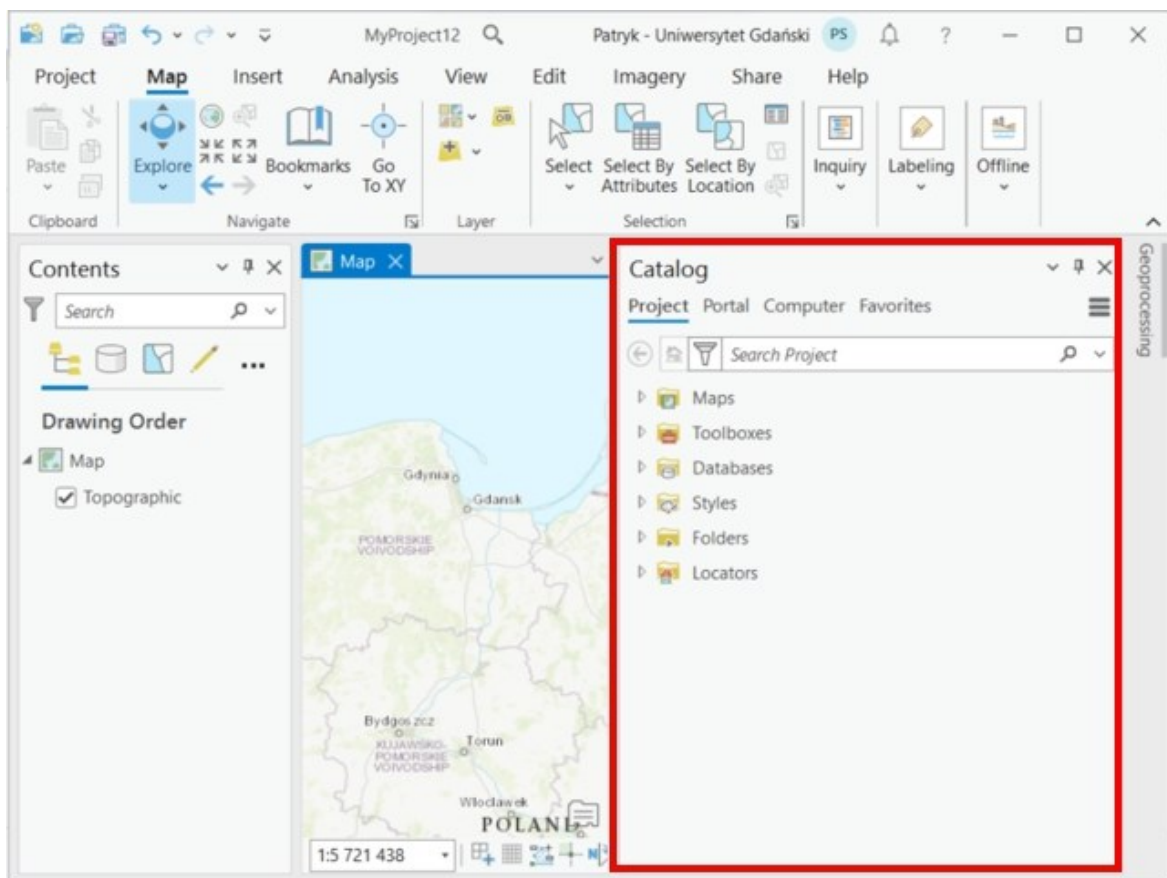


MANUAL

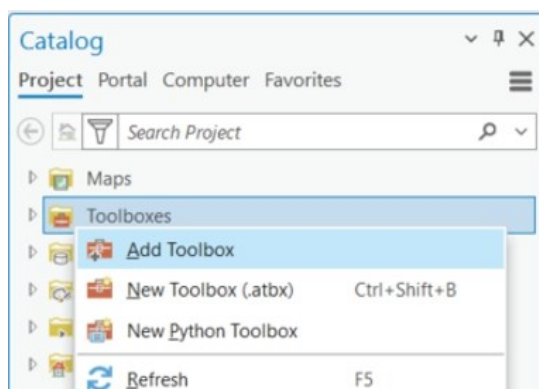
Beachmeter 1.2 by Sitkiewicz (2024)

