



Cgns **A**nalysis **T**ool for 2Dimensional Solvers

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I. Overview

CAT2D is “Cgns Analysis Tool for 2 Dimensional solver”. You can compare calculation results which is produced by any solvers on the iRIC software by using CAT2D. Also this tool provides the function which can extract longitudinal and cross-sectional calculation result along arbitrary line.

We hope this tool expand the usage of the iRIC software and your research or study would be promoted.

II. Project file Data structure

iRIC data set can be saved into two type of format as follows.

- a) Save as File(*ipro)
- b) Save as Project

The *.ipro file is ZIP file. So you can extract it after changing its extension from ipro to zip. After that you can get a folder which has the same name with *.ipro. You can get the same contents which you save your data as Project.

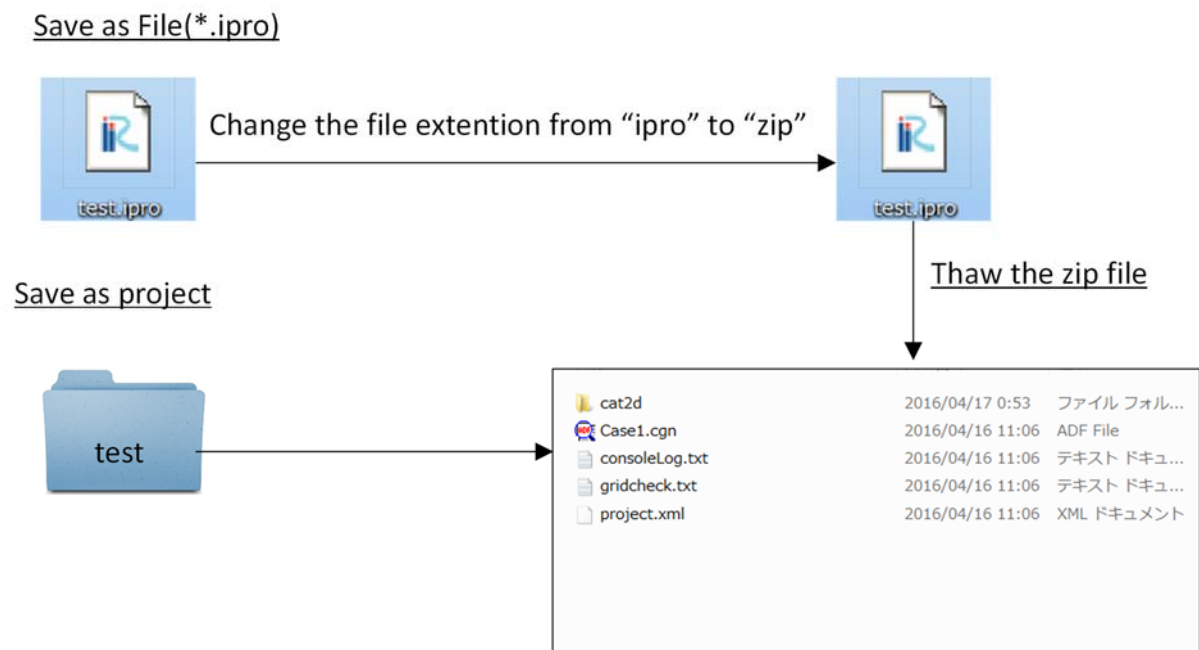
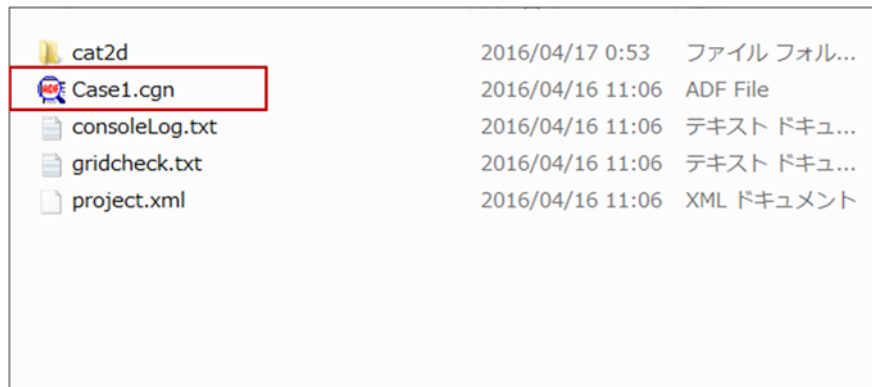


Figure 1 Data structure of iRIC project file

III. CAT2D

III.1 Structure

Calculation conditions, grid information and Calculation results are stored into cgns file. Its name is "Case1.cgn". You can find out the file at the iRIC project folder.



cat2d	2016/04/17 0:53	ファイル フォル...
Case1.cgn	2016/04/16 11:06	ADF File
consoleLog.txt	2016/04/16 11:06	テキスト ドキュ...
gridcheck.txt	2016/04/16 11:06	テキスト ドキュ...
project.xml	2016/04/16 11:06	XML ドキュメント

Figure 2 Contents of the iRIC project folder

This tool reads several Cgns files and integrates those data into a CGNS file. Also subtracted values from Base Case are produced at the same time. You can apply this tool for two dimensional solvers, structured and unstructured grid system.

River survey data is used for extracting longitudinal and cross sectional data as csv files.

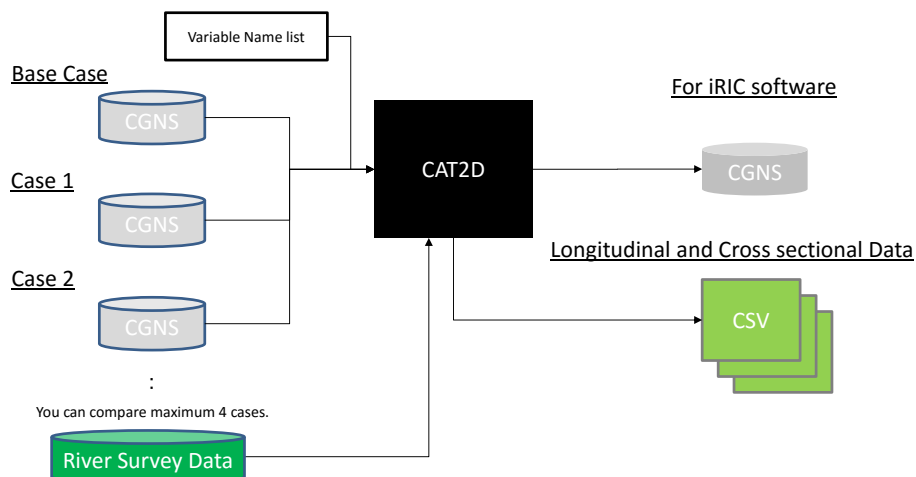


Figure 3 Feature of CAT2D

Current version has several restrictions as follows. Because this tool does not have interpolated functions.

