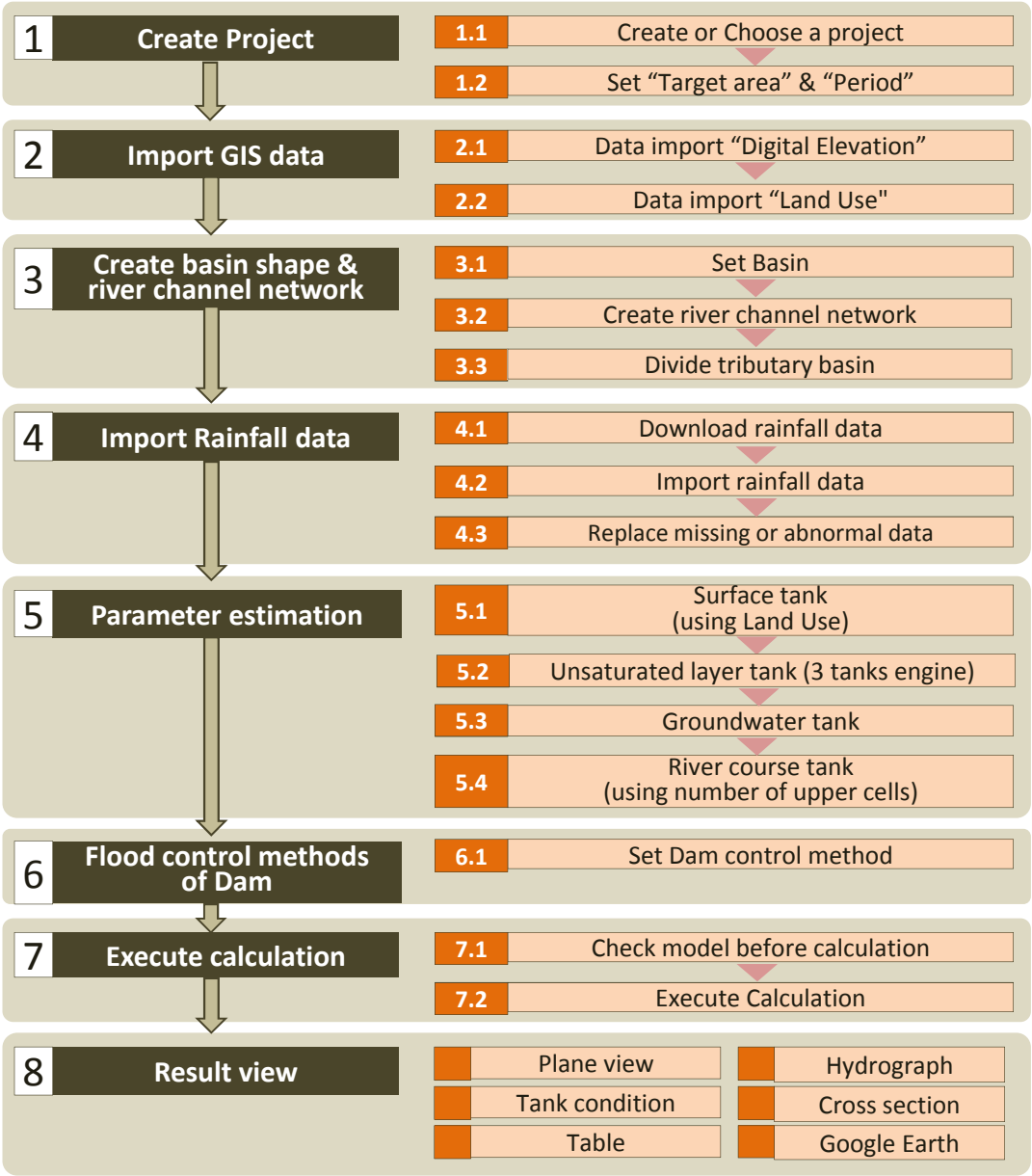
IFAS Quick Reference

IFAS is a software to calculate river discharge using satellite based rainfall and ground based rainfall data. Topography, Land Use and satellite-based rainfall data can be obtained free of charge. This makes it possible to predict and analyze the time and the scale of flood events in insufficiently gauged basins.



0 Prepare your basin information (area, flood period)

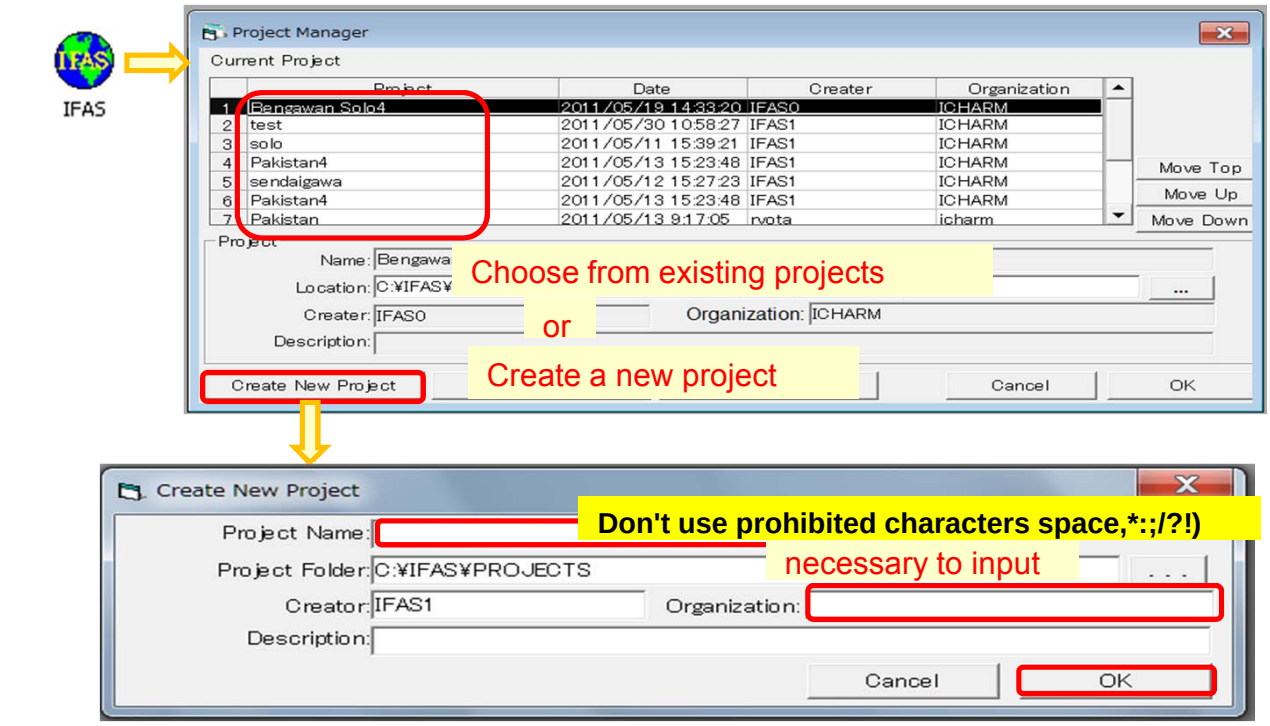
1. **Select river you want to calculate** (not necessarily to contain the river mouth. e.g. upstream of the gauging station and the main flood control point).

2. **Check latitude and longitude of the end sides of the basin** , doing so you specify to IFAS the rectangle in which the whole basin has to fit.

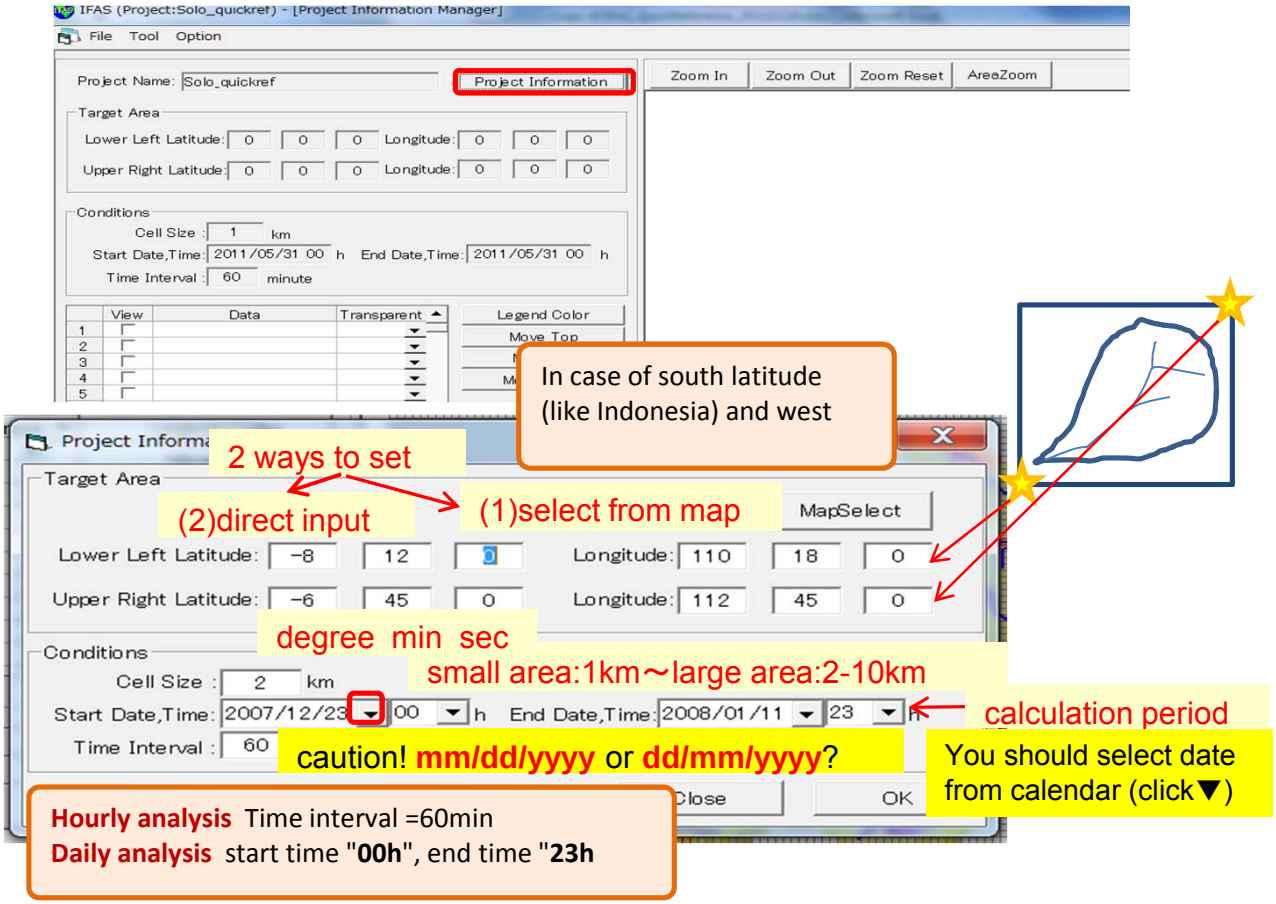
3. **Select calculation period**. For short term (largest flood, tropical cyclones, serious damaged flood) it is recommended to use hourly analysis and for long term (seasonal flood, monsoon) it is recommended to use daily analysis.

1 Create Project

1.1 Create or Choose project



1.2 Set "Target area" & "Period"

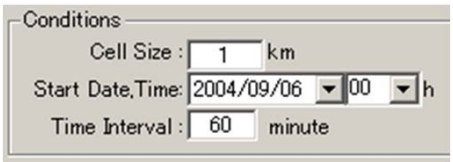


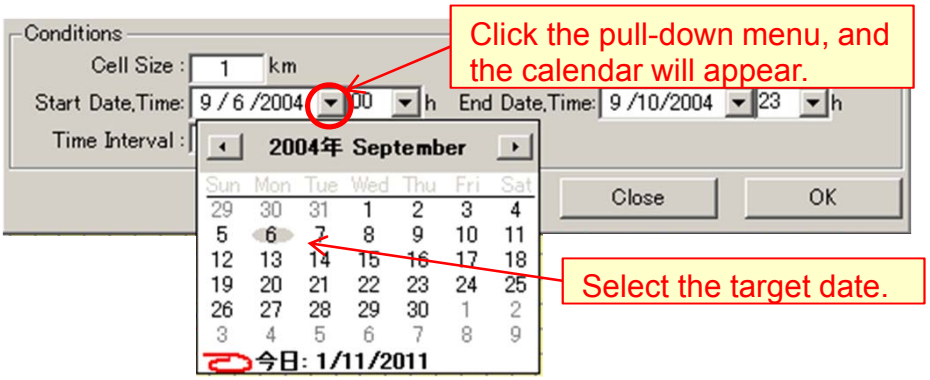
Calculation period setting

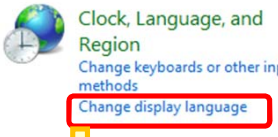
It is possible for users to manually input the dates into the date fields. However, It is better to select the dates from the calendar because date notation varies depending on the operating system installed on the users' PCs. It is easy to make a mistake about the order of day, month and year if done manually.

English style

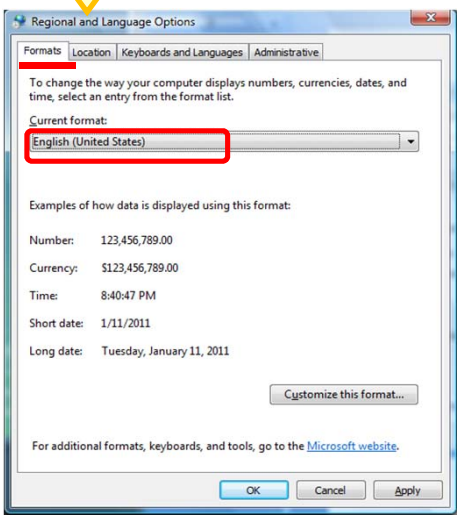
Japanese style







Please check Language of formats on your PC. (Control Panel →"Change display language"). Change current format to "English (United States)", PC is shown date and time in English style.



Thailand

Number:	123,456,789.00
Currency:	฿123,456,789.00
Time:	20:40:09
Short date:	11/1/2554
Long date:	11 มกราคม 2554

Indonesia

Number:	123.456.789,00
Currency:	Rp123.456.789
Time:	20:39:17
Short date:	11/01/2011
Long date:	11 Januari 2011

Thailand : adopts local calendar
Indonesia : digit grouping separator is displayed as "."

IFAS cannot recognize these local writings.

Estimation of mesh size

IFAS runs smoothly around 100*100 meshes. It is also easily viewable on screen.

Basin area ～10,000km^2:1km ～40,000km^2:2-4 km ～100,000km^2:4-8 km

Caution) If the basin is too large or a long-term analysis is run with a short time interval, it will take time to import rainfall data and to run the calculations.

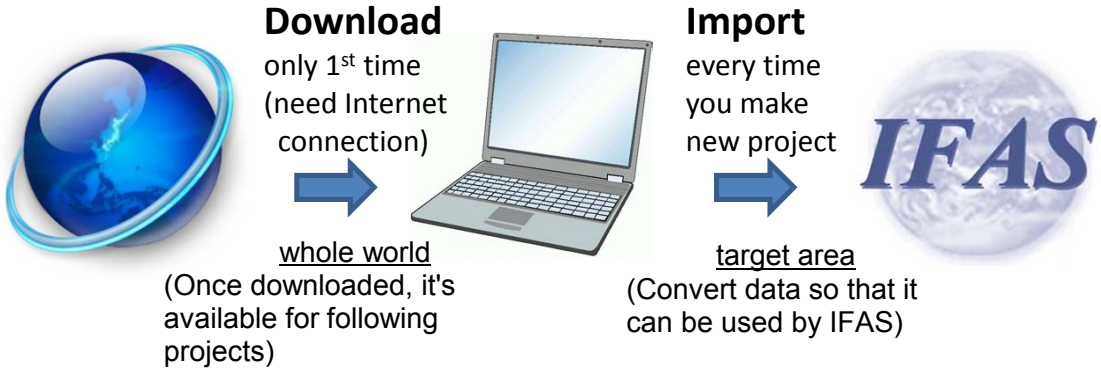
2 Import GIS data

Difference between "Download" and "Import"

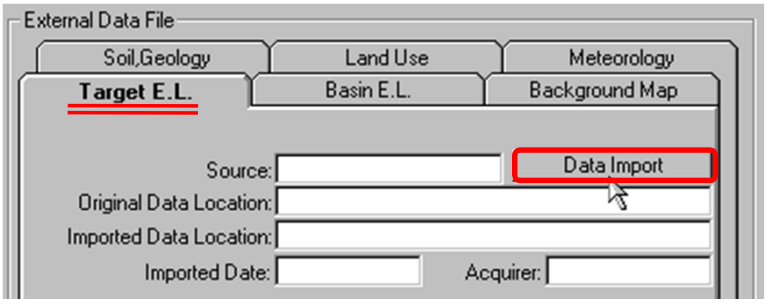
Download : IFAS copies DEM, Land Use or Rainfall data from provider via Internet. IFAS downloads data for the whole world. Please be aware of the size of data sets!!

