Choosing the IDF Source: Rain Gauge, Gridded or User Coefficients

MSMA 2nd Edition · https://mes100.com/docs/choosing-the-idf-source-in-mits/

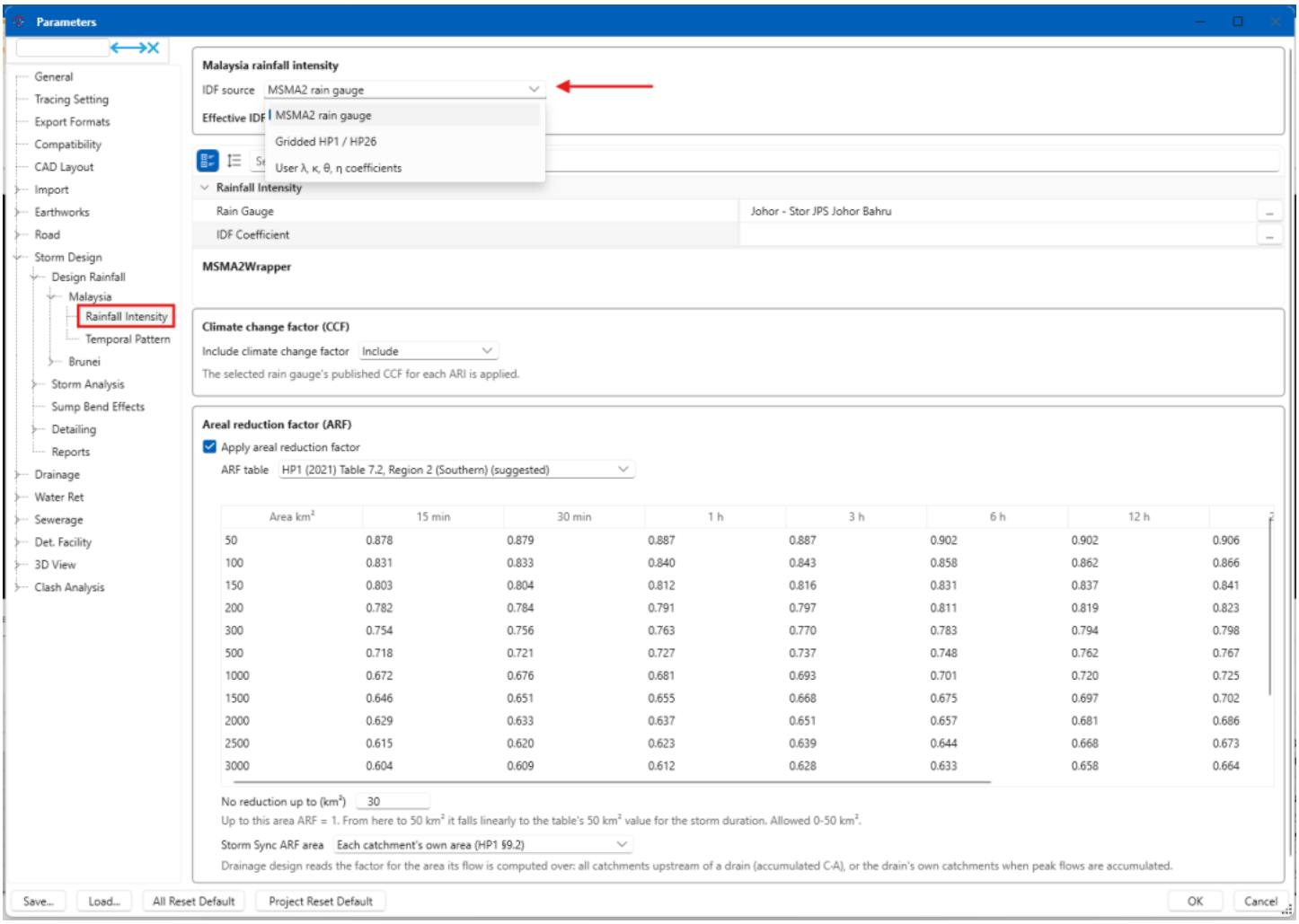
Every drain and catchment in Storm Design starts from a rainfall intensity, and that intensity comes from an IDF equation. The question this article answers is: whose coefficients go into that equation? The nearest published rain gauge, the HP1 or HP26 grid cell at your site, or values you were given for the job? MiTS now asks this once, through the **IDF source**, and prints the answer in every report.

In this article, we will go through where the setting is, what each source does to your design, and what happens to a project in which the rain gauge's coefficients have been edited before the implementation of this feature.

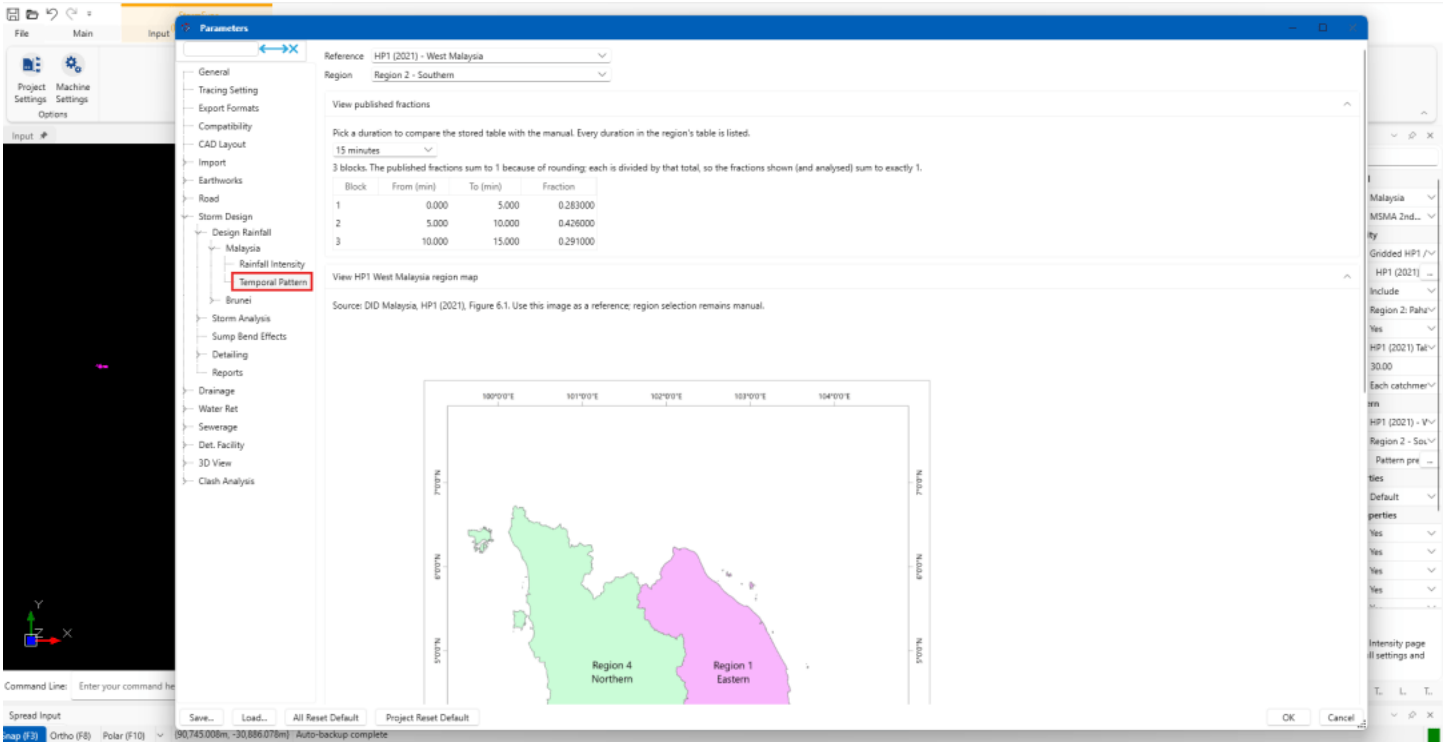
Where to set it

The rainfall settings are available in

> Options > Project Settings > Storm Design > Design Rainfall > Malaysia > Rainfall Intensity

