# IFAS Calibrator Version 2.0 User Manual

ICHARM (The International Centre for Water Hazard and Risk Management)

Public Works Research Institute

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### 1. <u>Introduction</u>

### 1.1 About IFAS Calibrator

IFAS Calibrator is a tool that optimizes parameters of the IFAS (Integrated Flood Analysis System) using the observed flow rate. The simulation can be run once an IFAS project is created. The optimization of an IFAS project is limited to a two-layer tank model.

1.2 Operating System Requirements

OS : Windows7/8.1/10 (32bit/64bit) CPU : at least 2GHz Memory : at least 2GB of RAM Required software : .NET Framework 4.6 or greater

### 1.3 Installation of Microsoft .NET Framework

IFAS Calibrator requires .Net Framework to operate, installation instructions are provided below:

① Download .Net Framework from Microsoft's software download portal.

(←) → ୯ û	① ▲ https://www.microsoft.com/en-US/download/details.aspx?id=53344	… ♥ ☆	III\ 🗉

Microsoft .NET Framework 4.6.2 (Offline Installer) for Windows 7 SP1, Windows 8.1, Windows 10, Windows 10 November Update, Windows Server 2008 R2 SP1, Windows Server 2012 and Windows Server 2012 R2

Important! Selectin that language.	g a language below will dynami	ally change the complete page	content to
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The Microsoft .NET Framework 4.6.2 is a highly compatible, in-place update to the Microsoft .NET Framework 4/4.5/4.5.1/4.5.2/4.6/4.6.1. The offline package can be used in situations where the web installer cannot be used due to lack of internet connectivity.

$\oplus$	Details
$\oplus$	System Requirements
$\oplus$	Install Instructions
$\oplus$	Additional Information

② Execute the downloaded file.

Depending on the security settings in place, a dialog similar to that shown below may appear. If this dialog appears, press "Yes".

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Show detai	ls	Yes No	
	<u>Chang</u>	e when these notifications ap	pear

③ Execute the installer and follow the provided prompts.

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Ir	nstallation Is Complete		
.INE	CI Framework 4.0.2 has been installed.		

 Installation Is Complete

 .NET Framework 4.6.2 has been installed.

 Check for more recent versions on Windows Update.

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# 2. IFAS Calibrator Installation

Do not use the IFAS Calibrator installer. Installation involves uncompressing the IFAS Calibrator archive into any location. The path of where IFAS Calibrator was uncompressed must not contain Japanese characters (ex. C:\).

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IFASCalibrator.pdb	4/17/2018 5:53 PM	PDB File	492 KB	
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🚳 Xamarin.Forms.Core.dll	2/23/2017 5:25 PM	Application extens	518 KB	
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Xamarin.Forms.Xaml.xml	2/23/2017 5:25 PM	XML Document	27 KB	
21 items				

# 3. <u>Parameter Optimization Settings</u>

### 3.1 Setup

Load a simulation from an IFAS project file.

NOTE: An optimized IFAS project is limited to a two-layer tank model.



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Tegoshi_F11_2014Oct.txt	2/3/2017 1:55 PM	Text Document	3	KB		

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### 3.2 IFAS Calibrator Startup

Double click on "IFASCalibrator.exe" in the location of the extracted archive file.

🕞 👪 🖛	Application Tools		IFASCalibr	rator –	□ ×
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Xamarin.Forms.Xaml.xml	2/23/2017	5:25 PM XM	<b>ML</b> Document	27 KB	

After the program opens, click "Calibration(C)" from the menu bar, and the interface for choosing settings will appear.



### 3.3 Opening an Optimized Target Model from IFAS Projects

In the "Target Model" section, from the IFAS Project field, clicking the "Select" button will display a folder selection dialog.

FASCalibrator	<u>20</u> 97	
🛫 Calibration(C) 📈 Result View(R) Help(H)		
🗶 IFAS Calibrator Setting		
Load past IFAS Calibrator settings(option)		
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Target Model		
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Parameter Not configured.		
CalibrationTerm 2014/10/05 00:00 🗐 🗸 ~ 2014/10/07 23:00 🗐 🕇		
Target Point		
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Calibration Parameter		
evaluation runation mean square error V		
Result Folder E:¥svn¥17G16¥Test¥Test01		
Executo		
Execute Cancer		

After the folder selection dialog is displayed, select the desired IFAS project folder by clicking on it.

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After selecting an IFAS project folder and pressing the "OK" button, project details, such as the Simulation Model name and Simulation period, will be displayed.