- This tool cannot compare the calculation result by different type of grid.
- Only calculation results by using the same grid can be compared.
- Output result time and its interval should be the same

These are the results by CTA2D analysis.

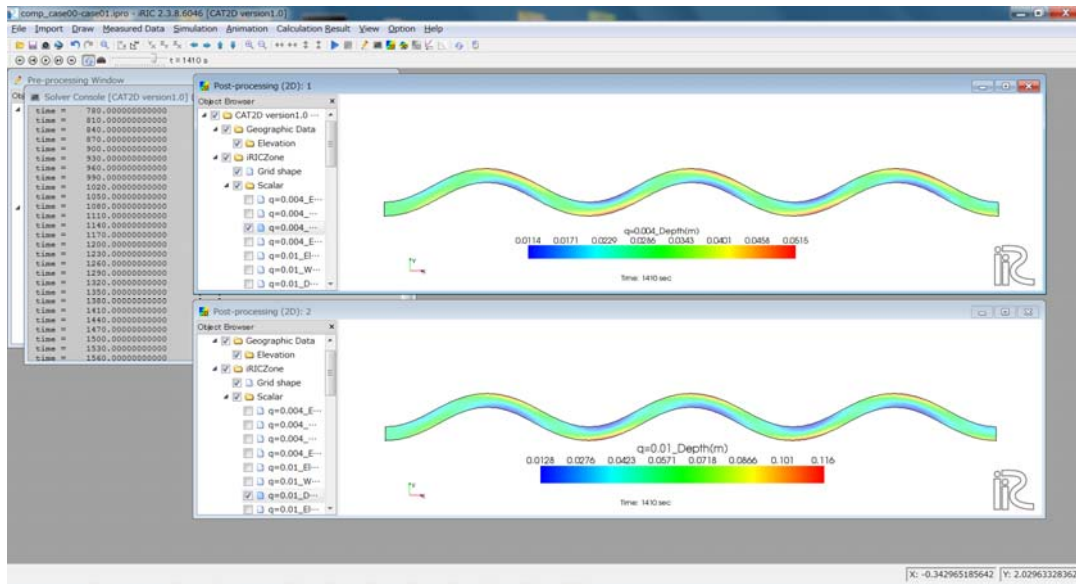


Figure 4 Depth contour: Discharge:0.004m³/s(above), 0.01m³/s(below). Several calculation results can be visualized and compared.

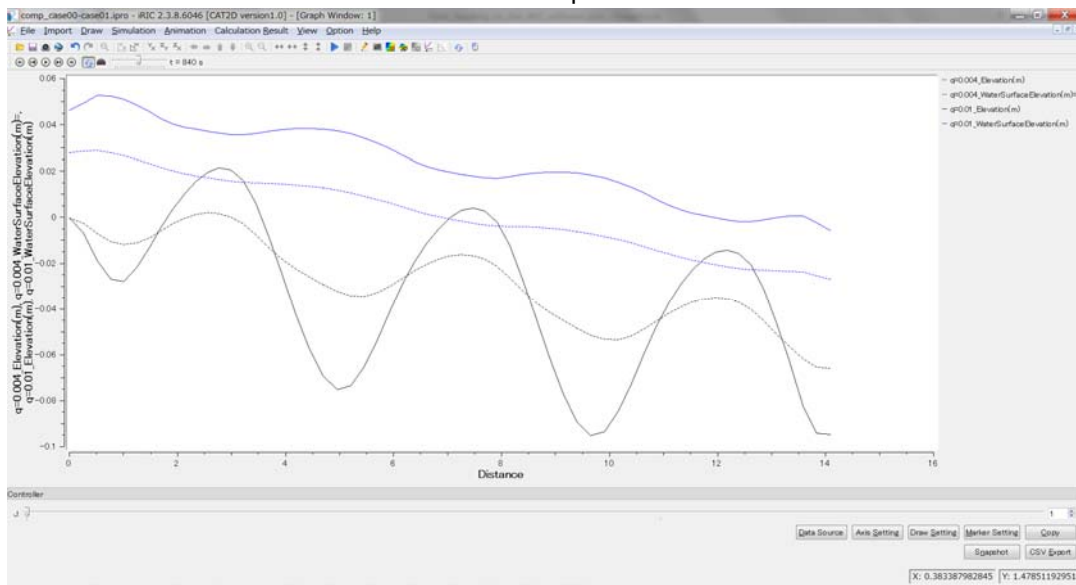


Figure 5 Longitudinal profiles of Elevation and Water Surface Elevation for two cases are drawn in one graph.

III.2 Conditions

Parameters which we should specify before running CAT2D, are described in this section.

III.2.1 Files

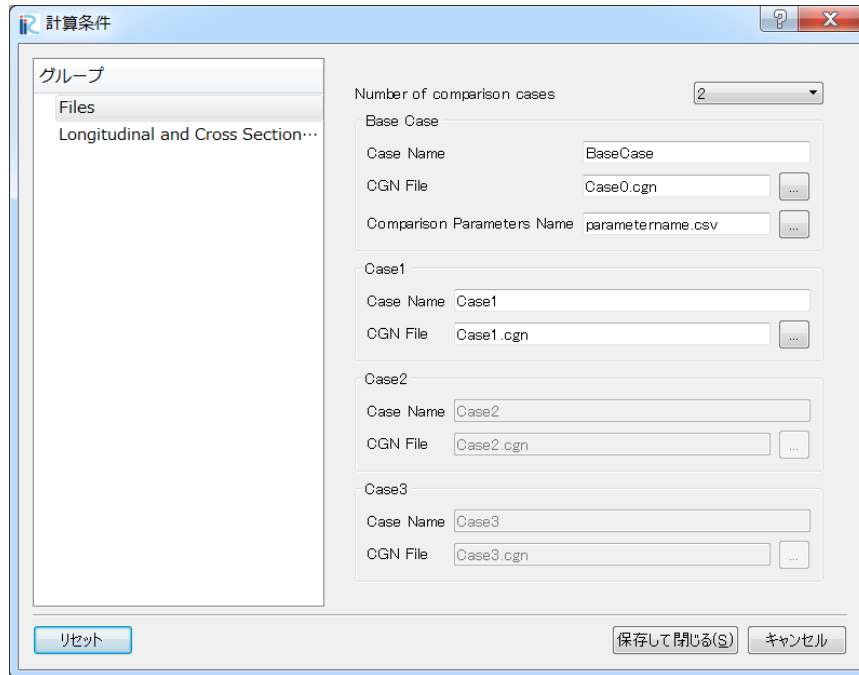


Figure 6 Setting Window for Files

Table 1 Files

#	Item Name	Description	Required/Optional
1	Number of comparison case	You can specify the number of comparison cases from 2 to 4.	Required
2	BaseCase	“Case Name” and the cgns file must be specified. “CaseName” is used for a parameter caption on the object browser. So short word is recommended. Also, “Comparison Parameters Name” are specified by file. <u>See next page.</u>	Required
3	Case1		Required
4	Case2		optional
5	Case3	In each case, “Case Name” and the cgns file must be specified. “CaseName” is used for parameters caption on the object browser. So short word is recommended for that.	optional

Csv file is used to specify the Comparison Parameter's Name. Figure 7 shows format for that. Parameter Name should be specified in each cases. And the parameter name in the same row would be compared. Also, the order of several parameters must be defined as follow

- (1) Bed elevation[m]
- (2) Water Surface Elevation[m]
- (3) Velocity in X direction [m/s]
- (4) Velocity in Y direction [m/s]

:

You can define what you want, after above.