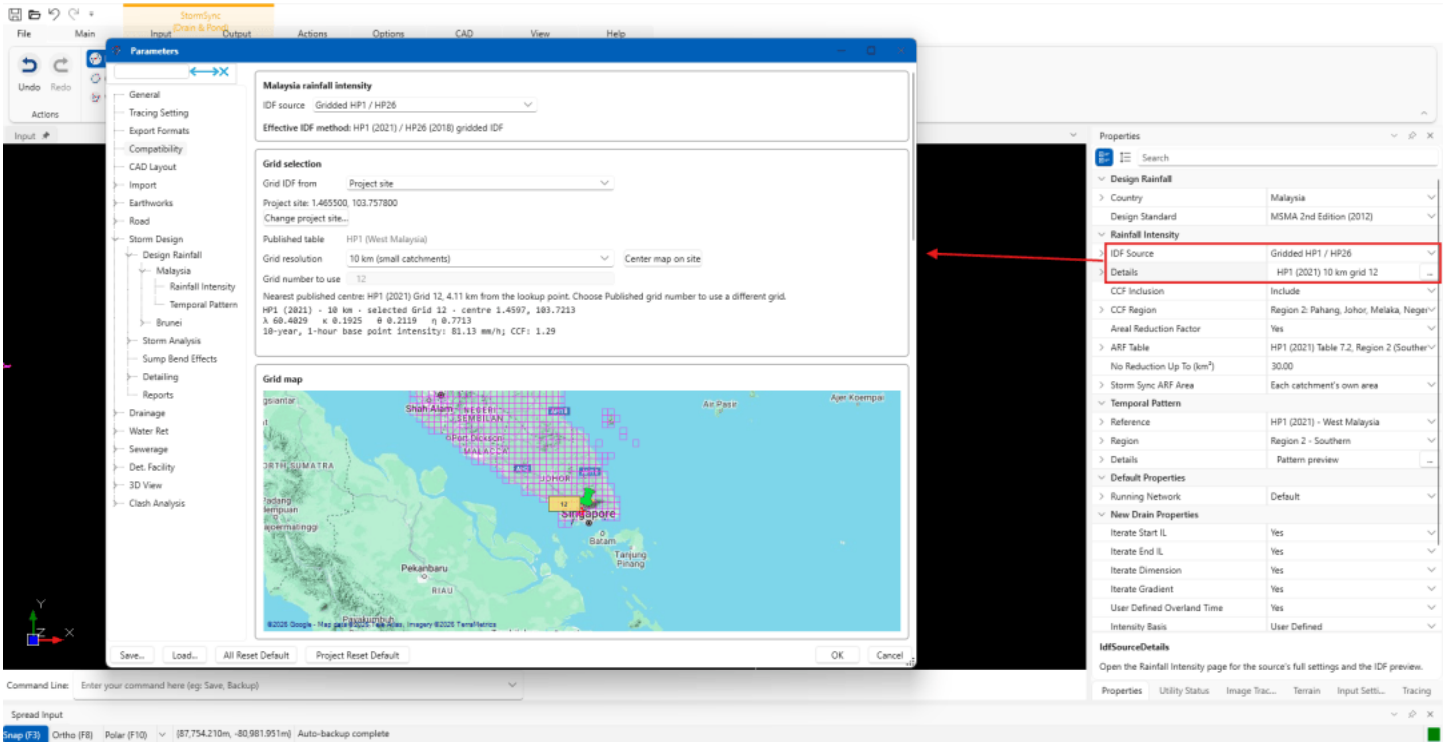


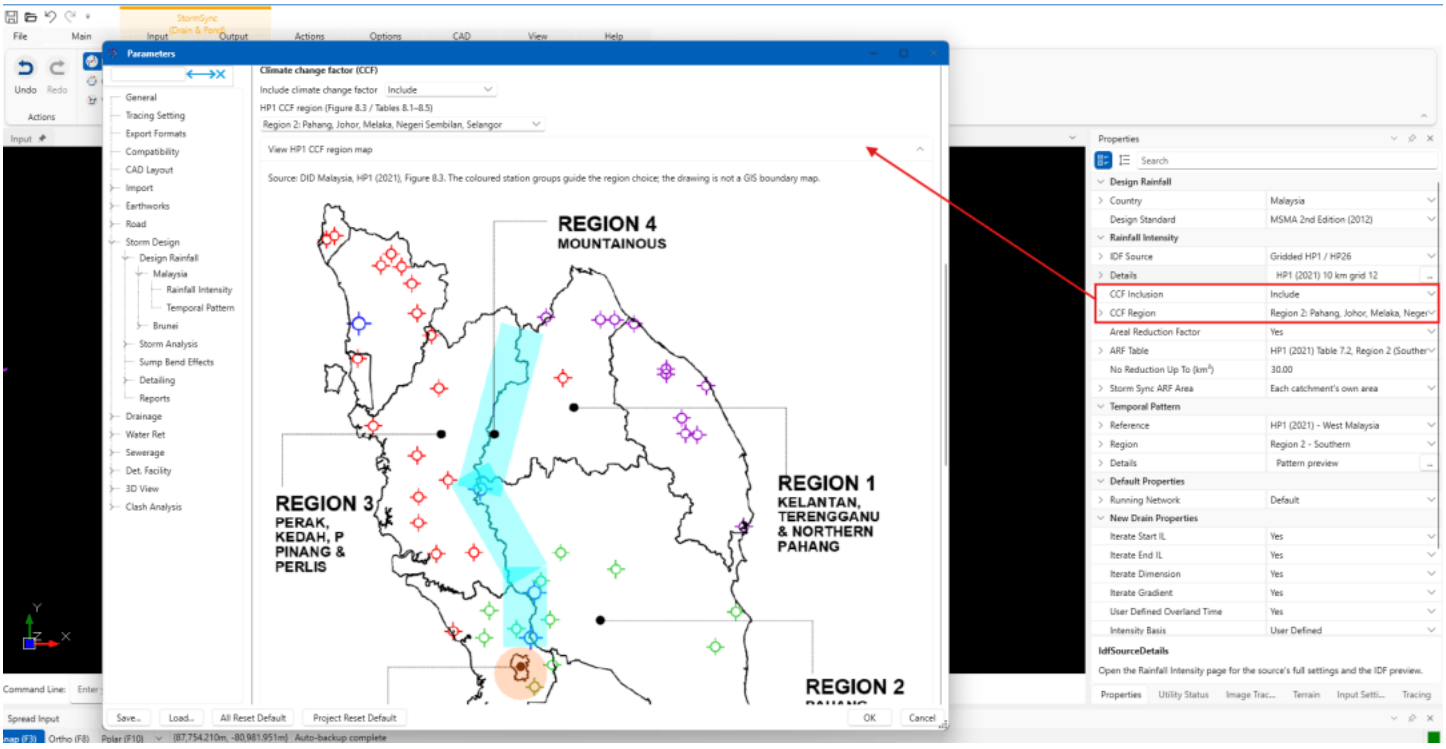
- **Design Rainfall** holds the **Country** (Malaysia or Brunei).
- **Malaysia** holds the **Design Standard**: MSMA 1st Edition (2000), MSMA 2nd Edition (2012) or MSMA 3rd Edition.
- **Malaysia > Rainfall Intensity** holds the **IDF source**, **CCF inclusion** and, when enabled, the **areal reduction factor (ARF)** and its table settings.
- **Brunei > Rainfall Intensity** holds its IDF source, CCF inclusion and ARF switch.
- **Malaysia > Temporal Pattern** holds the temporal-pattern reference and region. The pattern is chosen separately, so changing the IDF source does not change it. The one exception is a gridded cell that moves between HP1 and HP26: the reference then follows the cell, and you choose the region again.



