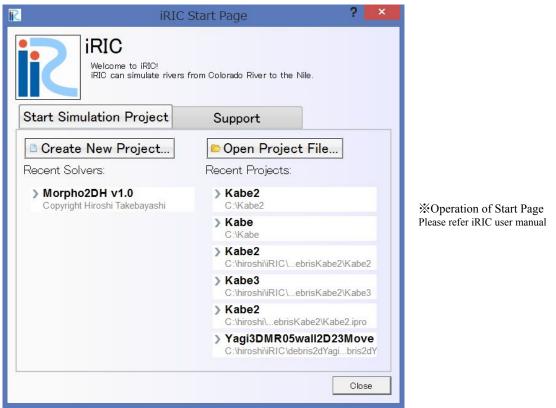


Figure I-1(1) Startup window

2. Select [Morpho2DH] in [Select Solver] window and click OK.

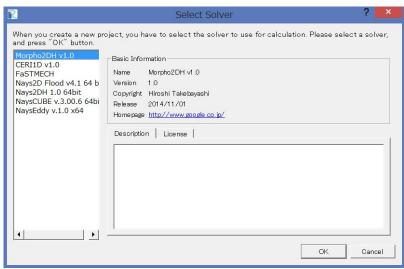


Figure I-1(2) Select solver

II. Bed deformation analysis on bed composed of nonuniform sediment(Mekong River)

• Purpose

The purpose of this chapter is for river engineers and university students who have no experience of bed deformation analysis to learn to perform bed deformation analysis on bed composed of non-uniform sediment by use of Morpho2DH and visualize the calculated results.

Procedure

Procedure in this chapter is shown in Figure II-1.

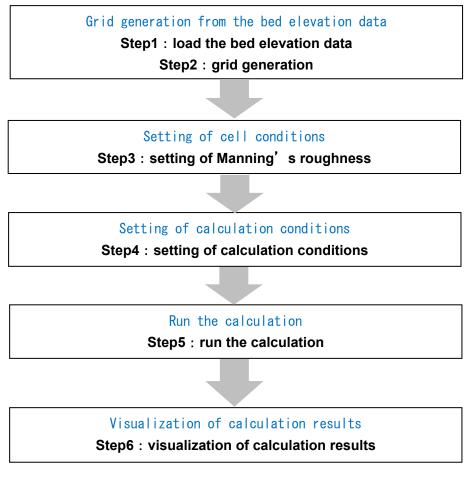


Figure II-1 Procedure in this chapter

II.1 Grid generation from bed elevation data

II.1.1 Load cross-section of the river

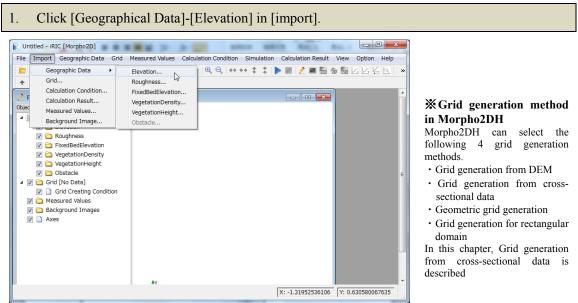


Figure II-2(1) Load the bed elevation data

2. Select [TanC.riv] in [Mekong] folde	er in Sample folder.	
i Select file to import Select file to import Select file to import Select file to import Nekong	▼ 4 Mekongの検索 ♪	
整理 マ 新しいフォルダー	🗋 🔞	
 ○ ドキュメント ○ ビクチャ ○ ビクチャ ○ ビデオ ○ ミュージック ○ ホームグループ ○ コンピューター ○ ローカルディスク(C ○ ネットワーク ○ D3348D00000 ▼ 	▼ River Survey data(*.riv) ▼	Cross-sectional data Cross-sectional data (*.riv) is composed of the bed elevation data in cross-section, distance from left bank, x and y coordinate at the both ends of the data. Format of the cross-sectional data is explained in iRIC manual.
	開く(0) ▼ キャンセル	

Figure II-2 (2) Load the bed elevation data

II.1.2 Grid generation

Selection of the grid generation algorithm

1. Click [Select algorithm to create grid] in [Grid].

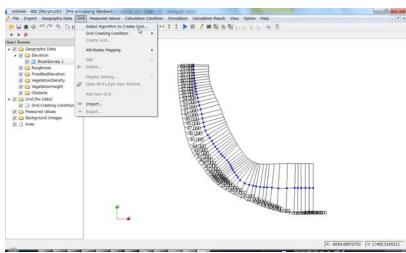


Figure II-3(1) Selection of the grid generation algorithm

2. Select [Create grid from river survey data] in [Algorithm] and click OK.

ilgorithm:	Description:
Create grid from polygonal line and widt Create grid from from river survey data Create grid by dividing rectangular regio Create compound channel grid Multifunction Grid Genarator	The grid shape is automatically defined using river survey data. You can specify the grid division number, by adding grid creation control points on river crosssections, river center, left bank, and right bank. Note: This algorithm is available only when river survey data is loaded!Please switch algorithm to this, after importing river survey data.

Figure II-3 (2) Selection of the grid generation algorithm

Division in transverse direction

When you click the blue line in transverse direction, the line becomes thicker.
 Open small windows by right click and select [Add Division Points].

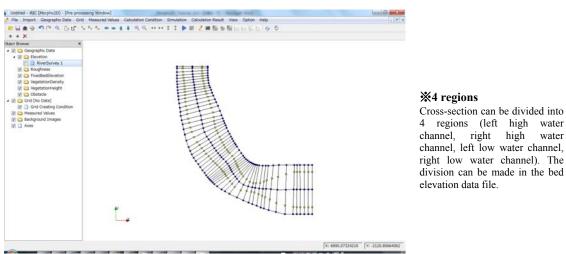


Figure II-4(1) Add division points in transvers direction

3 Division number and division method are set in [Add Division Point] window and click OK.

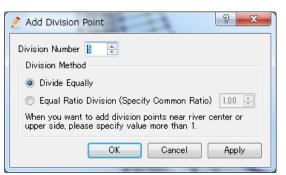


Figure II-4(2) Add division points in transvers direction

4 This procedure is repeated for 4 regions.

Figure II-4(3) Add division points in transvers direction

Grid generation

	processing Window]	Condition Simulation Calculation Result View Option Help	
Pre: Encot Cetaryte Cate	Select Algorithm to Create Grid Grid Orasting Condition Create Grid. Attributes Mitping Edit X Defants Display Sectorg Creat Bird's-Eye View Window Add New Grid		