:

<div> <div>No1. Elevation, No2. Water Surface Elevation, No3. Velocity in X direction, No4. Velocity in Y direction</div> </div>					
Different solvers use different parameter names. To compare those parameters, you should specify the parameter name that you want to compare.					
	A	B	C	D	E
1	No	BaseCase	Case1	Case2	Case3
2	1	Elevation	Elevation(m)	EL	
3	2	WaterSurf	WaterSurfaceE	WSE	
4	3	UG	VelocityX	vx	
5	4	VG	VelocityY	vy	
6	5	Depth	Depth(m)	Depth	
7					

Parameters in the same row would be compared.

Figure 7 File format for specification file of the comparison parameter name

III.2.2 Longitudinal and Cross sectional Data

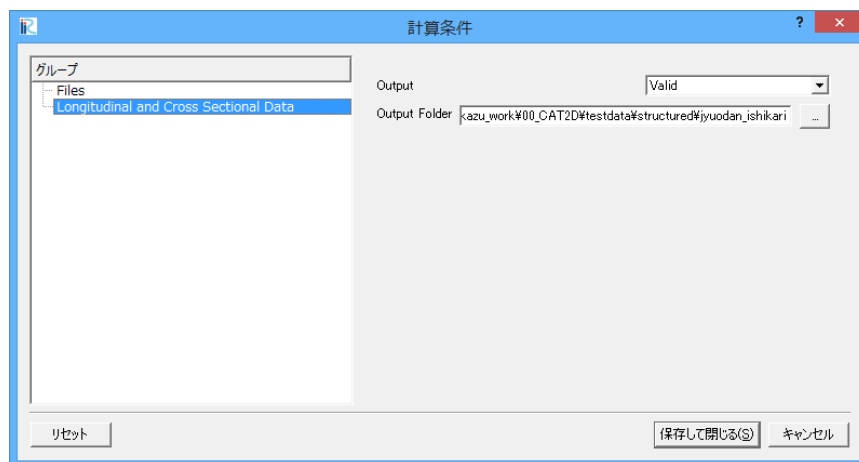


Figure 8 Setting Window for Files

Table 2 Files

#	Item Name	Description	Required/Optional
1	Output	You can choose Valid or invalid. Valid should be specified when you want to output longitudinal and cross sectional data.	required
2	Output Folder	Specify the place where you want to output the longitudinal and cross sectional data set.	Optional

You have to specify the output position by using River Survey data, when you choose “Valid” for “Output” in Longitudinal and Cross sectional Data section. River Survey data can be imported from Geographic Data on Object Browser. Using Center line of it (red line in Figure 9), CAT2D extracts the longitudinal data set from calculation result. Also using cross section line (purple line in Figure 9), the cross sectional data set of calculation result are extracted.

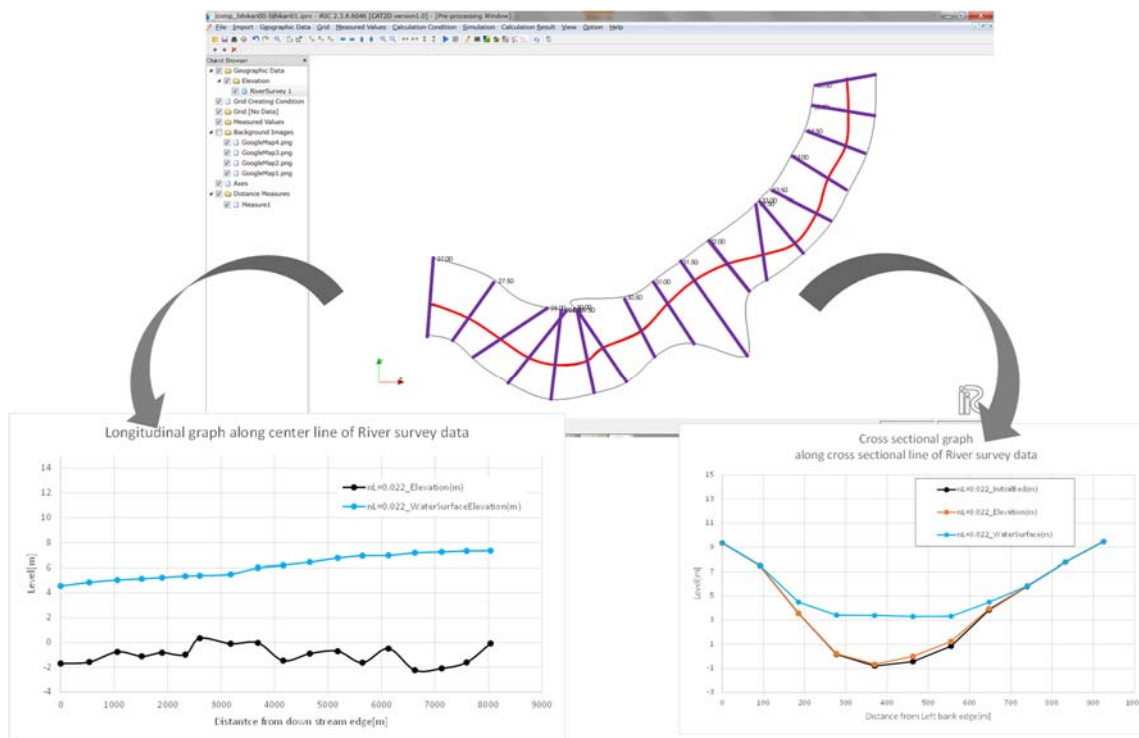
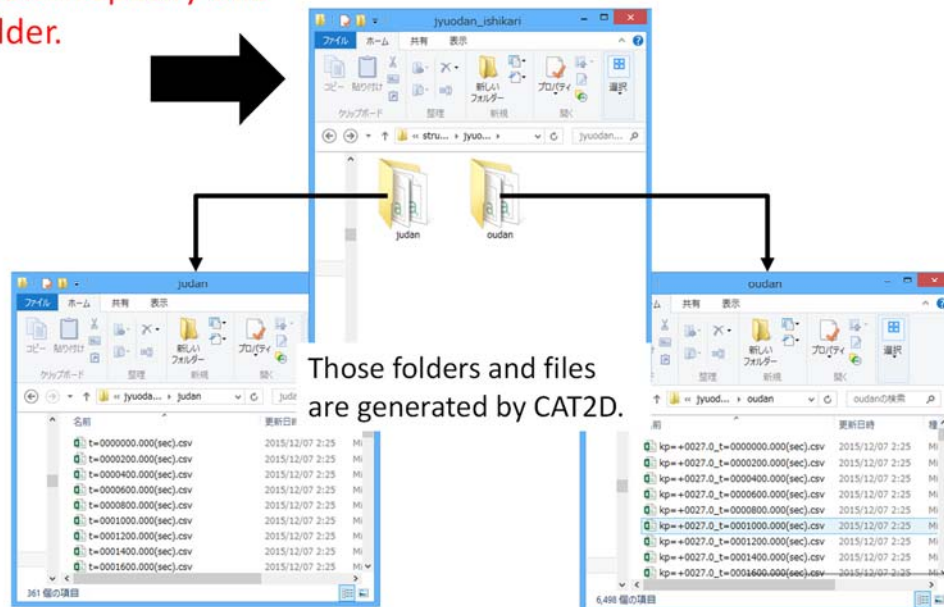


