Trainers for Visually Impaired Students Introduce 3D Printing

Tutorial Module 2
Available tools and sources to create tactile teaching materials

Tutorial for the T4VIS-In3D trainer course

Published by the
T4VIS-In3D project consortium

The project “T4VIS-In3D” was co-financed by the “ERASMUS+” Programme of the European Commission

This Tutorial is published by the T4VIS-IN3D project consortium.

Printed:
April 2021 by Berufsförderungswerk Düren gGmbH

The T4VIS-In3D Project Consortium:

Berufsförderungswerk Düren gGmbH (Project co-ordination)
Karl-Arnold-Str. 132-134, D52349 Düren, Germany, http://www.bfw-dueren.de

Fundacion Aspaym Castilla Y Leon
C/ Severo Ochoa 33, Las Piedras 000, 47130, Simancas Valladolid, Spain, https://www.aspaymcyl.org/

Hilfsgemeinschaft der Blinden und Sehschwachen Osterreichs
Jagerstrasse 36, 1200 Wien, Austria, https://www.hilfsgemeinschaft.at/

Instituttet for Blinde og Svagsynede, IBOS
Rymarksvej 1, 2900 Hellerup, Denmark, https://www.ibos.dk

Istituto Regionale Rittmeyer per i ciechi di Trieste
Viale Miramare 119, 34136 Trieste, Italy, http://www.istitutorittmeyer.it/

NRCB
24 Landos Str., Plovdiv, 4006, P. Box 11, Bulgaria, http://www.rehcenter.org

Content

1 General

The growing popularity of 3D printing is also increasing the number of tactile models available in repositories. Most of these are provided by relatives and teachers of blind and visually impaired students. Many of them are available as downloads free of charge. The majority of the models refer to tactile maps and braille. Since a large number of the models originate from the English-speaking world, their usability in another language area is limited unless having made certain modifications.

The selection shown here are only examples and their availability corresponds to the creation date of this tutorial (April 2021).

2 Available tools for braille learning and braille printing

As braille printers and labelling machines are very expensive, 3D printing seems to be the perfect choice for the production of braille elements. However, not all 3D printing processes are suitable for achieving good results. The FDM process in particular has some disadvantages when using the intended braille dimensions:

1. The dots are very sharp on the top and thus unpleasant to feel. The dots thus have to be sanded on the upper side.
2. The dots are very small and can easily be scraped off the surface.

For this reason, dots are often created larger than standardised to compensate for the disadvantages. Models made using the SLA method are much more comfortable to touch and to produce using 3D printing.

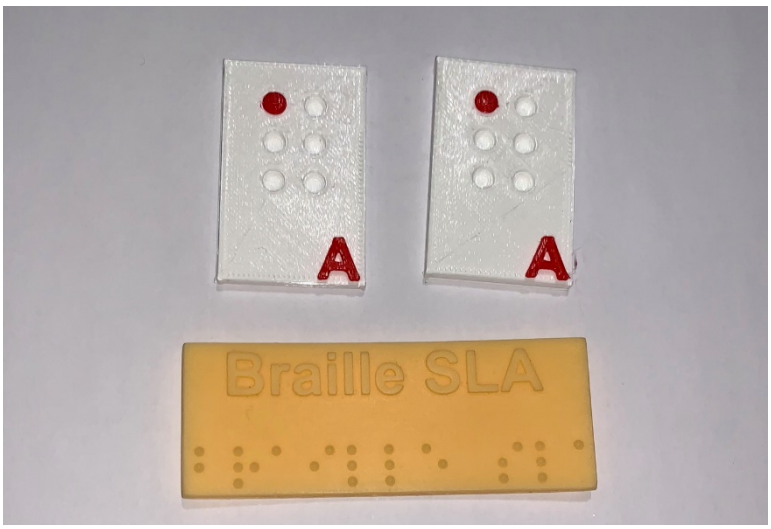

Figure 1 Example of braille printing. FDM (top) SLA (bottom)

Available braille apps for producing braille generate a background in the form of a tape to improve the adhesion of the dots. When printed, this looks similar to adhesive strips and is not very aesthetically attractive. In addition, these apps also come mainly from the English-speaking world and hence prevent the printing of special characters.

