

WUFI®

Guideline for Defining an Infiltration Source in WUFI® 2D

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Problem

Problem:

The current version of WUFI® 2D cannot directly model an infiltration source using the IBP model. First determine the source strength in WUFI® Pro, then import it into WUFI® 2D as a file.

Solution in 5 steps:

1. One-dimensional simulation of the relevant cross-section with WUFI® Pro (at the position where the infiltration source occurs)
2. Export the source strength as an ASCII file
3. Convert source strength from $[\text{kg}/(\text{m}^2 \cdot \text{s})]$ to $[\text{kg}/(\text{m} \cdot \text{s})]$ – multiply by the width of the source in the 2D model
4. Create a text file containing the converted source strength values
5. Insert the text file into WUFI® 2D as "Source from File"

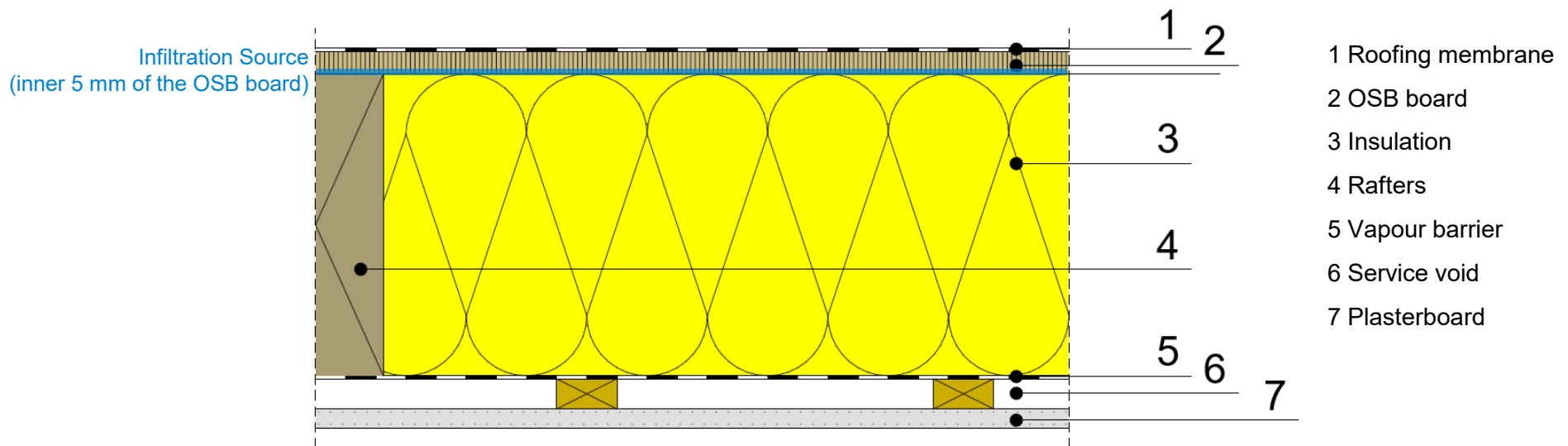
→ This procedure is explained step by step in the following slides.

Approach

The following slides explain the steps in detail using a flat roof assembly as an example.

Note:

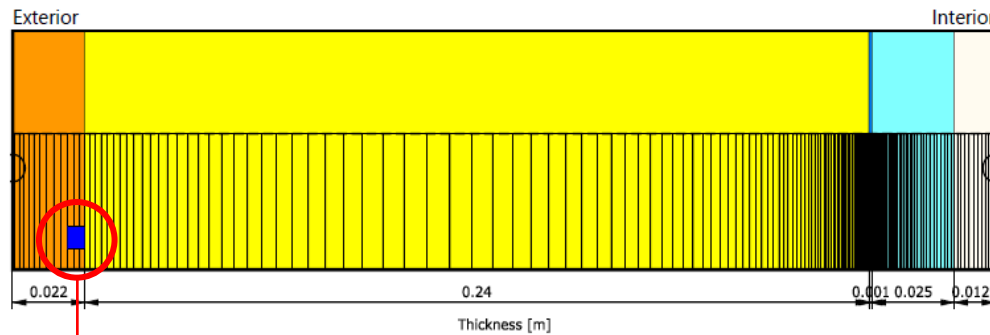
The flat roof construction shown here is only an example. Verification does not require a two-dimensional analysis of this assembly. A one-dimensional calculation through the cavity is sufficient.