Figure II-5(1) Grid generation

2 Press OK in [Grid generation] window.

ſ	2 Grid Creation
	Start Traversal Line: 65.000 End Traversal Line: 1.000 OK Cancel
Ĺ	Figure II-5(2) Grid generation
2	Confirmation
	Do you want to map geographic data to grid attributes now?
	Yes No
	Figure II-5(3) Grid generation
Plie Import Geog	12년 (사이가에에 Reduc) Angel Call Call Angel Call Call Angel Call Call Call Call Call Call Call Ca
	ever 1 version

Coefficient of Manning's roughness

1 Click [Roughness] in [Object Browser] by right button of mouse and select [add] and [Polygon].

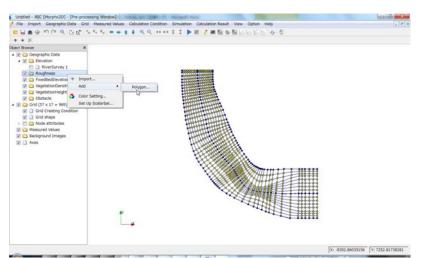


Figure II-6(1) Coefficient of Manning's roughness

2 Make a polygon by clicking at the corners of the polygon. The polygon should cover the whole calculation area. Double clicks stop to make the polygon.
3 Enter the roughness value in the small windows.

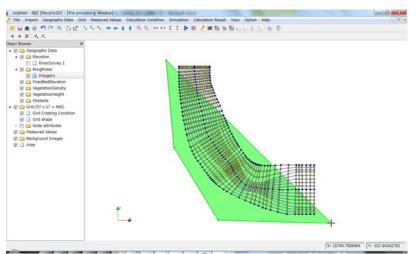


Figure II-6(2) Add division points in transvers direction

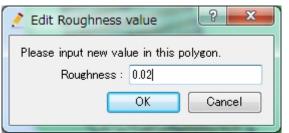
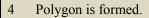


Figure II-6(3) Enter the Manning's roughness



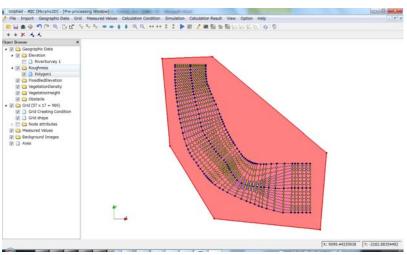


Figure II-6(4) Add division points in transvers direction

II.1.3 Load background image

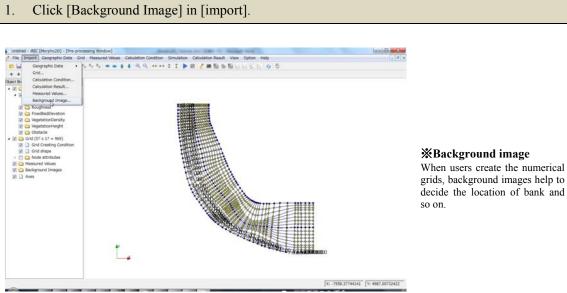


Figure II-7 (1) Load the background image

2. Select [TanChau.jpg] in [Mekong] folder in Sample folder.

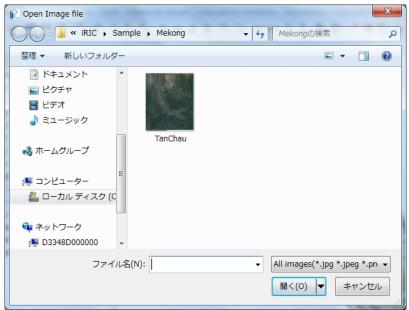


Figure II-7 (2) Load the background image

3. Background image is fitted to cross-sections by use of [Pan], [Rotate] and [Zoom] ation Condition Simulation Calculation Result View Option Help 이, 이, ++ ++ ‡ ‡ 🍺 📰 者 🖬 🛍 🕼 🖬 🔄 🖉 🖉 Q L D **%**Hints for the fitting Mouse ... ? X 0 Ctrl+ Pan Ctrl+ Zoom Ctrl+ Rotate ш Ľ., Details are in iRIC user manual H Y: -1158.613

Figure II-7(3) Load the background image

II.2 Setting of calculation conditions

II.2.1 Setting of calculation conditions

■Selection of solver type

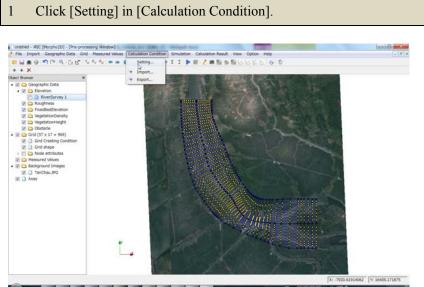


Figure II-8 Setting of calculation conditions

■Setting of boundary conditions

1 Click [Boundary Cor	ndition] in [Calculation Conditions] windo	w.
Groups Boundary Condition Calculation Type an Calculation Conditio Bed Material Vegetation Obstacle Hot Start	d Data Stage at Downstream Edit	Water discharge at the upstream end is set in [Water Discharge] window. Not only reading the data from files but also inputting the data directly. Unit of the time is second. Unit of the water discharge is m3/s.
Reset Figure II-9(1)	Save and Close Cancel	

2 Click [Import] to load the water discharge data.

Calculation Condition	n		-	1		2	X
Time (s) D		Discharge (m3/s)	000 800 600 400 0 0 0 0 0	200	400 600 Time (s)	800	1,000 cel

Figure II-9(2) Setting of temporal change of water discharge

3 Select [Discharge.csv] and click [Open].

R Choose a text file	THE OWNER WATCHING OF	X
🔾 🗸 🕹 🗸 4.19_Mort	oho 🕨 Sample_TanChau 🗸 😽 Sai	mple_TanChauの検索 👂
整理 ▼ 新しいフォルタ	-	II • 🔟 🔞
Subversion	^ 名前 [^]	更新日時 種類
📑 ドキュメント	🖾 Discharge	2013/03/25 10:42 Micro
📓 ピクチャ	SSize	2013/03/28 20:05 Micro
📑 ビデオ	🔊 WLevel	2013/03/25 10:54 Micro
🎝 ミュージック		
輚 ホームグループ		
🌉 コンピューター		
🚢 ローカル ディスク (C		
📬 ネットワーク	▼ (•
ファイ	ル名(N): Discharge 🔹 Text	files (*.csv *.txt)
	開	<(0) ▼ キャンセル

Figure II-9(3) Load the water discharge data

4 Water discharge data is loaded and the values of water discharge and the hydrograph are shown in the window. Click [OK] and go back to [Calculation Condition] window.