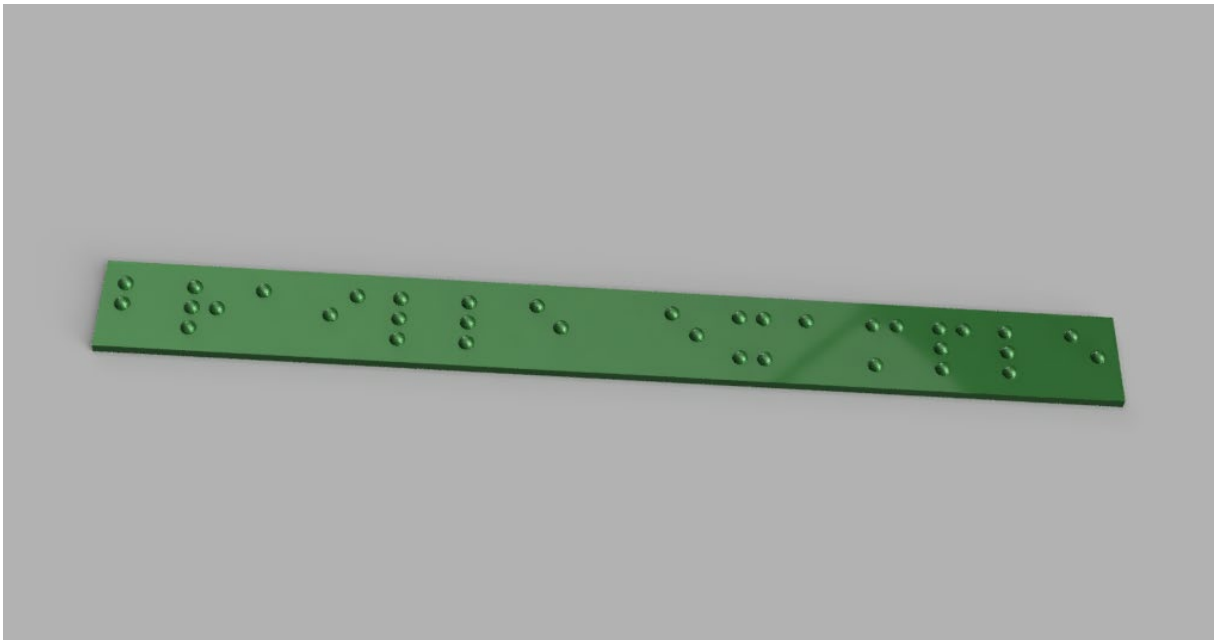

Figure 2 Example braille created with app

The following links are examples of available tactile models that can be used in training:

2.1 Learning

1. https://pinshape.com/items/35267-3d-printed-braille-blocks
2. https://www.myminifactory.com/object/3d-print-braille-alphabet-blocks-hope3d-submission-project-vision-phase-0-88775
3. https://pinshape.com/items/35293-3d-printed-modular-braille-labeling-and-learning-system

2.2 Printing and writing

1. https://www.thingiverse.com/thing:3490757
2. https://www.thingiverse.com/thing:3429056
3. https://touchsee.me/

2.3 Learning tools

1. Periodic table: https://cults3d.com/en/3d-model/various/improved-braille-periodic-table-density

3 Opportunities to create tactile maps

An important and interesting opportunity is the creation of tactile maps. Up to now, these could only be produced in a very complex way. However, they are very easy to realise using the 3D printing process.

3.1 Touch mapper

An excellent tool for creating tactile maps is the online solution Touch Mapper (https://touch-mapper.org/en/), which is based on the open source map material Open Streetmap.
After entering an address, this tool provides a selection of different map excerpts. This can then either be downloaded as an STL for printing on your own 3D printer or printed by the provider itself. The interface of this tool is available in four languages and is very easy to use. Touch Mapper also offers the option of selecting various print sizes and scales. Large maps can also be printed as tiles, which can subsequently be assembled.