Step 1 – 1D Simulation with WUFI® Pro

Assembly in WUFI® Pro (here: cross-section through the cavity)

One-dimensional section through the assembly in the area where the infiltration source occurs (here: cross-section through the cavity)



Define the infiltration source

- Spread Area (here: inner 5 mm of the OSB)
- Air Tightness Class (here: Class B)
- Stack Height (here: 5 m)

Hygrothermal Sources

Infiltration Source

Name: Infiltration 1

Spread Area

☐ Grid Element ☒ Area ☐ Whole Layer

right-fixed Thickness [m]: 0.005

Source Type

☐ Transient from File ☐ Fraction of incident Driving Rain ☒ Air Infiltration model IBP ☐ Constant Monthly Moisture Load

Source Term Cut-Off [kg/m³]

☐ No Cut-Off ☐ Cut-Off at Max. Water Content ☒ Cut-Off at Free Water Saturation ☐ User-Defined

Building air tightness level [m³/m²h]: 3

Air Tightness Class B (DIN 4108, tested <= 3 m³/m²h)

Stack Height [m]: 5

Mechanical Ventilation Overpressure [Pa]: 0

Delete source OK Cancel Help

Important:

The source location, climate data, and simulation period must match those in the planned 2D simulation.

Step 2 – Export the Source as an ASCII File

Export the source as an ASCII file

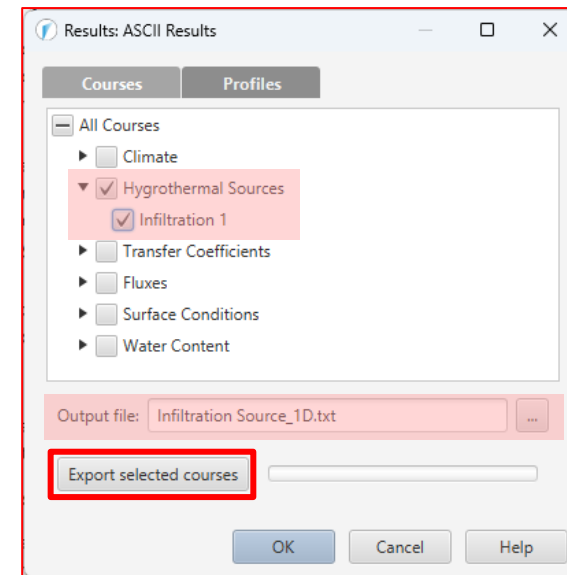
After the simulation, export the source strength using the ASCII export function:

Outputs → ASCII-Export

*Courses: Hygrothermal Sources
→ Check the box for "Infiltration 1"*

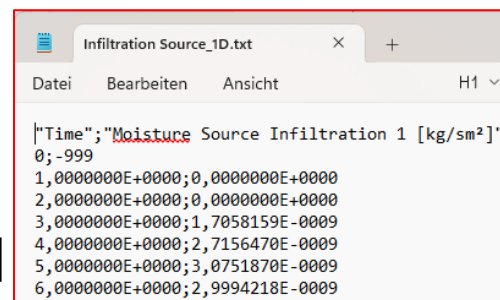
Select an output file

→ Export selected courses



Result:

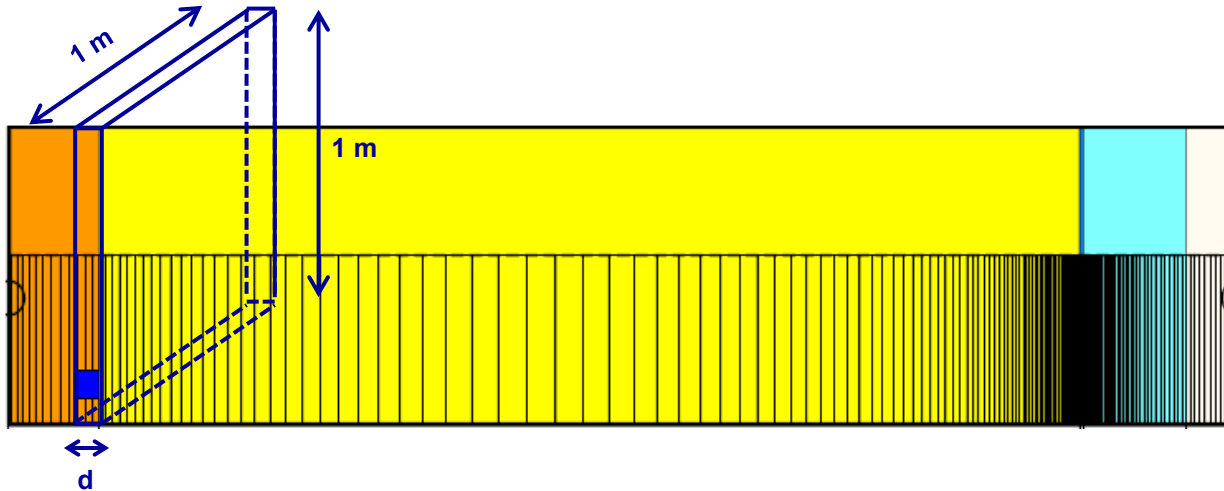
File with hourly values
of the source strength in [kg/(m²·s)]



Step 3 – Convert the Source for WUFI® 2D

Background: Why does the source have to be converted?

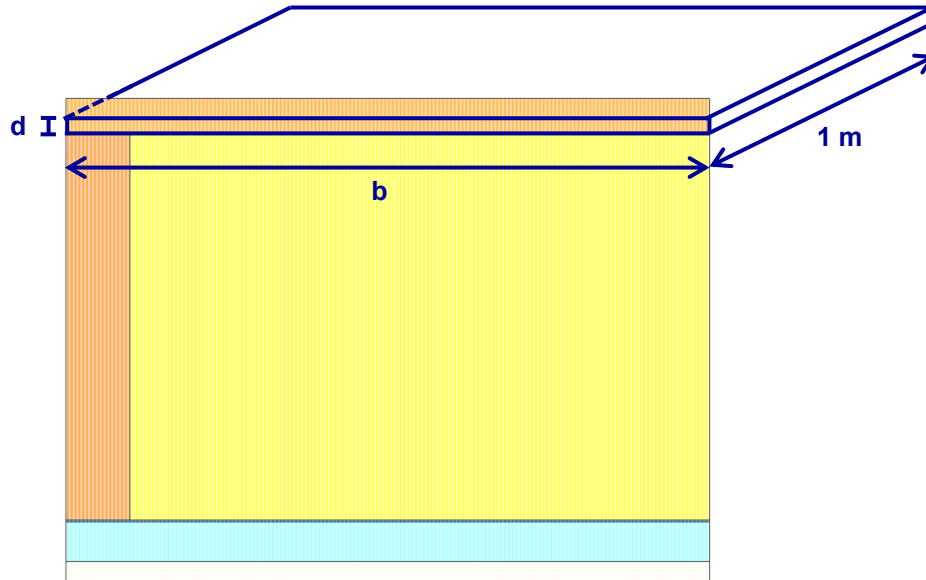
WUFI® Pro (1D): Source strength is expressed per unit area [$\text{kg}/(\text{m}^2 \cdot \text{s})$]



Step 3 – Convert the Source for WUFI® 2D

Background: Why does the source have to be converted?