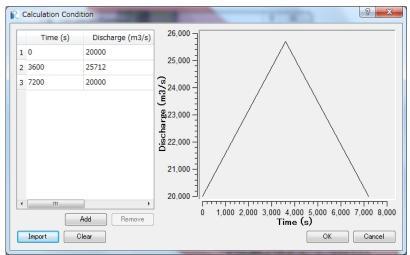
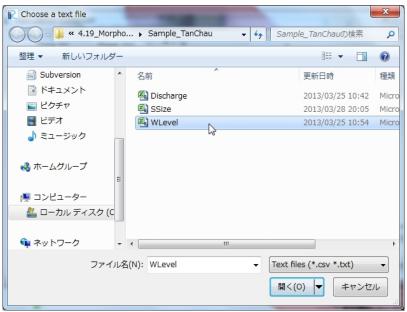


Figure II-9(4) Setting of hydrograph

5 Setting procedure of [Stage at Downstream] is the same as [Discharge]. Please select [WLevel.csv].



Water level at the upstream end is set in [Water Level] window. Not only reading the data from files but also inputting the data directly. Unit of the time is second. Unit of the water level is m.

Figure II-9(5) Setting of temporal change of water level at downstream end

Setting of the calculation type and output time step of data

- 1 Click [Calculation Type and Data] in [Calculation Condition] window.
- 2 Select [Bed Material Load] in [Calculation Type and Data].
- 3 [Start Time (s)] is 0.
- 4 [End Time (s)] is 7200 (s).
- 5 [Computational Time Step (s)] is 0.1 (s).
- 6 [Output Time Step for File (s)] is 60 (s).
- 7 [Output Time Step for Screen (s)] is 10 (s).
- 8 [Bed Deformation Start Time (s)] is 60 (s).

Boundary Conditions Calculation Type and Data Calculation Conditions (… Calculation Conditions (… Bed Material Vegetation Obstacle Hot Start	Start Time (s) End Time (s) Computational Time Step (s) Output Time Step for File (s) Output Time Step for Screen (s) Bed Deformation Start Time (s)	
Obstacle	Output Time Step for Screen (s)	

Figure II-10 Setting of calculation parameters

Select [Flow only] for flow calculation or [Bed Material Load] for bed deformation analysis considering bed material load in [Calculation Type and Data]

Start time of the calculation is set in [Start Time (s)]. Unit is second.

End time of the calculation is set in [End Time (s)]. Unit is second.

Time step Δt is set in [Computational Time Step (s)]. Unit is second. The time step is decided considering CFL condition.

Output time step for file is set in [Output Time Step for File (s)]. Unit is second.

Output Time Step of calculation condition for Screen is set in [Output Time Step for Screen (s)]. Unit is second. Short time step makes the calculation time longer.

Start time of bed deformation is set in [Start Time of Bed Deformation (s)]. Unit is second. When the calculation domain is long or water discharge is small, start time of the bed deformation should be late.

Setting of calculation conditions

- 1 Click [Calculation Conditions (Bed Material Load)] in [Calculation Condition] window.
- 2 7 is set for [Secondary Flow Coefficient].
- 3 0.0001 is set for [Coefficient of Permeability (m/s)].
- 4 [Bed and Suspended Load] is selected in [Sediment Transport Type].
- 5 [Lane-Kalinske Equation] is selected in [Suspended Load Equation].
- 6 Select [Dsabled Non-Erodible Area] in [Non-erodible Height].
- 7 Select [Input Value] in [Upstream Bed Slope], because the averaged bed slope at Tan Chau area in the Mekong River is negative value.
- 8 0.0001 is set for [Upstream Bed Slope Value].
- 9 1 is selected in [Ratio of Sediment Discharge to Equilibrium Sediment Discharge].
- 10 1 is selected in [Ratio of Bed Deformation DT to Flow DT]

Secondary flow coefficient is set. The value should be between 7 and 11 in [Secondary Flow Coefficient].

Coefficient of permeability below the bed surface is set in [Coefficient of Permeability (m/s)]. Unit is m/s.

Select the sediment transport type. When you consider bed load only, please select [Bed load]. When you consider suspended load, please select [Bed and Suspended Load] in [Sediment Transport Type]

Select the suspended load equation. Uses can select Lane-Kalinske's equation or Itakura-Kishi's equation in [Suspended Load Equation]

When some parts of the bed composed of rock or weir is set in the calculation area, please select [Enabled (Value in Polygon)].

Select the treatment of bed slop at the upstream end in [Upstream Bed Slope]. When you use the average bed slope value, please select [Average]. When you input the bed slope value, please select [input Value].

When you select [input Value] in [Upstream Bed Slope], please input the bed slope value in [Upstream Bed Slope Value].

Ratio of upstream sediment discharge to equilibrium sediment discharge is set in [Ratio of Upstream Sediment Discharge to Equilibrium Sediment Discharge]. For example, upstream boundary located at the dam, the ratio should be smaller than 1. When the upstream boundary located at the landslide location, the ration should be larger than 1.

Ratio of Bed Deformation Δt to Flow Δt is set in [Ratio of Bed Deformation DT to Flow DT]. Basically, users should use 1. In case, the unsteady characteristics of the flow is very week and users want to get faster, please set the value between 1 and 10.

Sroups Boundary Conditions Calculation Type and Data Calculation Conditions (Bed Materi Calculation Conditions (Debris/Mu Bed Material Vegetation Obstacle Hot Start	Secondary Flow Coefficient Coefficient of Permeability (m/s) Sediment Transport Type Suspended Load Equation Non-Erodable Height Upstream Bed Slope Upstream Bed Slope Value Ratio of Sediment Discharge Ratio of Bed Deformation DT to Flow DT	Bed and Suspended Loa Lane-Kalinske Equatio Disabled Input Valu	n <u>*</u>
--	---	--	------------

Secondary Flow Coefficient	7
Coefficient of Permeability (m/s)	0.0001
Sediment Transport Type	Bed and Suspended Load 💌
Suspended Load Equation	Lane-Kalinske Equation 💌
Non-Erodable Height	Disabled 🗾
Upstream Bed Slope	Input Value 💌
Upstream Bed Slope Value	0.0001
Ratio of Sediment Discharge to Equilibrium Sediment Discharge	1
Ratio of Bed Deformation DT to Flow DT	1

Figure II-11 Setting of calculation conditions

Setting of bed material conditions

- 1 Click [Bed Material] in [Calculation Condition] window.
- 2 Select [Non-uniform] in [Bed Material Type].
- 3 [Mean Grain Diameter (m)] is available, when you select [Uniform] in [Bed Material Type].
- 4 [Grain Size Distribution] is available, when you select [Non-uniform] in [Bed Material Type]. Click [Edit] to load the size distribution data of both surface layer and bottom layers. Setting procedure of size distribution data of bed material is the same as [Discharge].