🖳 IFASCalibrator	<u>1949</u> );	×
Calibration(C) Result View(R) Help(H)		 
🗵 IFAS Calibrator Setting		
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IFAS Calibrator Setting File		
Target Model		
IFAS Project E:¥svn¥17G16¥Test¥Abe_F11_2014Oct Select		
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Target Point		
Enable PointName Col Row Filepath ErrorWeight WeightRate MaxDischarge TotalDischarge		
GAdd XDel Enable multi target		
Calibration Parameter		
Method pyopt_sdpen v		
Iteration 2		
Evaluation Function Mean square error		
Result		
Result Folder E: +svri+1/G10+ ieSt# ieStU1		
Execute Cancel		

### 3.4 Optimized Target Simulation Selection

If there are multiple Simulation Models in the imported IFAS project, select the desired optimization target from the dropdown menu in the Simulation Model field.

<pre>ce claiteration ()</pre>	ErASCalibrator	200	X
Et FAS Calibrator Setting   Loda past IFAS Calibrator settings(option)   TAS Calibrator Setting File   Open IFAS Calibrator Setting File   Target Model   IFAS Project   Execute   Select   Select Parameter   Calibration rem   Calibration re	🗠 Calibration(C) 🐱 Result View(R) Help(H)		
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Enable PointName Col Row Filepath Error/Weight WeightRate MaxDischarge TotalDischarge   Iteration   Parameter   Method pyopt_sdpen   Iteration 2	Target Point		
Calibration Parameter  Method pyopt_sdpen  Iteration 2  Evaluation Function Mean square error  Result Result Folder E:#svn#17G16#Test#Test01  Execute Cancel	Enable PointName Col Row Filepath ErrorWeight WeightRate MaxDischarge TotalDischarge		
Calibration Parameter Metricol Iteration 2 Evaluation Function Result Result Folder E:¥svn¥17G16¥Test¥Test01 Execute Cancel	GAdd XDel Enable multi target		
Metricia pyopt_sdpen v Iteration 2 Evaluation Function Mean square error v Result Folder E:#svn#17G16#Test#Test01 Execute Cancel	Calibration Parameter		
Iteration 2 Evaluation Function Mean square error v  Result Folder E:#svn#17G16#Test#Test01  Execute Cancel	Method pyopt_sdpen v		
Evaluation Function Mean square error v  Result Result Folder E:#svn#17G16#Test#Test01  Execute Cancel	Iteration 2 📮		
Result Folder     Ei¥svn¥17G16¥Test¥Test01       Execute     Cancel	Evaluation Function Mean square error 🗸		
Execute Cancel	Result Result Folder EtYsyn¥1/G16¥Test¥Test01		
Execute			
	EXECUTE		

### 3.5 Setting the Optimization Scope

Click the "Select Parameter" button from the Parameter field.



IFAS parameters are enabled by clicking the respective check box in the "Enable" field. Minimum, maximum, and initial values can also be set for the optimization target. Click the "OK" button to set parameters.

"Enable", "Min", and "Max" are automatically set to default values, verify if any changes are necessary. "Initial Value" contains the values used in the selected IFAS simulation. Change values as necessary.

An error check will be performed for the values that you set, and an error message will be displayed for cells in error. Cells in red indicate an error. For an overview of error checking, see P12. Error checking is performed when the screen is opened. Therefore, when opening the screen for the first time, Min and Max may show error with the default values and the values used in the IFAS simulation.

	No.	Name	Enable	Log Scale	Min	Max	Initial Value	
•	1	SKF			0.0001	0.1	0.0005	
	1	HFMXD			0.1	1	0.10	
	1	HFMND			0.005	0.1	0.01	
	1	HFOD			0	0.1	0.005	
	1	SNF			0.01	2	0.70	
	1	FALFX			0	1	0.80	
	1	HIFD			0	1	0.00	
	2	SKF			0.0001	0.1	0.00002	
	2	HFMXD			0.1	1	0.05	
	2	HFMND			0.005	0.1	0.01	
	2	HFOD			0	0.1	0.005	
	2	SNF			0.01	2	2.00	٦
	2	FALFX			0	1	0.60	
	2	HIFD			0	1	0.00	
	3	SKF			0.0001	0.1	0.00001	
	3	HFMXD			0.1	1	0.05	

<Error checking outline>

- All parameters must have *Min<=Initial Value* < *Max.*
- Part one parameters must not be 0 (To prevent division by 0 errors)

• Part one parameters that must be greater or smaller than related variable must have appropriate values.