DEM: 1.7GB (Global Map) ～ 2.6GB (GTOPO30)
Land Use: 900MB
Rainfall: 240KB (3B42RT) / 3 hourly ～ 900KB (GSMaP_NRT) / 1 hour

Import : IFAS converts these data used for model creation and calculation. IFAS imports only target area's data.

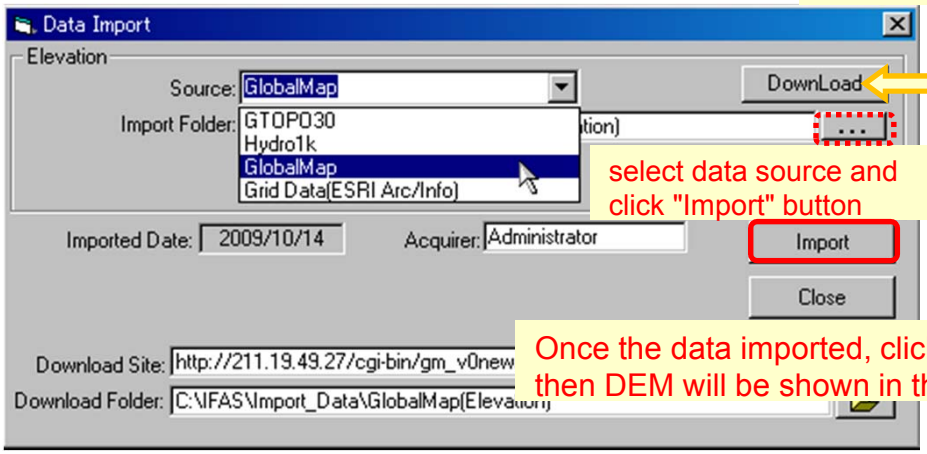


2.1 Data import "Digital Elevation"



"Data Import" has two function, [Download] and [Import].

*GTOPO30≒GlobalMap
*Hydro1k: modified original DEM so as to divide water basin.

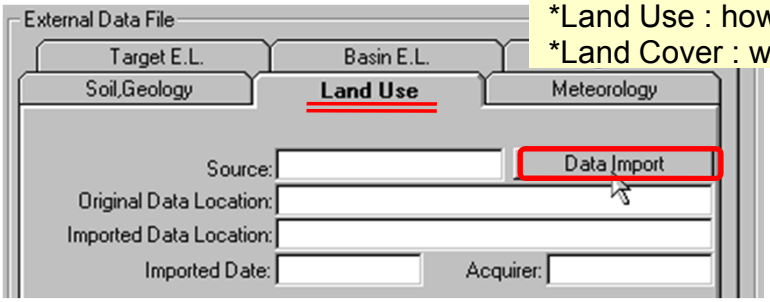


only the 1st time

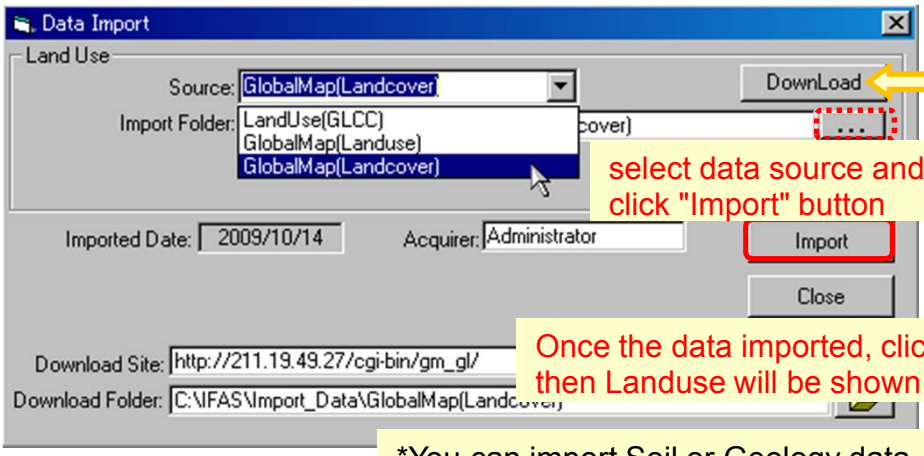
select data source and click "Import" button

Once the data imported, click "OK" → "Close" then DEM will be shown in the right display.

2.2 Data import "Land Use"



*Land Use : how people use the land
*Land Cover : what the land is covered with



only the 1st time

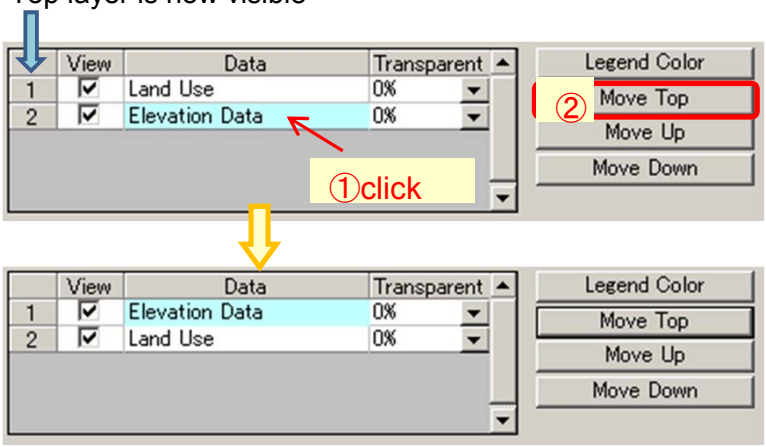
select data source and click "Import" button

Once the data imported, click "OK" → "Close" then Landuse will be shown in the right display.

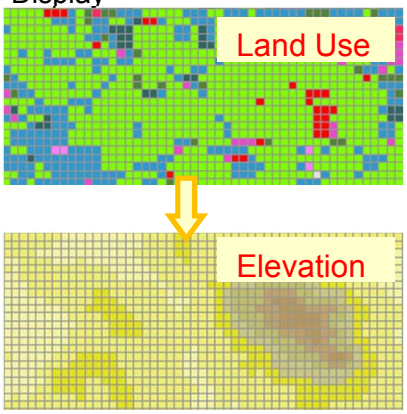
*You can import Soil or Geology data, but IFAS ver1.3 doesn't prepare parameter distribution automatically.

☆ Layer change

Change the view order (easy to see and to create basin)
Top layer is now visible



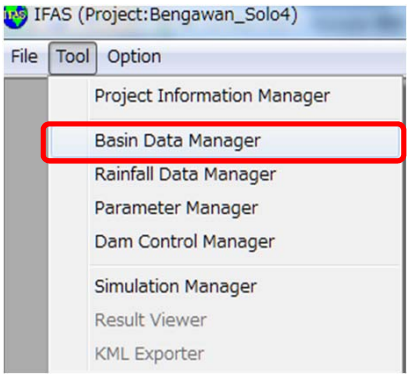
Display



Don't forget to save!!

Once you finished importing data, click "save" and "close"

3 Decide basin boundary & river channel network



Making basin boundary using topography data

If you have basin "shape" file, you can use this function

Set basin by elevation

Basin boundary shape file

Select basin

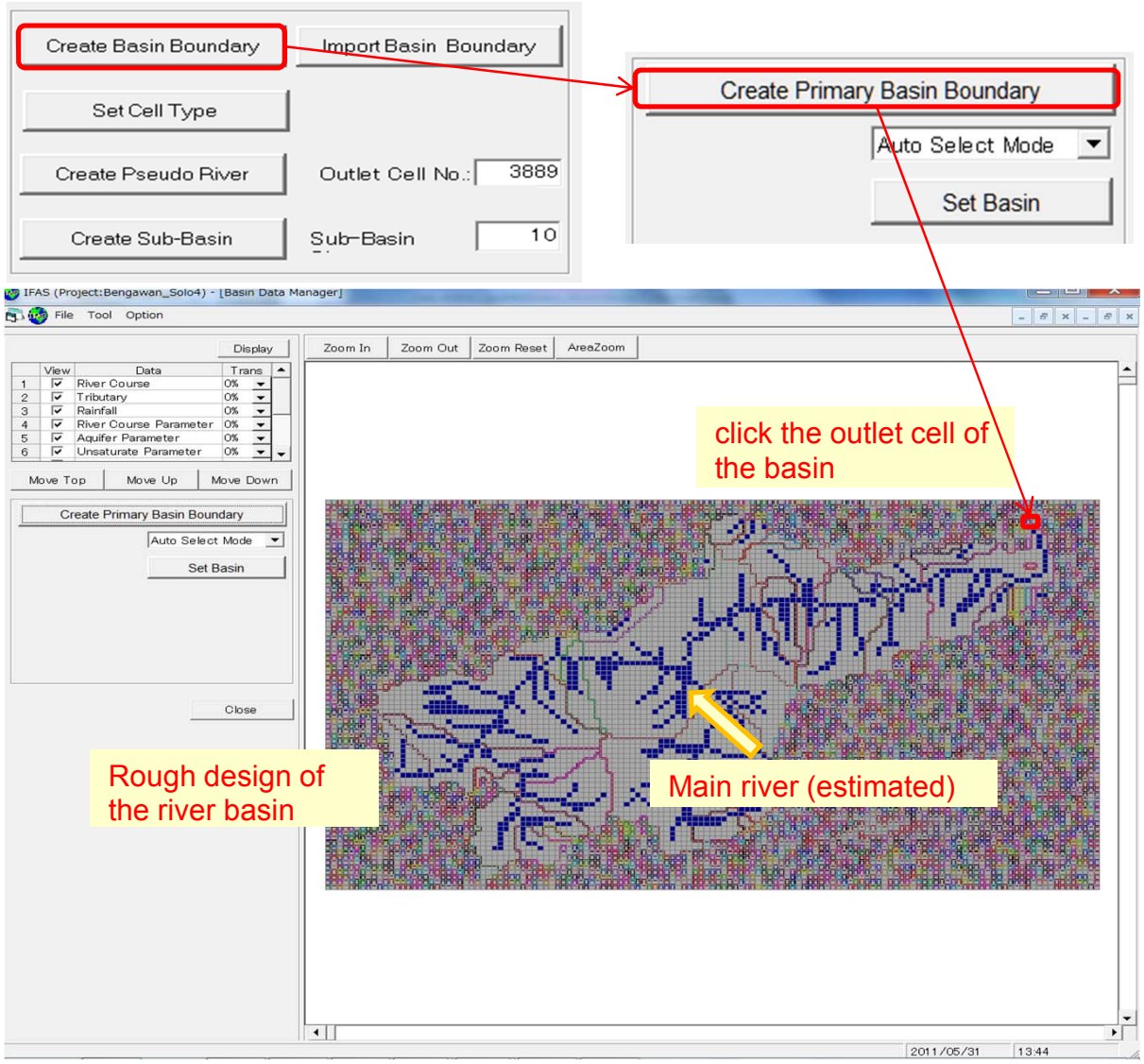
Import Shape file

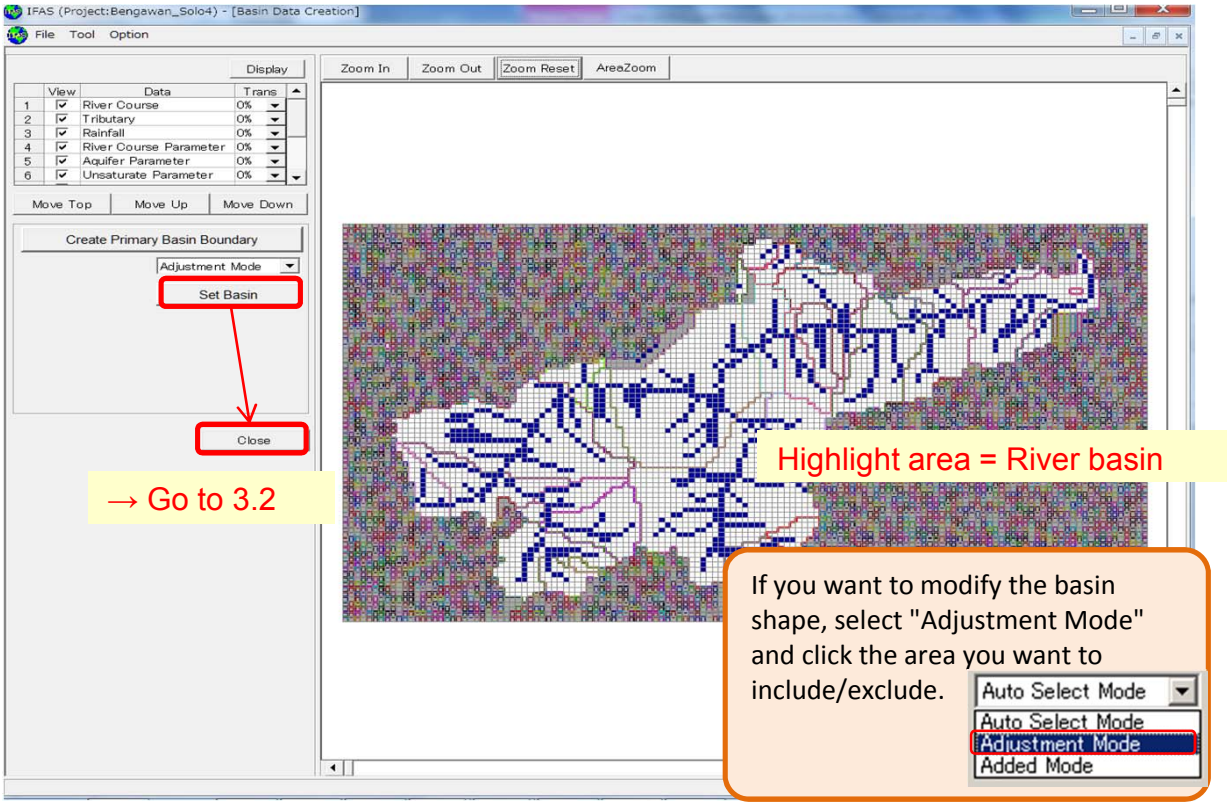
Create river channel network

Display main river & tributary basin

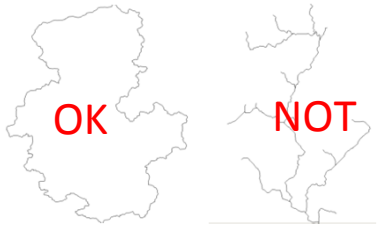
When large flat areas or big lakes are included, it is difficult for IFAS to decide basin boundary and river course.
IFAS cannot reproduce floodway. Moreover, we can only select 1 point as the river end.