Figure 9 Setting Window for Files

“judan” and “oudan” folder are generated under the specified folder, automatically. And the extracting data set of longitudinal are outputted into “judan” folder as csv files. Cross sectional data set are outputted into “oudan” folder, as the same. File naming rule and its contents are described in next page.

You can specify this folder.



(1) File name and contents of longitudinal data set

File name : t=0003600.000(sec).csv

time

Kp : Cross sectional name
xx, yy : coordinate value of the center point

BaseCase result Case1 result

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
	xx	yy	ss	BaseCase_Init	BaseCase_Elev	BaseCase_WaterSurface	BaseCase_Velocity	BaseCase_Velocity	BaseCase_Velocity	Case1_Init	Case1_Elev	Case1_WaterSurface	Case1_Velocity	Case1_Velocity	Case1_Velocity	
				alElev(m)	ation(m)	erSurface(m)	(m/s)	(m/s)	(m/s)	alElev(m)	ation(m)	erSurface(m)	(m/s)	(m/s)	(m/s)	
1	35.5	-51454.8594	-94010.7811	-0.07962373	-0.07962373	2.76281408	-0.03203432	-0.03203432	-0.03203432	-0.07962373	-0.07962373	2.52830374	-0.03401088	-0.03401088	-0.03401088	-1.19280079
2	35.5	-51448.1333	-94459.1643	-1.158895	-1.158895	2.76692029	0.1411103	0.1411103	0.1411103	-1.05590303	-1.05590303	2.52830374	-0.03401088	-0.03401088	-0.03401088	-1.19280079
3	34.5	-51480.8059	-94822.6641	-2.075016	-2.075016	2.73272944	-0.19300328	-0.19300328	-0.19300328	-0.07962373	-0.07962373	2.52830374	-0.03401088	-0.03401088	-0.03401088	-1.19280079
4	34	-51712.3438	-95374.7296	-2.21258481	-2.21258481	2.71345398	-0.22014554	-0.22014554	-0.22014554	-0.07962373	-0.07962373	2.52830374	-0.03401088	-0.03401088	-0.03401088	-1.19280079
5	33.5	-51882.8805	-95836.2734	-0.45762806	-0.45762806	2.68437473	-0.39751084	-0.39751084	-0.39751084	-0.07962373	-0.07962373	2.52830374	-0.03401088	-0.03401088	-0.03401088	-1.19280079
6	33	-52189.8175	-96231.3671	-1.62064827	-1.62064827	2.65330772	-0.42090715	-0.42090715	-0.42090715	-0.07962373	-0.07962373	2.52830374	-0.03401088	-0.03401088	-0.03401088	-1.19280079
7	32.5	-52599.1907	-96634.8351	-0.55904852	-0.55904852	2.64459692	-0.38403315	-0.38403315	-0.38403315	-0.07962373	-0.07962373	2.52830374	-0.03401088	-0.03401088	-0.03401088	-1.19280079
8	32	-53104.8008	-97032.8391	-1.00162285	-1.00162285	2.63805515	-0.248076	-0.248076	-0.248076	-0.07962373	-0.07962373	2.52830374	-0.03401088	-0.03401088	-0.03401088	-1.19280079
9	31.5	-53691.8008	-97520.0541	0.03157044	0.03157044	0.04071944	0	0	0	-0.07962373	-0.07962373	2.52830374	-0.03401088	-0.03401088	-0.03401088	-1.19280079
10	31	-54069.2712	-97952.0541	0.1527597	0.1527597	2.83025291	-0.21025522	-0.21025522	-0.21025522	-0.07962373	-0.07962373	2.52830374	-0.03401088	-0.03401088	-0.03401088	-1.19280079
11	30.5	-54273.3604	-97423.7891	-0.42764849	-0.42764849	1.01584132	-0.98994309	-0.98994309	-0.98994309	-0.07962373	-0.07962373	2.52830374	-0.03401088	-0.03401088	-0.03401088	-1.19280079
12	30	-54785.793	-97981.4921	0.33630045	0.33630045	1.049194	-0.11613713	-0.11613713	-0.11613713	-0.07962373	-0.07962373	2.52830374	-0.03401088	-0.03401088	-0.03401088	-1.19280079
13	29.5	-55001.4531	-97848.0621	-0.98381537	-0.98381537	0.93030215	-0.40527902	-0.40527902	-0.40527902	-0.07962373	-0.07962373	2.52830374	-0.03401088	-0.03401088	-0.03401088	-1.19280079
14	29	-55432.4882	-97900.7571	-0.80847223	-0.80847223	0.80487031	-0.5914074	-0.5914074	-0.5914074	-0.07962373	-0.07962373	2.52830374	-0.03401088	-0.03401088	-0.03401088	-1.19280079
15	28.5	-55795.4922	-97788.2571	-1.14806601	-1.14806601	0.87514418	-0.44416636	-0.44416636	-0.44416636	-0.07962373	-0.07962373	2.52830374	-0.03401088	-0.03401088	-0.03401088	-1.19280079
16	28	-56182.2205	-97545.4921	-0.80102481	-0.80102481	0.83921341	-0.36395249	-0.36395249	-0.36395249	-0.07962373	-0.07962373	2.52830374	-0.03401088	-0.03401088	-0.03401088	-1.19280079
17	27.5	-56618.625	-97255.5701	-1.55170269	-1.55170269	0.83921341	-0.36395249	-0.36395249	-0.36395249	-0.07962373	-0.07962373	2.52830374	-0.03401088	-0.03401088	-0.03401088	-1.19280079
18	27	-57124.1641	-97081.1094	-1.65489535	-1.65489535	0.81980962	-0.48841953	-0.48841953	-0.48841953	-0.07962373	-0.07962373	2.52830374	-0.03401088	-0.03401088	-0.03401088	-1.19280079
19																
20																
21																
22																
23																
24																
25																