NOTE: The error message does not change any values. All values must be changed and confirmed by the user.

Examples of error messages.





	×
HFMND must be less than HFMXD	
OK	

The "Parameter" field will change to "Configured." when settings are properly set.



### 3.6 Setting the Optimization Evaluation Period

The optimization evaluation run duration can be shortened.

The dates can be chosen from a drop-down calendar, but time must be directly entered.

# IFASCalibrator version 2.0	<u>20</u> 7	Х
🗠 Calibration(C) 🐱 Result View(R) Help(H)		
🗵 IFAS Calibrator Setting		
Load past IFAS Calibrator settings(option)		
IFAS Calibrator Setting File		
Target Model		
IFAS Project C:¥17G16¥Abe_F11_2014Oct		
Simulation Model C-band_2L-def-unif V		
Parameter Not configured.		
CalibrationTerm 2014/10/05 00:00 💽 ~ 2014/10/07 23:00 🕞		
- Target Point 4 October 2014		
Enable Sun Mon Tue Wed Thu Fri Sat h MaxDis harge TotalDischarge		
5 6 7		
Add Score Enable multi target		
Calibration Parameter		
Method pyopt_sdpen 🗸		
Iteration 2		
Evaluation Function Mean square error 🗸		
Result		
Result Folder		
Execute Cancel		

### 3.7 Setting the Observation Point

Click the "Add" button in the "Target Point" section to set the observation point for the optimal flow rate to be used for optimization.

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🗠 Calibration(C) 🛛 🖉 Result View(R) 🛛 Help(H)		
🗵 IFAS Calibrator Setting		
Load past IFAS Calibrator settings(option)		
IFAS Calibrator Setting File		
Target Model		
IFAS Project C:#17G16#Abe_F11_2014Oct		
Simulation Model C-band_2L-def-unif V		
Parameter Not configured.		
CalibrationTerm 2014/10/05 00:00 🗊 🗸 2014/10/07 23:00 🗊		
- Target Point		
Enable PointName Col Row Filepath ErrorWeight WeightRate MaxDischarge TotalDischarge		
G Add XDel Enable multi target		
Calibration Parameter		
Method pyopt_sdpen 🗸		
Iteration 2		
Evaluation Function Mean square error 🗸		
Result		
Execute Cancel		

Enter the observation Name, then Cell ID, or the Col and Row of the desired observation point of the corresponding IFAS project. Click the "Select" button to select the observation flow data file.

	Target Point	>
Name	Miyanojo	
Cell ID	364 - Col 46 - Row 21 -	
Discharge File	C:\FAScalibration\Abe_F11[2014Oct\Tegoshi_F11_2014Oct.txt	Select
	OK	Cancel

		scharge		V O Search	Discharge	~
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Data ^	Name	Date modified	Туре	Size		
mackerel_projec	🚺 narama_test.txt	9/13/18 13:37	TXT File	2 KB		
PM	🛐 tegoshi_test.txt	9/13/18 13:37	TXT File	2 KB		
PS2_Bios_scph10	🕤 ushiduma_test.txt	9/13/18 13:37	TXT File	2 KB		
Script						
シャニライ						
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The observation flow data file must be in the format as shown below. NOTE: each line must be "YYYYMMDDhhmm(space or tab)<flowrate>"

201406150000 49.21 201406150100 45.03 201406150200 42.34 201406150300 41.03 201406150400 39.74 201406150500 38.46 201406150600 38.46

Make sure the observed flow files are always in the same interval as the IFAS project calculation interval for the entire period of the IFAS project to be optimized. The entire duration of the IFAS project is required, not only the optimization evaluation period. Also, each line must contain data, there must not be missing data within the time frame. For example, if the duration of the project is  $6/15/2014 \ 00:00$  to  $6/17/2014 \ 23:00$ , with a calculation interval of 60 minutes, there must be  $24 \ge 3 = 72$  rows all containing data (no missing values).

### 3.8 Multiple Target Optimization Settings

If multi-point multi-objective observation is desired, click the "Enable multi target" box to allow multiple points to be enabled. Click the check box in the "Enable" field to enable the target point.