WUFI® 2D: Source strength is expressed per unit length [kg/(m·s)]



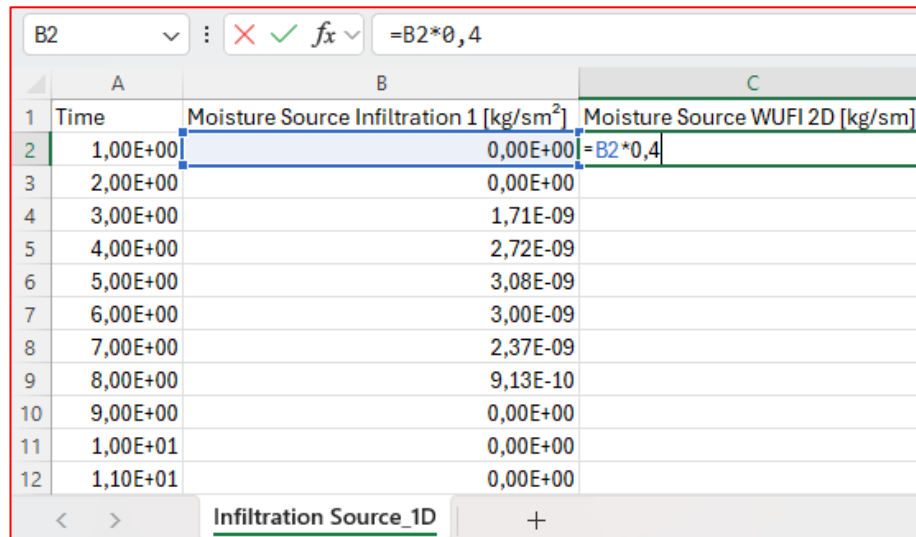
→ Conversion: $SourceStrength2D = SourceStrength1D * b$

where b is the width of the source in the 2D model in [m]

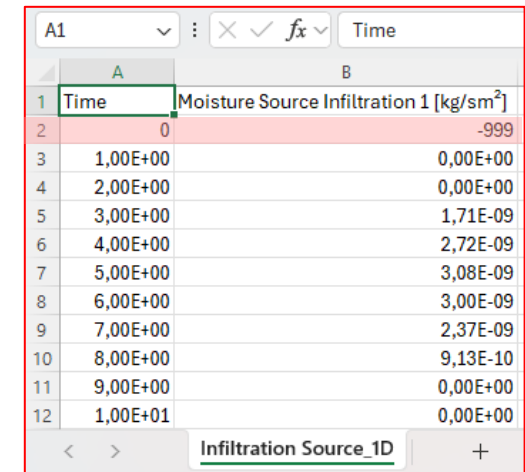
Step 3 – Convert the Source for WUFI® 2D

Conversion using Excel, for example

- Open the exported file "Infiltration Source_1D.txt" in Excel
- Delete the row containing the entries "0" and "-999"
- New column: = $SourceStrength1D * b$
(read the width b of the source from the 2D model;
here: $b = 0.4$ m)



	A	B	C
1	Time	Moisture Source Infiltration 1 [kg/sm ²]	Moisture Source WUFI 2D [kg/sm]
2	1,00E+00	0,00E+00	=B2*0,4
3	2,00E+00	0,00E+00	
4	3,00E+00	1,71E-09	
5	4,00E+00	2,72E-09	
6	5,00E+00	3,08E-09	
7	6,00E+00	3,00E-09	
8	7,00E+00	2,37E-09	
9	8,00E+00	9,13E-10	
10	9,00E+00	0,00E+00	
11	1,00E+01	0,00E+00	
12	1,10E+01	0,00E+00	