Step by step using the Beachmeter as a tool in ArcGIS Pro by ESRI

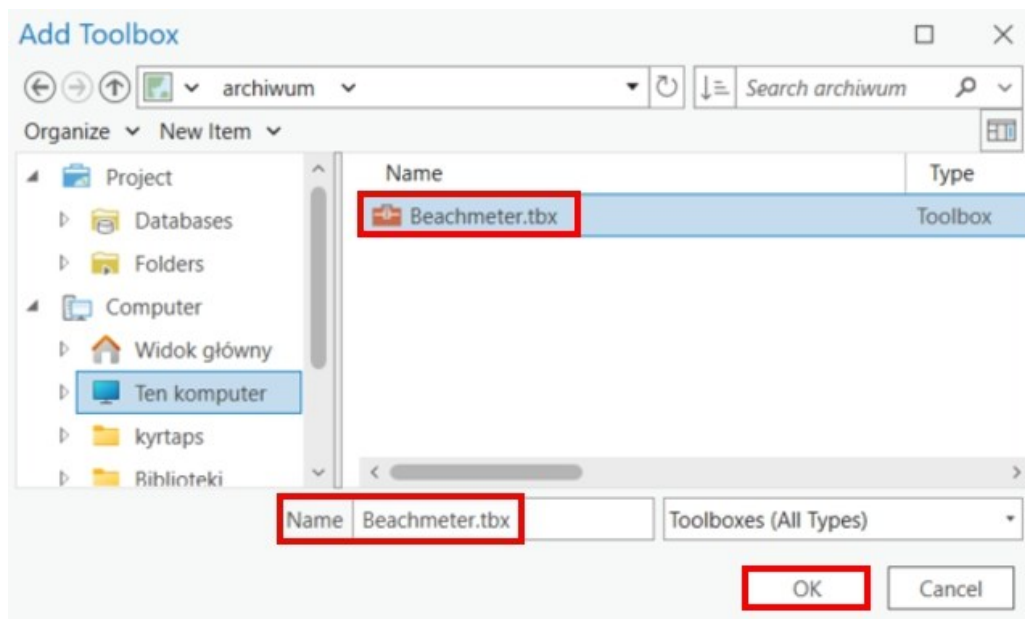
1. Launch ArcGIS Pro. Open a new project or any existing one.
2. Add the Beachmeter script as an ArcGIS tool:
 - a. Go to the Catalog window.



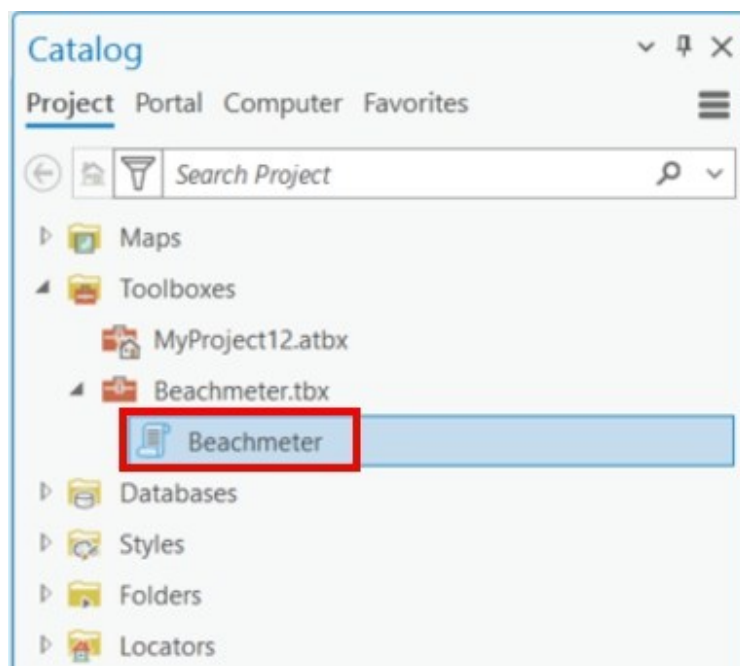
- a. Right click "Toolboxes". Left click "Add Toolbox".



c. Select "Beachmeter.tbx" on your computer and click "OK".



3. Launch Beachmeter script inside your ArcGIS Pro by left double clicking.



4. The Beachmeter has been opened as a Geoprocessing window. Fill out the parameters form.

- type the name of the shore section that you would like to analyze now
- change the “warning sea level” according to the proper elevation value [m] related to your beach seaward border; it should be the warning sea level for the nearest tide gauge station in conformity to the proposed measurement method (Sitkiewicz, 2024)
- change the “water-level P=0.2%” according to the proper elevation value [m] related to your beach landward border; the proposed beach measurement method (Sitkiewicz, 2024) posits that it should be the maximum storm surge water level that probably occurs once 500 years ($P=0.2\%$) and its value should be calculated for every shore section using hydraulic modeling and can be read on Flood Risk Maps
- Input the first DEM (digital elevation model) of the coastal zone representing reference state;
- Input the timestamp of the first DEM to indicate the measurement date

Geoprocessing Beachmeter

Parameters Environments ?