For a new project, the same settings are set once in step 2 of Setting Up A New Project with Project Setup.

The same settings appear in the RHS panel when you click the Drain button: the **Design Rainfall** section (Country, Design Standard) and the **Rainfall Intensity** section (IDF Source, CCF Inclusion, the gauge or urban centre, and a **Details** row). For an HP1 gridded source, **CCF Region** also appears here, so you can select the HP1 region directly from the RHS panel. For Malaysia, the panel also shows **Areal Reduction Factor**; when it is on, review **ARF Table**, **No Reduction Up To (km²)** for HP1/HP26, and **Storm Sync ARF Area**. The "**…**" button on **Details** opens the Rainfall Intensity page for the settings that need more room.


Parameters
Malaysia rainfall intensity
IDF source Gridded HP1 / HP26
Effective IDF method: HP1 (2021) / HP26 (2018) gridded IDF
Grid selection
Grid IDF from Project site
Project site: 1.465500, 103.757800
Change project site...
Published table HP1 (West Malaysia)
Grid resolution 10 km (small catchments)
Center map on site
Grid number to use 12
Nearest published centre: HP1 (2021) Grid 12, 4.11 km from the lookup point. Choose Published grid number to use a different grid.
HP1 (2021) · 10 km · selected Grid 12 · centre 1.4597, 103.7213
λ 60.4829 κ 0.1925 θ 0.2119 η 0.7713
10-year, 1-hour base point intensity: 81.13 mm/h; CCF: 1.29
Grid map
Singapore
Pekanbaru
RIAU
Batam
Tanjung Pinang
Save...
Load...
All Reset Default
Project Reset Default
OK
Cancel
Properties
Design Rainfall
Country Malaysia
Design Standard MSMA 2nd Edition (2012)
Rainfall Intensity
IDF Source Gridded HP1 / HP26
Details HP1 (2021) 10 km grid 12
CCF Inclusion Include
CCF Region Region 2: Pahang, Johor, Melaka, Negeri
Areal Reduction Factor Yes
ARF Table HP1 (2021) Table 7.2, Region 2 (Souther
No Reduction Up To (km²) 30.00
Storm Sync ARF Area Each catchment's own area
Temporal Pattern
Reference HP1 (2021) - West Malaysia
Region Region 2 - Southern
Details Pattern preview
Default Properties
Running Network Default
New Drain Properties
Iterate Start IL Yes
Iterate End IL Yes
Iterate Dimension Yes
Iterate Gradient Yes
User Defined Overland Time Yes
Intensity Basis User Defined
IdfSourceDetails
Open the Rainfall Intensity page for the source's full settings and the IDF preview.


Parameters
Climate change factor (CCF)
Include climate change factor Include
HP1 CCF region (Figure 8.3 / Tables 8.1–8.5)
Region 2: Pahang, Johor, Melaka, Negeri Sembilan, Selangor
View HP1 CCF region map
Source: DID Malaysia, HP1 (2021), Figure 8.3. The coloured station groups guide the region choice; the drawing is not a GIS boundary map.
REGION 4
MOUNTAINOUS
REGION 3
PERAK, KEDAH, P PINANG & PERLIS
REGION 1
KELANTAN, TERENGGANU & NORTHERN PAHANG
REGION 2
Save...
Load...
All Reset Default
Project Reset Default
OK
Cancel
Properties
Design Rainfall
Country Malaysia
Design Standard MSMA 2nd Edition (2012)
Rainfall Intensity
IDF Source Gridded HP1 / HP26
Details HP1 (2021) 10 km grid 12
CCF Inclusion Include
CCF Region Region 2: Pahang, Johor, Melaka, Negeri
Areal Reduction Factor Yes
ARF Table HP1 (2021) Table 7.2, Region 2 (Souther
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Details Pattern preview
Default Properties
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Iterate Start IL Yes
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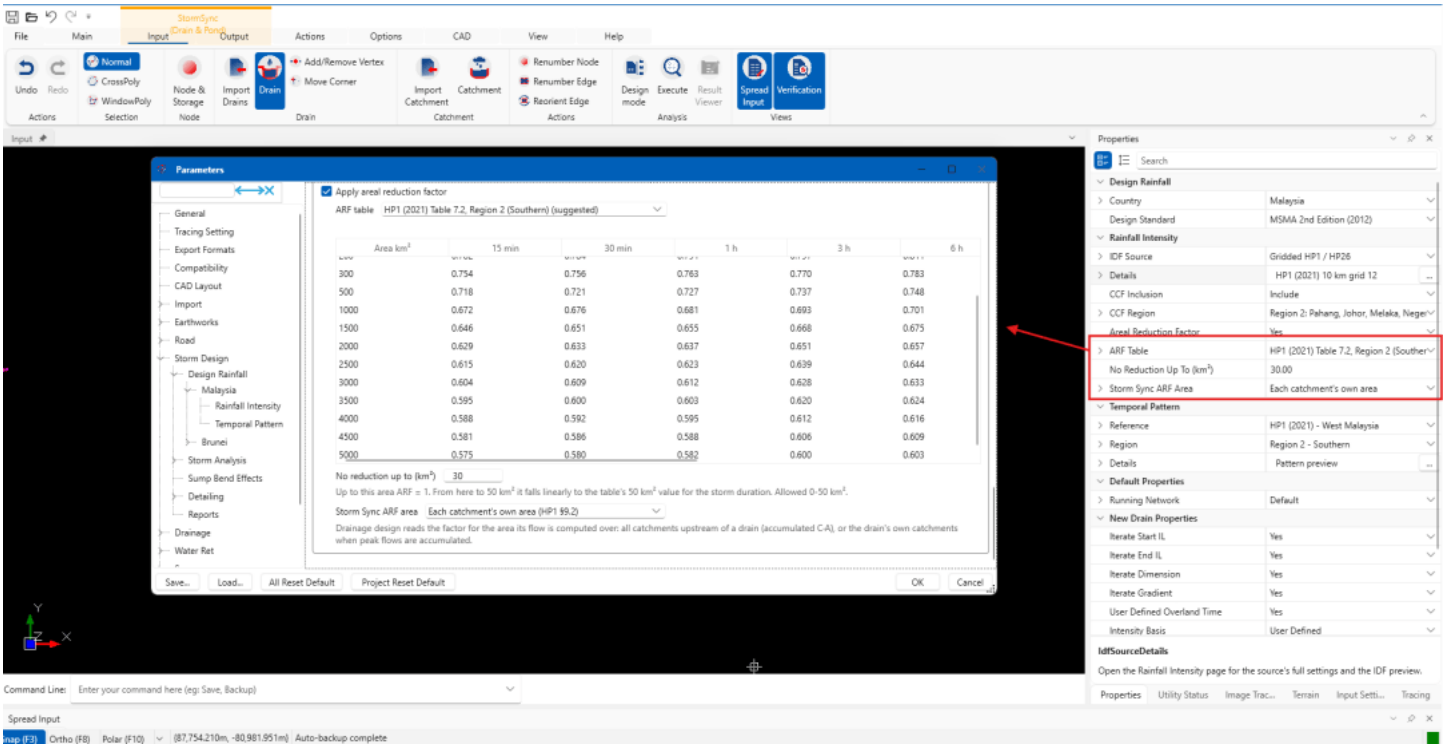
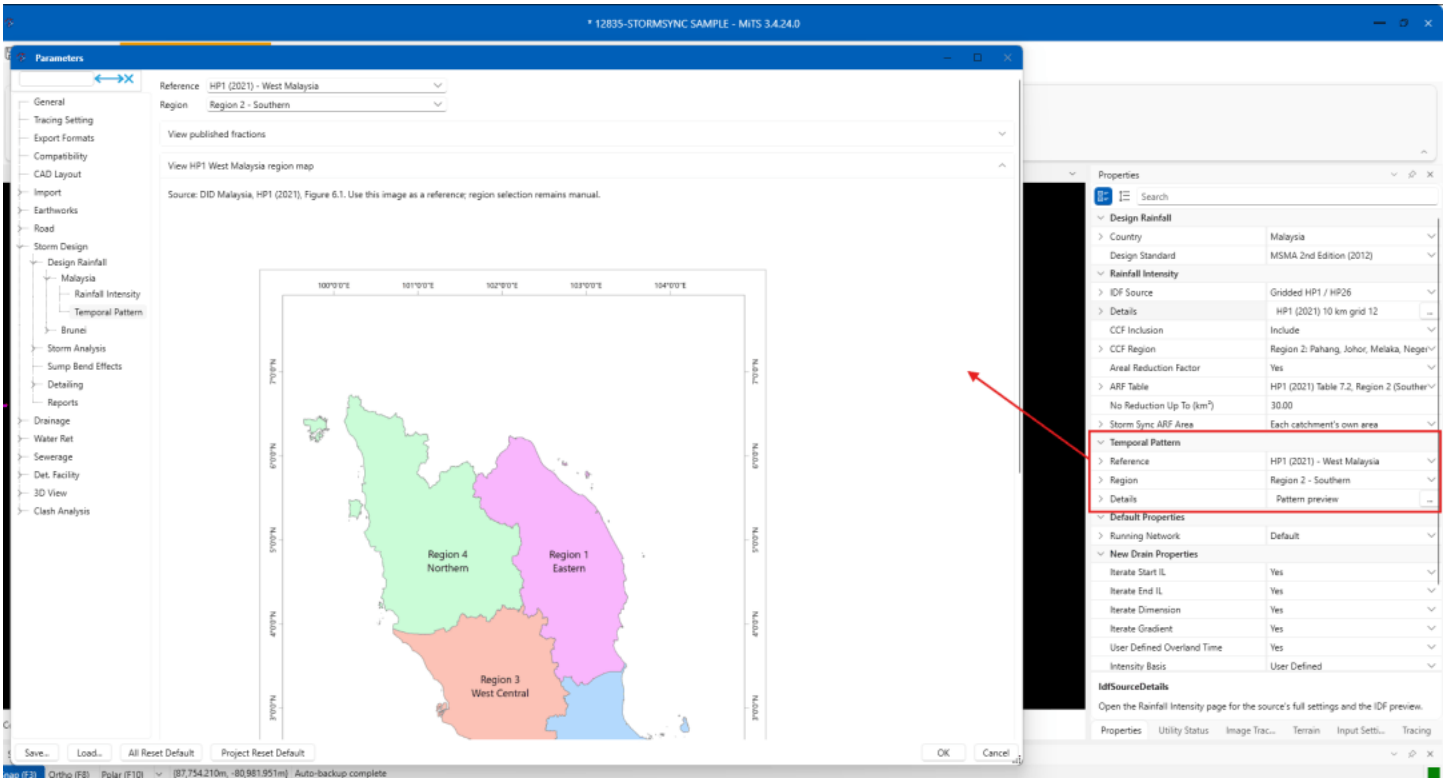
Iterate Gradient Yes
User Defined Overland Time Yes
Intensity Basis User Defined
IdfSourceDetails
Open the Rainfall Intensity page for the source's full settings and the IDF preview.