When bed material is treated as uniform sediment, please select [Uniform]. When bed material is treated as nonuniform sediment, please select

Input mean grain diameter in [Mean Grain Diameter (m)]. This function is available only for

[Non-uniform].

uniform sediment

Calculation Condition Groups Boundary Conditions Calculation Type and Data Calculation Conditions Bed Material Vegetation Obstacle Hot Start	Bed Material Type Mean Grain Diameter (m) Grain Size Distribution Exchange Layer Thickness (m) Number Of Deposition Layer Initial Layer Number	Ron-Uniform 0.01 Edit 0.3 25 ⊕ 15 ⊕
Reset	Save a	nd Close Cancel

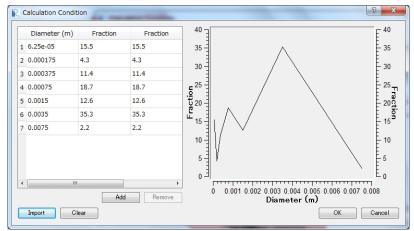
Figure II-12(1) Setting of bed material conditions

5 Select [SSize.csv] and click [open].

R Choose a text file		X
😋 🗢 🚽 « 4.19_Morph	ho 🕨 Sample_TanChau 🛛 👻 🐓	Sample_TanChauの検索 👂
整理 ▼ 新しいフォルダ-	-	:= - 🔟 🔞
Bubversion	~ 名前 ~	更新日時 種類
■ ドキュメント	🔄 Discharge	2013/03/25 10:42 Micro
📔 ピクチャ	SSize	2013/03/28 20:05 Micro
ビデオ	🖾 WLevel 😽	2013/03/25 10:54 Micro
 ♪ ミュージック ペ ホームグループ ■ コンピューター ▲ ローカル ディスク (C 		
📬 ネットワーク	▼	
ファイル	∠名(N): SSize	Text files (*.csv *.bxt) 開く(0) ▼

Figure II-12(2) Setting of bed material conditions

6 Fraction of each sediment size class of surface layer is shown in the second column and fraction of each sediment size class of bottom layer is shown in the third column.



Both 100 (%) and 1 are available for the summation of fractions, because fractions are recalculated at the start of the calculation for the summation of the fractions to be 1.

Lines of both surface and bottom size distribution are drawn. In the left figure, the same size distributions are used for the surface and the bottom layers. Hence the line of the size distribution seems one.

Figure II-12(3) Setting of bed material conditions

- 7 0.3m is used for [Exchange Layer Thickness (m)].
- 8 25 is used for [Number of Deposition Layer].
- 9 15 is used for [Initial Layer Number].

Calculation Condition		? ×
Groups Boundary Conditions Calculation Type and Data Calculation Conditions Bed Material Vegetation Obstacle Hot Start	Bed Material Type Mean Grain Diameter (m) Grain Size Distribution Exchange Layer Thickness (m) Number Of Deposition Layer Initial Layer Number	Non-Uniform ▼ 0.01 Edit 0.3 25 ÷ 15 ÷
Reset	Save an	d Close Cancel

Figure II-12(2) Setting of bed material conditions

Setting of vegetation conditions

- Click [Vegetation] in [Calculation Condition] window. 1
- Select [Disabled] in [Vegetation Density]. 2
- 3 Select [Disabled] in [Vegetation Height]

Groups Boundary Conditions Calculation Type and Data Calculation Conditions Bed Material Vegetation Obstacle Hot Start	Vegetation Density Vegetation Height	Disabled ▼ Disabled ▼
--	---	--------------------------

If vegetation is considered, [Enabled] is always selected in [Vegetation Density]. Polygons of vegetation regions must be set and the vegetation density values must be inputted.

If vegetation height is considered, [Enabled] is selected in [Vegetation Height]. Polygons of vegetation regions must be set and the vegetation height values must be inputted. If [Disabled] is selected in [Vegetation Height], the vegetation height becomes infinity.

Figure II-13 Setting of vegetation conditions

Setting of obstacle

- 1 Click [Obstacle] in [Calculation Condition] window.
- 2 [Disabled] is selected in [Obstacle].

i	Calculation Condition		? <mark>×</mark>	
	Groups Boundary Conditions Calculation Type and Data Calculation Conditions Bed Material Vegetation Obstacle Hot Start	Obstacle	Disabled •	If obstacles are considered, [Enabled] is selected in [Obstacle] and polygons of obstacle regions must be set.
	Reset		Save and Close Cancel	

Figure II-14 Setting of obstacle conditions

Setting of hot start

- Click [Hot Start] in [Calculation Condition] window. 1
- 2
- Select [New] in [Hot Start]. No need to select [Continue File]. 3

Continue File flowprn	

When users perform new calculation, please select [New]. When users want to start the calculation from the end of the previous calculation, please select [Continue].

Figure II-15 Setting of hot start

Finish of setting of calculation conditions

Calculation Condition		? ×
roups Boundary Conditions Calculation Type and Data Calculation Conditions Bed Material Vegetation Obstacle Hot Start	Hot Start Continue File flowprn	New -

Figure II-16 Finish of setting of calculation conditions

II.3 Run the calculation

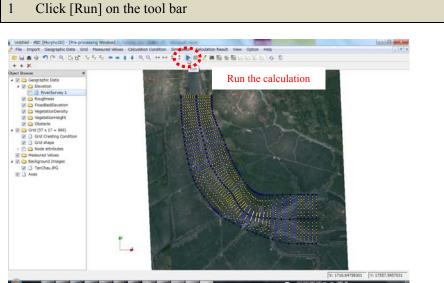


Figure II-17(1) Run the calculation

2 Please select [Yes] and [OK] in the warning window and the information window, respectively.



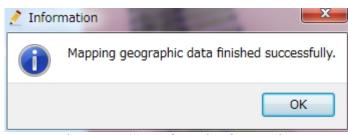


Figure II-17(3) Information for mapping

- 3 Click [Yes] in [Information] window.
- 4 Select [Save as File (*.ipro)] and click [OK] in [Select How to Save Project].
- 5 Decide the file name (ex. TanChau.ipro) and click [save] in [Save iRIC project file]

