Excalibur Tutorial

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Downloading Excalibur

Excalibur can be downloaded and installed from <u>http://www.lighttwist.net/wp/excalibur</u>. It is only available for PC.

Creating a new case

Click on **File > New Case**. The Realisations window of the new case automatically opens. If the window does not open, click on **Items** for the window to appear.

File	Items	Experts	Assessments	Edit	Calculate	Window	Help			
B	P P									
	_									
	🖳 Rea	lisations o	lata: NONAME							×
	Nr.	Id	:	Scale	Realization	Full N	lame			
	1			LOG						

Adding items

Type the item's *ID*, *Scale* (either LOG or UNI; see **Help > Excalibur Glossary** for more information), and *Full Name*. If the item is a calibration variable, also type the *Realization*. Leave *Realization* blank if the item is not a calibration variable. TAB moves between an item's fields. Press ENTER (once or twice, depending on which cell or row is active) to add a new item.

ID and Scale are required fields. Realization is required for calibration variables. Full Name is optional.

Adding the first 10 items from the Nremoval study looks like this:

2	Items	Experts Assessments	Edit	Calculate	Window Help
	6 🖪				
_					
-					
	👘 Rea	alisations data: NONAM	E		
	Nr.	ld	Scale	Realization	Full Name
	1	OUT_W_I	UNI	42	outgoing total nitrogen load (kg TN) from the sub-watershed over rain
	2	OUT_W_II	UNI	56	outgoing total nitrogen load (kg TN) from the sub-watershed over rain
	3	OUT_W_III	UNI	13.3	outgoing total nitrogen load (kg TN) from the sub-watershed over rain
	4	OUT_W_IV	UNI	22.75	outgoing total nitrogen load (kg TN) from teh sub-watershed over rain
	5	IN_A_V	UNI		incoming TN load (kg) to BMP A
	6	OUT_A_V	UNI		outgoing TN load (kg) to BMP A
	7	IN_B_V	UNI		incoming TN load (kg) to BMP B
	8	OUT_B_V	UNI		outgoing TN load (kg) to BMP B
	9	IN_C_V	UNI		incoming TN load (kg) to BMP C
	10	OUT C V	UNI		outgoing TN load (kg) to BMP C

The Edit menu allows you to make some changes to all of the items in a case.

Edit > Change all scales to UNI assigns all items in the case a uniform (UNI) scale.

Edit > Change all scales to LOG assigns all items in the case a logarithmic (LOG) scale.

Edit > Change floating point format provides options for the number of decimal places and digits stored for realizations in the case.

File Items I	Experts Assessments	s Edit	Calculate Win	dow Help
<mark>B 🗟</mark>				
Real	isations data: NONAM	ЛЕ		
Nr.	Change Floating Pr	oint Dat	- 0 X	Name
1	change Hoating re	Jint Data		ping total nitrogen load (kg TN) from the sub-watershed over rai
2	Format	int 🔘 Scientific	Cancel	ping total nitrogen load (kg TN) from the sub-watershed over rai
3	🔘 Fixed Point 🔘 🤅			ping total nitrogen load (kg TN) from the sub-watershed over rai
4	 Mixed (compact) 		Reset	ping total nitrogen load (kg TN) from teh sub-watershed over rai
5	Field width Doo n	12000		ning TN load (kg) to BMP A
6		aces	Οκ	ping TN load (kg) to BMP A
7	4	•		ning TN load (kg) to BMP B
8	<u></u>	200		oing TN load (kg) to BMP B
9	IN_C_V	LOG	i	incoming TN load (kg) to BMP C 👻

Adding experts

Click **Experts**. When adding experts to a case for the first time, the Quantiles menu appears. This enables specification of the number of quantiles (typically 3 or 5) and the relevant percentiles (typically 5, 50, and 95 for 3 quantiles or 5, 25, 50, 75, and 95 for 5 quantiles).



After confirming the quantiles, the Experts data window appears. Experts are added in the same way as items. *ID* is mandatory, and *Full Name* is optional.

Adding assessments

An expert's assessments can be viewed in two ways:

- 1. Double-click the expert's row in the Expert window.
- 2. Single click on the expert's row (column Nr.) in the Expert window to highlight it and click **Assessments**.