Which sources are offered

The design standard decides which IDF sources you can pick:

Design standard	IDF sources offered
MSMA 2nd Edition (2012), MSMA 3rd Edition	**MSMA2 rain gauge**, **Gridded HP1 / HP26**, **User λ, κ, θ, η coefficients**
MSMA 1st Edition (2000)	**MSMA1 urban centre (Table 13.A1)**, **User a, b, c, d coefficients (MSMA1 equation)**
Brunei (Country)	**Brunei rain gauge**, **User λ, κ, θ, η coefficients**

If a project was saved with a source that its standard does not allow, for example a gridded source under MSMA 1st Edition, the saved choice is kept and listed last, marked *not allowed*. Runs are blocked until you pick an allowed source. MiTS does not swap the source for you.

The page also shows the **Effective IDF method**, the design standard and the temporal pattern in one summary line. Check it before running.

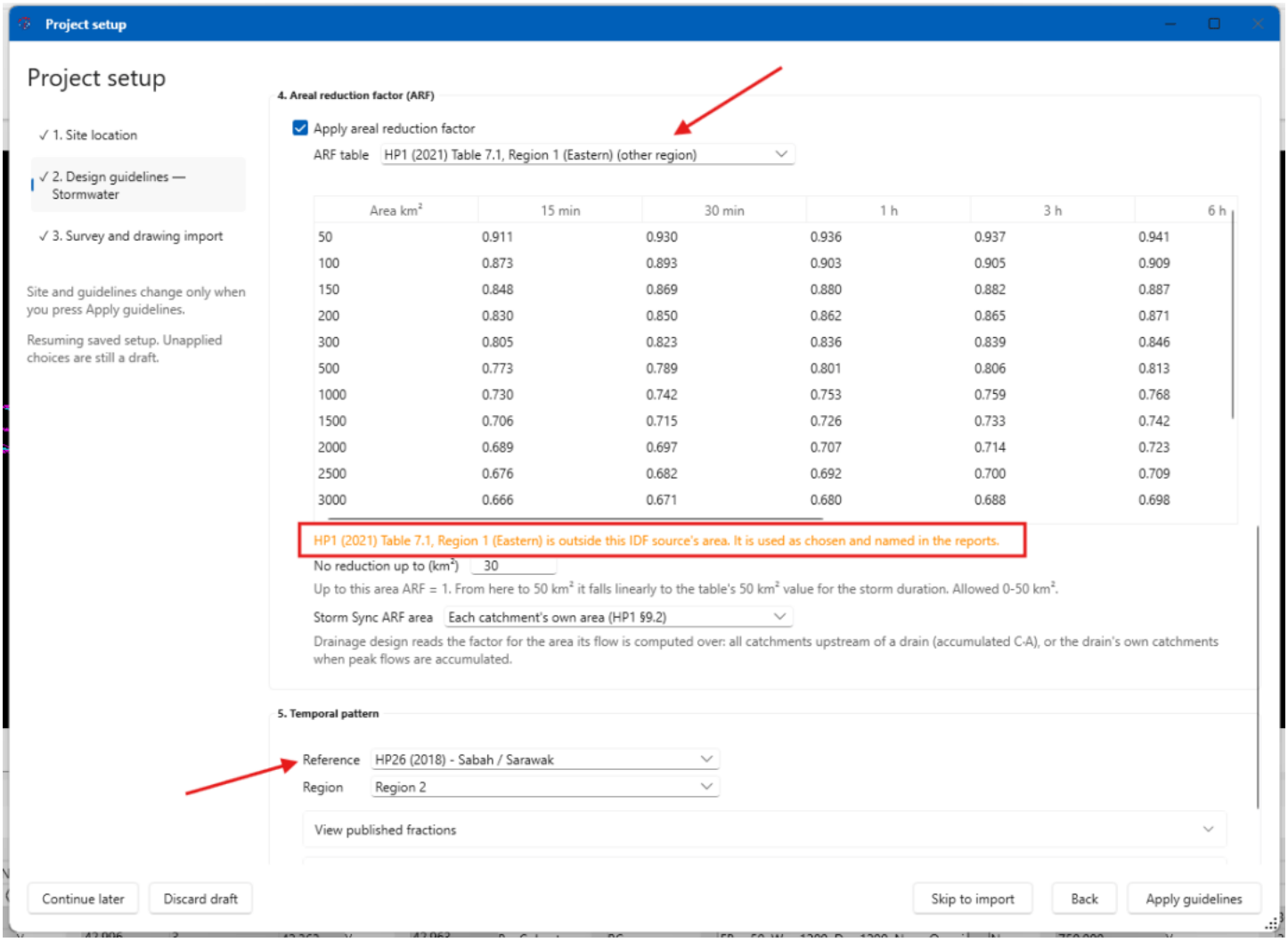
Areal reduction factor

The IDF equation gives a point rainfall intensity. When **Apply areal reduction factor** is on, MiTS multiplies it by the selected ARF for the area and storm duration to estimate average rainfall over that area. The published table preview is *read-only*.