3.1 Set Basin (from DEM)

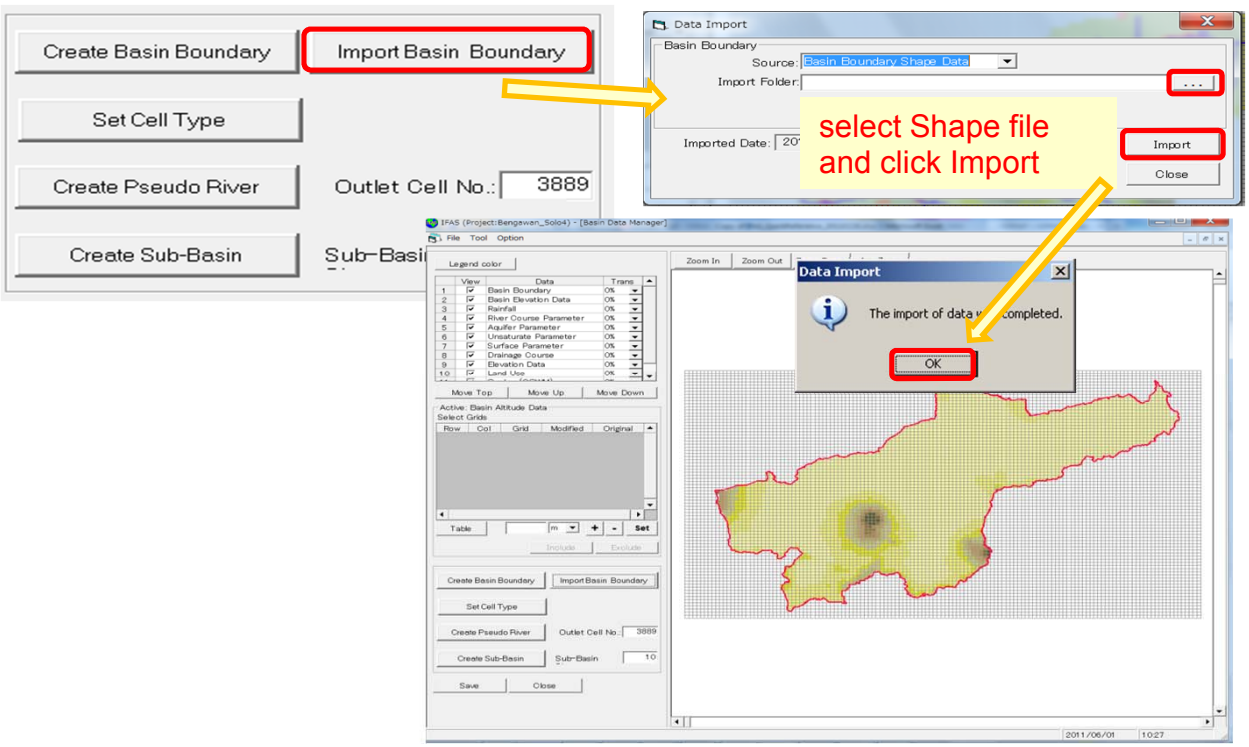




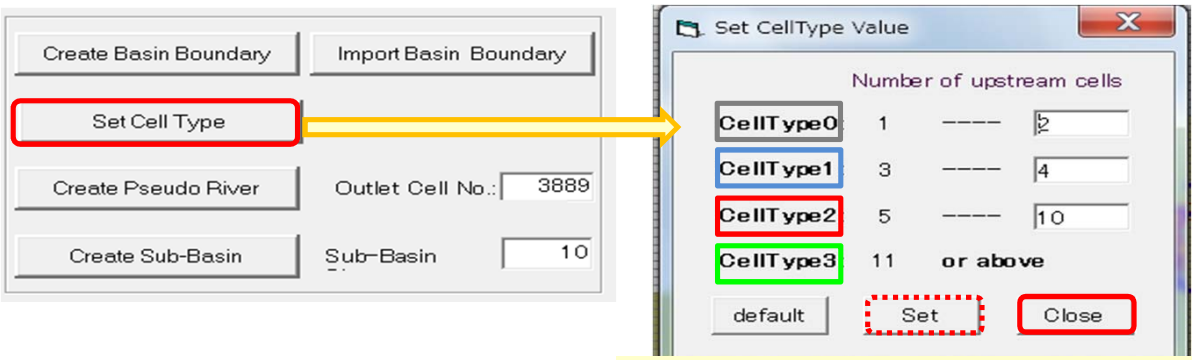
3.1 Set Basin (Importing Shape file)



Coordinate system must be based on Geographic longitude and latitude (WGS84, degree-minute-second), not UTM.
If you make a shape file on ArcGIS, save it as "Polygon" and coordination has to be "Geographic(WGS84)".
IFAS can only intake **basin boundary,** not river course.



3.2 Create river channel network



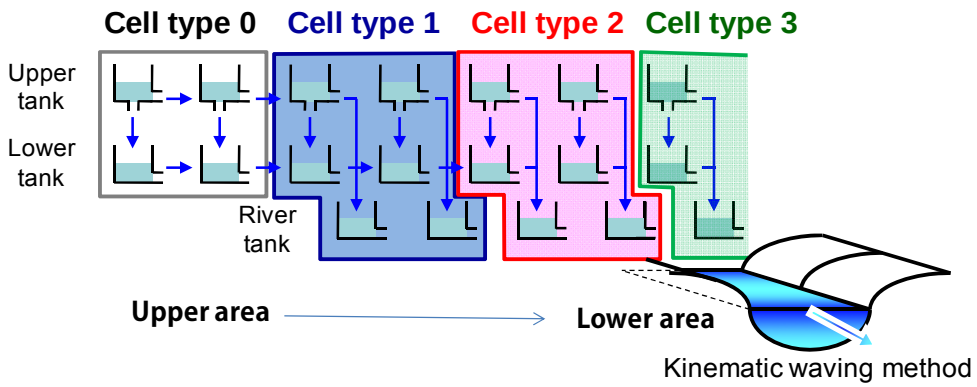
If you change, click "Set" and "close"

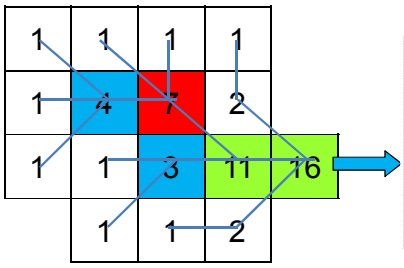
Advanced Learning

Cell type classification

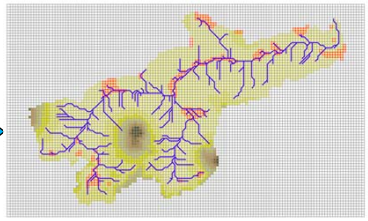
IFAS core engine is "PWRI Distributed Hydrological Model (PDHM)". PDHM adopts "Cell type" to set runoff process in upper, middle reach and downstream area.Run-off process in tank (how water flows) is different for each Cell type.
IFAS has 4 categories of Cell type. Each mesh is divided into each CellType. Cell type is classified as "the number of upstream cells (including itself)". Cell type 0 is the Cell type for the most upstream area because it includes only 1 or 2 mesh.

Each mesh has 2 tanks vertically superposed. Only Cell type 1,2 and 3 have a third tank, the River course tank. And Cell type 3 is considered delay of river

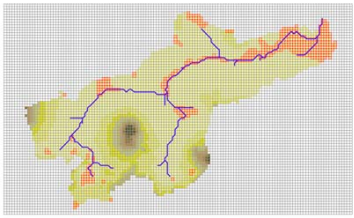




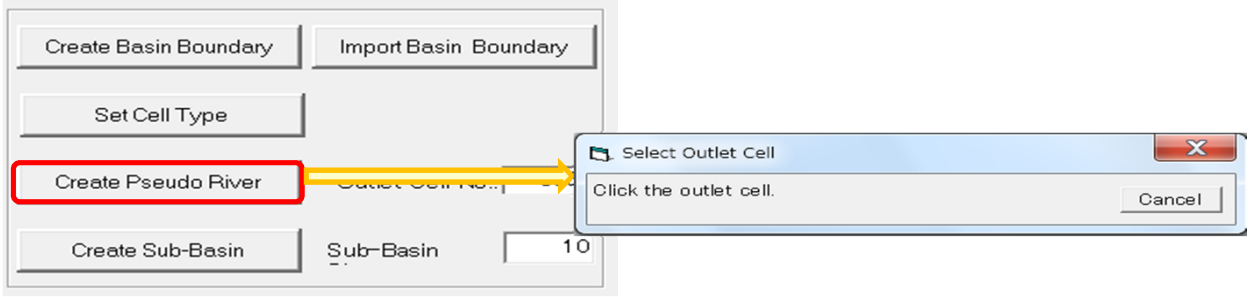
Relationship between upstream cells and Cell type

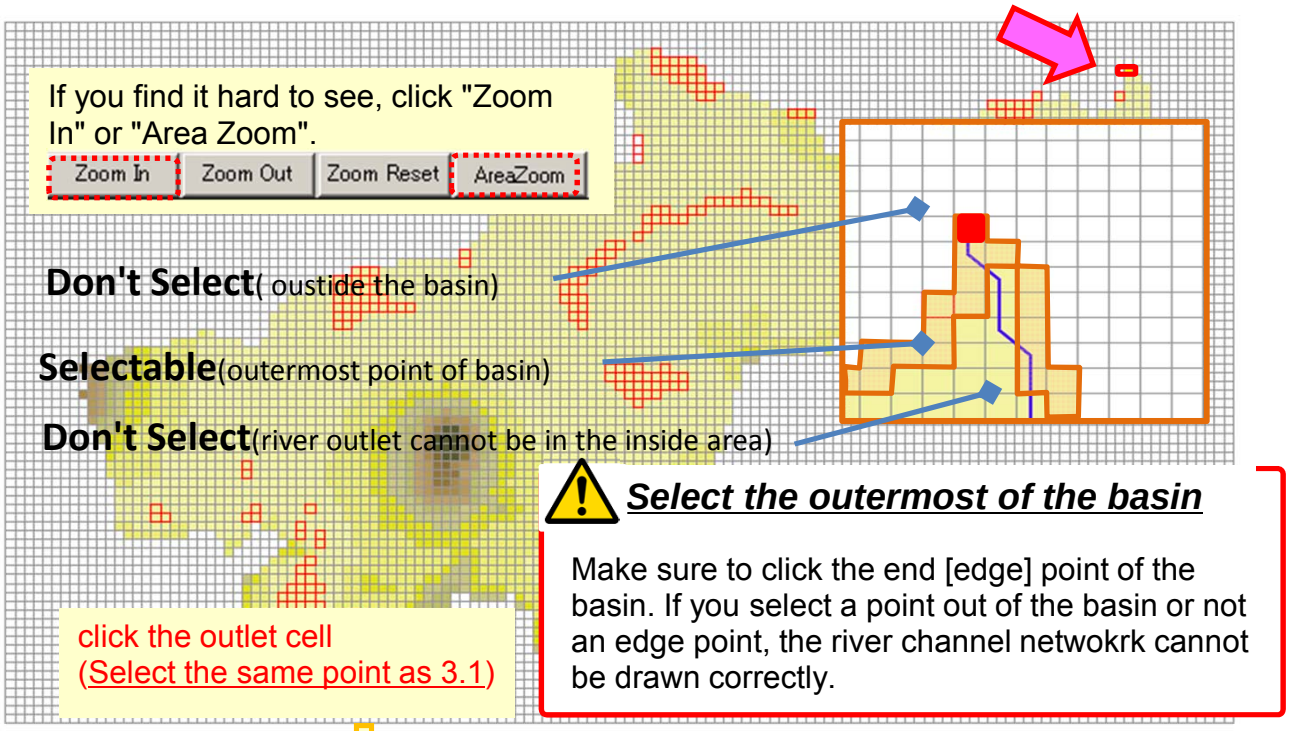


Cell type3 : over **11** cells



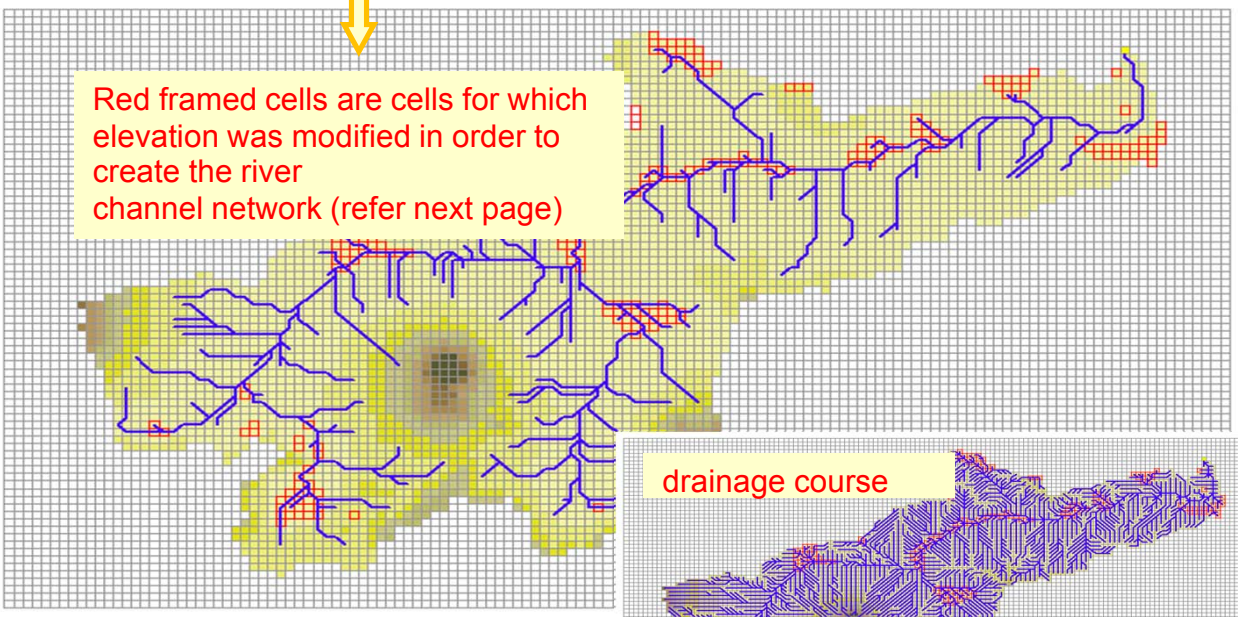
Cell type3 : over **65** cells

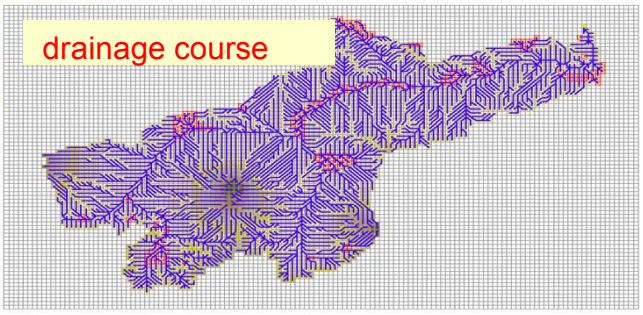




Select the outermost of the basin

Make sure to click the end [edge] point of the basin. If you select a point out of the basin or not an edge point, the river channel netwokrk cannot be drawn correctly.

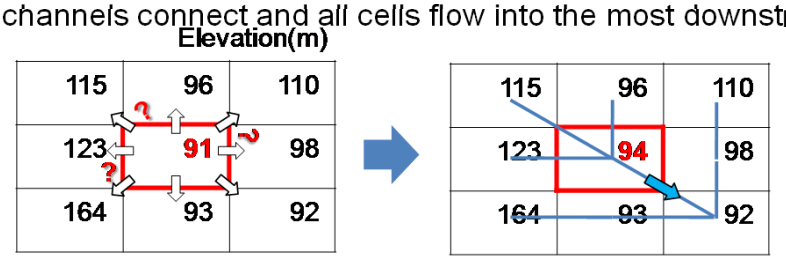




Advanced Learning

Modify elevation data

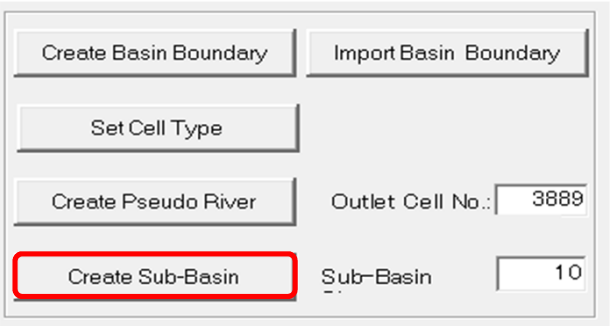
River channel network is created by elevation. Water flows to lower mesh, but sometimes there can be a cell in a depression, i.e. the cell elevation is the lowest compared to surrounding cells elevations. As a result, this cell cannot be connected to the drainage course.
IFAS has a function allowing to modify automatically the elevation of these disconnected cells in order to reconnect them to the drainage course. Thus, all river channels connect and all cells flow into the most downstream cell.