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🔀 Calib	ration( <u>C</u> )	Result View(R	<u>R)</u> Helj	o( <u>H</u> )							 
IFAS	Calibrator S	etting									
- Loac	l past IF	AS Calibrat	or sett	ings(	option)						
IFAS	Calibrato	r Setting File				Open IFAS Ca	librator Setting F	ile			
Tarra	et Mode	12									
Tary	AS Project	C:¥17G16¥Ab	e F11 2	014Oct					Select		
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0		Configured.			Select Paramet	ter					
Calibra		2014/10/05 0	0:00 🔲	- ~	2014/10/07 23:00						
Tarc	ot Doin										
	Enable	PointName	Col	Row	Filepath	ErrorWeight	WeightRate	MaxDischarge	TotalDischarge		
		Ushiduma	49	64	C:¥17G16¥discha	0.1848	0.8813	1416.79	27199.26		
•		Tegoshi	49	90	C:¥17G16¥discha	0.0249	0.1187	3859.59	39066.34		
		Narama	25	76	C:¥17G16¥discha	0.7903	0	685.13	10073.42		
		Pal									
	kaa j	Dei						ME	hable multi target		
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i1		ation <mark>40</mark>	*		Max Population 10	0					
Eval		tion Mean squ	uare erro	r v							
Res	ult										
Rest	ult Folder	C:¥17G16¥Tes	t03_02_	J_T					🐂 Select		
					Execut	te			Cancel		
				_					<b>.</b>	1	

The weight of error evaluation function for each point that have "Enable" checked can be set in the field "ErrorWeight".

Enable	PointName	Col	Row	Filepath	ErrorWeight	WeightRate	MaxDischarge	TotalDischarge
	Ushiduma	49	64	C:¥17G16¥discha	0.15	0.8813	1416.79	27199.26
	Tegoshi	49	90	C:¥17G16¥discha	0.0249	0.1187	3859.59	39066.34
	Narama	25	76	C:¥17G16¥discha	0.7903	0	685.13	10073.42

Right-clicking the header of the maximum flow rate (MaxDischarge) or the total flow rate (TotalDischarge) displays a menu where the error weight can be automatically set based on the maximum flow rate or the total flow rate.

	Enable	PointName	Col	Row	Filepath	ErrorWeight	WeightRate	MaxDisc	narge TotalDischarge
1		Ushiduma	49	64	C:¥17G16¥discha	0.15	0.8813	1416.	Set ErrorWeight from MaxDischarge(Mean square error)
		Tegoshi	49	90	C:¥17G16¥discha	0.0249	0.1187	3859.	Set ErrorWeight from MaxDischarge(Log of Mean square erro
		Narama	25	76	C:¥17G16¥discha	0.7903	0	685.1	Cancel

### 3.9 Configuring Optimization Algorithms

Select the desired optimization method.



The algorithms to choose from are listed below.

Solver	Algorithm					
pyopt_sdpen	Sequential Penalty Derivative-free method for Nonlinear					
	constrained optimization					
pyopt_slsqp	Sequential Least Squares Programming					
pyopt_psqp	Preconditioned Sequential Quadratic Programming					
pyopt_algencan	Augmented Lagrangian with GENCAN					
pyopt_filtersd	FILTERSD uses a generalization of Robinson's method,					
	globalised by using a filter and trust region.					
pyopt_conmin	CONstrained function MINimization					
pyopt_ksopt	Kreisselmeier–Steinhauser Optimizer					
pyopt_cobyla	Constrained Optimization BY Linear Approximation					
pyopt_solvopt	SOLver for local OPTimization problems					
pyopt_alpso*	Augmented Lagrangian Particle Swarm Optimizer					
pyopt_nsga2*	Non Sorting Genetic Algorithm II(pyopt)					
pyopt_alhso	Augmented Lagrangian Harmony Search Optimizer					
r_mco_nsga2*	Non-Sorting Genetic Algorithm II(R)					

\*Requires a setting other than the number of calculations.

Detailed descriptions of each pyopt algorithm can be found at the following site: <u>http://www.pyopt.org/reference/optimizers.html</u>

Detailed description of r\_mco\_nsga2 can be found at the following site: https://www.rdocumentation.org/packages/mco/versions/1.0-15.1/topics/nsga2 Once the algorithm is selected, set the calculation count (Iteration).