MiTS automatically suggests an *ARF Table* based on the **chosen IDF Source and location**. For selected standard **MSMA 1st Edition** or **Brunei**, software will follow **MSMA1 Table 13.1**. As for selected ARF Table based on **HP1 guidelines**, software will follow *one of the* ***four regional tables*** *(HP1 Tables 7.1-7.4)*. The suggested ARF Table will be based on the **selected *HP1 Temporal Pattern region***- Just remember that the ARF region is different from the HP1 CCF region. For ARF Table that is based on **HP26 guidelines**, the software will use **Table 6.12 for Sabah and Table 6.13 for Sarawak**; Do note that *only* for **IDF Source - MSMA2 rain gauge** can suggest the correct ARF Table region, as **IDF Source- Gridded HP 26** does not contain region data, you will need to *manually select between Table 6.12 or 6.13* depending on the states and regions.

For **user-defined coefficients** of selected standard MSMA 2nd Edition or MSMA 3rd Edition, the software does not carry the location data, thus, we will need to manually opt between the HP1 or HP26 ARF Table region that applies to the project. Whenever MiTS cannot automatically identify or

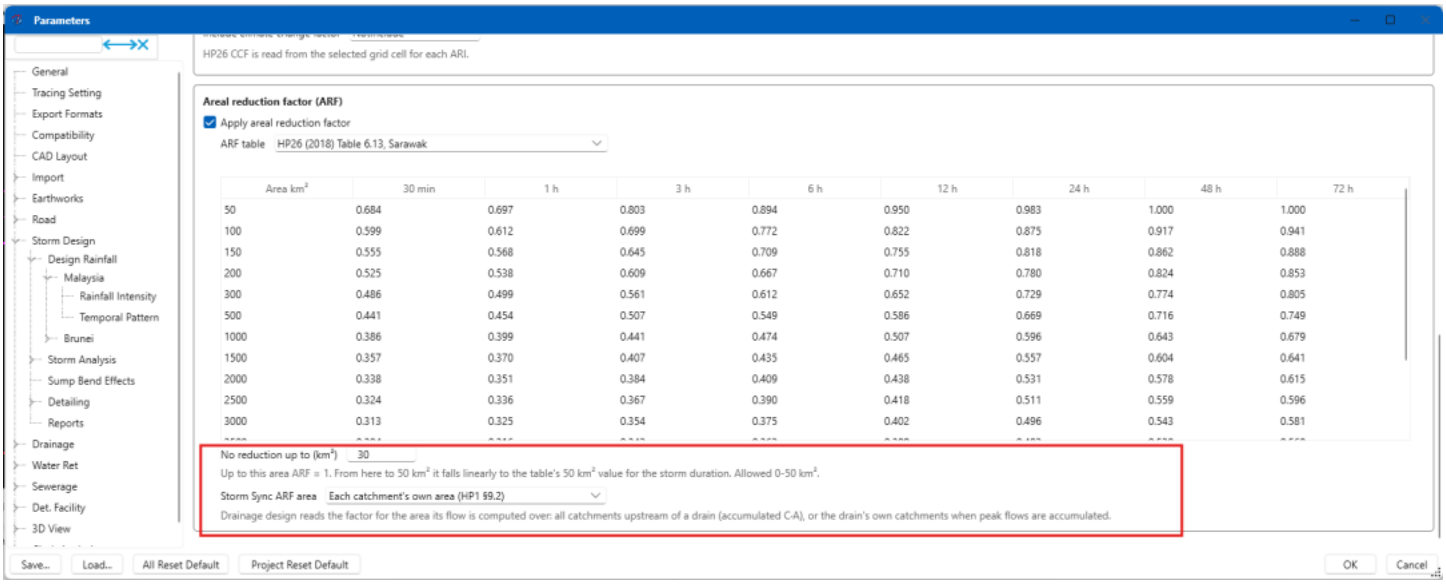
suggest a unique region, simply select manually from the listed ARF Table. However, if the region selected is **outside of the IDF Source's location**, we will be warned by the software on the mismatch and how the chose table will still be recorded in the results as in the image below.



HP1 and HP26 tables start at 50 km². **No Reduction Up To (km²)** defaults to 30 km² and accepts 0–50 km². ARF remains 1 up to the chosen area, then falls linearly to the table's 50 km² value. MSMA1 Table 13.1 does not use this threshold.

For Storm Sync, **Storm Sync ARF Area** chooses whether each catchment uses its own area (HP1 §9.2 recommends this) or the total area of its connected drain network. The network total gives every catchment on that network the same factor, so splitting a catchment does not change it; it also applies the larger network area to upstream catchments, which HP1 warns can underestimate their flows. Drainage design uses the area its flow calculation covers, such as accumulated upstream catchments or the drain's own catchments when peak flows are accumulated; it does not use this

Storm Sync setting.



MSMA2 and MSMA3 sources

MSMA 2nd Edition, MSMA 3rd Edition and the HP1/HP26 grids all use the same generalized IDF equation:

$$i = \dfrac{\lambda T^{\kappa}}{(d + \theta)^{\eta}}$$

where:

- i is the rainfall intensity in mm/h
- T is the ARI in years
- d is the storm duration in hours
- λ, κ, θ, η are the fitted coefficients (The three sources differ only in where λ, κ, θ, η come from)

MSMA2 rain gauge

For **IDF Source - MSMA2 Rain Gauge**, we will need to select any of the published gauge. To find one, simply type any part of its name or state, such as *Selangor* or *Sarawak*, and the list narrows as you type. Once the published gauge is selected, MiTS uses that gauge's coefficients and CCF and will show the values as ***read-only***. Note that selecting another gauge will load that gauge's published values, and these values are instantaneously reflected in the UI and the reports.

Read-only coefficients will the change most users will notice- In earlier versions, you could edit the gauge's coeffcients in place. You can't now, because a report that says *Kuala Lumpur - Puchong Drop* should mean the published Puchong Drop valies. If you are required to use different values as your coefficients, you may opt for **User λ, κ, θ, η coefficients**.

Gridded HP1 / HP26

DID's HP1 (2021) for Peninsular Malaysia and HP26 (2018) for Sabah and Sarawak publish λ, κ, θ, η for every cell of a 10 km and a 20 km grid. With this source MiTS picks the published grid cell for a location, so you don't select a gauge. The steps are summarised below; Gridded HP1 and HP26 IDF Coefficients covers the cell selection, coverage and checks in full.