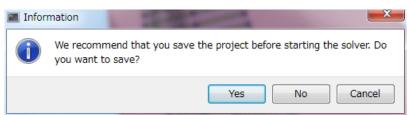


Figure II-17(4) Information for save the project

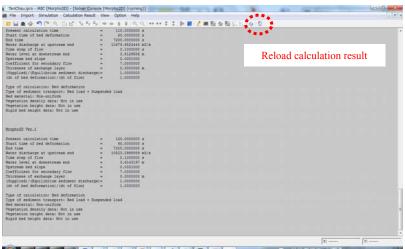


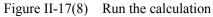
Figure II-17(5) Select the save type

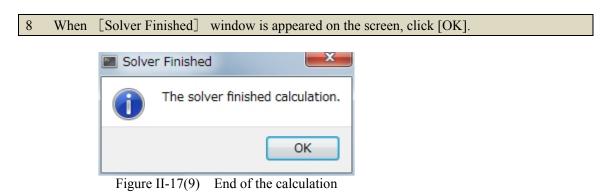
R Save iRIC project file		x
Image: Second state ✓	4.19_Morpho2Dの検索	٩
整理 ▼ 新しいフォルダー	:≡ ▼ (?
■ ドキュメント ▲ 名前 ▲	更新日時	種
■ ピクチャ	2013/04/19 6:14	7
♪ ミュージック		
ペ ホームグループ E		
1乗 コンピューター		
🏭 ローカル ディスク (C:)		
• • • • · · · ·		•
ファイル名(N): TanChau		-
ファイルの種類(T): iRIC project file (*.ipro)		-
● フォルダーの非表示	保存(S) キャンセル	

Figure II-17(6) Decide the file name

- 6 Startup the gray colored screen automatically. Information on the File Import Simulation Calculation Result View Option He ■ Section Result View Option Head View Option Head ■ Section Result View Option Head View Option Head ■ Section Result View Option Head View Option Head ■ Section View Option Head View Option Head View Option Head ■ Section View Option Head View Option Head View Option Head ■ Section View Option Head View Option View Option Head View Option View Option View Option View Option View Option View Optio Ж screen 110.0000000 # 60.0000000 # 7200.0000000 # 10479.6524446 m3 0.1000000 # 3.6129386 m Present calculation time (s) tharge at upstream and of flow Start time of bed deformation (s) trean end End time (s) condary flow oge layer brium mediment di tion)/idt of flow Water discharge at upstream end (m3/s) of calculation: Bed deformation of sediment transport: Bed load sterial: Non-uniform Time step of flow (s) density data: Not in use height data: Not in use height data: Not in use Water level at downstream end (m) Initial bed slope Coefficient for secondary flow calculation time ime of bed deform Thickness of exchange layer (m) (Supplied)/(Equilibrium sediment rean end discharge) (dt of bed deformation)/(dt of flow) sediment di (dt of flow Type of calculation, ulation: Bed deformation ment transport: Bed load -Type of sediment transport, penalty data: Not in use height data: Not in use eight data: Not in use Type of bed material, Vegetation density data, Vegetation height data, Figure II-17(7) Run the calculation Rigid bed height data
- 7 When you want to check the calculation results during the calculation, please click [Reload calculation result] and draw figures of calculation results. The method how to draw the figures are explained in the next chapter.







II.4 Visualization of calculation results

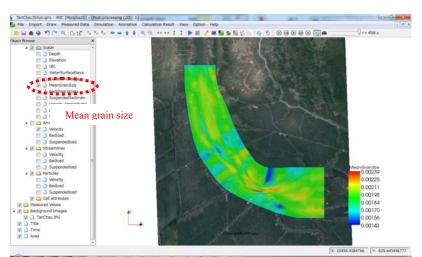
II.4.1 Visualization of calculation results

TanChau (pro - IRIC (Morpho2D) - [Solver Console [Morpho2D] (running)] - [Solv	
File Import Simulation Calculation Result View Option Help	1.(#)X
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resent calculation time = 3650.0000000 s	
tart time of bed deformation = 60.0000000 #	
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Reter level at downstream end = 4.0812081 m	
Deffinient for secondary flow = 7.0000000	
hickness of exchange layer = 0.3000000 m	
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ype of sediment transport: Bed load + Suspended load	
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egetation Height data: Not in use	
Norgho2D Yez.1	
resent calculation time = 3660.0000000 s	
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ad time = 7200.0000000 #	
Hater discharge at upstream end = 25450.5407778 m3/s line step of flow = 0.1000000 s	
later level at downstream end = 4.0795465 m	
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coefficient for secondary flow = 7.0000000	
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ype of calculation: Bed deformation ype of sediment transport: Bed load + Suspended load	
led material: Hon-uniform	
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Repetation beight data; Not in use	
ligid hed height data: Not in use	
	X: Y:

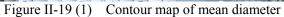
Figure II-18 Open New 2D Post-Processing Window

■ Contour map

- 1 Check [Scalar] in [Object Browser].
- 2 Check [TanChau.jpg] in [Background Images] in [Object Browser].
- 3 Horizontal distribution of mean sediment diameter is shown by selecting [MeanGrainSize].
- 4 By using animation tool bar, results can be checked by a movie.



You can draw the contour maps of water depth, bed elevation, wet/dry, water level, elevation change, mean diameter, non-dimensional shear stress, depth averaged concentration of suspended sediment, velocity magnitude, bed load, suspended load by Morpho2DH.



- 5 When you want to modify contour, please open [Property] by clicking [Scalar] by the right click.
- 6 When you want to draw low water channel only, please select [Region Setting] in [Scalar setting] window.
- 7 [Custom Region] must be on in [Region Setting] and please set that [J Min] is 4 and [J Max] is 14.