* beach name

warning sea-level

water-level P=0.2%

* before - DEM

* before - timestamp

* after - DEM

* after - timestamp

expected beach area (sq m)

expected shoreline length (m)

before - DEM

Hel-Bor 2020 lidar

Organize New Item

Name Type

N-34-50-B-a-1-1-2020.tif Raster Data

Name N-34-50-B-a-1-1-2020.tif Rasters (All Local Types)

Geoprocessing Beachmeter

Parameters Environments ?

beach name

warning sea-level

water-level P=0.2%

* before - DEM

* before - timestamp

* after - DEM

* after - timestamp

expected beach area (sq m)

expected shoreline length (m)

- f. Input the second DEM of the coastal zone representing the coast after a period of time;
- g. Input the timestamp of the second DEM to indicate when the second measurement of coastal relief was performed

NOTE: It is highly recommended to view DEMs before the Beachmeter launch in order to validate the dataset and find out the expected beach dimensions within the input DEMs.

- h. Fill out fields “expected beach area” and “expected shoreline length”. These parameters prevent recognizing different areas located at the same level as the beach. Input values must be smaller than the beach dimensions on the DEMs. Input values of 60-80% of the real beach dimensions are recommended.
5. Run The Beachmeter when the form is filled out.

The screenshot shows the 'Beachmeter' tool window in a GIS software. The window has a title bar with 'Geoprocessing' and standard window controls. Below the title bar is a toolbar with a back arrow, a forward arrow, and a help icon. The main area is divided into two tabs: 'Parameters' (selected) and 'Environments'. The 'Parameters' tab contains the following fields:


- beach name:** A text box containing 'Hel Bor'.
- warning sea-level:** A numeric input box with the value '0,5'.
- water-level P=0.2%:** A numeric input box with the value '2,3'.
- before - DEM:** A file selection box showing 'N-34-50-B-a-1-1-2020.tif'.
- before - timestamp:** A text box containing '2020'.
- after - DEM:** A file selection box showing 'N-34-50-B-a-1-1-2021.tif'.
- after - timestamp:** A text box containing '2021'.
- expected beach area (sq m):** A numeric input box containing '50000'.
- expected shoreline length (m):** A numeric input box containing '1500'.

At the bottom right of the window, there is a blue button with a play icon and the text 'Run', which is highlighted by a red rectangular box.

6. Check the results. Open "Messages".

Beachmeter (Beachmeter) X


Started: Today at 09:55:24
Completed: Today at 09:55:58
Elapsed Time: 34 Seconds




Parameters Environments Messages (9) 

beach name	Hel Bor
warning sea-level	0,5
water-level P=0.2%	2,3
before - DEM	C:\Morska Geomorfologia\00. UGrants-start\DANE\Hel-Bor\2020\lidar\N-34-50-B-a-1-1-2020.tif
before - timestamp	2020
after - DEM	C:\Morska Geomorfologia\00. UGrants-start\DANE\Hel-Bor\2021\lidar\N-34-50-B-a-1-1-2021.tif
after - timestamp	2021
expected beach area (sq m)	50000
expected shoreline length (m)	1500

Beachmeter (Beachmeter) X

Started: Today at 09:55:24
Completed: Today at 09:55:58
Elapsed Time: 34 Seconds

Parameters Environments Messages (9) 

Start Time: sobota, 2 grudnia 2023 09:55:24

The approximate length of the analyzed shore section is 2212 meters.

2020 -> the HelBor beach area was 40951 square meters

2021 -> the HelBor beach area was 54027 square meters

2020 -> the HelBor beach average width was 19 meters

2021 -> the HelBor beach average width was 24 meters

The beach surface area and its sediment volume above the seaward elevation limit have been saved: C:/Beachmeter/2023-12-02\HelBor2020_volume.csv and C:/Beachmeter/2023-12-02\HelBor2021_volume.csv

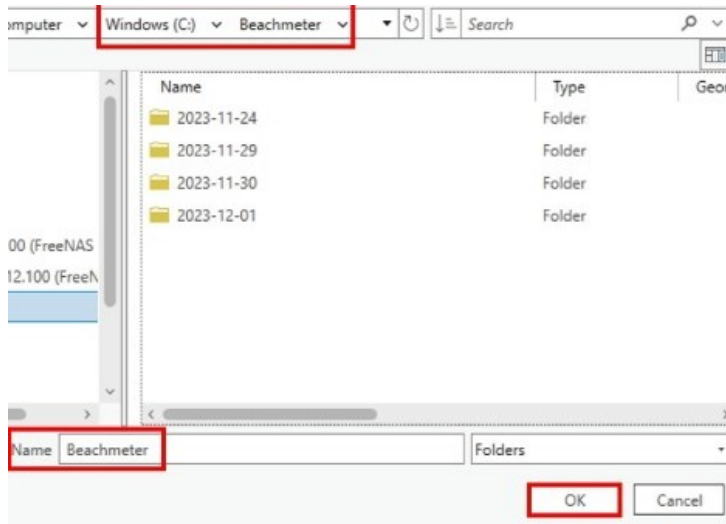
You can find digital elevation models of your beach in the current working folder: C:/Beachmeter/2023-12-02/HelBor.gdb