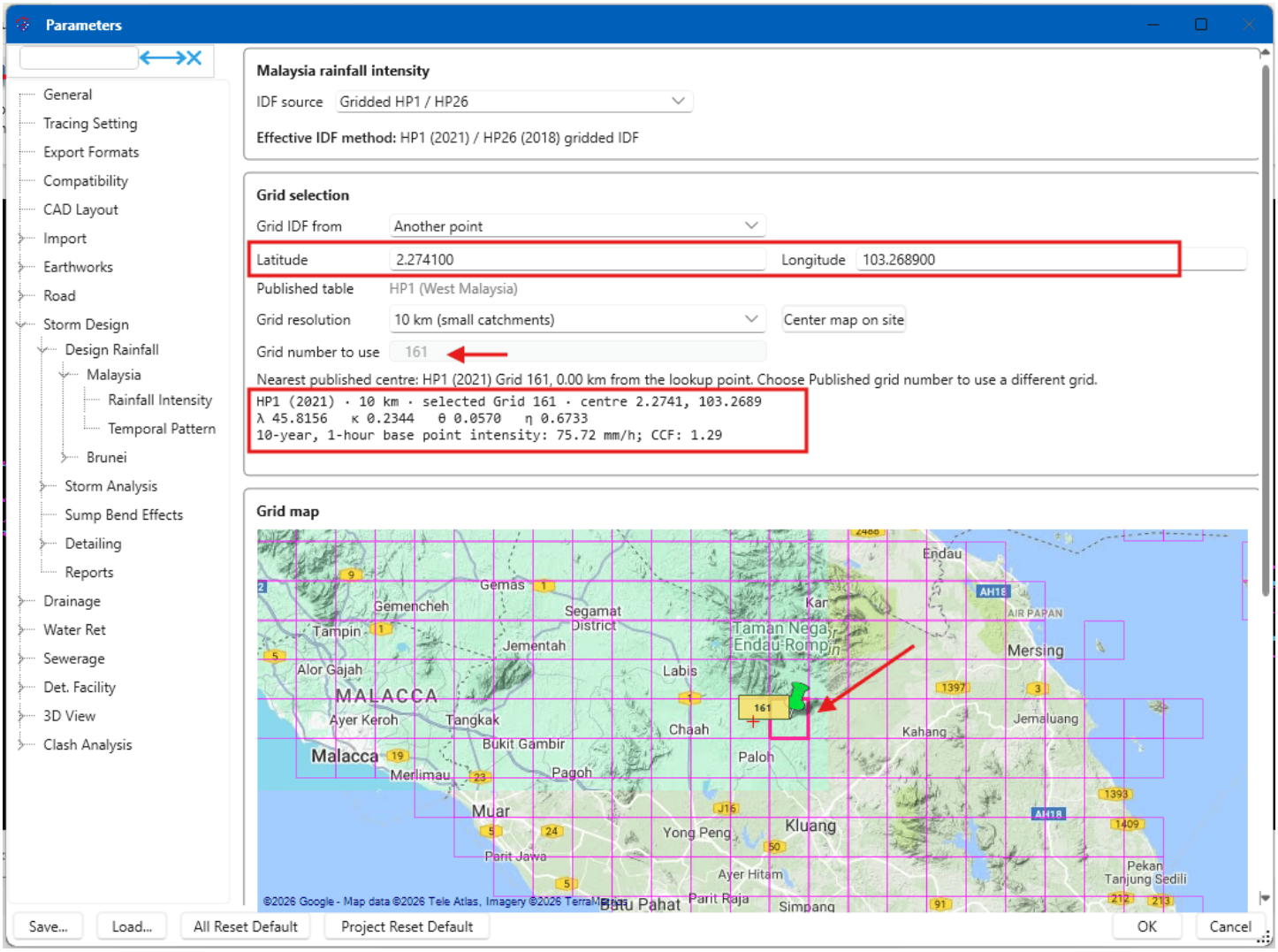
Steps:

1. Set **Grid IDF from**: **Project site** (the site set in Project Setup), **Another point** (type a latitude and longitude, WGS84, or click the map), or **Published grid number** (below).
2. Choose the **Grid resolution**: **10 km (small catchments)** or **20 km (medium / large catchments)**, as HP1 and HP26 recommend.
3. Check the cell. MiTS picks HP1 or HP26 from the location and selects the grid with the nearest published centre, then shows its grid number (greyed out, since the location decides it), its distance from the location and its four coefficients. The map outlines the selected cell in pink.

A site in Brunei, offshore, or too far from any published centre gets **Out of coverage**. MiTS does not reach for the nearest cell across a border. Choose a different site, or use a gauge or User coefficients.

CCF depends on the publication. HP26 publishes CCF for each grid cell and ARI, so MiTS picks it automatically. HP1 publishes CCF by region (Figure 8.3), so you choose the **HP1 CCF region**. MiTS suggests one from the state of the listed town nearest the location. Check it with **View HP1 CCF region map**, especially near Kuala Lumpur, mountain areas and region edges. CCF regions are not the same as temporal-pattern regions.

If you already know the grid number, for example from the HP1 Volume II tables, or you want a different cell from the one at your location, set **Grid IDF from** to **Published grid number**, choose HP1 or HP26 under **Published table**, and type the number. MiTS starts from the cell nearest the project site. No site coordinate is stored in that case.



User λ, κ, θ, η coefficients

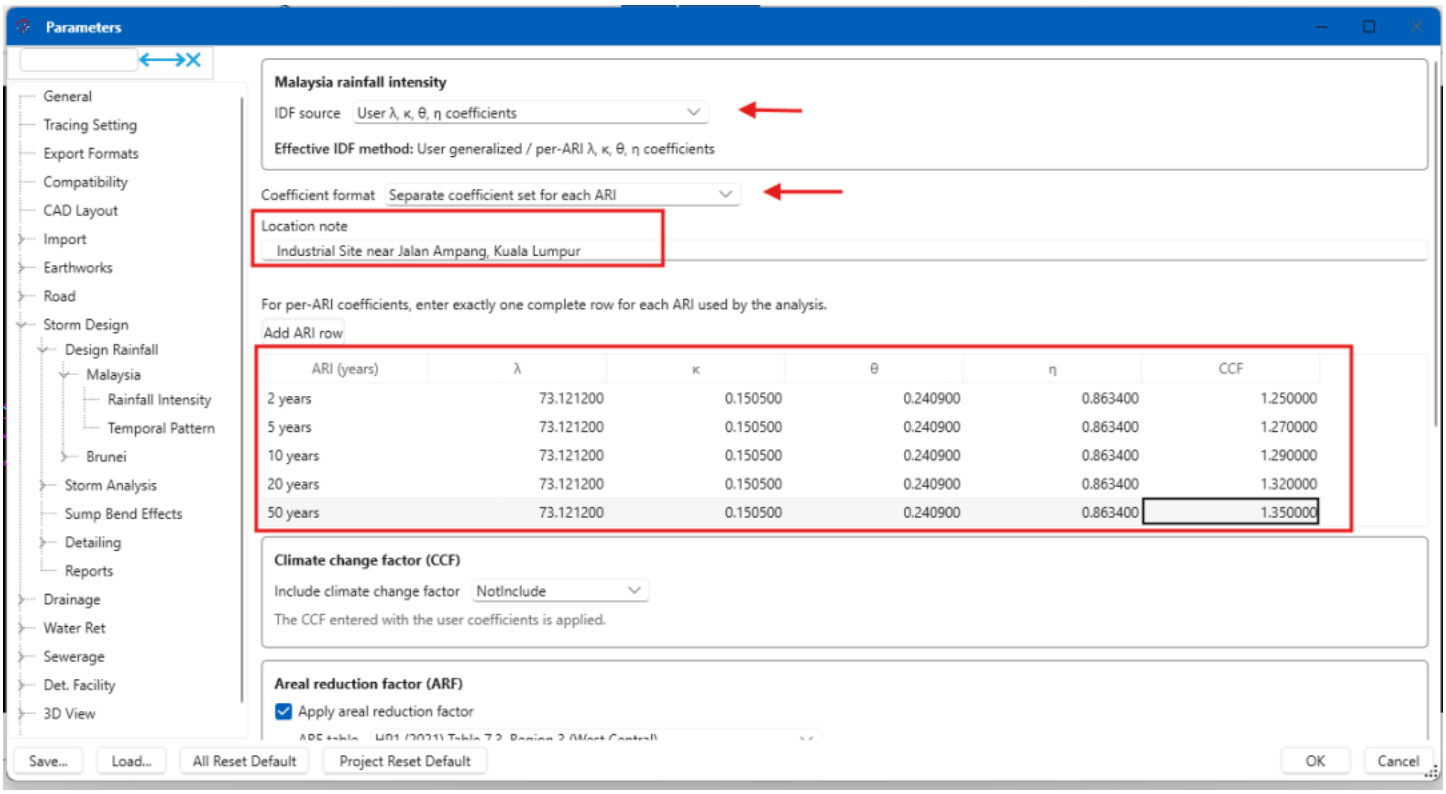
This source is applicable when we are required to use coefficients from somewhere else: a local gauge analysis, the authority's instruction, or a published gauge's value that needs adjustments.