Distance from downstream edge[m]

(2) File name and contents of Cross sectional data set

File name : kp=+0027.0 t=0014600.000(sec).csv

Cross sectional name Time

Distance from Left bank edge

Coordinates(x,y)

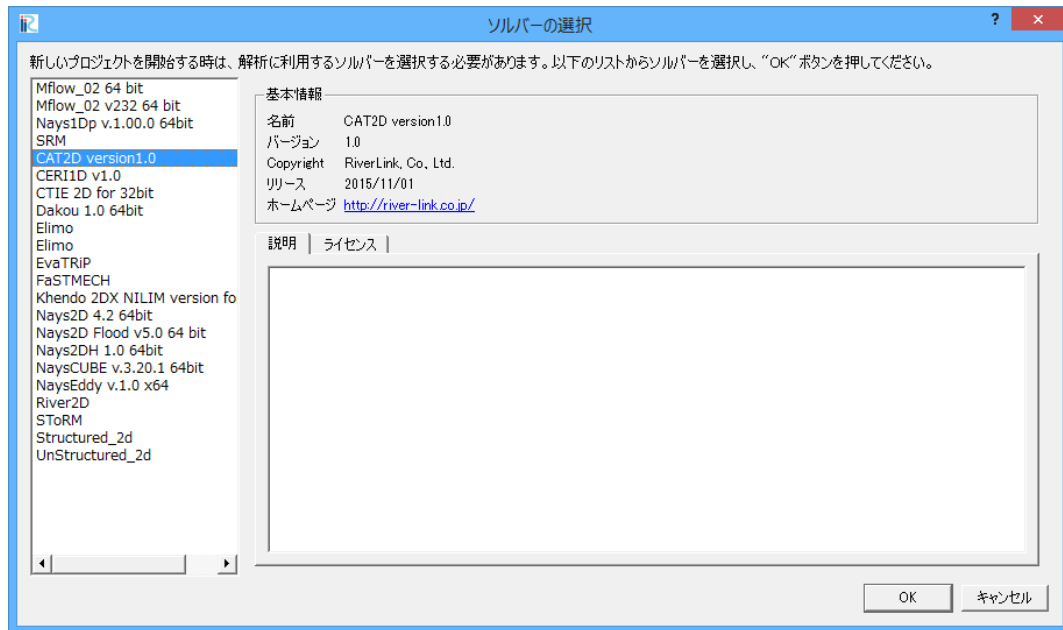
Base case Result Case result

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
	xx	yy	ss	BaseCase_Init	BaseCase_Elev	BaseCase_WaterSurface	BaseCase_Velocity	BaseCase_Velocity	BaseCase_Velocity	Case1_Init	Case1_Elev	Case1_WaterSurface	Case1_Velocity	Case1_Velocity	
				alElev(m)	ation(m)	erSurface(m)	(m/s)	(m/s)	(m/s)	alElev(m)	ation(m)	erSurface(m)	(m/s)	(m/s)	
1	-57153.2617	-97493.998	11.30748525	11.30748525	11.30748525	0	0	0	0	11.30748525	11.30748525	11.30748525	0	0	0
2	-57145.8555	-97388.796	105.3621895	8.47310674	8.4731068	0	0	0	0	8.47310674	8.47310675	8.47310675	0	0	0
3	-57145.8555	-97388.796	105.3621895	8.47310674	8.4731068	0	0	0	0	8.47310674	8.47310675	8.47310675	0	0	0
4	-57145.8555	-97388.796	105.3621895	8.47310674	8.4731068	0	0	0	0	8.47310674	8.47310675	8.47310675	0	0	0
5	-57145.8555	-97388.796	105.3621895	8.47310674	8.4731068	0	0	0	0	8.47310674	8.47310675	8.47310675	0	0	0
6	-57145.8555	-97388.796	105.3621895	8.47310674	8.4731068	0	0	0	0	8.47310674	8.47310675	8.47310675	0	0	0
7	-57145.8555	-97388.796	105.3621895	8.47310674	8.4731068	0	0	0	0	8.47310674	8.47310675	8.47310675	0	0	0
8	-57145.8555	-97388.796	105.3621895	8.47310674	8.4731068	0	0	0	0	8.47310674	8.47310675	8.47310675	0	0	0
9	-57138.4453	-97283.695	210.7246537	2.697773	2.697773	4.50791278	-0.29949195	0.04952838	2.697773	2.69754077	4.0422551	-0.39014513	0.06452012		
10	-57138.4453	-97283.695	210.7246537	2.697773	2.697773	4.50791278	-0.29949195	0.04952838	2.697773	2.69754077	4.0422551	-0.39014513	0.06452012		
11	-57138.4453	-97283.695	210.7246537	2.697773	2.697773	4.50791278	-0.29949195	0.04952838	2.697773	2.69754077	4.0422551	-0.39014513	0.06452012		
12	-57138.4453	-97283.695	210.7246537	2.697773	2.697773	4.50791278	-0.29949195	0.04952838	2.697773	2.69754077	4.0422551	-0.39014513	0.06452012		
13	-57138.4453	-97283.695	210.7246537	2.697773	2.697773	4.50791278	-0.29949195	0.04952838	2.697773	2.69754077	4.0422551	-0.39014513	0.06452012		
14	-57138.4453	-97283.695	210.7246537	2.697773	2.697773	4.50791278	-0.29949195	0.04952838	2.697773	2.69754077	4.0422551	-0.39014513	0.06452012		
15	-57138.4453	-97283.695	210.7246537	2.697773	2.697773	4.50791278	-0.29949195	0.04952838	2.697773	2.69754077	4.0422551	-0.39014513	0.06452012		
16	-57138.4453	-97283.695	210.7246537	2.697773	2.697773	4.50791278	-0.29949195	0.04952838	2.697773	2.69754077	4.0422551	-0.39014513	0.06452012		
17	-57138.4453	-97283.695	210.7246537	2.697773	2.697773	4.50791278	-0.29949195	0.04952838	2.697773	2.69754077	4.0422551	-0.39014513	0.06452012		
18	-57138.4453	-97283.695	210.7246537	2.697773	2.697773	4.50791278	-0.29949195	0.04952838	2.697773	2.69754077	4.0422551	-0.39014513	0.06452012		
19	-57138.4453	-97283.695	210.7246537	2.697773	2.697773	4.50791278	-0.29949195	0.04952838	2.697773	2.69754077	4.0422551	-0.39014513	0.06452012		
20	-57138.4453	-97283.695	210.7246537	2.697773	2.697773	4.50791278	-0.29949195	0.04952838	2.697773	2.69754077	4.0422551	-0.39014513	0.06452012		
21	-57138.4453	-97283.695	210.7246537	2.697773	2.697773	4.50791278	-0.29949195	0.04952838	2.697773	2.69754077	4.0422551	-0.39014513	0.06452012		
22	-57138.4453	-97283.695	210.7246537	2.697773	2.697773	4.50791278	-0.29949195	0.04952838	2.697773	2.69754077	4.0422551	-0.39014513	0.06452012		
23	-57138.4453	-97283.695	210.7246537	2.697773	2.697773	4.50791278	-0.29949195	0.04952838	2.697773	2.69754077	4.0422551	-0.39014513	0.06452012		
24	-57138.4453	-97283.695	210.7246537	2.697773	2.697773	4.50791278	-0.29949195	0.04952838	2.697773	2.69754077	4.0422551	-0.39014513	0.06452012		
25	-57138.4453	-97283.695	210.7246537	2.697773	2.697773	4.50791278	-0.29949195	0.04952838	2.697773	2.69754077	4.0422551	-0.39014513	0.06452012		