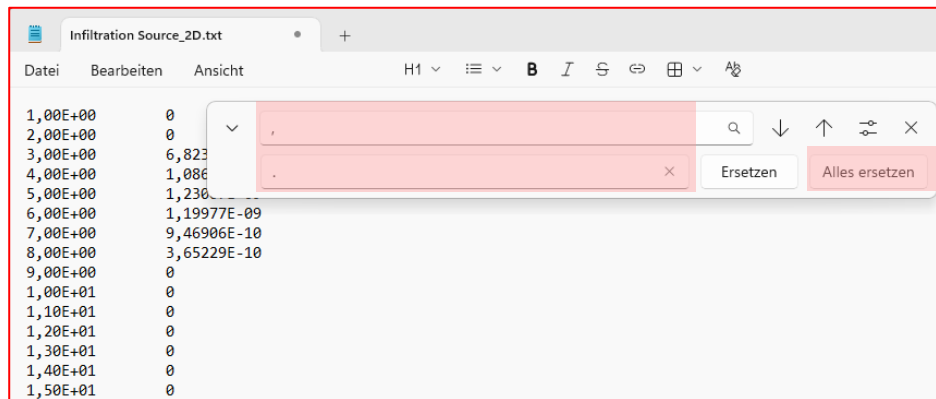


	A	B
1	Time	Moisture Source Infiltration 1 [kg/sm ²]
2	0	-999
3	1,00E+00	0,00E+00
4	2,00E+00	0,00E+00
5	3,00E+00	1,71E-09
6	4,00E+00	2,72E-09
7	5,00E+00	3,08E-09
8	6,00E+00	3,00E-09
9	7,00E+00	2,37E-09
10	8,00E+00	9,13E-10
11	9,00E+00	0,00E+00
12	1,00E+01	0,00E+00

Step 4 – Create a Text File for WUFI® 2D

Creating a text file to import the source strength into WUFI® 2D

- Select and copy the columns "Time" and "Moisture source WUFI 2D" excluding the headers
- Paste the data into a new file in a text editor
- If necessary, replace decimal commas with decimal points (*Edit → Replace → Replace all*)



Time	Moisture source WUFI 2D
1.00E+00	0
2.00E+00	0
3.00E+00	6.82326E-10
4.00E+00	1.08626E-09
5.00E+00	1.23007E-09
6.00E+00	1.19977E-09
7.00E+00	9.46906E-10
8.00E+00	3.65229E-10
9.00E+00	0
1.00E+01	0
1.10E+01	0
1.20E+01	0
1.30E+01	0
1.40E+01	0
1.50E+01	0
1.60E+01	0
1.70E+01	0
1.80E+01	0

- Save the file in .txt format

Step 4 – Create a Text File for WUFI® 2D

Checklist for the correct text file format

- ☒ no header
- ☒ exactly two columns (hour, source strength)
- ☒ decimal separator = decimal point
- ☒ columns separated by a tab or a space
- ☒ no blank lines at the end of the file

Step 5 – Insert the Source into WUFI® 2D

Insert the Source into WUFI® 2D

- Insert a moisture source and define its area in the 2D geometry
here: inner 5 mm of the OSB board

Note:

For simplicity, the source is distributed across the full width, including the rafters.

The screenshot shows the WUFI 2D software interface. On the left is a project tree with the following items: Project, Geometry, Numerical Grid, Materials, Initial Conditions, Surface/Weather, **Sources, Sinks** (highlighted), Computational Parameters, and Processing. The main window displays a 2D grid with axes ranging from -100 to 600 on the X-axis and 0 to 250 on the Y-axis. A blue horizontal line is drawn across the grid at Y=279, representing the moisture source. Below the grid is a table with the following data:

ID	Type	X [mm]	Y [mm]	Width [mm]	Height [mm]	Edit
Source1	Moisture Source	0	279	400	5	Edit...

The status bar at the bottom right of the table area shows 'Ready'.

Step 5 – Insert the Source into WUFI® 2D

Insert the Source into WUFI® 2D

- Click 'Edit' to define the source strength
- Source Type: Select "Transient Moisture Source from File"
- Select the text file you created
- Start the simulation
(*The start date and simulation period must match those used in the WUFI® Pro simulation.*)