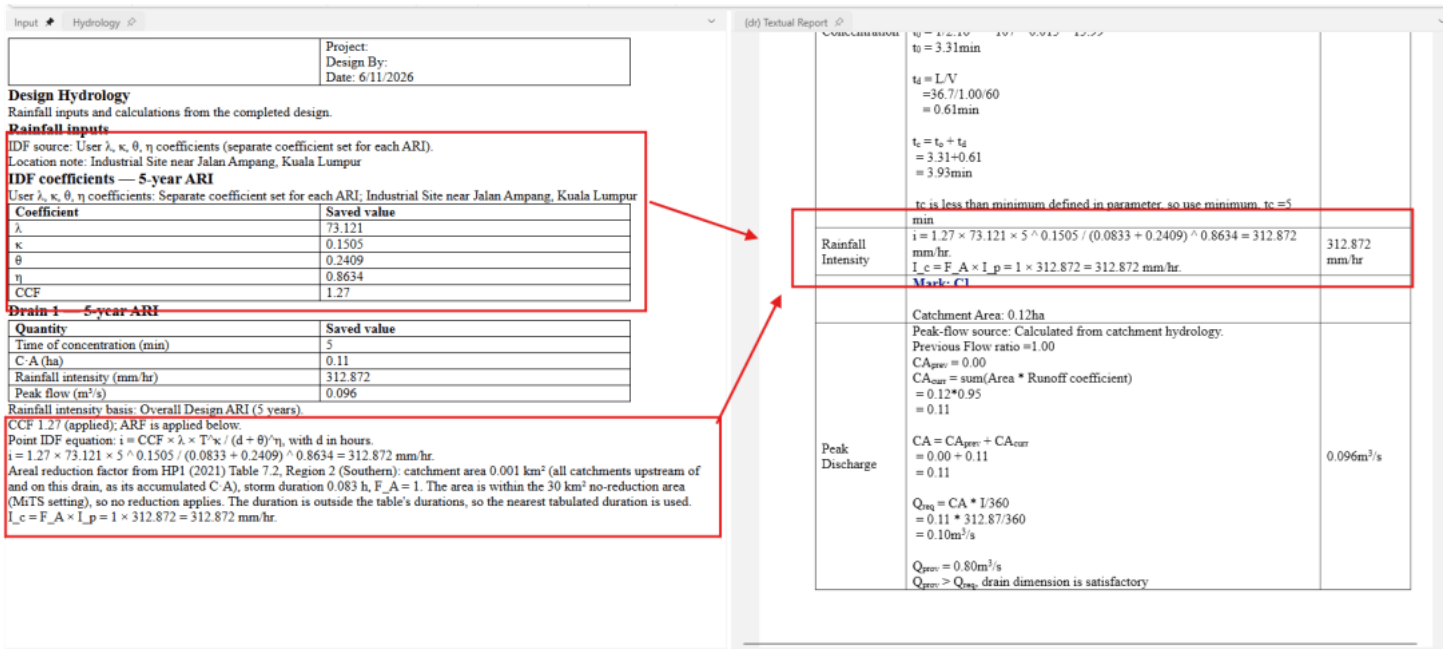
Steps:

1. Choose the **Coefficient format**:
   - **One coefficient set for every ARI**: a single λ, κ, θ, η set, with the ARI entering through T^\kappa. This is the form of a generalized IDF fit such as HP1's.
   - **Separate coefficient set for each ARI**: one complete row for each ARI, as in the MSMA2 station tables. Click **Add ARI row** for each ARI.
2. Enter λ, κ, θ, η and the **CCF** for each set. CCF is applied when **CCF inclusion** is on.

3. Enter a **Location note**, for example *Industrial site near Jalan Ampang, Kuala Lumpur*. It is printed in the reports so a checker knows where the values apply. MiTS does not geocode it.

With the separate-set format, every ARI that the analysis uses needs exactly one complete row. If one is missing, the run stops with a message naming that ARI. MiTS does not borrow the nearest ARI's values.





MSMA 1st Edition sources

MSMA 1st Edition uses a different equation, a cubic in the logarithm of duration:

$$\ln I = a + b \ln t + c (\ln t)^2 + d (\ln t)^3$$

where:

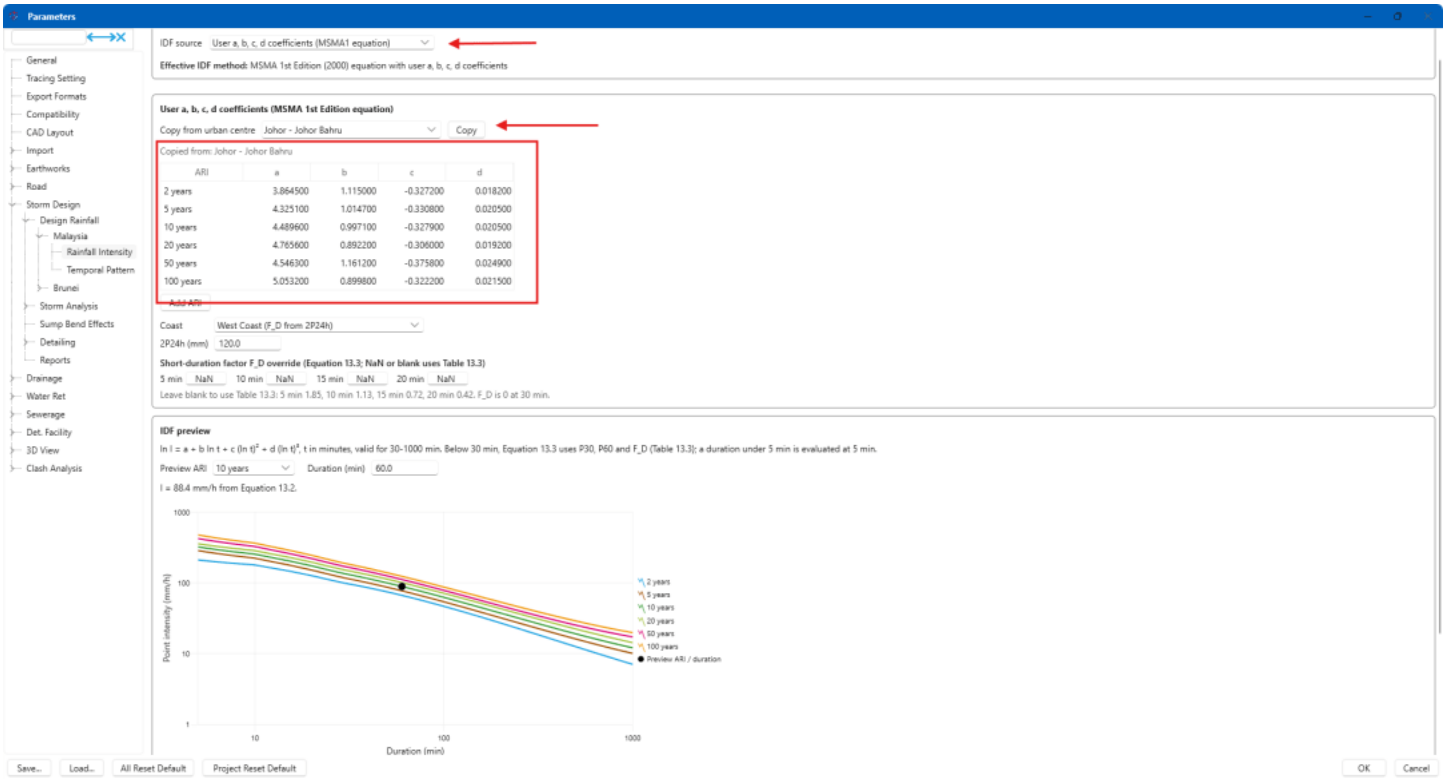
- I is in mm/h
- t is the duration in minutes.