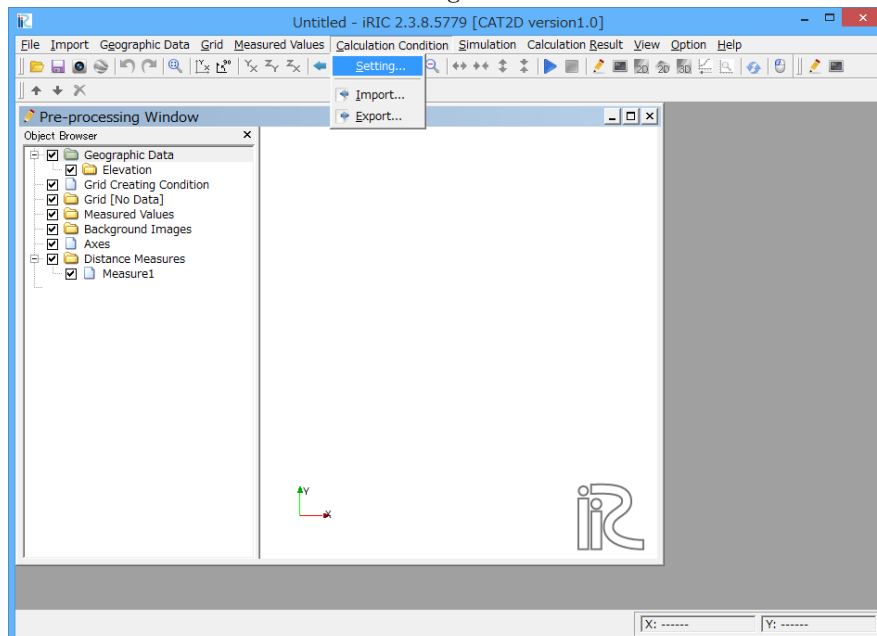
IV. Example

Let's compare Nays2DH calculation results here. Flow and bed variation under different discharge in the same channel and grid would be compared.

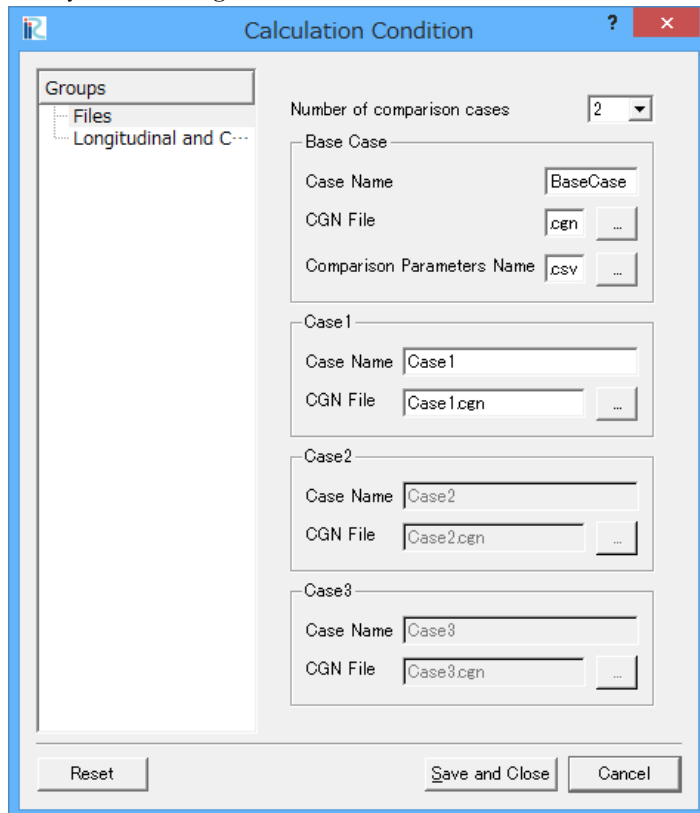
Step1: Double click the iRIC icon on the Desktop and you can see following window.
Select “CAT2D version1.0” and click “OK”.



Step2: Select “Calculation Condition>Setting” and click.



Step3: “Calculation Condition” window are shown. And specify following values to each conditions.



