Roughness Mapping Tool – Users Guide

The method is described in Gál and Unger 2009, 2014 and in Unger et al 2014. It is free to use for any purpose, but please cite these papers.

The program do not needs installing, but it needs Java runtime environment to run: http://www.oracle.com/technetwork/java/javase/downloads/java-se-jre-7-download-432155.html

The program starts with RoughnessMappingToolV1.1.jar. Befor the start of the program the folder of the input and output files have to be defined in config.properites (normal text file). First the input data have to be defined.

💿 Roughness Calculator	*
Input data Output data Details	
Choose building shp	
Column of geometry	-
Column of height	
Min distance between blocks	0.9
Frontal area precision	: 1
Border distance around the area	: 100
Choose tree shp	
Column of geometry	
Column of height	
Transmittance (0 - 1)	0.6
Ellipse width	500
Ellipse height	: 150
Wind direction	: 0
Choose input point shp	
Column of geometry	:
	Distance between points:
Min X:	Min Y:
Max X:	Max Y:
	Calculate Roughness

First step is the input building data. It containes building footprints and heights values and it have to be stored in ESRI shapefile format.

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Look <u>i</u> n: 📑	Roughness_Sample_Input	- a ê e e e
🗋 building.dl	Ŋf	
🗋 building.sl	np	
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DOI.dbf		
🗋 POI.shp		
🗋 POI.shx		
File <u>N</u> ame:	building.shx	
Files of <u>T</u> ype:	All Files	-
		Open Cancel

The geometry is the shape column in the shapefile. All times it called here the geom. Height is the height of the buildings above the ground in meters. Min distance between block is in meter and when two building footprints are closer than this value than they will considered as connected buildings (=building blocks). Frontal area precision is in meters and it defines the distance between the projection lines laid over the buildings for the frontal area calculation. The border distance around the area is in meters and it defines the maximum size of the plot area around the buildings.

📀 Roughne	ss Calculator			(x
Input data	Output data Details]			
	Choose building shp		building.shp		
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	Colum	of height	MAGASSAG		-
	Min distance hetwe	en blocks	0.9		-
	Frontal area	precision:	1		-
	Border distance aroun	d the area:	100		
	Choose tree shp				
	Column of	geometry:			-
	Colum	n of height:			-
	Transmitta	nce (0 - 1):	0.6		_
	Elli	ipse width:	500		
	Ellip	ose height:	150		
	Wind	direction:	0		
	Choose input point shp				
	Column of	geometry:			-
			Distance between points:		
Min X:			Min Y:		
Max X:			Max Y:		
		(Calculate Roughness		

Tree shp contains the footprints and heights of the tree crowns. It is optional, and the setup is same to the buildings. Transmittance is the porosity of the tree crowns.

The software calculate the roughness parameters for plot polygons (around building blocks) and after that it calculates the average roughness parameter in an elliptical shape area (Gál and Unger 2014). ellipse width is the longer and ellipse height is the shorter axis of this ellipse.

Frontal area is depend on wind direction, this direction can be setup in wind direction field.

Next part is the definition of the point of interest, where we want to calculate the roughness. It can be defined by a point shape file or by the coordinates of the boundary of the study area and a resolution for the points. If you use shape file than you have to select is using Choose input point shp button.

🍰 Open	
Look <u>i</u> n:	🖹 Roughness_Sample_Input 💌 🕼 🔂 🗂 📴 📴
🗋 buildin	ıg.dbf
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🗋 buildin	ig.shx
POI.db	ſ
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File <u>N</u> ame:	POI.shp
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	Open Cancel

Next we have to define the outputs of the calculation.