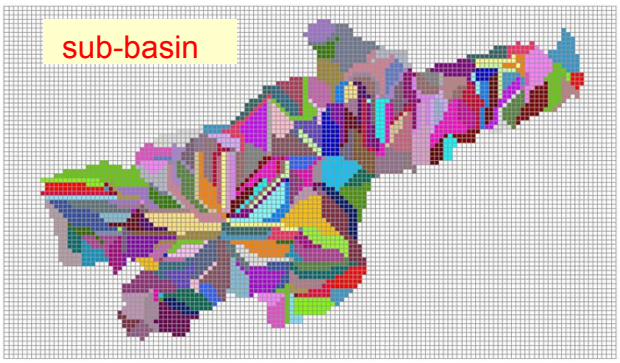


Lowest elevation compared to the surrounding cells.

Drainage course: **Not connected** **Connected**

3.3 Divide tributary basin

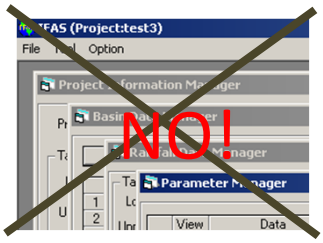




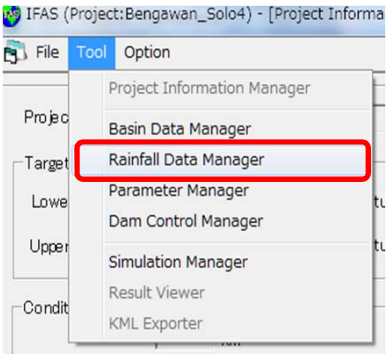
Don't forget to click "save" and "close"

Don't open several managers at the same time!!

You have to proceed with one manager at a time.
When you finish setting on one manager, you should always close this manager window first.
Then you can open another manager window.
If you open several manager windows at the same time, IFAS cannot run correctly.



4 Import Rainfall data



Satellite rainfall : 1. Download 2. Import
If you have Ground rainfall data : 1. Create CSV file 2. Import

"Download" is a function to get, via Internet, satellite based rainfall data which covers almost the whole world .
"Import" is a function to decompress downloaded files and pick up target area's data.

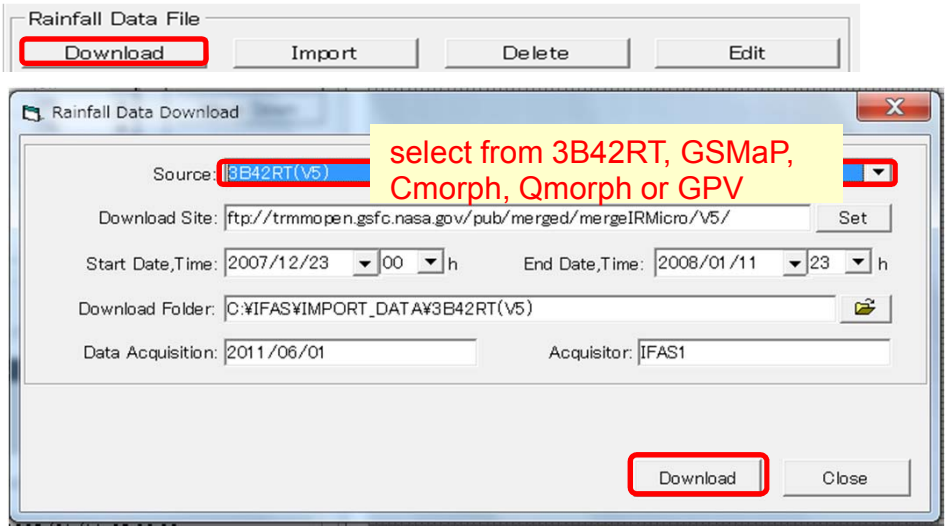
Size 3B42RT: 200KB, GSMaP: 900KB, Cmorph: 1100KB
GSMaP_MVK+(hourly) downloads data for the whole month. It can take a lot of time to download!! (**700MB**)

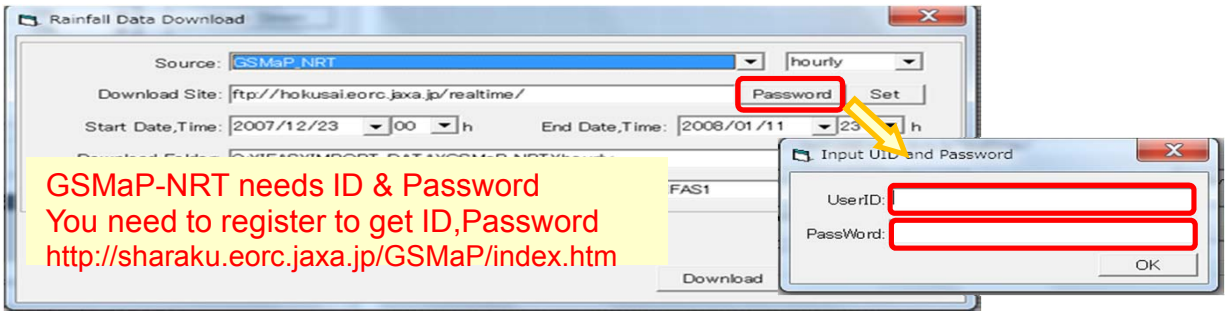
☆ Periods for which rainfall data are available

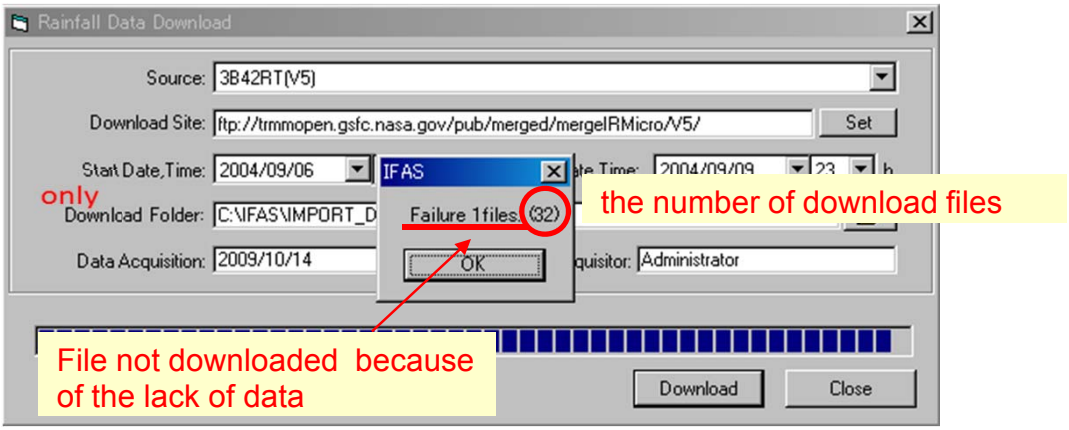
3B42RT(V5)	Feb2002	Feb2009
3B42RT(V6)	Oct2008	Present
GSMaP_MVK+	Jan2003 Dec2006	
GSMaP_NRT	Dec2007	Present
Cmorph, Qmorph	latest 2 weeks	

Jan～Nov 2007
GSMaP data not exist

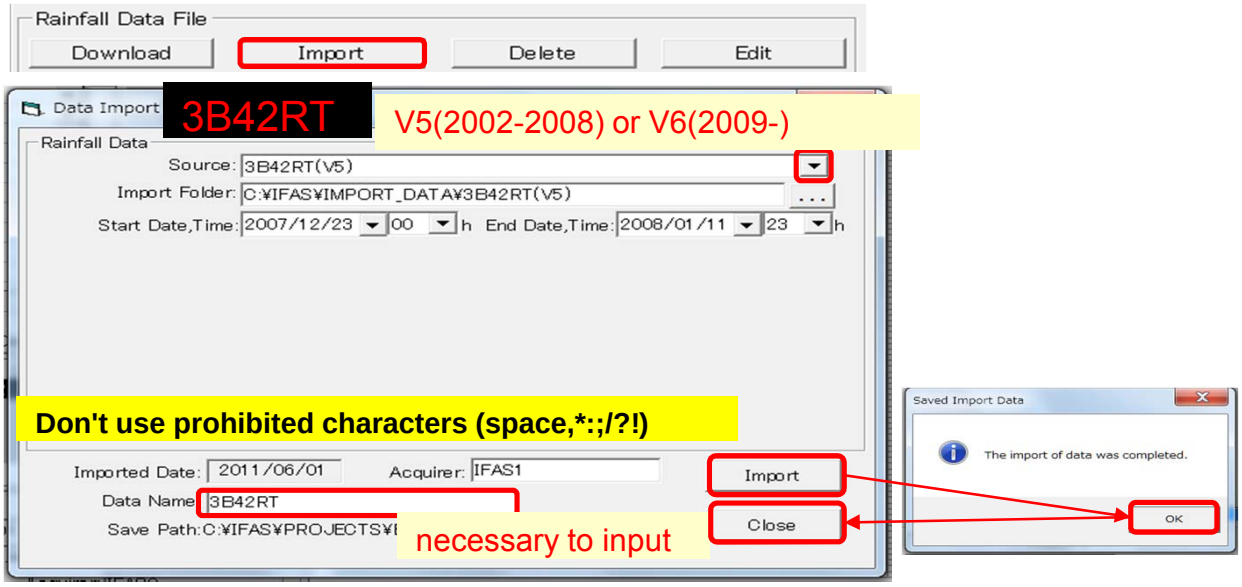
4.1 Download rainfall data - Need Internet connection -

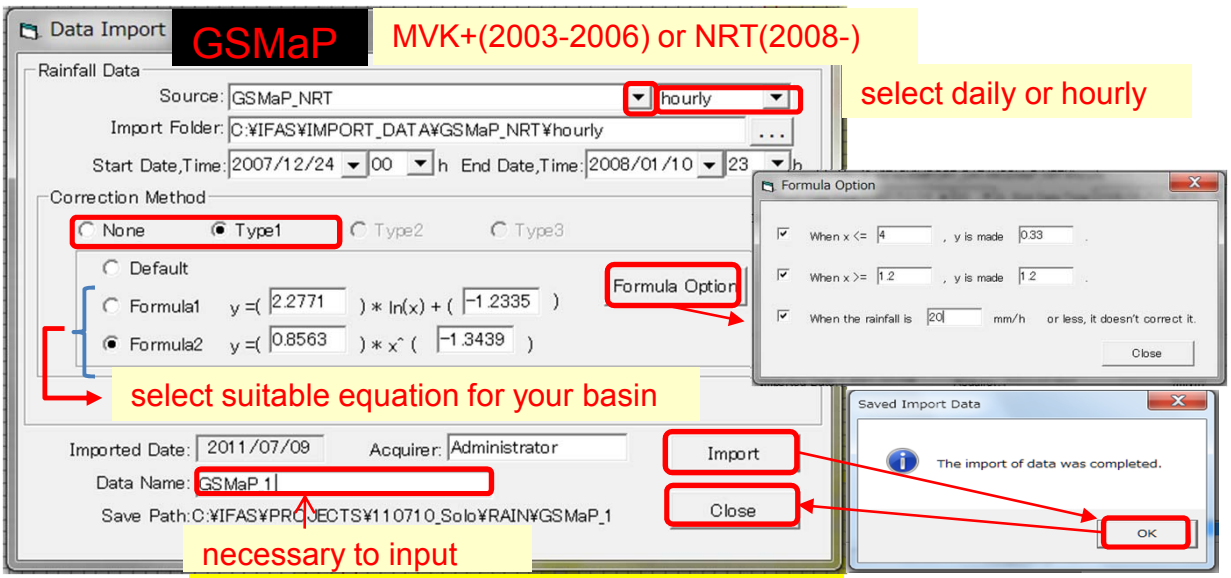






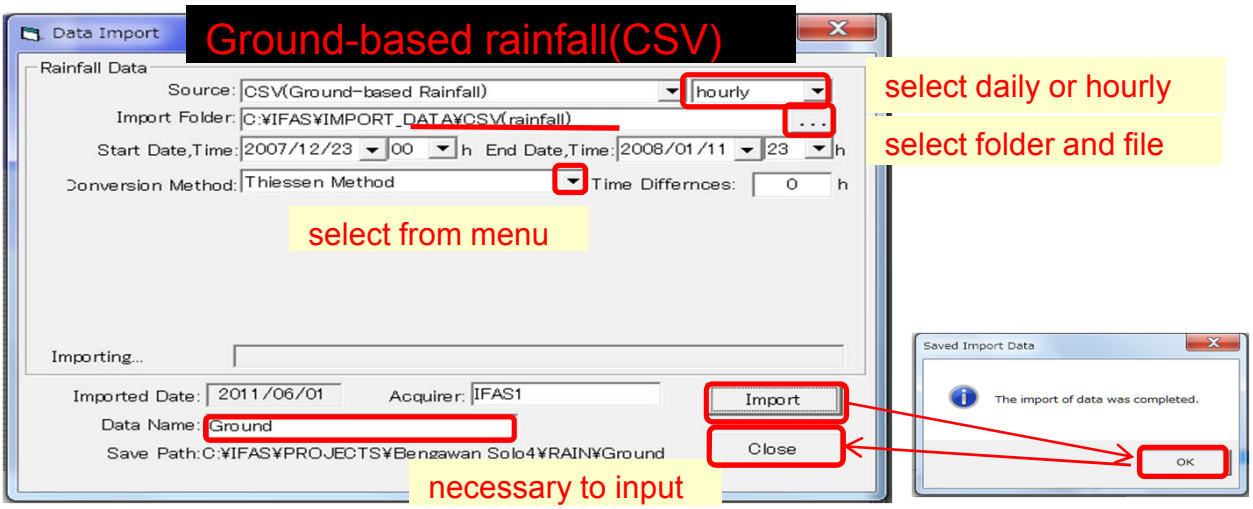
4.2 Import rainfall data



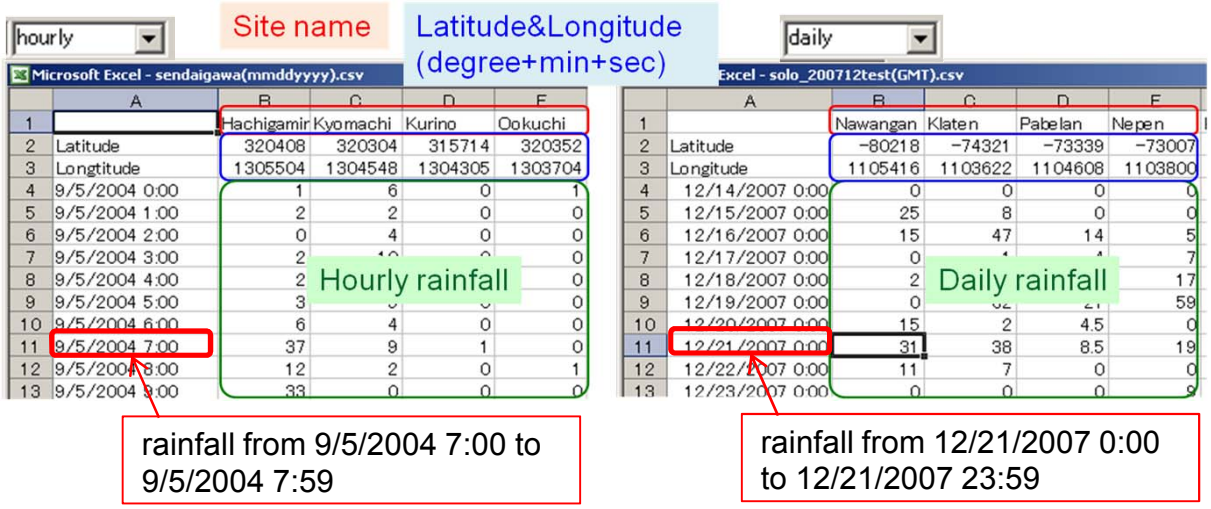


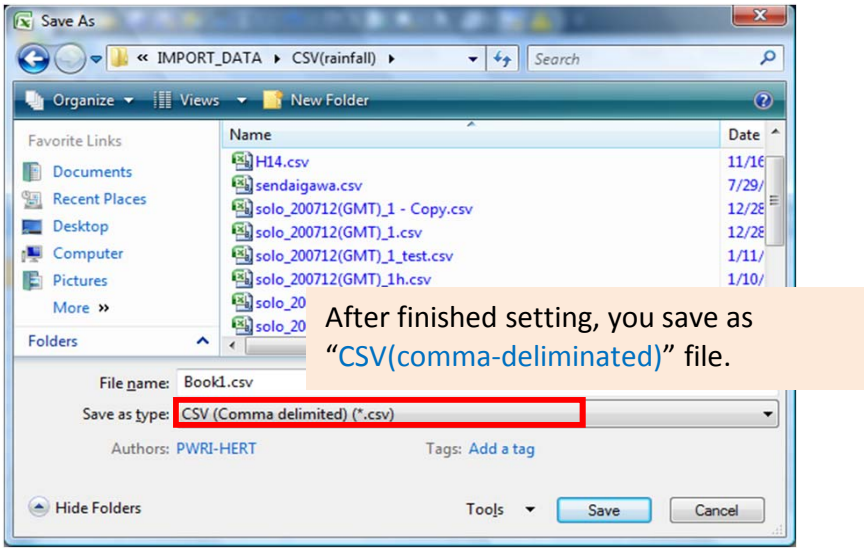
None: observed(original) value
Type1: correction method considering the movement of rain area

⚠ ***Click "Close" before importing other rain product***



★ How to create CSV data?