Number = 2

Base Case:

- Case Name=Case00
- CGN file=...¥case00¥Case1.cgn
- Comparison Parameters Name = parametername.csv

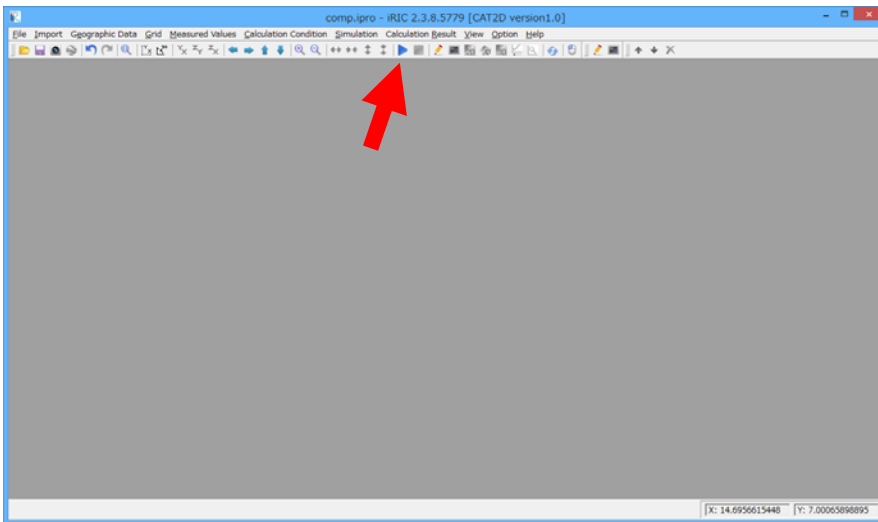
Case1:

- Case Name=Case01
- CGN file= ...¥case01¥Case1.cgn

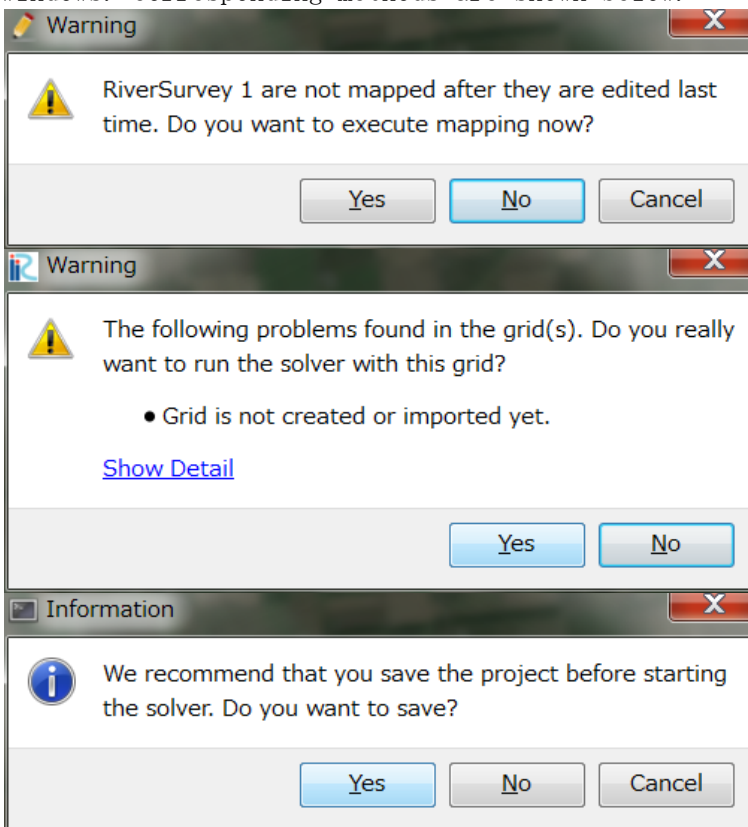
Parametername.csv: File contents is follow. All parameters name are the same in both BaseCase and Case1. Because both of calculation results are Nasy2DH result in this time.

parametername.csv - Excel				
Kazutake Asahi				
	A	B	C	D
1	No	BaseCase	Case1	Case2
2	1	Elevation(m)	Elevation(m)	Case3
3	2	WaterSurfaceElevation(m)	WaterSurfaceElevation(m)	
4	3	Velocity(ms-1)_X	Velocity(ms-1)_X	
5	4	Velocity(ms-1)_Y	Velocity(ms-1)_Y	
6	5	Depth(m)	Depth(m)	
7				
8				
9				
10				

Step4: Close the “Calculation Condition” window and click Run button.



Attention: You can see several warning message windows. Corresponding methods are shown below.

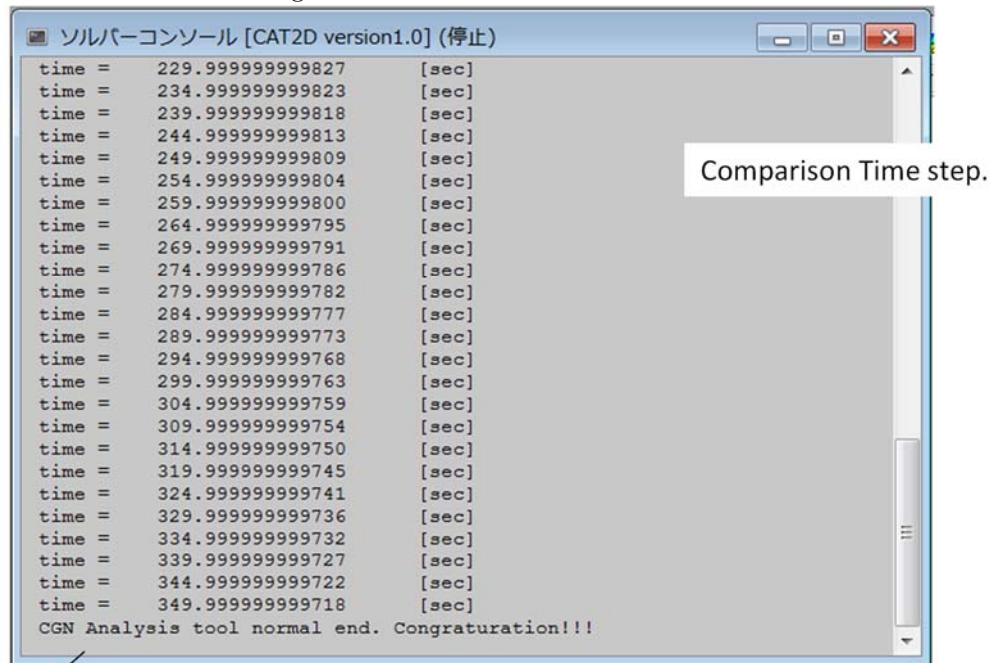


You don't need to execute mapping. So Click “No”.

CAT2D does not use grid. So Click “Yes”.