IFAS	Calibrator	Result View(	3) Hel	p(H)						<u>200</u> 7	×
IFA:	S Calibrator	Setting								<u>,</u>	
Loa	d past I	FAS Calibrat	or set	tings(	option)						
IFA	S Calibrate					Open IFAS Ca	librator Setting F	ile			
Tarc	jet Mod										
		C:¥17G16¥Ab	pe_F11_2	2014Oct	l.				📁 Select		
		C-band_2L-de	ef-unif	~							
		Configured.			📕 Select Paramet	ter					
Calibr		2014/10/05 0	0:00 🔲	- ~	2014/10/07 23:00	0+					
Tar	not Poir	vt.									
i i i i i i i i i i i i i i i i i i i	Enable	DointNamo	Col	Row	Filonath	Error Majaht	WeightBate	MayDischarge	TotalDischarge		
		Ushiduma	49	64	C:¥17G16¥discha	0.15	0.8576	1416.79	27199.26		
Ľ,		Tegoshi	49	90	C:¥17G16¥discha	0.0249	0.1424	3859.59	39066.34		
		Narama	25	76	C:¥17G16¥discha	0.7903	0	685.13	10073.42		
- Cali	Add bration	Del Parameter ethod pyopt_s	dpen	×				⊠ Ei	nable multi target		
		ration 100									
		(RED) Mean squ	uare erro	r v							
Res		C·¥17C16¥Tos	+02 02	υт					L'E Calent		
NES .	suit Poluei	C.+1/010+1es		0_1					Select		
-	_				Execut	te			Cancel		

If you select a Solver (see P19) that requires a setting other than the number of calculations, it will appear as follows:

For pyopt\_nsga2 or r\_mco\_nsga2, set the maximum number of individuals (Max Population) and the maximum number of generations (Max Generation). The maximum number of individuals can only be a multiple of 4. The number of calculations will be "Max Population" and "Max Generation".

- (	Calibration Para	ameter				
	Method	pyopt_nsga2	~			
	Max Generation	40 🔹		Max Population	100	•
	Evaluation Function	Mean square error	~			

For pyopt\_alpso, set the number of particles in "SwarmSize" and the number of external loops in "MaxOuterIter"

- Ca	alibration Para	ameter				
	Method	pyopt_alpso	~			
	MaxOuterIter	25 🔹		SwarmSize	32	•
S E	Evaluation Function	Mean square error	~			

Set the error evaluation function to use as shown in the figure below.

IFAS	Calibrator	Result View(R	t) Heli	o(H)						<u>20</u>	×
IFAS Loac	Calibrator <b>past If</b> Calibrato	Setting FAS Calibrator or Setting File	or sett	ings(	option)	Open IFAS Ca	librator Setting F	le			
- <b>Targ</b> IF Simula	<b>et Mode</b> AS Project tion Model	C:¥17G16¥Ab C-band_2L-de	e_F11_2 ef-unif	2014Oct					Select		
Calibra		Configured.	0:00 🔲	- ~	Elect Paramet 2014/10/07 23:00	er V					
- Targ	Enable	PointName Ushiduma	Col 49	Row 64	Filepath C:¥17G16¥discha	ErrorWeight	WeightRate 0.8576	MaxDischarge 1416.79	TotalDischarge 27199.26		
		Narama	25	76	C:¥17G16¥discha	0.7903	0	685.13	10073.42		
- Calil	<b>oration</b> Max Gener	Parameter	sga2	~	Max Population 10	0			hable multi target		
Eval Rest Rest	uation Fur <b>uit</b> ult Folder	Ction Mean squ Mean squ Relative e C:¥17 Log of M	Jare erro Jare erro error ean squa	re error					E Select		
				-	Execut	:e			Cancel		

The three error evaluation function choices are listed below.

n is the number of calculation steps of the IFAS project to be optimized,  $x_t$  is the calculated flow rate of IFAS in the calculation step t,  $o_t$  is the observation flow rate in the calculation step t.

 $\cdot$  Mean square error

$$E_m = \sum_{t=0}^n \frac{(x_t - o_t)^2}{n}$$

 $\cdot$  Relative error

$$E_r = \sum_{t=0}^n \left| \frac{x_t}{o_t} - 1 \right|$$

• Log of Mean square error

$$E_l = \log\left(\sum_{t=0}^n \frac{(x_t - o_t)^2}{n}\right)$$

### 3.10 Setting the Result Folder

Click the "Select" button beside the Result Folder field and the save location for results will be set.