In case of "read error"

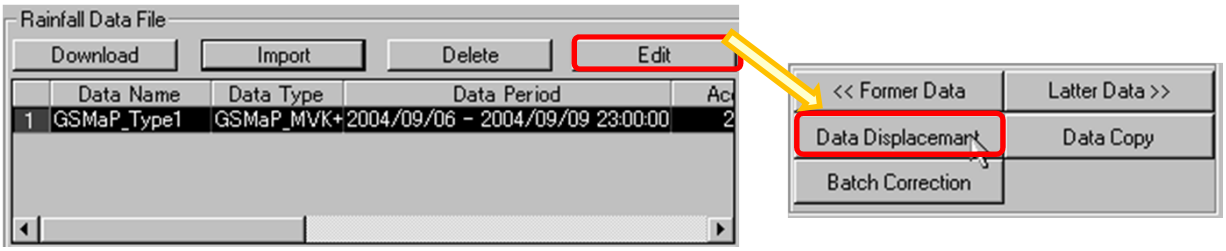
Sometimes, all the values in a rainfall file are "0" though IFAS imported CSV data with no error. (Files are saved as /IFAS/Projects/[your project]/RAIN/[data name])

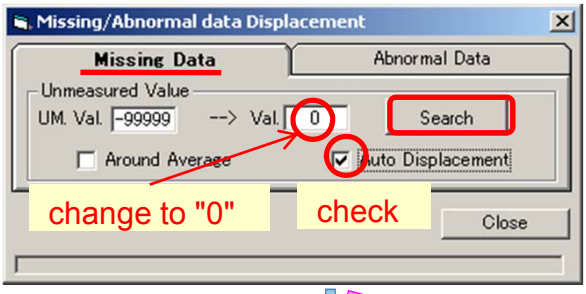
1. Did you select "hourly" or "daily" correctly?
2. Please check relations between project period and daily CSV time. (refer table)
3. In case of south latitude and west longitude, insert "-".
4. In case of Project time step = 60min, CSV rainfall = Daily, rainfall is divided into 24 identical hourly files. (24 files are created)

	Project period	Daily CSV format	Time difference	Import
Base	Sep6 0:00 - Sep9 23:00	Sep6 0:00 – Sep9 0:00	0	OK
	Sep6 0:00 - Sep9 23:00	Sep6 7:00 – Sep9 7:00	7	OK
	Sep6 7:00 – Sep10 6:00	Sep6 7:00 – Sep9 7:00	0	OK
	Sep6 0:00 - Sep9 23:00	Sep6 7:00 – Sep9 7:00	0	NG

4.3 Replace of missing or abnormal data

Sometimes, satellite rainfall file has no data (-99999) or abnormal data.
IFAS can find those error data and change them into "0" or anything you want.

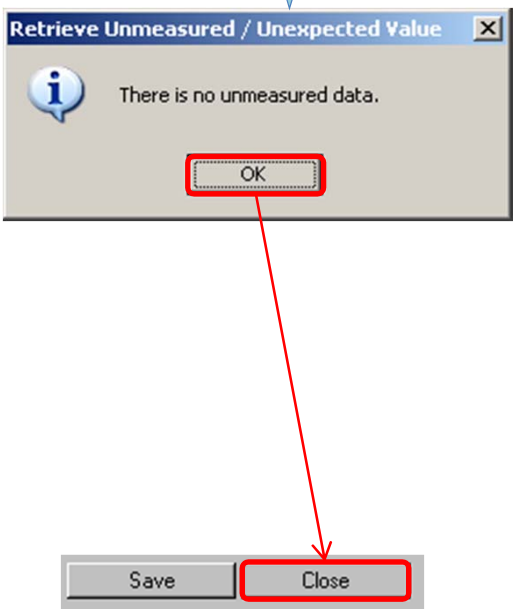


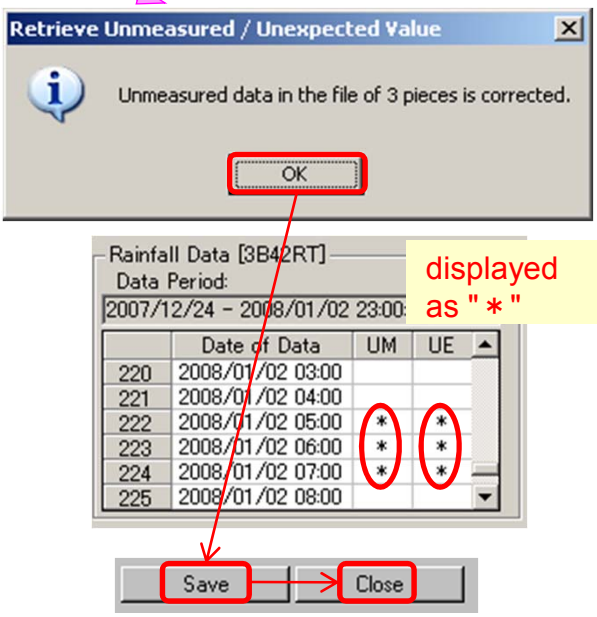


【caution】If there are still "-99999" values, an error message will appear in the check window

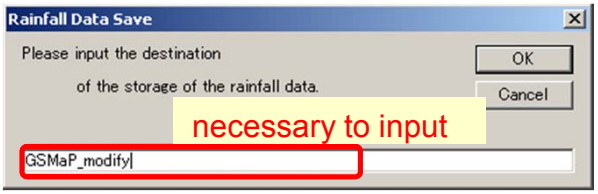
not found

found



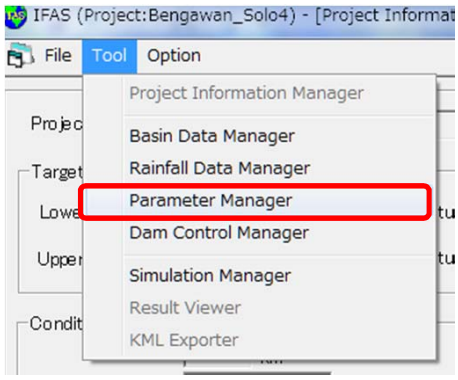


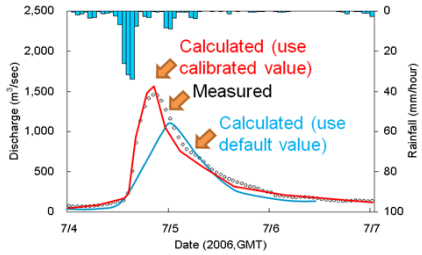
If rainfall data were replaced, Don't forget to save with a different name.



Close "Rainfall manager" before opening another manager.

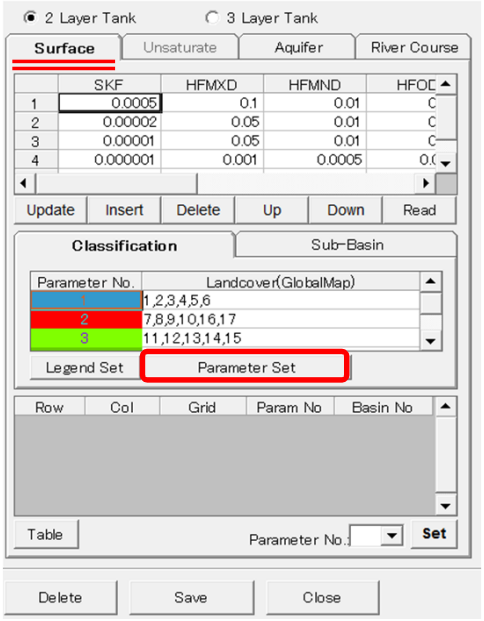
5 Parameter estimation

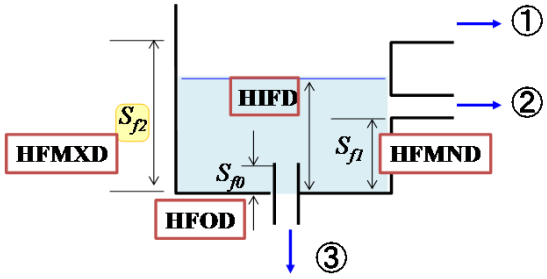




IFAS has a set of default parameter values, and you can use theses parameter values at first.
If you have Ground rainfall and Measured discharge data, you shall use them to calibrate parameter values.
→ see next page

5.1 Surface tank (from Land Use)



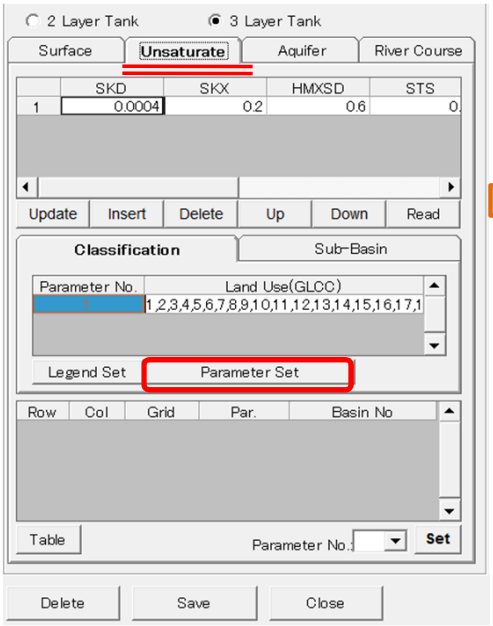


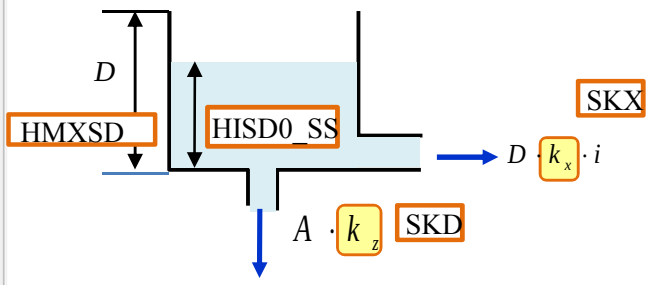
①Surface flow: $L\frac{1}{N}(h-S_{f_2})^{\frac{5}{3}}\sqrt{i}$ SNF

②Subsurface flow: $\alpha_n A f_0(h-S_{f_1})/(S_{f_2}-S_{f_1})$ FALFX

③Infiltration: $A f_0(h-S_{f_0})/(S_{f_2}-S_{f_0})$ SKF

5.2 Unsaturated layer tank (for 3 tanks engine)





STS : saturated moisture

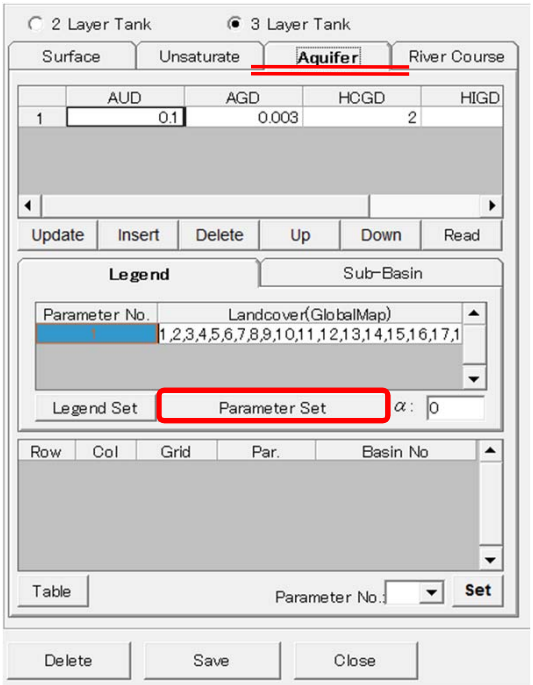
STW : minimum moisture

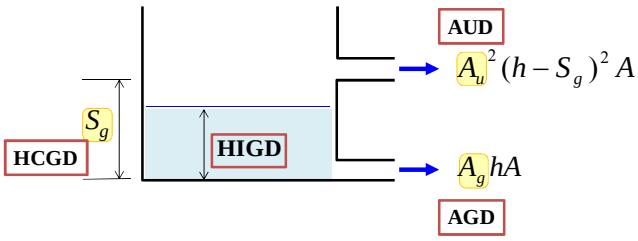
SBD : relationship Φ and θ

HISD0_SS : initial condition of moisture

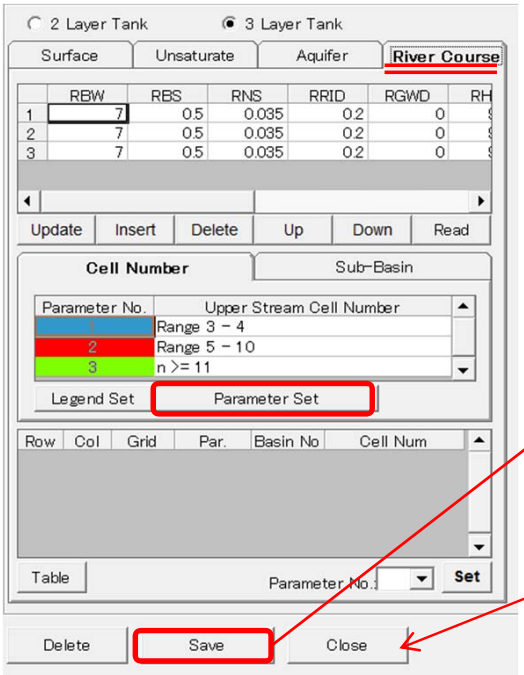
SK0D : initial coefficient of vertical saturation

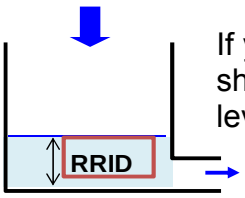
5.3 Groundwater tank





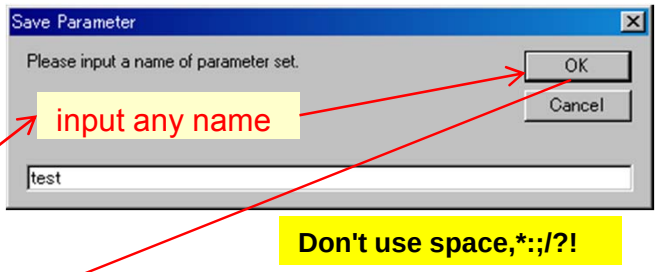
5.4 River course tank (from number of upper cells)





If you don't have river data, you should only change initial water level (RRID) value.

$$= B\frac{1}{n}h^{5/3}\sqrt{i}$$



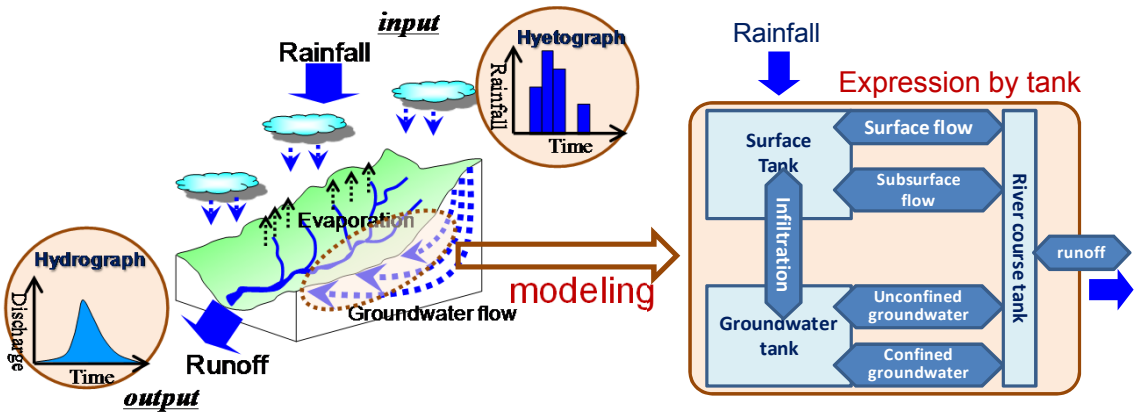
Close "Parameter manager" before opening another manager.