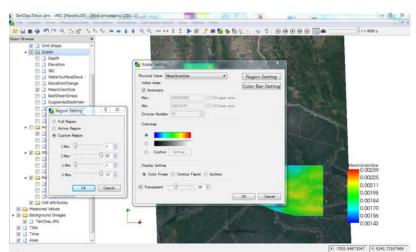


Figure II-19(2) Modification of contour

%Modification of contour

Here, for example, region is modified and contour map on floodplain is deleted. Another functions are introduced in iRIC uses manual

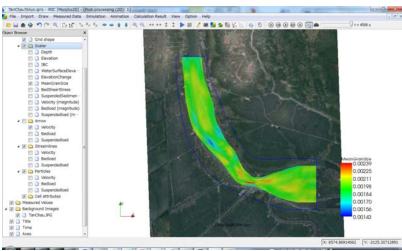


Figure II-19(3) Modification of contour

Other visualization functions

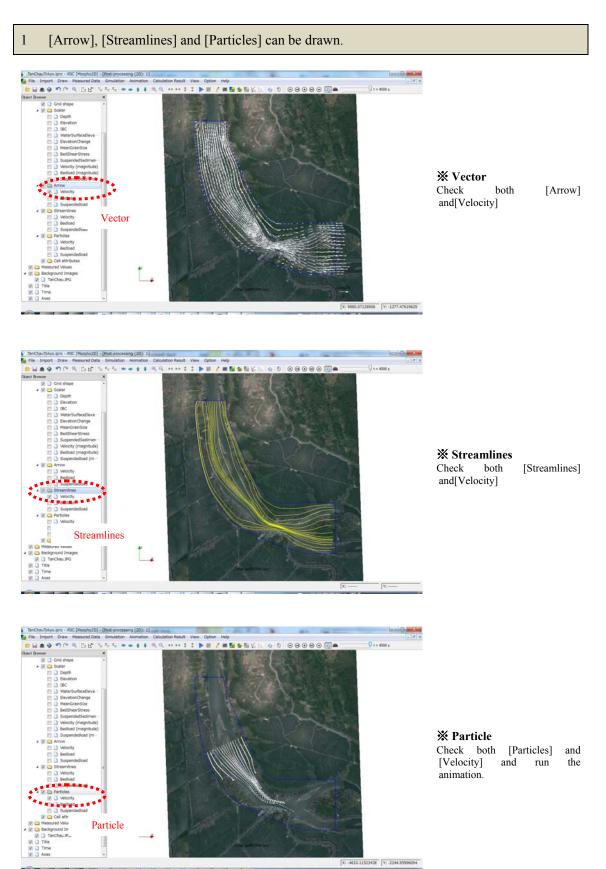
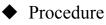


Figure II-20 Other visualization functions

III. Bed deformation analysis with vegetation (Mekong River)

• Purpose

The purpose of this chapter is for person who finished Chapter II to learn to perform bed deformation analysis with vegetation by use of Morpho2DH.



Procedure in this chapter is shown in Figure III-1.

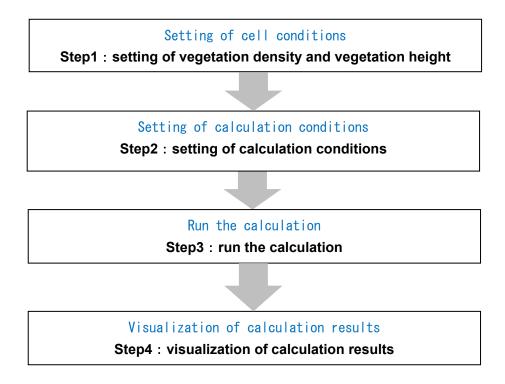


Figure III-1 Procedure in this chapter

III.1 Setting of vegetation density and vegetation height

III.1.1 Setting of vegetation density

Setting of vegetation density

1 Please click [VegetationDensity] in [Object Browser] by right button of the mouse and select [add] and [Polygon].

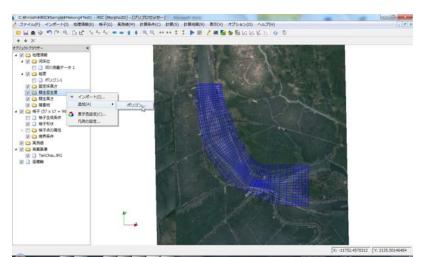


Figure III-2(1) Make a polygon

- 2 Make a polygon by clicking at the corners of the polygon. The polygon should cover the vegetation area (here, the sand bar in the upstream region). Double clicks stop to make the polygon.
- 3 Enter the vegetation density value.

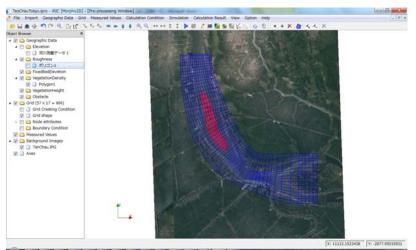


Figure III-2(2) Make a polygon

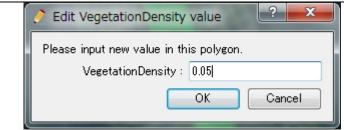


Figure III-2 (3) Enter the vegetation density

Polygon for vegetation height is the same as the polygon of vegetation density. Hence, the polygon of vegetation density is copied and is used for vegetation height. Click [Polygon1] in [VegetationDensity] in [Object Browser] by right button of the mouse and select [Copy].
Select [VegetationHeight] in [Select Geographic data] window and click [OK].

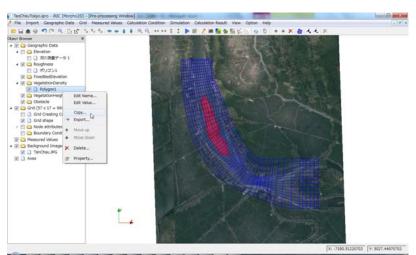


Figure III-2(4) Make a polygon

🧷 Select Geogra	phic Data	? <mark>×</mark>
Please select whi	ch geographic data to	copy this polygon.
VegetationHeight		•
	ОК	Cancel
Figure III-2	(5) Select the geog	graphic data

III.1.2 Setting of calculation conditions of vegetation

Setting of vegetation density

- 1 Click [Vegetation] group in [Calculation Condition] window.
- 2 [Enabled] is selected in [Vegetation Density].
- 3 [Enabled] is selected in [Vegetation Height].

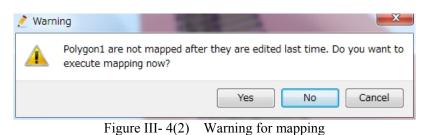
R Calculation Condition	? <mark>×</mark>
Groups Boundary Conditions Calculation Type and Data Calculation Conditions Bed Material Vegetation Obstacle Hot Start	Vegetation Density Enabled Vegetation Height Enabled
Reset	Save and Close Cancel

Figure III-3 Setting vegetation conditions

III.2 Run the calculation

1 Click [Ru	a] in the tool bar.	
	Figure III-4(1) Run the calculation	

2 Please select [Yes] and [OK] in the warning window and the information window, respectively.



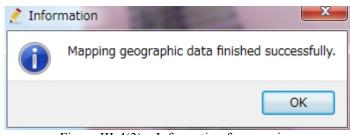


Figure III-4(3) Information for mapping

Click [Yes] in [Information] window.
Select [Save as File (*.ipro)] and click [OK] in [Select How to Save Project].