Table 13.A1 gives a, b, c, d for each ARI at 35 urban centres. The equation is fitted for 30 to 1000 minutes. Below 30 minutes, MSMA1 Equation 13.3 works from the 30- and 60-minute depths and the short-duration factor F_D (Table 13.3).

Steps:

- **MSMA1 urban centre (Table 13.A1)**: select the urban centre; typing any part of its name or state narrows the list. Its published a, b, c, d are shown read-only.
- **User a, b, c, d coefficients (MSMA1 equation)**: enter a, b, c, d for each ARI (**Add ARI**). **Copy from urban centre** fills the table with a published centre's values as a starting point. Set the **Coast** (West or East, which decides how F_D is found) and **2P24h**. You may also override F_D at 5, 10, 15 and 20 minutes; leave a cell blank to use Table 13.3.

Both MSMA1 sources show an **IDF preview**: a chart of the curves and the intensity at a chosen ARI and duration, with the Equation 13.3 working when the duration is under 30 minutes. MSMA 1st Edition publishes no CCF, so none is applied under this standard.



Projects saved before this change

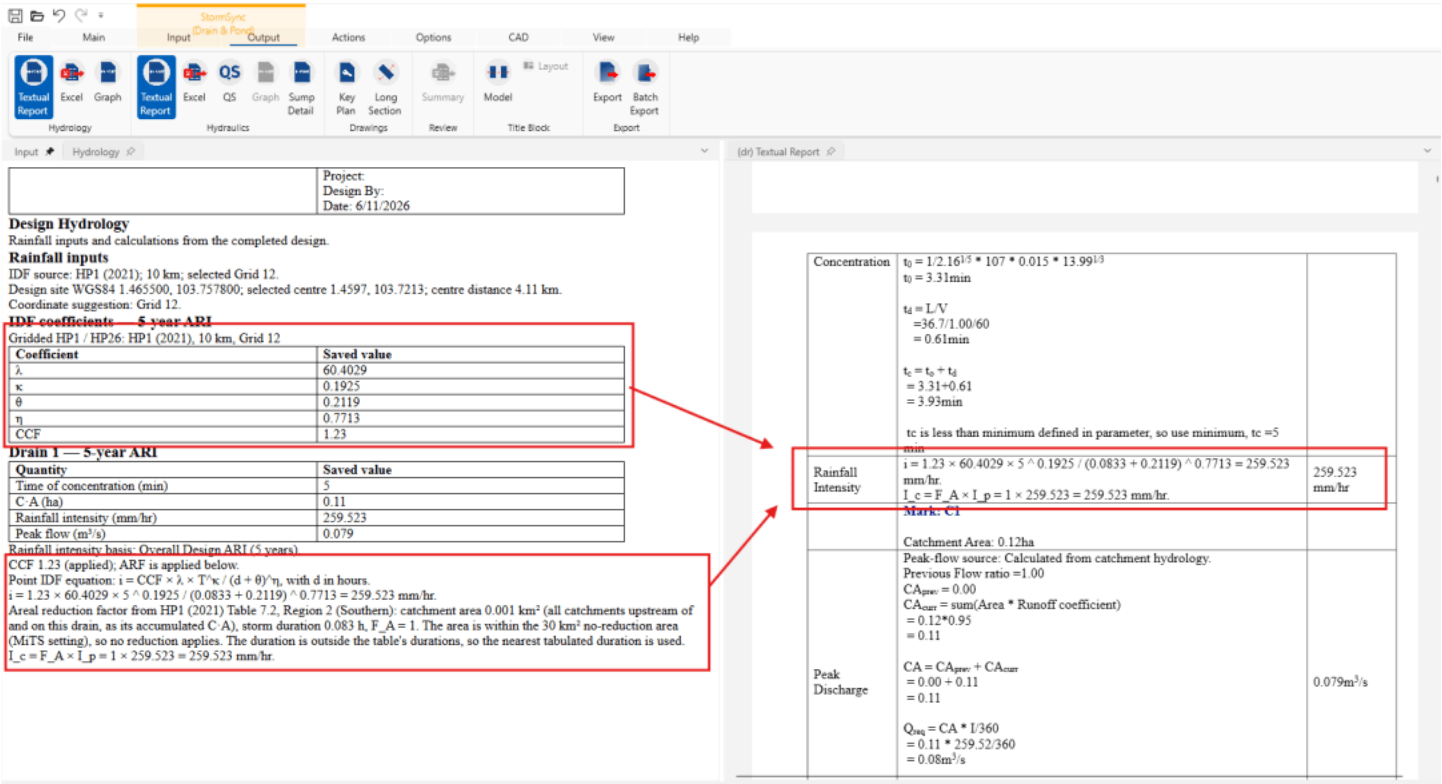
When you open an older project, MiTS compares its rain gauge coefficients with the published values for that gauge:

- **Unchanged**: the project opens with **MSMA2 rain gauge** and the same gauge.
- **Edited**: the project opens with **User λ, κ, θ, η coefficients**, format **Separate coefficient set for each ARI**. Your edited values and CCF are kept exactly, and the old gauge name is kept as the record of where they came from. The Location note is blank, and the page prompts you to fill it in. Old calculations are not blocked.

Either way, the project calculates the same intensities as before. Saved results from an older version do not record their IDF source, so their reports say the source is unavailable and ask for a rerun. MiTS does not fill it in from the current settings.

What appears in the reports

The drainage and Storm Design text reports state the IDF source using the names above. They also give the gauge, the grid (publication, resolution and grid number), or the User format and Location note. The coefficients and CCF setting used are printed as well. Drainage reports and Storm Sync outputs also record the ARF table and factor applied; Storm Sync outputs include the area basis. These values come from the run that produced the result, so changing the settings afterwards does not rewrite an old report.



Conclusion

Users must pick the source that matches where your coefficients came from- Apply the gauge when the published station is the agreed basis, apply the grid when the site is ungauged and HP1/HP26 is applicable and when someone handed you the numbers (coefficients), apply the User λ, κ, θ, η coefficients option with the location note written so the next reader knows why.

Note that published values stay **read-only**, anything that you type goes under User λ, κ, θ, η coefficients, and will be reflected in the report.

Related



Ngu Soon Hui

I’m the Benevolent Dictator for Life for MiTS Software cum Editor of this website. Read more here.

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