😢 Roughness Calculator			×
Input data Output data Details			
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Filename pretag:	output	mins of the output data	
POI with roughness data	geometry	×	frontal area
All None	✓ z0	у	ellipse width
	⊯ zd	wind direction	🗌 ellipse height
	📃 sum area of in	tersect polygons	number of polygons
Voronoi polygons with Roughness data	🖌 geometry	🗌 frontal area	🔄 area of voronoi polygon
All None	⊮ z0	🔲 frontal area precision	
	⊯ zd	🔲 area of buildings	🔄 area of trees
	📃 lambda P	volume of buildings	volume of trees
	📃 lambda F	weighted height	weighted height of trees
	wind direction	border distance	transmittance of tree
Ellipse polygons with roughness data	🗹 geometry	×	🗌 frontal area
All None	✓ z0	у	ellipse width
	⊯ zd	wind direction	ellipse height
	🔲 sum area of in	tersect polygons	number of polygons
Block polygons	🖌 geomety	min distance between	blocks
All None	📄 area	number of buildings	
	Calculate Rou	ghness	

Default outputs are grey. If only the roughness is important for us than we have to check the POI with roughness data. And also we should modify the Filename pretag (e.g. wind direction, area, etc)

📀 Roughness Calculator				X
Input data Output data De	tails			
	Calaatt			
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POI with roughness data		✓ geometry	×	frontal area
All		✓ z0	□y	ellipse width
		🗹 zd	wind direction	🗌 ellipse height
		🔲 sum area of int	ersect polygons	number of polygons
Voronoi polygons with Rough	nness data	a 🖌 geometry	🗌 frontal area	area of voronoi polygon
All None		∠ z0	🔲 frontal area precision	
		🗹 zd	area of buildings	🔄 area of trees
		📃 lambda P	volume of buildings	volume of trees
		📃 lambda F	weighted height	weighted height of trees
		wind direction	border distance	transmittance of tree
Ellipse polygons with roughn	iess data	✓ geometry	×	🗌 frontal area
All None		∠ z0	у	ellipse width
		∠ zd	wind direction	🗌 ellipse height
		🔲 sum area of int	ersect polygons	number of polygons
Block polygons		✓ geomety	🔲 min distance betweer	n blocks
All None		🔤 area	number of buildings	
		Calculate Rou	ghness	

Than before starting the calculations it is useful to click on Details. In this screen we can follow the process of the calculation. The calculation starts with Calculate Roughness button.

Input data Output data Details
Add input and output data to calculate
< · · · · · · · · · · · · · · · · · · ·
Calculate Roughness
Roughness Calculator
Input data Output data Details
[13:38:55] Verifying input data.
[13:33:55] Ellipse datas are valid.
[13:38:55] Point datas are valid. [13:38:55] All input data verifyed.
13:38:55] Generate blocks by building data.
[13:39:2] Generate voronoi polygons around buildings.
1339:22] Voronoi polygons generated.
[13:39:22] Calculate ended!
1 3/3/22] Calculate ended [13:39:22] Exporting POI! [13:39:23] Decemented
(13:39:22) Calculate ended [13:39:22] Exporting POII [13:39:23] POI exported [13:39:23] Calculating and saving finished!
[13:39:22] Calculate ended[[13:39:22] Exporting POI! [13:39:23] POI exported! [13:39:23] Calculating and saving finished!
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(13:39:22) Calculate endedi (13:39:23) POI exported! [13:39:23] Calculating and saving finished!

In config.properties all of these options can be defined. The program can be started without GUI if useGui=true is changed to useGui=false. In this case all of the options will be to the same to config.properties, and only the calculation will done (it is useful e.g. if we use the program in a Linux server, and we started it from a script).

Unger J, Gál T, Csépe Z, Lelovics E, Gulyás Á, 2014. Development, data processing and preliminary results of an urban human comfort monitoring and information system. Időjárás (accepted).

Gál T, Unger J, 2014: Calculation of the sky view factor and roughness parameters in a medium sized city. Environmental Engineering and Management Journal, (accepted).

Gál T, Unger J, 2009: Detection of ventilation paths using high-resolution roughness parameter mapping in a large urban area. Building and Environment 44, 198-206.