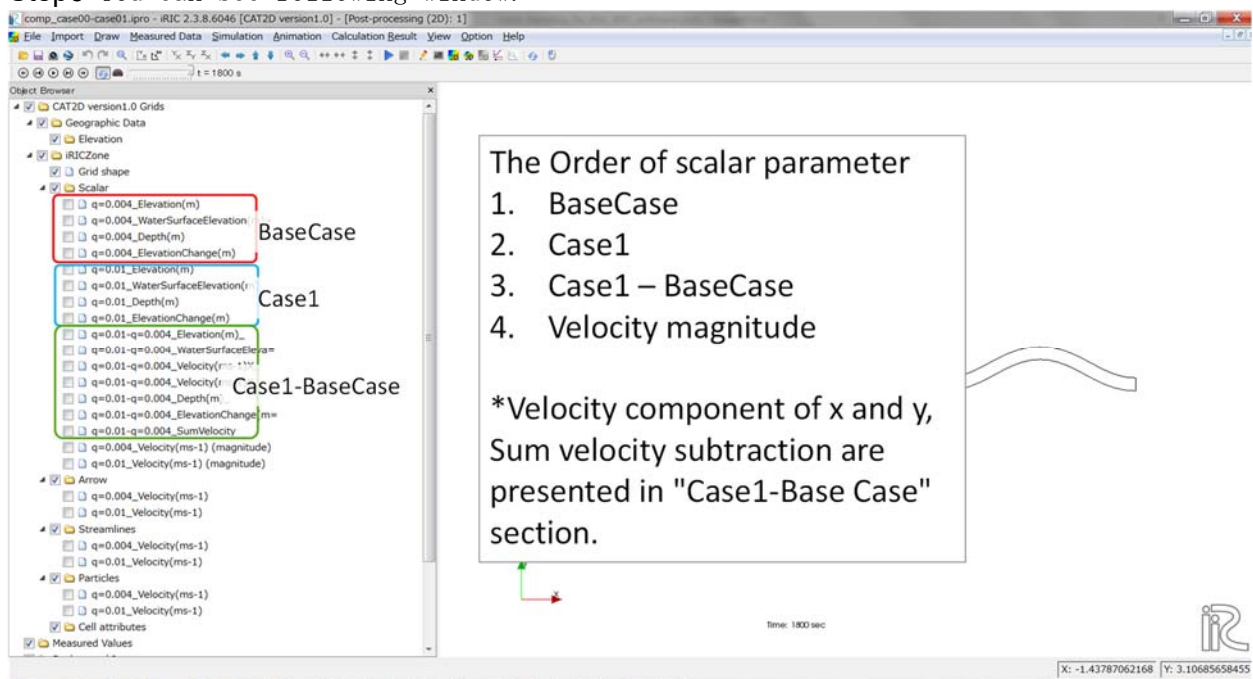
I strongly recommend to save your project before running solver. So Click “Yes”.

Step5: You can see CAT2D running window.

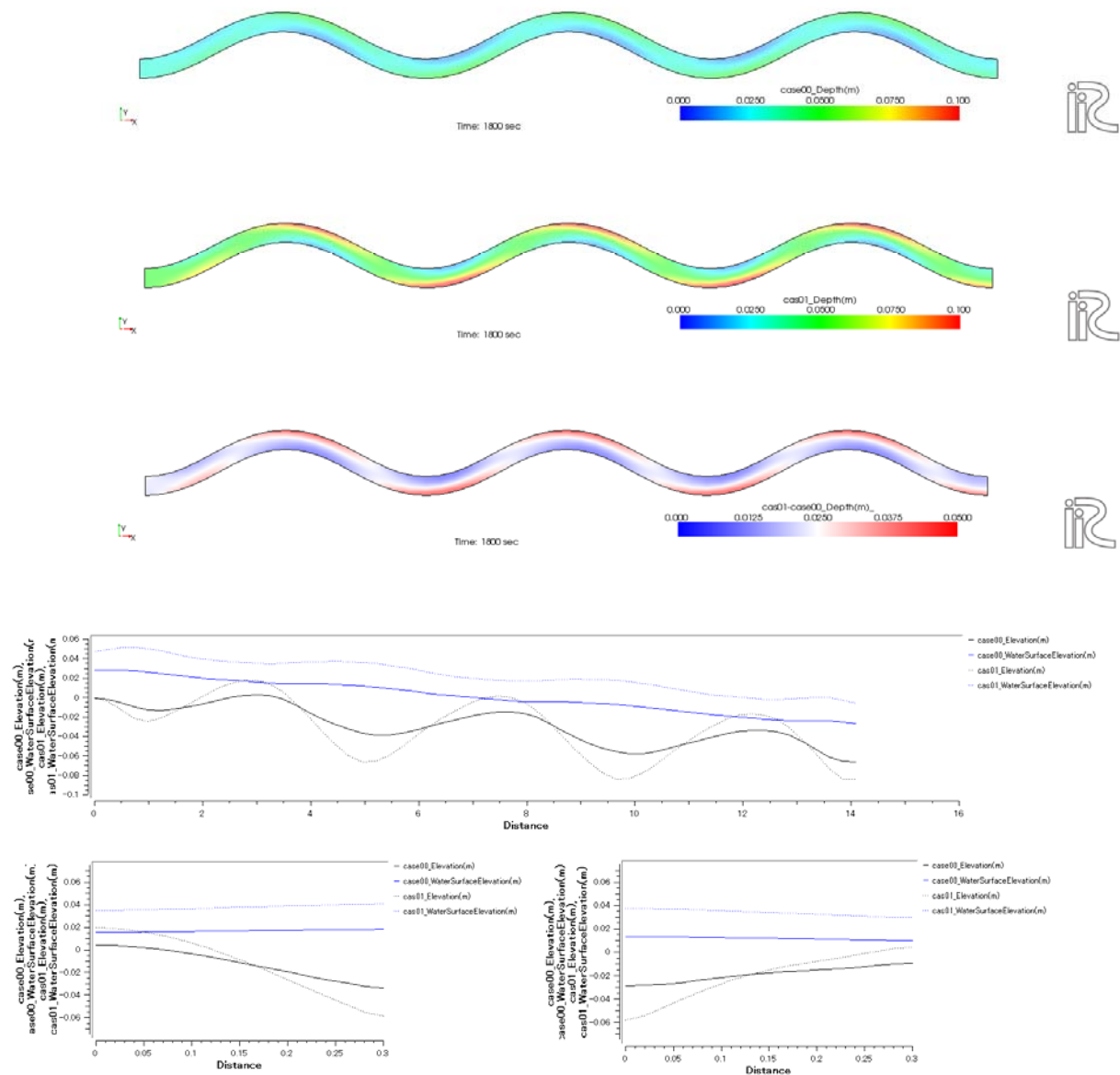


The CAT2D process would be completed normally when you get the message "CGN Analysis tool normally end. Congratulation!!!".

Step6 You can see following window.



Step7 You can use all of iRIC functions for comparison data set. Here is an example to compare depth result. The difference between Case00 and Case01, is discharge. Discharge is 0.004m³/s for case00, and 0.01m³/s for case01. Other conditions are the same. First row is depth contour for the case00, and second row is for the case01. Third row is a depth subtraction contour for case01-case00. Also you can investigate those data by longitudinal and cross sectional graph tool. Furthermore, time variation of those values can be investigated on the iRIC software.



To Reader

- Please indicate the use of iRIC software, if you publish a paper with the results using iRIC software.
- Let us know your suggestions, comments and concerns at **<http://i-ric.org>**.

iRIC Software CAT2D Manual

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