IFAS	Calibrator								– o x
🗠 Calib	oration( <u>C</u> )	🛃 Result View( <u>R</u>	) Help	o( <u>H</u> )					
IFAS	Calibrator S	Setting							
Load	d past IF	AS Calibrate	or sett	ings(	option)				
IFAS	6 Calibrato	or Setting File				Open IFAS Ca	librator Setting F	ile	
- larg	et Mode	CIVI7C16VAb	o E11 - 2	0140et					- Soloct
	-AS Project	C:#1/G10#AD	e_FII_2	2014000					Select
Simula	nulation Model C-band_2L-def-unif 🗸								
	Parameter Configured. I Select Parameter								
		2014/10/05 00	):00 🔲	- ~	2014/10/07 23:00	<b>•</b>			
Tarc	iet Poin	t							
	Enable	PointName	Col	Row	Filenath	ErrorWeight	WeightRate	MaxDischarge	TotalDischarge
•		Ushiduma	49	64	C:¥17G16¥discha	0.15	0.8576	1416.79	27199.26
		Tegoshi	49	90	C:¥17G16¥discha	0.0249	0.1424	3859.59	39066.34
		Narama	25	76	C:¥17G16¥discha	0.7903	0	685.13	10073.42
G P	Add	🗙 Del						🗹 Er	nable multi target
Cali	bration	Parameter							
		athed pyopt_ns	sga2	~					
		ation 40			Max Population 10	0			
		ction Mean squ	are erro	- v	1	-			
Doc	ult								
Res	ult Folder	C:¥17G16¥Test	:03_02_0	U_T					Select
					Execut	0			Capcel
					LACCU				Cancer

NOTE: Multi-byte characters must not be used in the path and Result Folder.

### 4. Optimization Execution

🔛 IFASCalibrator							- 🗆 X
Calibration( <u>C</u> )	Result View( <u>R</u> )	Help( <u>H</u> )					
IFAS Calibrator S	letting						
- Load past IF	AS Calibrator	setting	s(option)				
IFAS Calibrato	r Setting File			🧯 Open IFAS Ca	librator Setting F	ile	
- Target Mode							
IFAS Project	C:¥17G16¥Abe_F	11_2014	Oct				Select
Simulation Model	C-band_2L-def-u	nif ~					
	arameter Configured. # Select Parameter						
CalibrationTerm 2014/10/05 00:00 🗐 🗸 🗸 2014/10/07 23:00 🗐 🔻							
Target Poin	t						
Enable	PointName	Col R	ow Filepath	ErrorWeight	WeightRate	MaxDischarge	TotalDischarge
▶ ☑	Ushiduma	49 64	C:¥17G16¥discha	0.15	0.8576	1416.79	27199.26
	Tegoshi -	49 90	C:¥17G16¥discha	0.0249	0.1424	3859.59	39066.34
	Narama	25 76	C:¥17G16¥discha	0.7903	0	685.13	10073.42
Add	Add     X Del   Enable multi target						
Calibration	Parameter						
	thed pyopt_nsgal	2	×.				
	ation 40 🚔			100 ≑			
	ction Mean square	error	~	Training (			
Result							
Result Folder	C:¥17G16¥Test03	02 U T					늘 Select
			Exect	ute			Cancel

Click the "Execute" button to run the optimization.

After the calculations are saved, the below message will appear.

	×
Finished.	
OK	

# 5. <u>Verification of Optimization Results</u>

### 5.1 Loading the Optimized Results

From "Result View" in the menu bar, click "Error/Hydro Graph".

🖳 IFASCalibrator		- 🗆 X				
Calibration(C)      Kesult View(R) Help(H)						
IFAS Calibrato						
- Load past II no camprator secondo (option)						
IFAS Calibrator Setting File	File					
Target Model						
IFAS Project C:¥17G16¥Abe_F11_2014Oct		📒 Select				
Simulation Model C-band_2L-def-unif V						
Parameter Configured.						
CalibrationTerm 2014/10/05 00:00 📑 🗸 2014/10/07 23:00 📑						
Target Point						
Enable PointName Col Row Filepath ErrorWeight WeightRate	MaxDischarge	TotalDischarge				
Image: Point during         Col         Herr         Image: Point during         Col         Herr         Point during         Col         Herr         Point during         Col         Point during         Col         Point during         Point d	1416.79	27199.26				
Image: Construction         Image: Construction	3859.59	39066.34				
Narama 25 76 C:¥17G16¥discha 0.7903 0	685.13	10073.42				
G Add X Del	🗹 Er	nable multi target				
Calibration Parameter						
Method pyopt_nsga2 🗸 🗸						
Max Generation 40 🚔 Max Population 100 🚔						
Evaluation Function Mean square error						
Posult						
Result Folder C:¥17G16¥Test03_02_U_T		늘 Select				
Execute		Cancel				

	Gelect
Project Infomation	Condition
IFAS Project Name :	Solver :
Simulation Name :	Method :
	Evaluation Function :

Click the "Select" button and choose the desired Result Folder.