🛅 Inform	mation
i	We recommend that you save the project before starting the solver. Do you want to save?
	Yes No Cancel

Figure III- 4(4) Information for save the project

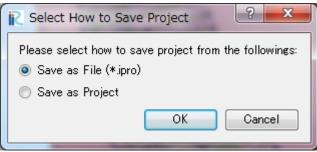


Figure III-4(5) Select the save type

5 Decide the file name (ex. TanChau.ipro) and click [save] in [Save iRIC project file]

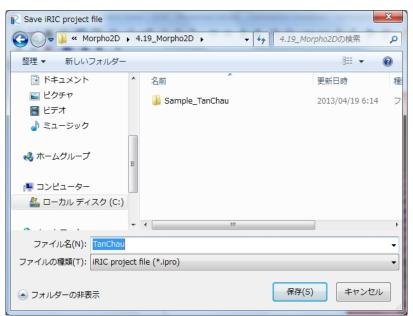


Figure III-5(6) Decide the file name

6 Click [OK] in [Solver Finished] window.

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		X: Y:

Figure III-5(7) Run the calculation

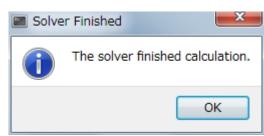


Figure III-5(8) Finish of the calculation

III.3 Visualization of calculation results

III.3.1 Visualization of calculation results

TanChauTokyo.ipro - IR3C [Morpho2D] - (Solver Console [Morpho2D] (stopped)]		0.0.0
File Import Simulation Calculation Result View Option Help	410.	- [#]
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Thickness of exchange layer - 0.300000 m (dupplied)/Equilibrium estimate discharge)- 1.0000000 (dt of bed deformation)/(dt of flow) - 1.000000		
Type of calculation: Bed deformation Type of sediment transport: Bed load + Surpended load Bed material: Non-walform Vegentation density data: In use		
Vegetation Sendriy dataf in une Kipid Led height dataf in une		
Norpho20 Yer.1		
Present calculation time = 120.0000000 s Start time of bed deformation = 60.0000000 s East time = 7200.0000000 s		
Mater discharpe at upstream end = 20190.2413533 m3/s Time step of fice = 0.1000000 s Mater level at downstream end = 5.4143197 m		
Upstream hed slope = 0.0001000 Coefficient for secondary flow = 7.0000000 Thickness of exchange layer = 0.000000 m (Dexplicit/(Explicit) estimat discharge) = 1.0000000		
(dt of bed deformation)/(dt of flow) = 1.0000000		
Type of seleviation: Bed deformation Type of seleviates transport: Bed load + Suspended load Bed meterial: Non-walform Weperation density data: In use		
Vegetation height data: In use Rigid hed height data: Not in use		

Figure III-6 Open New 2D Post-Processing Window

■ Contour map

- 1 Check [Scalar] in [Object Browser].
- 2 Check [TanChau.jpg] in [Background Images] in [Object Browser].
- 3 Horizontal distribution of mean sediment diameter is shown by checking [MeanGrainSize]. You can find that fine material is deposited in the vegetation area.

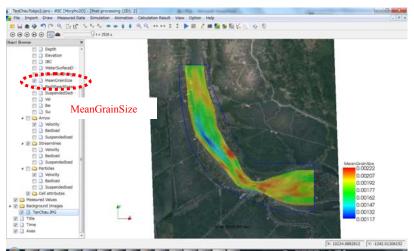
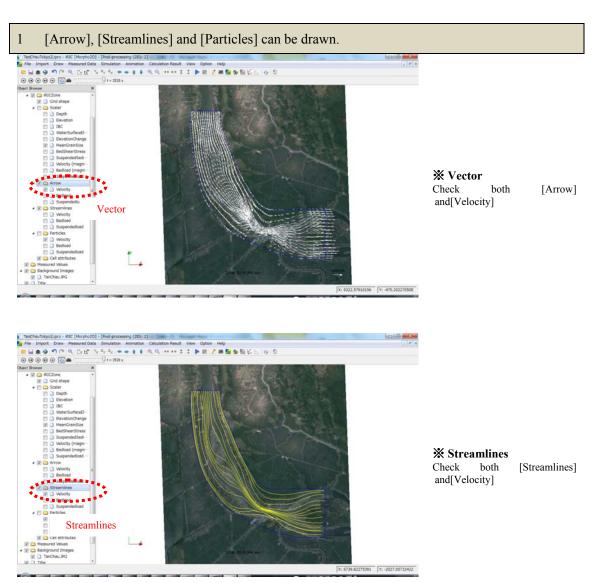
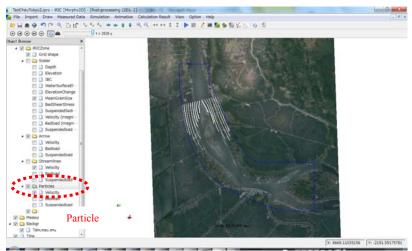


Figure III-7 Contour map of mean diameter

Other visualization functions





※ Particle

Check both [Particles] and [Velocity] and run the animation.

Figure III-8 Other visualization function

IV. Bed deformation analysis with river regulation works (Mekong River)

Purpose

The purpose of this chapter is for person who finished Chapter II and III to learn to perform bed deformation analysis with river regulation works by use of Morpho2DH.

Procedure

Procedure in this chapter is shown in Figure IV-1.

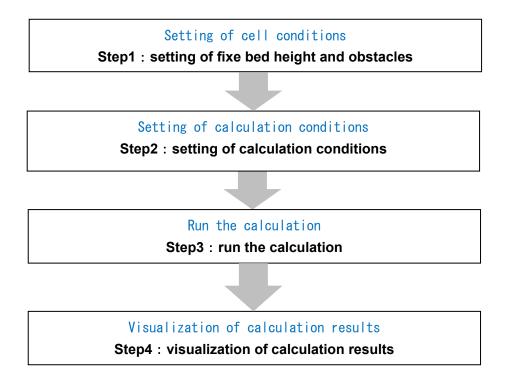


Figure IV-1 Procedure in this chapter

IV.1 Setting of fixed bed height data and obstacles

IV.1.1 Setting of fixed bed height data

Setting of fixed bed height data

1 Please click [FixedBedElevation] in [Object Browser] by right button of the mouse and select [add] and [Polygon].

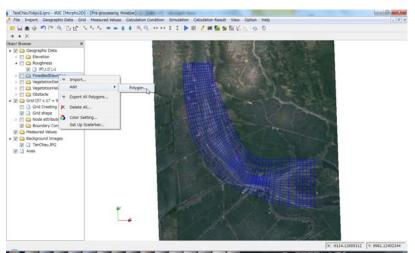


Figure IV-1(1) Make a polygon

- 2 Make a polygon by clicking at the corners of the polygon. The polygon should cover the fixed bed elevation area. Double clicks stop to make the polygon.
- 3 Enter the fixed bed elevation value.