The HelBor beach differential map has been generated with success: C:/Beachmeter/2023-12-02/HelBor.gdb\HelBor_DEM_difference

The HelBor beach volume loss and gain were calculated and saved: C:/Beachmeter/2023-12-02\HelBor2021_vol_loss.txt and C:/Beachmeter/2023-12-02\HelBor2021_vol_gain.txt

Succeeded at sobota, 2 grudnia 2023 09:55:58 (Elapsed Time: 33,24 seconds)

7. To show and use the spatial results saved as shapefiles (polylines) and rasters (DEMs and difference map), connect your ArcGIS to the Beachmeter folder. The result folder is located by default in C://Beachmeter. Inside the folder, subfolders are created. The name of the subfolder corresponds to the current date.

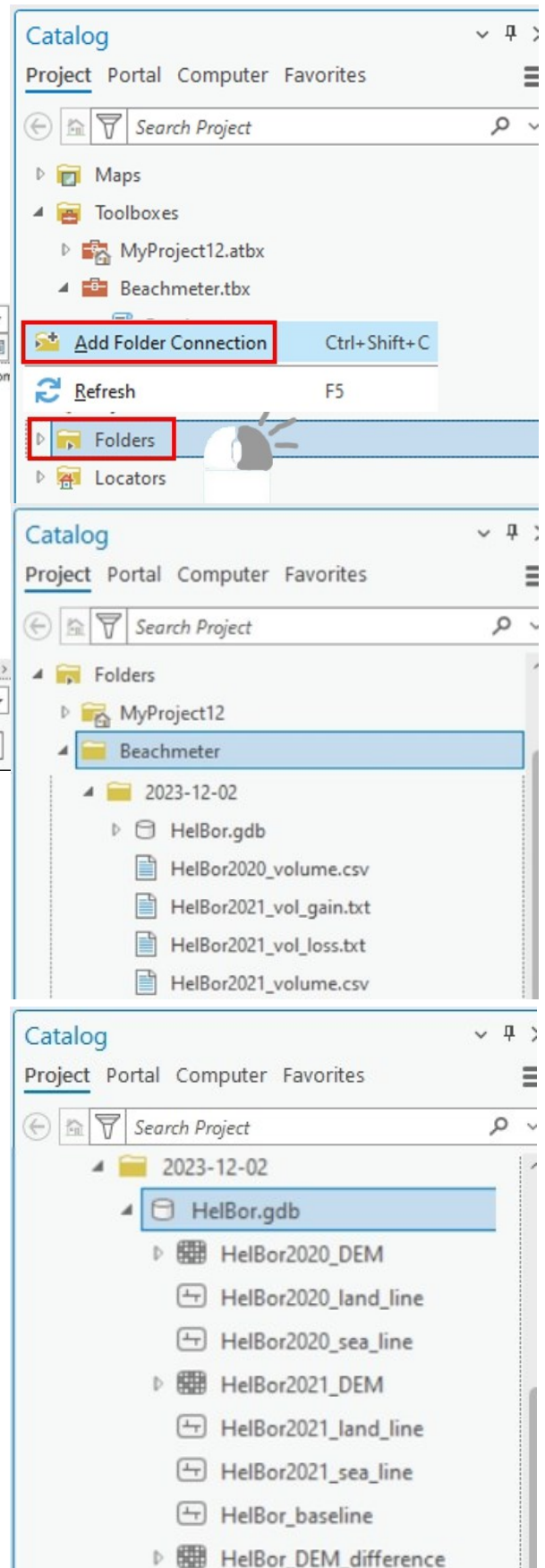


Troubleshooting and recommendations

The Beachmeter failed due to an error? The most common reason is mismatching of input beach parameters and DEMs.

- check your input DEMs
- compare DEMs and the input values of the expected beach area and shoreline length
- compare DEMs and the input values of the beach boundaries

The Beachmeter is ready to work with standard DEM sheets, for example, available online in many geoportals and the service of Polish Maritime Offices. However, in some cases, the user should cut the DEM to the proper shore area before using it in the Beachmeter. Low-lying coastal lakes and peatlands may be erroneously classified as a beach, so they should be cut from DEM. Moreover, some DEM files may include more than one beach. Hence, coastal barriers should be divided into more than one DEM because analyzing open-sea beaches and coastal lagoon beaches at the same time may be erroneous.



More information and tutorial video:

Sitkiewicz, P. (2024). Beachmeter – a simple tool for semi-automatic beach morphodynamics measurement. *SoftwareX* (under review).