After a folder is selected, "Open Error/ Hydro Graph" button will be displayed on the screen. If multi target optimization is enabled, the "Open Pareto Chart" button will also be displayed.

roject moma	tion			Condition	
IFAS Proje	ct Name :	Abe_F1	1_2014Oct	Solver :	r
Simulation Name : C-band_2L-def-unif			_2L-def-unif	Method :	r_mco_nsga2
				Evaluation Function :	Mean square error
Point List	Col	Row	FilePath		ErrorWeight
Fundivarie	001		C:¥17G16¥discharge¥ushiduma_test.csv		
Ushiduma	49	64	C:¥17G16¥dis	scharge¥ushiduma_test.csv	8.6786E-005
Ushiduma Tegoshi	49 49	64 90	C:¥17G16¥dis C:¥17G16¥dis	scharge¥ushiduma_test.csv scharge¥tegoshi_test.csv	8.6786E-005 1.0006E-005

### 5.2 Verification of Error Graph and Hydrograph

Click the "Open Error / Hydro Graph" button to display a graph of the error values for each trial.

The "Trial Number" list box is sorted in descending order of error value.

By default, the trial number with the smallest error is selected.





Click the "Hydro Graph" radio button to display a hydrograph of the flow rate in the trial.

- 5.3 Confirmation of Pareto chart
- 5.3.1 Display Pareto Charts

Click the "Open Pareto Chart" button to display the Pareto chart. By default, the X and Y axes display the same target points (TargetPoint). Different target points can be selected from the "TargetPoint" dropdown menu.





#### 5.3.2 Pareto Chart Zoom

The mouse wheel can be used to zoom in and out of the Pareto chart.

In the figure below, the green point is the minimum error of the "TargetPoint X". The yellow point is the minimum error of the "TargetPoint Y". The red point is the minimum error when considering the sum of both target points. The pink points are the 10 best points when considering the sum of both target points.



### 5.3.3 Pareto Chart Rectangle Selection

A rectangular area of the Pareto chart can be selected by dragging the mouse. The selected area can be zoomed into or deleted.



### 5.3.4 Hydrograph Display

Double-clicking a point on the plot will display the hydrograph of the trial times for both "TargetPoint X", and "TargetPoint Y".



#### 5.3.5 Plot Filtering

The box on the right side of the screen are parameters for plot filtering.

Plots can be refined and will be displayed in the graph on the left. Plots can be filtered by either evaluation values or parameter range.

The plot points to be deleted will appear in grey.

Entering range values then removing focus of the text box will grey points outside if the range.

Clicking the "Apply" button will delete the points in grey. Clicking "Cancel" will restore the graph to its original appearance.

Once a deletion is performed by clicking the "Apply" button, the graph cannot be restored to its original form.



### 5.3.6 Output

After finding the Pareto boundary, by using the filtering and rectangular deletion functions, click the "Output CSV" button to save the parameter set, that describes the Pareto boundary, to file.

After finding the Pareto boundary, the filtering and rectangular deletion functions can be used to save the parameter set to a file by clicking the "Output CSV" button.



The Pareto boundary can be reproduced by reading in the output file.



NOTE: Any file in CSV format, where first line is a header and first column contain the trial count, can be loaded. Keep the plot containing trial numbers that match the loaded file and delete all other plots.

(The first line is treated as a header line and is ignored.)
879, · · · (The second column is ignored and its contents can be anything.)
902, · · ·
909, · · ·
957, · · ·
989, · · ·
1002, · · ·

### 5.3.7 Support Features

Additionally, the following support functions are provided:

Buttons can be used operate the Pareto Chart when the mouse wheel is unavailable.



🛃 : Display all (return to initial display)

Rectangular areas can be selected by entering text into the following ranges when the mouse drag is unavailable.



### 5.4 Analysis of Optimization Results

From "Result View" in the menu bar, click "Data Analysis" in the drop-down menu.

R IFASCalibrator	<u>200</u> 2	×
Calibration(C) 📈 Result View(R) Help(H)		

Click the "Select" button and choose the desired "Result Folder".

Data Analysis	×
Select Data Colleo Project	Select
General Point List Project Infomation IFAS Project Name : Simulation Name :	Condition Solver : Method :
Display Point Index Solver Method Result Folder	Add

Click the "Add" button to add the selected folder to the list.