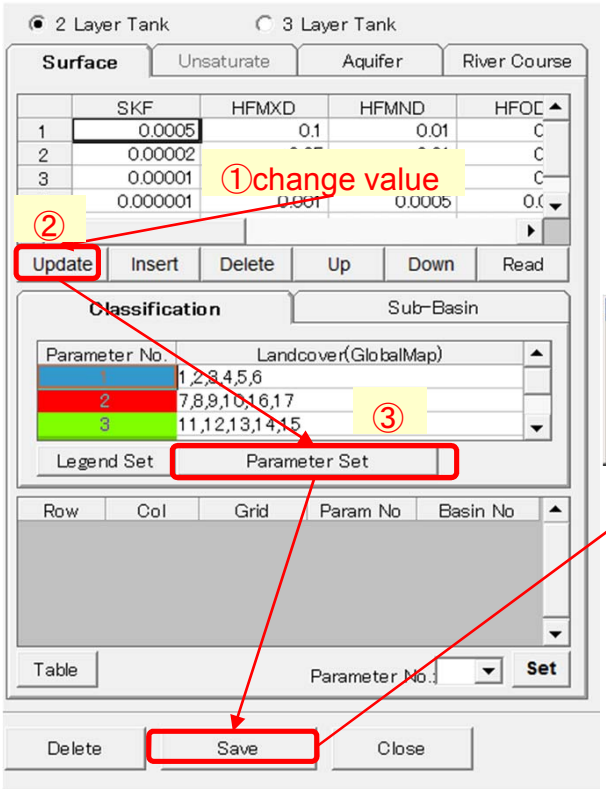
Advanced Learning

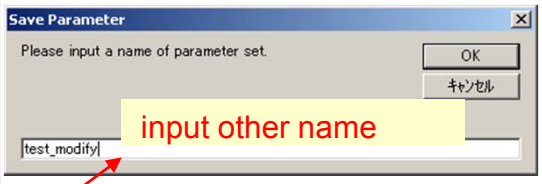
Parameter calibration

If you want to get more accurate results, it's better to calibrate parameters using Ground rainfall data and Measured discharge data. Details are given in the manual.

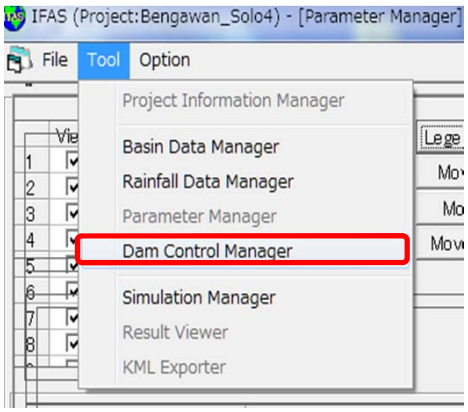
If you want to increase base flow, change AGD into a bigger value.
If you want to increase surface flow, change SKF into a smaller value (it decreases in infiltration flow) or HFMXD into a smaller value (it moves up the surface flow).







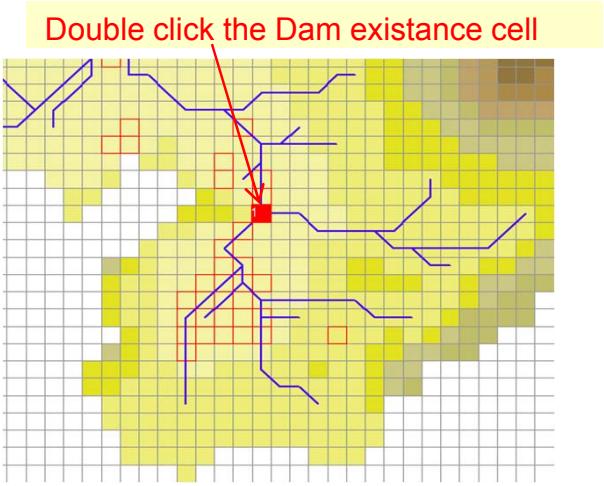
6 Flood control methods of Dam

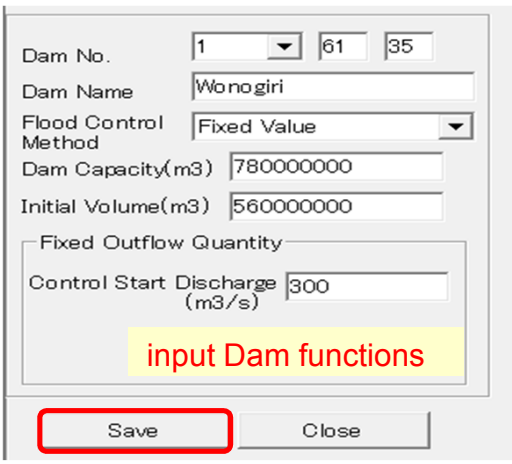


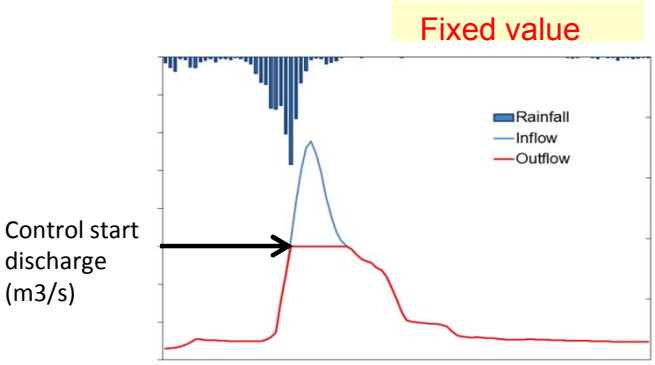
IFAS has a function making possible to consider flow control by dam, barrage or water intake facility.
During a flood event, flood control dam stores water in the dam reservoir. Thus, the flood peak is cut.

If there is no dam in your basin, skip this manager.

6.1 Set Dam control method

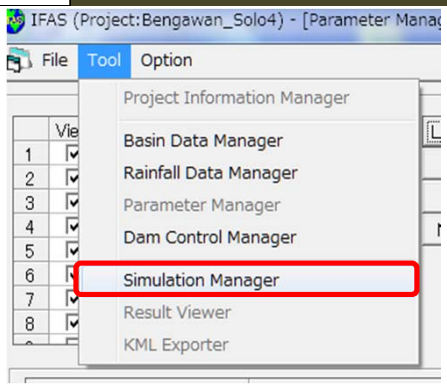




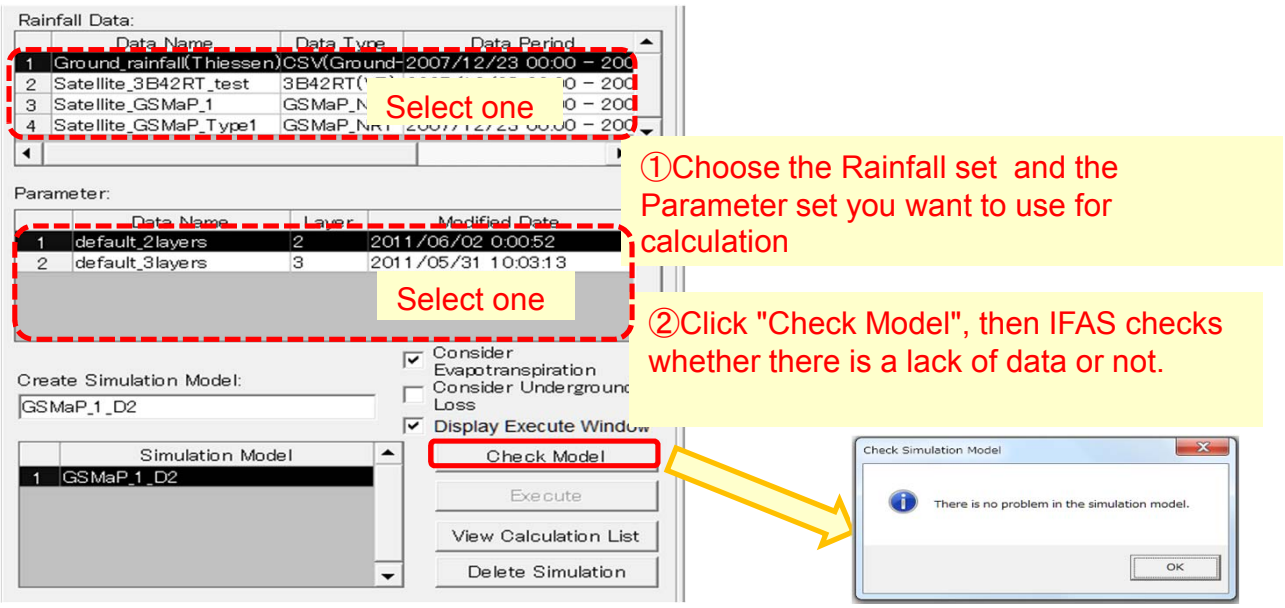


Close "Dam control manager" before opening another manager.

7 Execute calculation



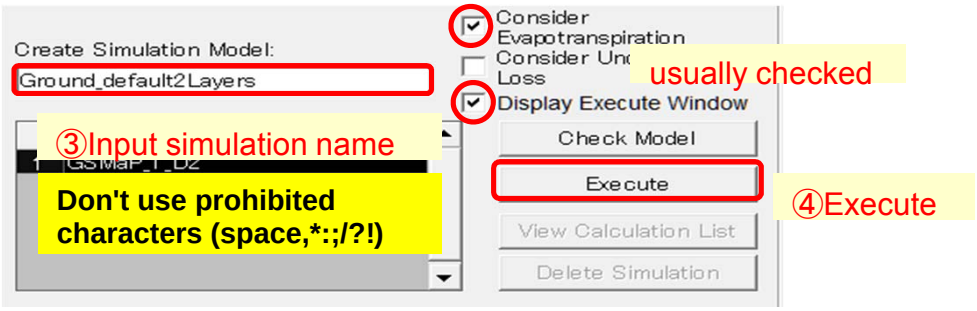
7.1 Check model before calculation



①Choose the Rainfall set and the Parameter set you want to use for calculation

②Click "Check Model", then IFAS checks whether there is a lack of data or not.

7.2 Execute calculation

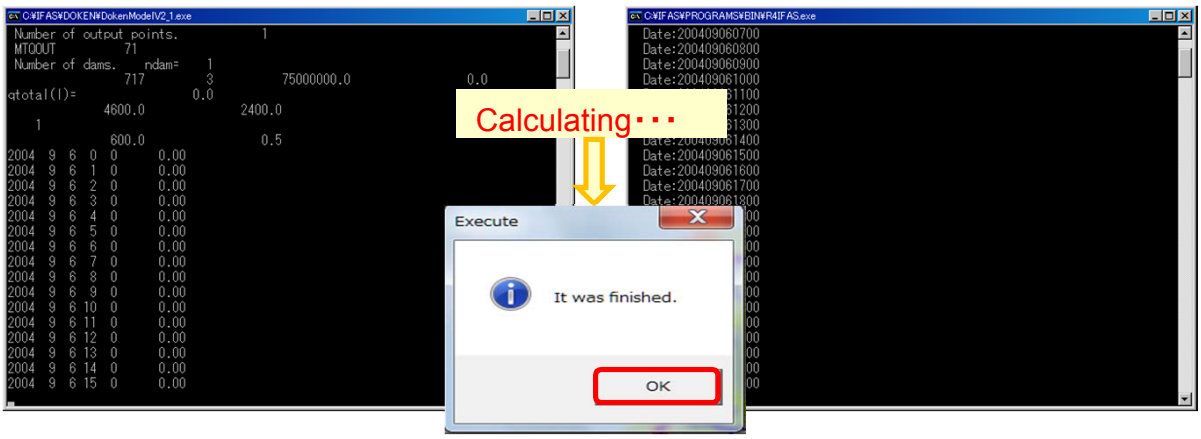


usually checked

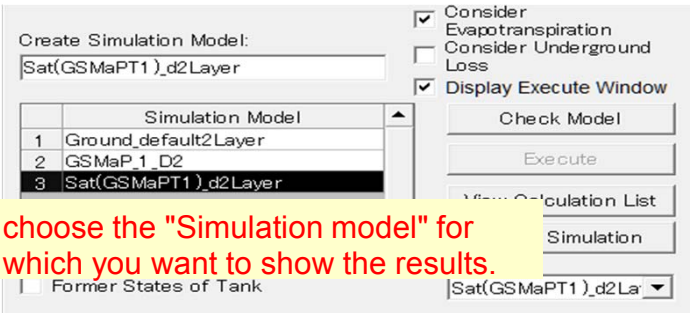
③Input simulation name

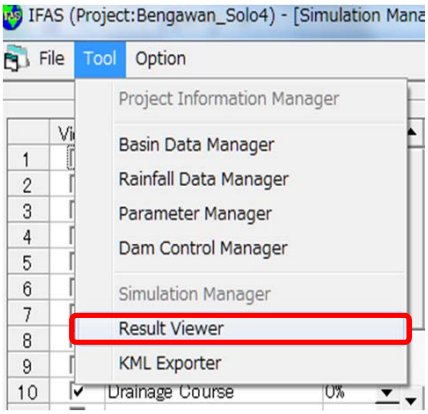
Don't use prohibited characters (space,*:;/?!)

④Execute



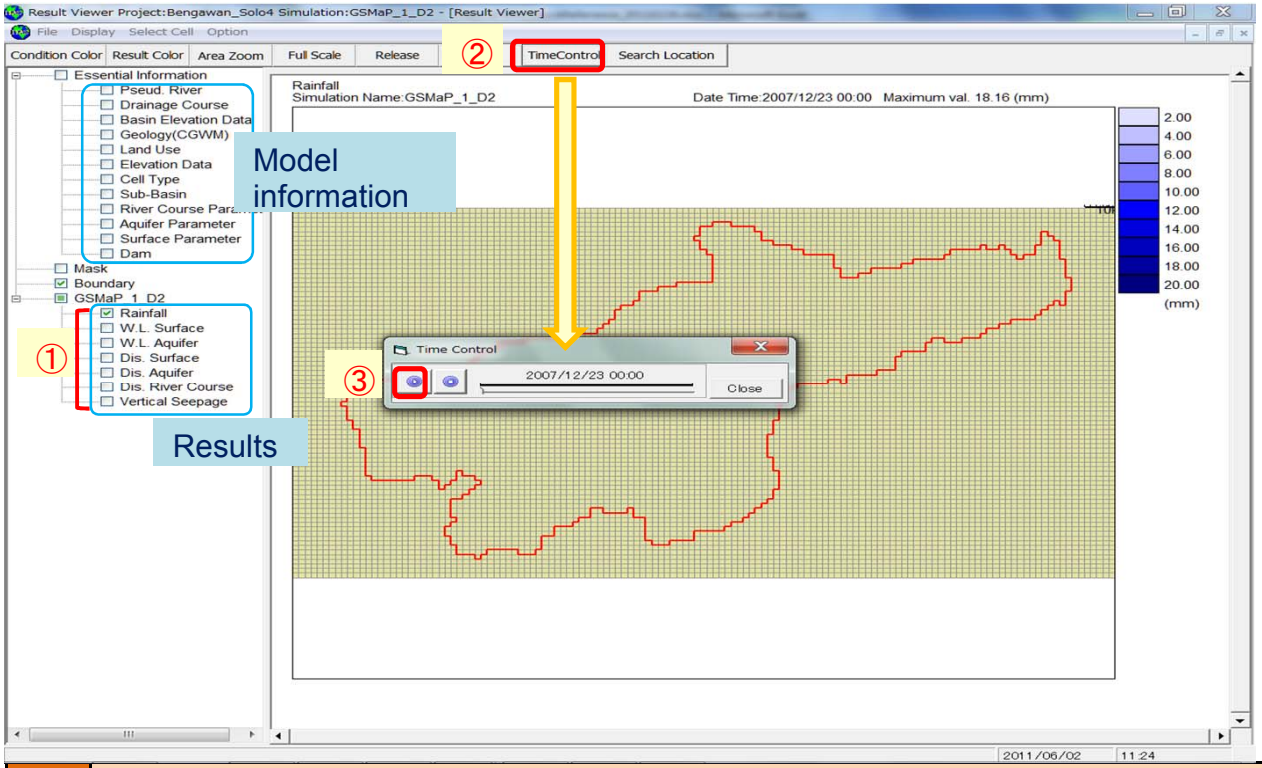
8 Result view





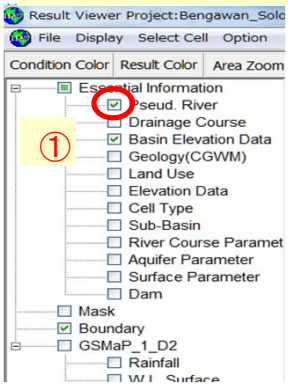
From here, there is no particular order.