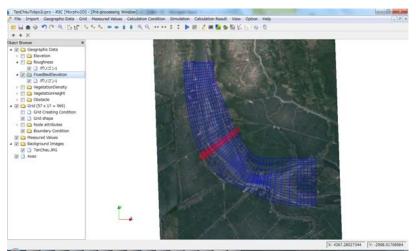


Figure IV-1(2) Make a polygon

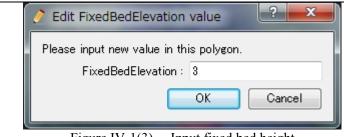


Figure IV-1(3) Input fixed bed height

IV.1.2 Setting of calculation conditions of obstacle

Setting of obstacles

1 Please click [Obstacle] in [Object Browser] by right button of the mouse and select [add] and [Polygon].

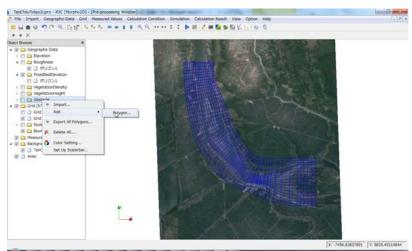


Figure IV-2(1) Make a polygon

- 2 Make a polygon by clicking at the corners of the polygon. The polygon should cover the obstacle area. Double clicks stop to make the polygon.
- 3 Select [Obstacle] in [Edit Obstacle Value] window and click [OK]

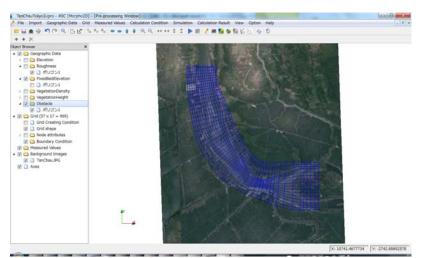
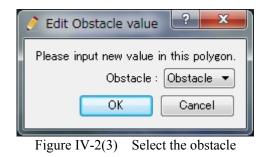


Figure IV-2(2) Make a polygon



IV.1.3 Setting of calculation conditions of fixed bed height and obstacles

Setting of fixed bed height

- Click [Calculation Conditions] group in [Calculation Condition] window. 1 2
- [Enabled (Value in Polygon)] is selected in [Non-erodible height].

Calculation Condition Groups Boundary Conditions Calculation Type a····	Secondary Flow Coefficient Coefficient of Permeability (m/s)	2010	? ×	
Calculation Conditi Bed Material Vegetation Obstacle Hot Start	Sediment Transport Type Suspended Load Equation Non-Erodable Height Upstream Bed Slope Upstream Bed Slope Value Ratio of Sediment Discharge to Equilibrium Sediment Discharge		linske Equation V in Polygon) V Input Value V 0.0001	When the initial bed elevation is used for the fixed bed height, please select [Enabled (Initial bed elevation)].
Reset	Ratio of Bed Deformation DT to Flow DT	Save and	1 Close Cancel	

Setting of fixed bed height Figure IV-3

Setting of obstacles

1	Click [Obstacle] group in [Calculation Condition] window.
2	[Enabled] is selected in [Obstacle].

Calculation Condition	6 f - 16,885	? 🗙
Groups Boundary Conditions Calculation Type and Data Calculation Conditions Bed Material Vegetation Obstacle Hot Start	Obstacle	Enabled -
Reset		Save and Close Cancel

Setting of obstacles Figure IV-4

IV.2 Run the calculation

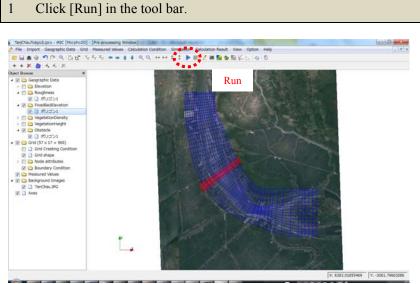
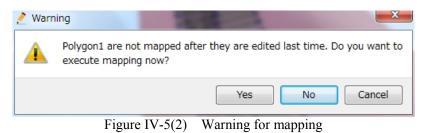


Figure IV-5(1) Run the calculation

2 Please select [Yes] and [OK] in the warning window and the information window, respectively.



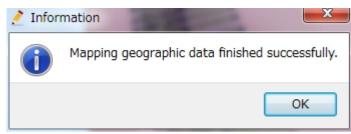


Figure IV-5 (3) Information for mapping

- 3 Click [Yes] in [Information] window.
- 4 Select [Save as File (*.ipro)] and click [OK] in [Select How to Save Project].

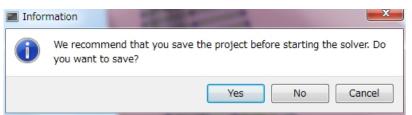


Figure IV-5(4) Information for save the project

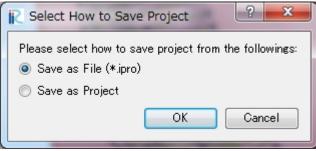


Figure IV-5(5) Select the save type

5 Decide the file name (ex. TanChau.ipro) and click [save] in [Save iRIC project file]

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Figure IV- 5(6) Decide the file name

7 Click [OK] in [Solver Finished] window.

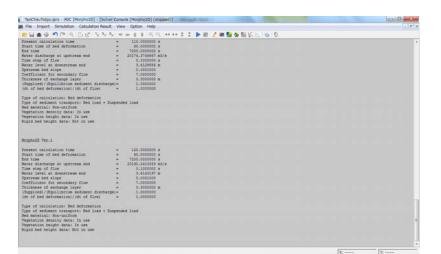


Figure IV-5(7) Run the calculation

Solve	r Finished	-
1	The solver finished calculation.	
	ОК	

Figure IV-5(8) Finish of the calculation

IV.3 Visualization of calculation results

IV.3.1 Visualization of calculation results

TenChauTokyo.pro - IR3C [Morpho2D] - [Solver Console [Morpho2D] (stopped)]	
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Figure IV-6 Open New 2D Post-Processing Window

■Contour map

- 1 Check [Scalar] in [Object Browser].
- 2 Check [TanChau.jpg] in [Background Images] in [Object Browser].
- 3 Horizontal distribution of water depth is shown by checking [Depth]. You can find that water depth is zero in the obstacle area and is shallow in the fixed bed area.