Also, if multiple points have been optimized, the point to be analyzed can be selected from the "Display Point" dropdown menu.

oneo mojeet					
Result Folder C:¥17	G16¥Test02			Select	
General Point List					
Project Infomation		Condition			
IFAS Project Name :	Abe_F11_2014Oct	Solver :	r		
Simulation Name :	C-band_2L-def-unif	Method : r_mco		nsga2	
	1.	Evaluation Function :	Mean squar	e error	
Ind <mark>ex Solver Met</mark> 1 r r_mc	hod Result Folder o_nsga2 C:¥17G16¥Test0	2			

In the optimization analysis screen, the observed flow rate and the calculated flow rate of all trials of optimization calculation are displayed. Manipulating the grid below the graph will narrow down the range of parameters and calculated flow to be displayed. This is done for further refinement of the optimization.



## 6. Loading Previous Optimization Settings

To load previous optimization settings to continue calculations, click the "Open IFAS Calibrator Setting File" button and select the "IFASCalibrationParam.xml" in the optimization result folder.

🖳 IFASCalibrator	– 🗆 🗙				
😢 Calibration(C) 📈 Result View(R) Help(H)					
区 IFAS Calibrator Setting					
Load past IFAS Calibrator settings(option)					
IFAS Calibrator Setting File					
- Target Model					
IFAS Project	Select				
Simulation Model					
Parameter Select Parameter					
CalibrationTerm 🔲 🗸 🗸					
Target Point					
Enable PointName Col Row Filepath ErrorWeight WeightRate MaxDischarge Total	Discharge				
	5.17				
C Add X Del Enable r	nulti target				
Calibration Parameter					
Method pyopt_sdpen 🗸					
Iteration 2					
Evaluation Function Mean square error 🗸					
Result					
Result Folder	Select				
Execute	Cancel				
	2				

📕   🕞 📕 = I	test2			0		×
File Home Share View						v 🕐
	~	Ç	Search test2			,o
Name	Date modified	Туре		Size		
🐌 MP_out	12/12/2018 5:50 PM	File fol	der			
퉬 RAIN	12/12/2018 5:50 PM	File fol	der			
퉬 rvk_out	12/12/2018 5:50 PM	File fol	der			
WORK_OUT	12/12/2018 5:50 PM	File fol	der			
FASCalibrationParam.xml	2/23/2017 5:25 PM	XML D	ocument	2	7 KB	
5 items 1 item selected 26.8 KB						

The previous optimization settings are loaded.

IFASCalibrator	Result View(R)	Help(	H)					– 🗆 X
IFAS Calibrator Setting         Load past IFAS Calibrator settings(option)         IFAS Calibrator Setting File								
- Target Mod IFAS Projec Simulation Mode Paramete CalibrationTerm	Target Model         IFAS Project       C:¥17G16¥Abe_F11_2014Oct         Simulation Model       C-band_2L-def-unif         Parameter       Configured.         Select       Parameter         CalibrationTerm       2014/10/05 00:00							
Target Poin Enable	PointName Ushiduma Tegoshi Narama	Col 49 49 25	Row 64 90 76	Filepath C:¥17G16¥discha C:¥17G16¥discha C:¥17G16¥discha	ErrorWeight 0.1848 0.0249 0.7903	WeightRate 0 0.0305 0.9695	MaxDischarge 1416.79 3859.59 685.13	TotalDischarge 27199.26 39066.34 10073.42
Calibration Parameter       Method       r_mco_nsga2       ✓         Max Generation       40       Max Population       100       ●         Evaluation Function       Mean square error       ✓								
Result       C:¥17G16¥Test03_02_T_N_02         Execute       Cancel								

### 7. <u>Troubleshooting</u>

If the following error occurs when performing steps in sections "5.1 Verification of Error/Hydro Graph" and "5.3 Analysis of Optimization Results", it indicates that the specified optimization output file cannot be read.



If the file "datafile.txt" exist in the location specified by the message, the following causes of error may exist:

#### A) Data of the observation flow rate mismatch

Ensure that the observed flow file has the same interval as the IFAS project calculation interval for the entire period of the IFAS project that is being optimized. Please note the entire duration of the IFAS project is required rather than the optimization evaluation range.

#### B) Divergence of IFAS

The calculation results diverge, and the optimization process may have ended prematurely. In this case, one of the files under the "WORK\_OUT" folder in the optimization results folder contain "nan" values. Review the search scope of the parameters and perform the optimization again.

#### C) Divergence of error value evaluation of optimization

For multi-objective optimization, if the weight is large, the evaluation function may diverge, and the optimization process may have prematurely ended. In this case, reduce the weighting and perform the optimization again.