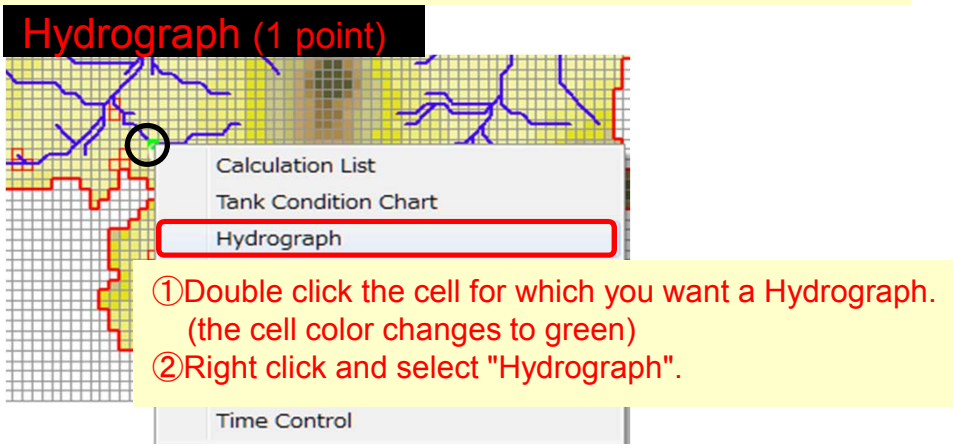
Plane view

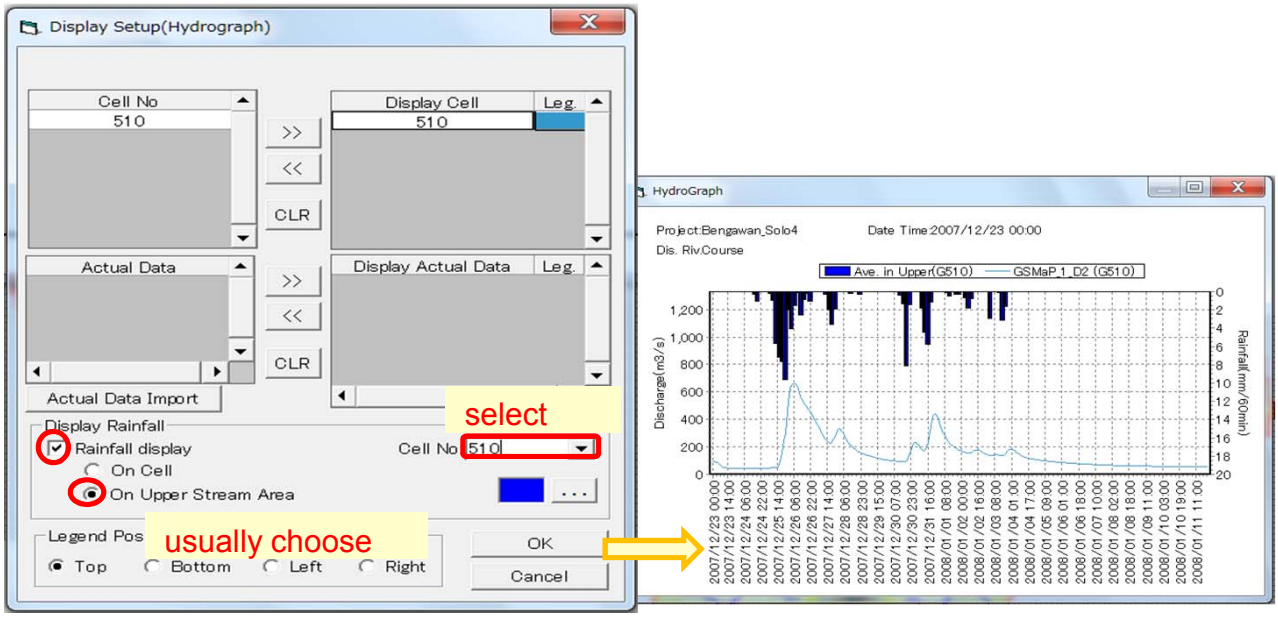


Hydrograph

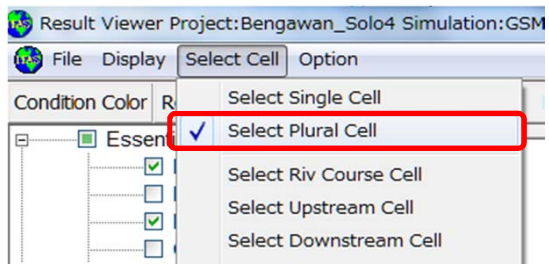
Discharge is calculated for each mesh. This feature enables IFAS to display calculation results for any given point.

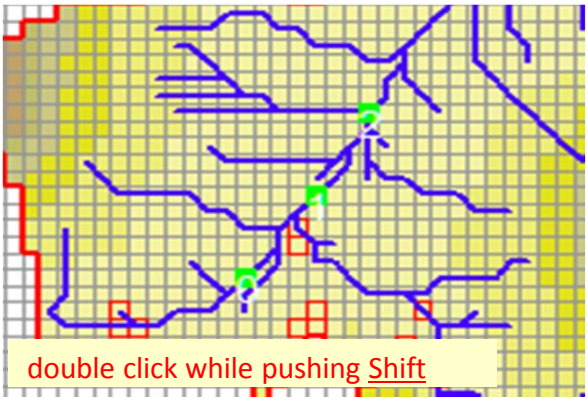


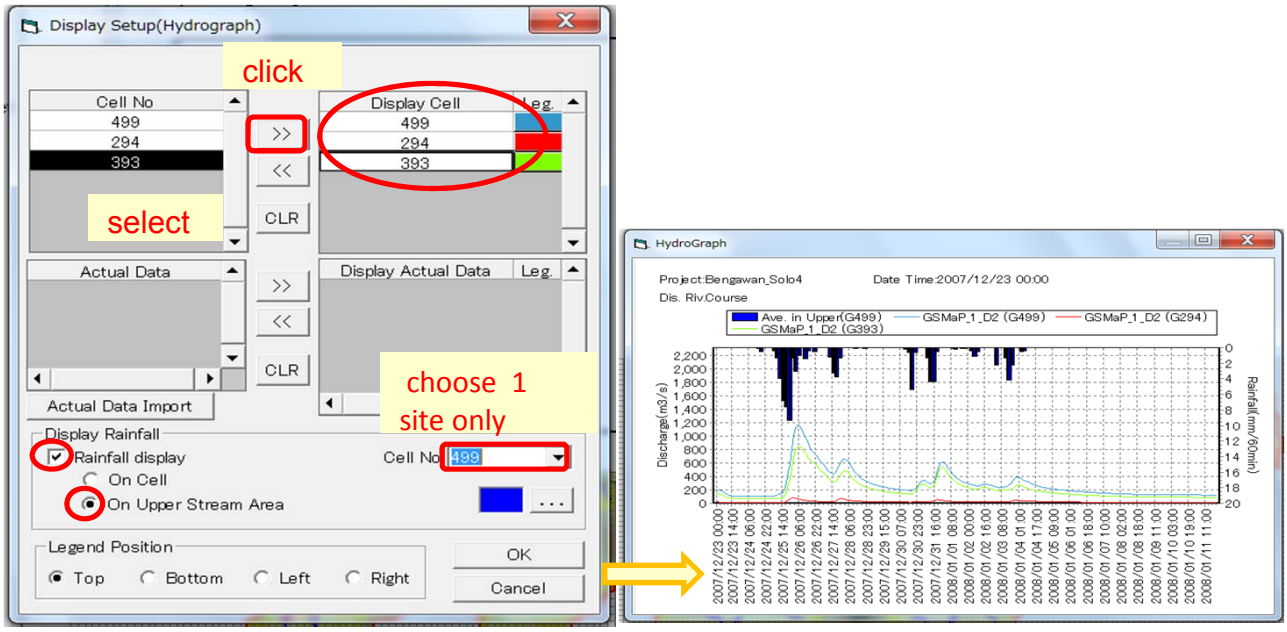




Hydrograph (several points)

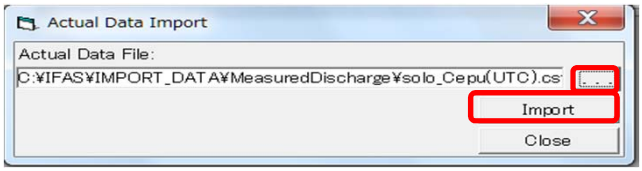


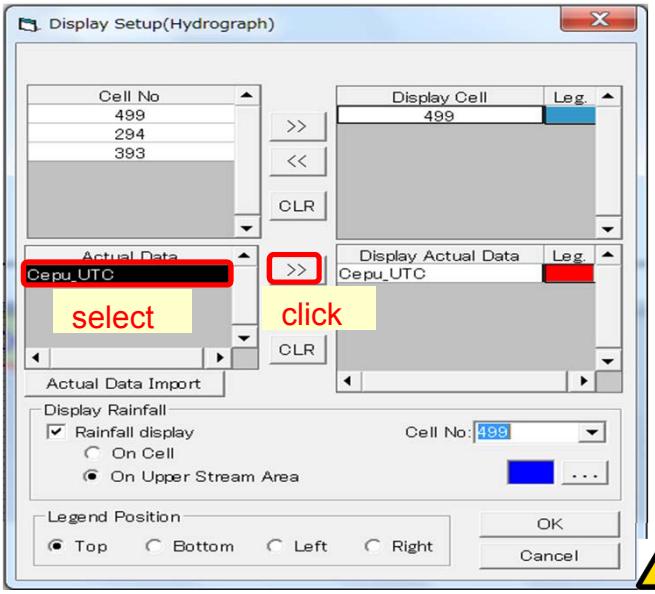




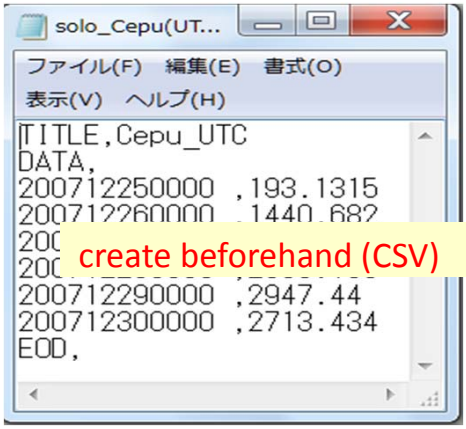
Hydrograph
(calculate + observed)

If you want to compare calculation results with measured discharge, click **"Actual Data Import"** Actual Data Import





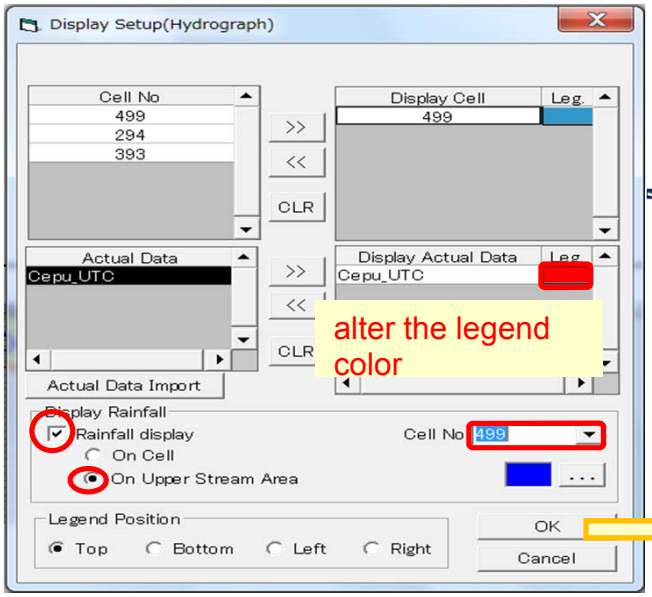
Measured Discharge (CSV)

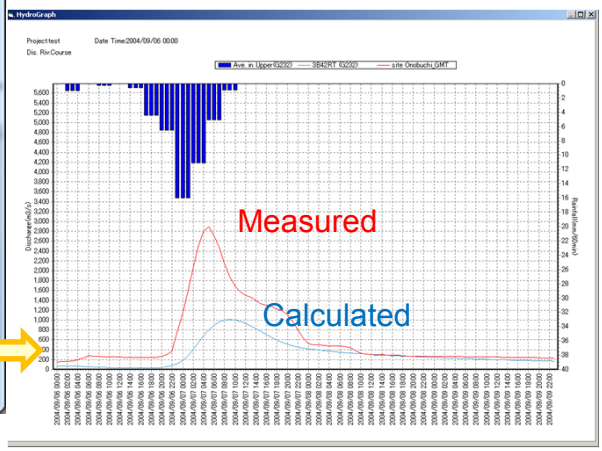


TITLE, [name]
DATA,
YYYYMMDDhhmm , [value1]
YYYYMMDDhhmm , [value2]
……
YYYYMMDDhhmm , [valueX]
EOD,

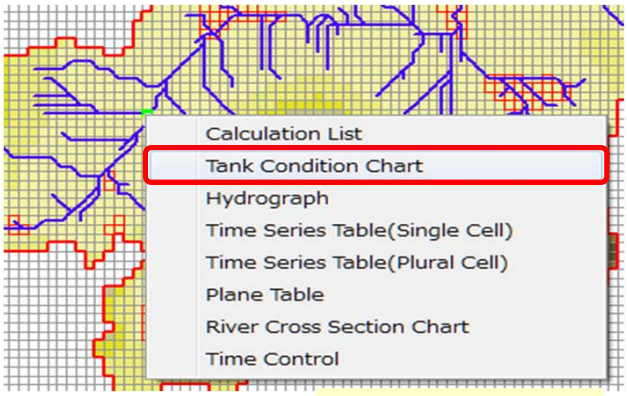
Order of date

When you create time series data for measured discharge with Excel, please pay special attention to the order of dates. After creation, please check with Notepad.