۸.	recoments for the F	ivnart: 10		he ID and Fi	ull Name (i	present) of	the expert
	sessiments for the t	.xpert. 10	N N	ho provided	these ass	essments.	Carrier Carrier Carrier
Nr.	Id	Scale	5%	50%	95%	Realization	Full Name
1	OUT_W_I	UNI				42	outgoing total nitroge
2	OUT_W_II	UNI				56	outgoing total nitroge
3	OUT_W_III	UNI				13.3	outgoing total nitroge
4	OUT_W_IV	UNI				22.75	outgoing total nitroge
5	OUT_W_V	UNI				7.35	outgoing total nitroge
6	IN_A_V	UNI					incoming TN load (kg
7	OUT_A_V	UNI					outgoing TN load (kg)
8	IN_B_V	UNI					incoming TN load (kg
9	OUT_B_V	UNI					outgoing TN load (kg)
10	NCV	UNI					incoming TN load (kg

Type the expert assessment data in this table.

Save the case

Click File > Save As... or File > Save Case to save the case. This creates two files in the specified directory:

- a .dtt file containing the expert assessment data
- an .rls file containing the realization data.

Excalibur requires both files to calculate performance scores and combined weights.

The .dtt and .rls files are ascii files. They can be viewed in text editors and other programs. Be careful editing the files outside of Excalibur, though, as Excalibur depends on the exact spacing it sets in the files.

Opening a case

Click **File > Open Case** to open a previously saved case file. Note that you only select the .dtt file to open a case. If the accompanying .rls file is not in the same directory, though, the realizations data will not properly load.

Calculating expert scores and combinations

The following examples use the Nremoval case files.

Click Calculate to bring up the Run Parameters window, which looks like:

The 4 types of DMs DM parameters, these default values ere good for most cases. NOTE: DM optimisation Chief in the construction of the dome for them and clobed with the dome for the dome for them and clobed with the dome for th		Run Parameters Set the desired parameters and clic	k on Calculate/Run	
DM parameters, These default values are good for most cases, Note: DM optimisation @ Bayesian Updates @ Discrepancy Calibration Power 1.1 <= 1.000 <= 1.0 0.1 <= 1.000 <= 1.0 Decision Maker Name Calculate Buttons to run DM calculations Buttons to run DM calculations	The 4 types of DMs 🔶	Weights Chi2	Inf New Old	Legacy features that replicate old code. Always use "New" for these parameters
entry be done for item and Clobal Weights. BUN Robustness (items) Robustness (experts)	DM parameters. These default values are good for most cases. NOTT=: DM	DM optimisation Bayesian Up Calibration Power 0.1 <= 1.000 <= 1.0 0.01 <= Decision Maker Name	Jates Discrepancy Intrinsic Range 0.10 <= 100.0	parameters.
analysis.	eptimization can only be done for liam and Clobal Weights.	Calculate RUN Robustness (items)	Robustness (experts)	Buttons to run DM calculations and robustness analysis.

More information on these parameters is available in the Excalibur Help file and Glossary (found at **Help > Excalibur Help** and **Help > Excalibur Glossary**).

Calculating Equal Weight Decision Makers

To create an Equal Weight Decision Maker named "EW", use the following Run Parameters:

Run Parameters							
Set the desired parameters and click	on Calculate/Run						
Weights Chi2 ◯ Global	Inf New Old						
DM optimisation Bayesian Upda Calibration Power In 0.1 <= 1.000 <= 1.0 0.01 <=	ates V Discrepancy atrinsic Range 0.10 <= 100.0						
Decision Maker Name EW							
Calculate RUN Robustness (items) Robustness (experts)							
Re	eset Cancel						

Click Run and produce a table of outputs:

esu Bay Sig	its of sco /esian Up nificance	dates:no We Level: 0	d Relative Info ights: equal Calibration Po	mation to the DM DM Optimisation: no wer: 1						
Vr.	ld	Calibr.	Mean relative	Mean relative	Numb	UnNormalized	Normaliz.weigh	Normaliz.weigł	Rel.Inf to DM	Rel.Inf to D
			total	realization	real	weight	without DM	with DM	total	realiz.
1	1	0.492	2.635	3.747	11	1.844	0.1	0.3577	1.743	2.943
2	2	7.543E-012	5.669	5.987	11	4.516E-011	0.1	8.763E-012	3.268	2.555
3	3	2.496E-006	2.501	4.367	11	1.09E-005	0.1	2.115E-006	1.525	1.391
4	4	0.0007985	1.969	2.731	11	0.002181	0.1	0.0004232	1.808	2.452
5	5	3.211E-014	5.156	5.639	11	1.811E-013	0.1	3.513E-014	2.553	1.745
6	6	2.789E-005	3.788	4.938	11	0.0001377	0.1	2.672E-005	1.722	2.16
7	7	0.0007985	3.623	4.59	11	0.003665	0.1	0.0007112	1.733	1.834
8	8	0.7062	2.923	4.17	11	2.945	0.1	0.5714	1.457	2.616
9	9	0.0011	1.317	2.618	11	0.00288	0.1	0.0005588	1.442	2.325
10	10	3.211E-014	0.5074	0.3431	11	1.102E-014	0.1	2.138E-015	0.9556	1.022
11	EW	0.197	1.19	1.809	11	0.3563		0.06914	0	0

The columns in the table display (again, more information is available in **Help > Excalibur Help** and **Help > Excalibur Glossary**):

- 1. The expert ID (including any decision makers created by the analyst in this session)
- 2. The calibration score
- 3. The information score. The first column is averaged over all items; the second column is averaged over only the seed questions (i.e., the questions with realizations).
- 4. The number of seed questions.
- 5. The combined score (i.e., the product of calibration and information on the seed questions).
- 6. The normalized expert weight for the most recently calculated decision maker, excluding the decision maker.
- 7. The normalized expert weight for the most recently calculated decision maker, including the decision maker.
- 8. The discrepancy analysis, comparing the information of the expert to that of the active decision maker. Note that this is typically used with the Equal Weight Decision Maker. The first column is averaged over all items; the second column is averaged over only the seed questions (i.e., the questions with realizations). These columns only appear when Discrepancy is checked.

Calculating Performance Weight Decision Makers

To calculate an optimised performance weight decision maker, check DM optimisation. Select Global or Item Weights, depending on the weighting scheme desired.

💽 Run Parameters							
Set the desired parameter	ers and click on (Calculate/Run					
Weights	Chi2 New Old	Inf ⊚ New ⊚ Old					
DM optimisation Ba Calibration Power 0.1 <= 1.000 <= 1.0 Decision Maker Name GW	yesian Updates Intrinsi 0.01 <= 0	Discrepancy ic Range .10 <= 100.0					
Calculate RUN Robustness (items) Robustness (experts)							

Calculating User Weight Decision Makers

To create a User Weight Decision Maker, make sure DM optimisation is unchecked. Select User Weights in the Run Parameters window, and the following window pops up:

Exp	perts data:	Nremoval	
Nr.	Id	User Weight	Full Name
1	1	0.15	
2	2	0.05	
3	3	0.1	
4	4	0.1	
5	5	0.1	
6	6	0.1	
7	7	0.1	
8	8	0.1	
9	9	0.1	
10	10		

Manually enter the weight desired for each expert. Leave the User Weight blank for one expert, and Excalibur calculates it so that all the user weights sum to 1. After entering the user weights, click Run to see the expert and decision maker scores.

Creating multiple decision makers

Excalibur allows you to create and compare several decision makers. For example, you can create Equal Weight, Global Weight, and Item Weight decision makers and compare their scores. To remove the decision makers you've created, click Reset on the Run Parameters window. Note: This removes all decision makers; you cannot selectively remove decision makers.

Displaying results

Excalibur has several built-in options for displaying results.

Double-clicking a decision maker in the Expert scores window brings up its assessments:

Sol Resu Bay	lution for : GW Iting solution (con yesian Updates: no	nbined DM di D Weights:	istribution of global DM	values assessed Optimisation: ye	l by experts) es	- Paramete	- • X
Sig Nr.	nificance Level: (0.7062 Calib Scale	5%	50%	95%	Realization	Full Name
1	OUT_W_I	UNI	36.61	76.43	116.3	42	outgoing total nitrogen load (kg TN) from the sub-watershed over rai
2	OUT_W_II	UNI	39.9	83.3	126.7	56	outgoing total nitrogen load (kg TN) from the sub-watershed over rai
3	OUT_W_III	UNI	5.456	11.36	17.26	13.3	outgoing total nitrogen load (kg TN) from the sub-watershed over rai
4	OUT_W_IV	UNI	13.17	27.49	41.82	22.75	outgoing total nitrogen load (kg TN) from the sub-watershed over rai
5	OUT_W_V	UNI	2.349	4.89	7.431	7.35	outgoing total nitrogen load (kg TN) from the sub-watershed over rai
6	IN_A_V	UNI	0.9459	1.97	2.993		incoming TN load (kg) to BMP A
7	OUT_A_V	UNI	0.6441	1.566	3.453		outgoing TN load (kg) from BMP A
8	IN_B_V	UNI	0.2235	0.4653	0.7072		incoming TN load (kg) to BMP B
9	OUT_B_V	UNI	0.1002	0.2917	0.7043		outgoing TN load (kg) from BMP B
10	IN_C_V	UNI	0.09665	0.2012	0.3058		incoming TN load (kg) to BMP C
11	OUT_C_V	UNI	0.05274	0.1261	0.3397		outoing TN load (kg) from BMP C
12	OUT_W_VI	UNI	63.31	132.2	201	80.5	outgoing total nitrogen load (kg TN) from the sub-watershed over rai
13	IN_A_VI	UNI	26.2	54.7	83.21		incoming TN load (kg) to BMP A
14	OUT_A_VI	UNI	17.85	43.48	96.1		outgoing TN load (kg) from BMP A

Clicking the Range Graph (expertswise) or Range Graph (itemwise) buttons in the Run Parameters window creates text range graphs of the experts' and decision makers' assessments, ordered either by expert or item. The itemwise range graphs for the Nremoval study look like:



In these text figures, the brackets ([,]) indicate the range of the assessment, the asterisk (*) indicates the median, and the hashtag (#) is the realization for the seed items.

These text graphics can be copy/pasted into another program. However, to display properly, they need a monospace font (e.g., Courier) sized small enough that the assessments are shown on one line of text.

Exporting results

The decision maker assessments can also be exported for use with other programs, such as Excel or R. This gives more flexibility in displaying results or conducting additional analysis.

To export the quantiles (i.e., the percentiles elicited) or full distributions, go to **File > Export as space delimited** and choose **Quantiles** or **Distributions** (the latter extrapolates the full distribution based on the elicited percentiles and the uniform or log uniform distribution). A window appears that lets you select which items and experts/decision makers to export. Click Export to save the file. This creates an ascii file with the extension .dis that can be read in a text editor or imported into Excel, R, or the program of your choice.



You can also export most windows (e.g., DM Solution, Export Scores, etc) to text files by selecting the window and then clicking **File > Export as text** and selecting the window type. Note that only the active window will be available to export as text.

Robustness analysis

Excalibur features two built-in options for robustness analysis: robustness on items and on experts.

To run the robustness analysis, go to the Run Parameters window (if it isn't visible, click **Calculate**). Click Robustness (items) or Robustness (experts). Robustness on items removes seed items one at a time and recalculates the decision maker (using the settings in the Run Parameters window). Robustness on experts removes experts one at a time and recalculates the decision maker. More information is available in **Help > Excalibur Help**.

Filtering items and experts

In addition to the simple built-in robustness analysis, Excalibur allows you to filter out experts and/or items and recalculate decision makers, getting more information than the robustness analysis provides. For example, you can remove an expert, create the Global Weight Decision Maker, and then export the quantile assessments of this decision maker to explore the results if one expert had been excluded.

WARNING! Always store a safe copy of your data before filtering items and/or experts. NEVER click Reset on the Run Parameters window while items or experts are filtered. This will delete the filtered items/experts. Instead, undo the filtering so the experts/items are active again, and then Reset.

To filter items, click **Items** to bring up the items window. Click on the row to highlight the item you'd like to filter (i.e., remove from the subsequent calculations) and then press F4 or click **Edit > Filter Experts/Items**. To undo the filtering, highlight the row and press F4 or click **Edit > Filter Experts/Items** again. To undo all filtering, press F5 or click **Edit > Disable Filtering**. This makes everything active. To re-enable filtering, press F5 again or click **Edit > Enable Filtering**.

To filter experts, click **Experts** to bring up the experts window and follow the same instructions as for filtering items.

Filtered experts/items appear in grey rather than black, but that can be tough to see on some displays.