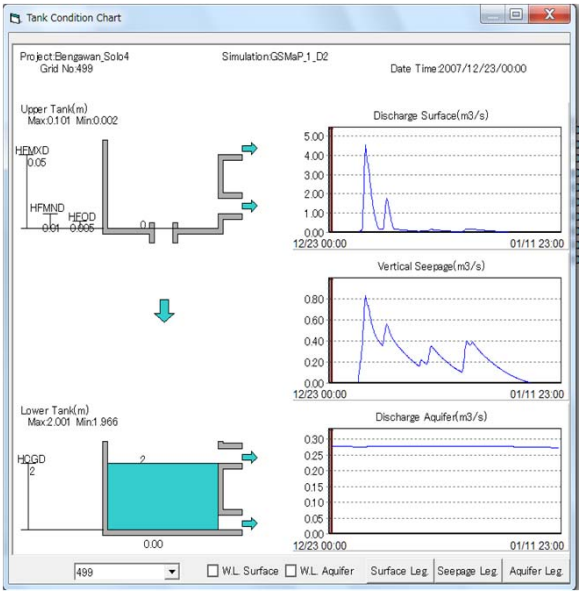




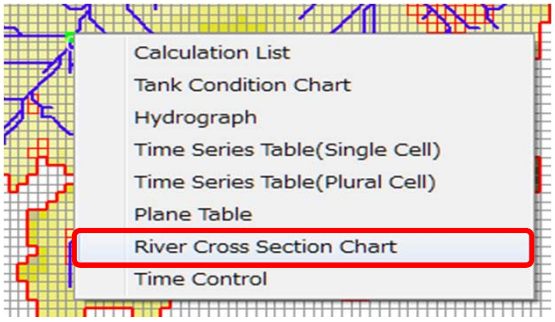
Tank condition



You can also see time series

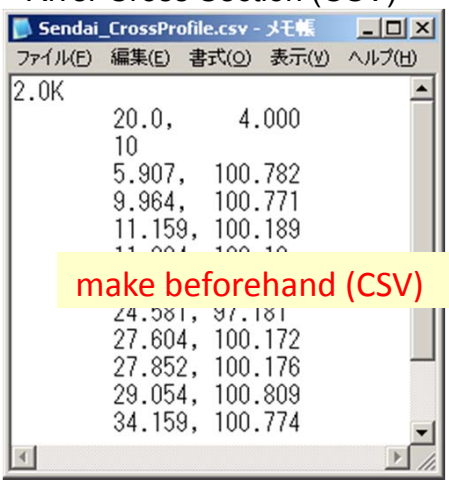


River cross section

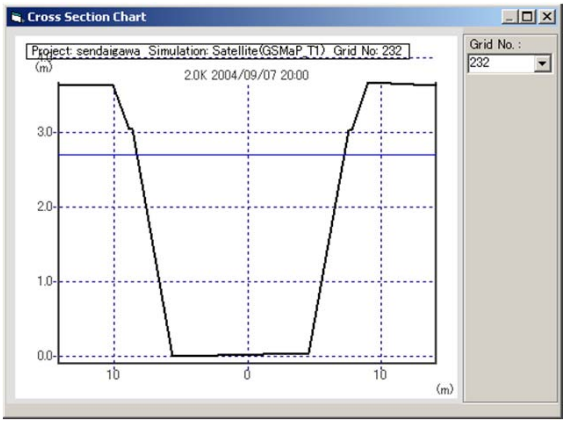


【caution】water level is calculated from H-Q curve. Cross section chart is displayed only image. (It isn't considered configuration)

River Cross Section (CSV)



make beforehand (CSV)



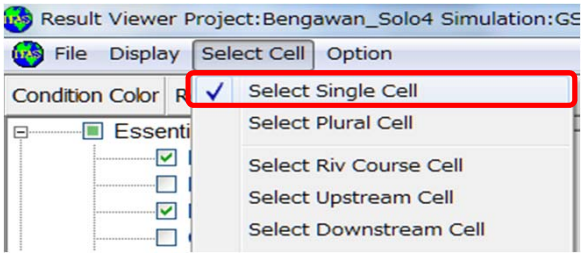
You can also see time series

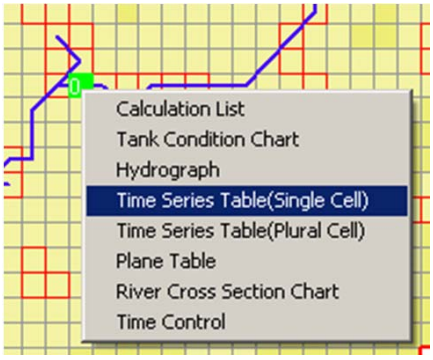
$$H = \sqrt{Q/a} - b$$

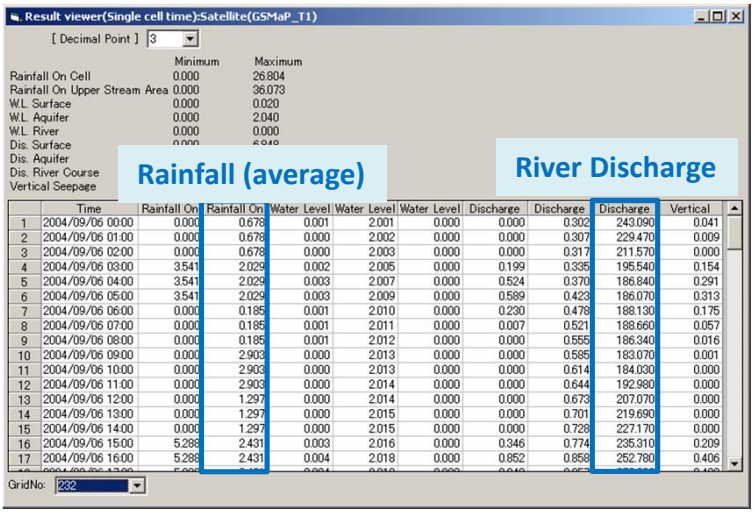
[site name]
a, b
[number of cross sections]
X_1, Y_1
X_2, Y_2
……
X_n, Y_n

Table

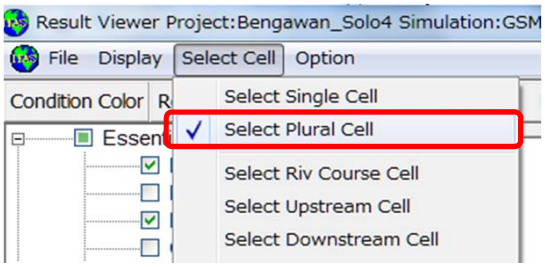
★ Single Cell

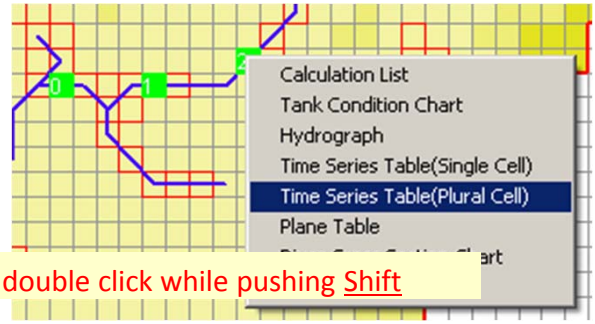


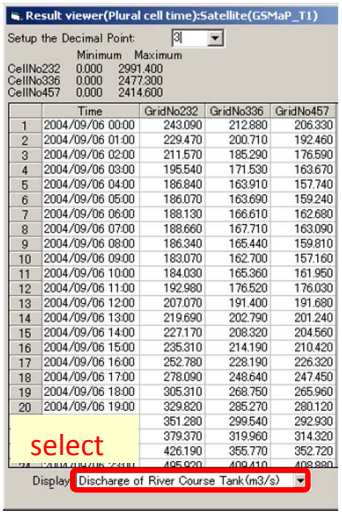




★ Several Cells







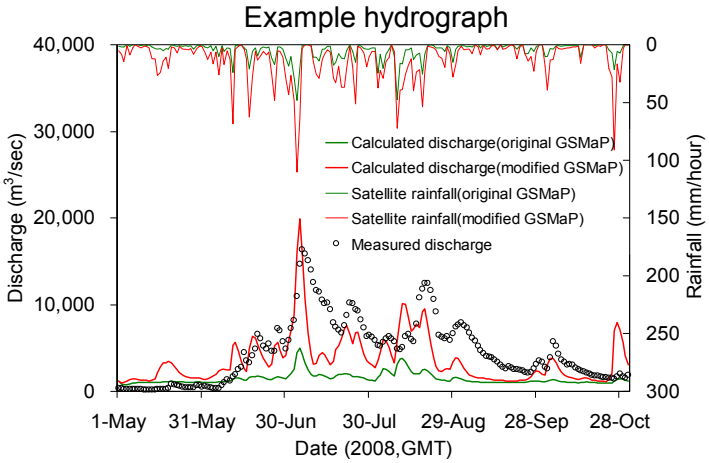
★ Proceed data on Excel

①select column

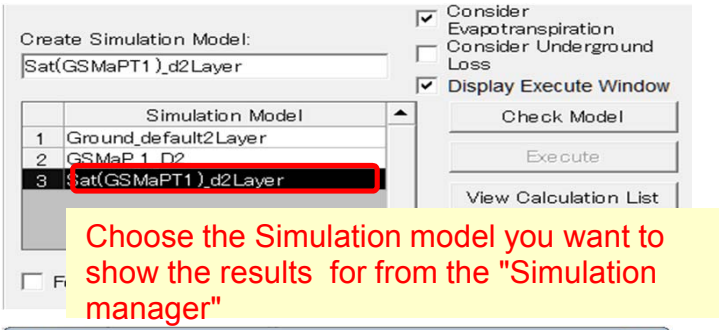
②copy Ctrl + C

③paste to Excel

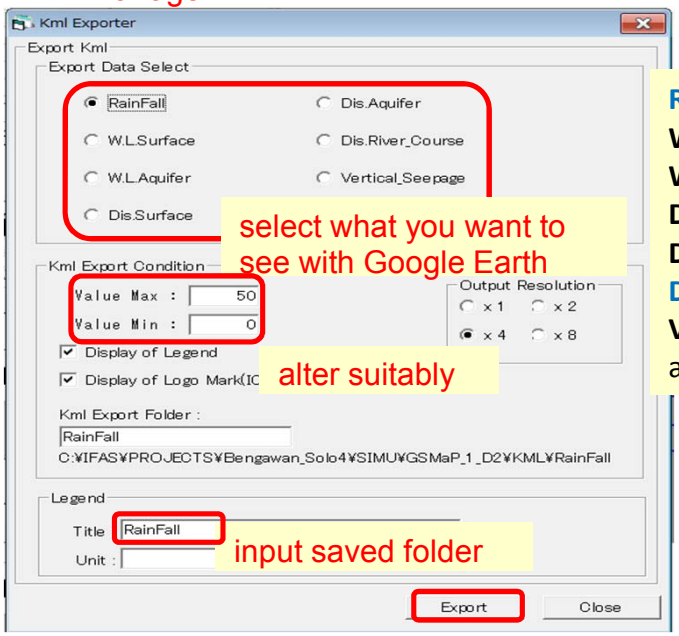
Ctrl + V



Google Earth



Choose the Simulation model you want to show the results for from the "Simulation manager"



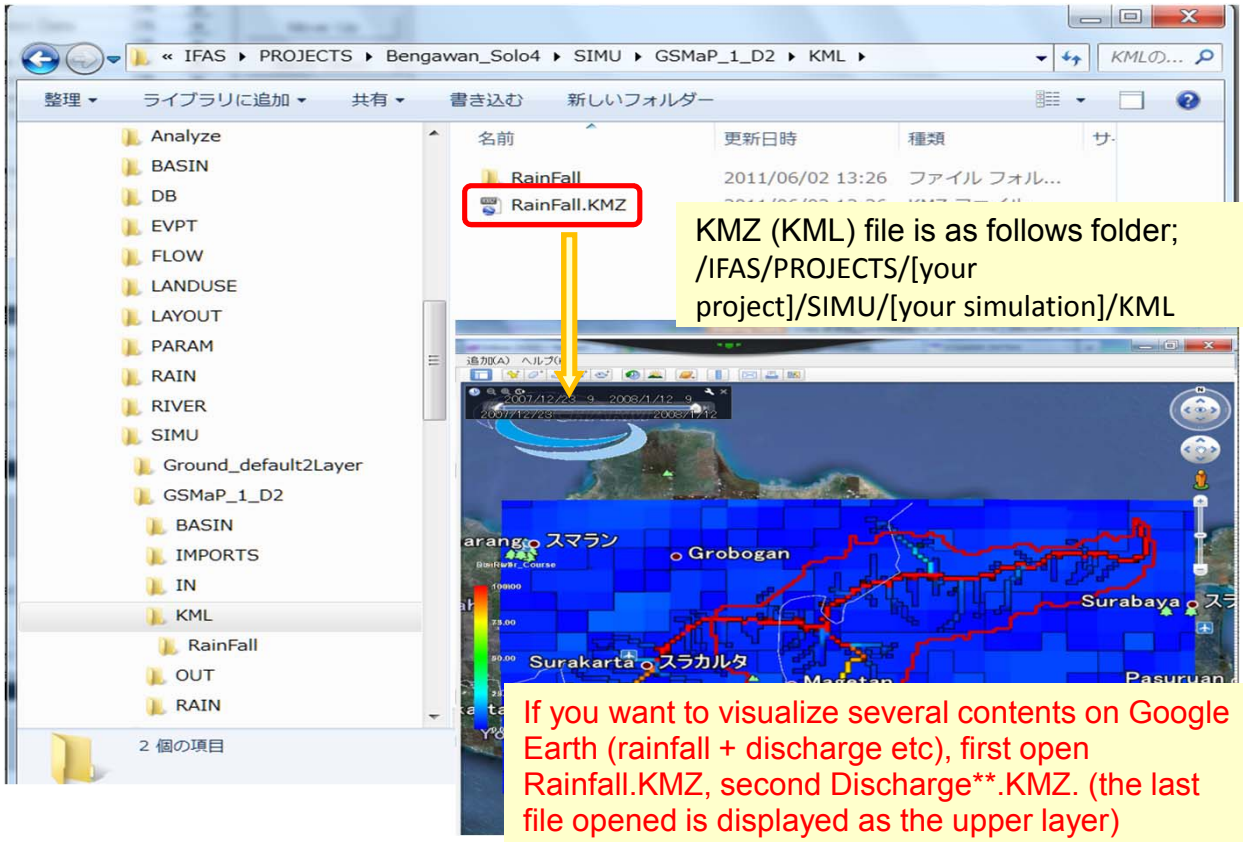
select what you want to see with Google Earth

alter suitably

input saved folder

Rainfall

W.L.Surface: water level of surface tank
W.L.Aquifer: water level of aquifer tank
Dis.Surface: discharge from surface tank
Dis.Aquifer: discharge from aquifer tank
Dis.River_Course: river discharge
Vertical_Seepage: infiltration surface to aquifer



KMZ (KML) file is as follows folder;
/IFAS/PROJECTS/[your project]/SIMU/[your simulation]/KML

If you want to visualize several contents on Google Earth (rainfall + discharge etc), first open Rainfall.KMZ, second Discharge**.KMZ. (the last file opened is displayed as the upper layer)

MEMO

MEMO

MEMO

MEMO

☆ Folder structure : Projects and Simulation (only primary folders)

- **IFAS**
  - **IMPORT_DATA**
    - Gtopo30
    - hydro1k
    - GlobalMap(Elevation)
    - DEM (whole world)
    - Landuse(GLCC)
    - GlobalMap(LandUse)
    - GlobalMap(LandCover)
    - Landuse (whole world)
    - BasinBoundary — If you have Basin shape data, insert them into this folder.
    - 3B42RT(V5)
    - 3B42RT(V6)
    - GSMaP_MVK+
    - GSMaP_NRT
    - Cmorph
    - Qmorph
    - Satellite rainfall — Click "Download" at "Rainfall Data Manager", rainfall data are downloaded and stored these folder.
    - CSV(rainfall) — If you have ground rainfall data, create a CSV file and save it here.
    - GPV — Forcast rainfall data
    - MeasuredDischarge — If you have measured discharge data, create a CSV file and save it here.
    - CrossSection — If you have cross section data, create a CSV file and save it here.

All the data downloaded are stored in this folder.
If you have measured data, create or convert them to a CSV file and save it for each folder.

- **Projects**
  - Projects_1 ・・・・・Basin: **A** Period: **Sep,2010**
  - Projects_2 ・・・・・Basin: **A** Period: **Jan,2011**
  - Projects_3 ・・・・・Basin: **B** Period: **Sep,2010**
    - ALD
    - BASIN
    - EVPT
    - FLOW
    - LANDUSE
    - PARAM
    - RAIN
    - Import data of target basin
    - Projects_3.ifasproj
    - **SIMU**
      - Simu_A ・・・・・Rain: **3B42RT** Parameter: **test1**
      - Simu_B ・・・・・Rain: **GSMaP_NRT** Parameter: **test2**
        - KML — KML file (see on Google Earth)

IFAS creates a Project for each "Basin" and "Period".

These files are saved as ".asc" format. If you have your own DEM or landuse data, you can replace the values, but don't change the header. (see manual)

Simulation is run as a combination of one rainfall data set and one parameter set. One Project has several Simulation models.

IFAS Quick Reference for ver 1.3
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