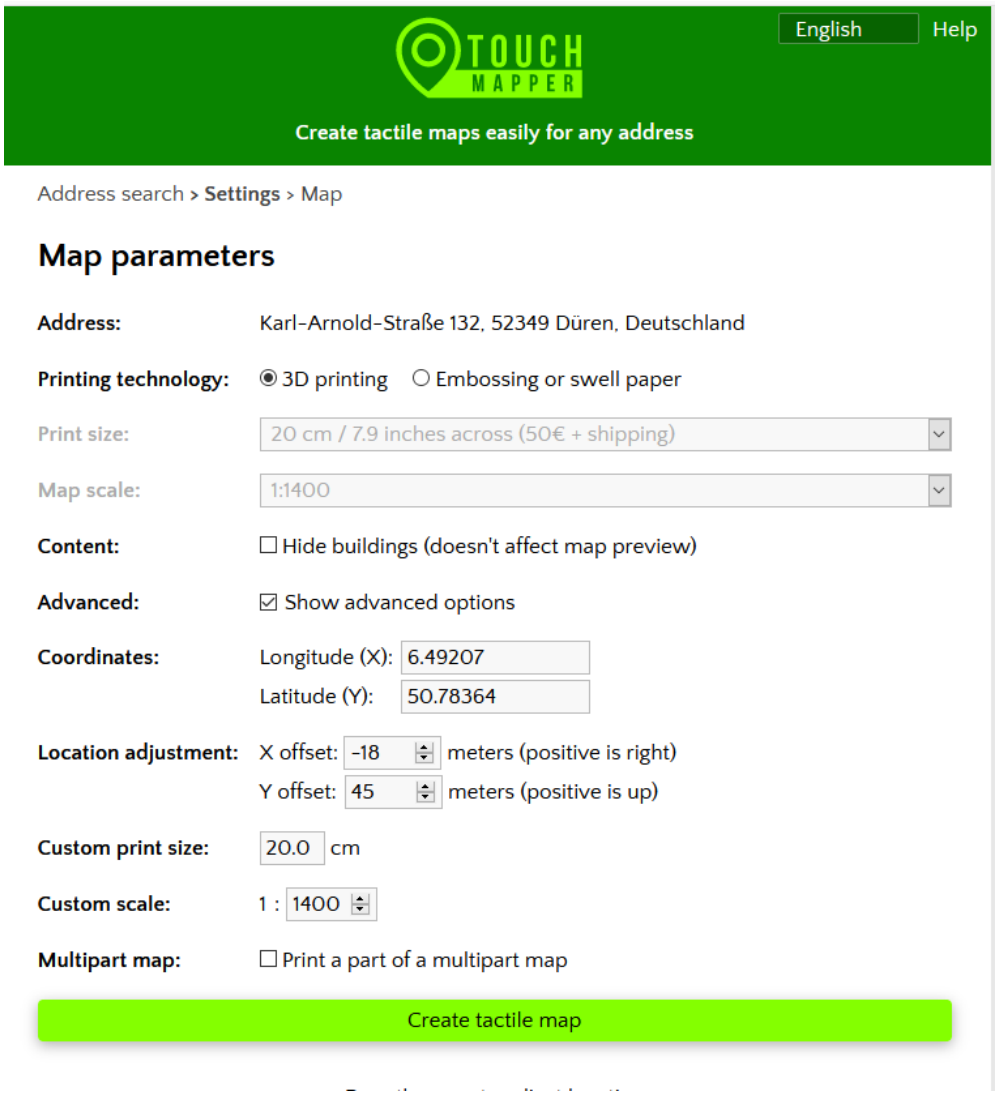

Figure 3 Control panel of Touch Mapper

The map sections can be moved and the scale adjusted via the available selection fields.

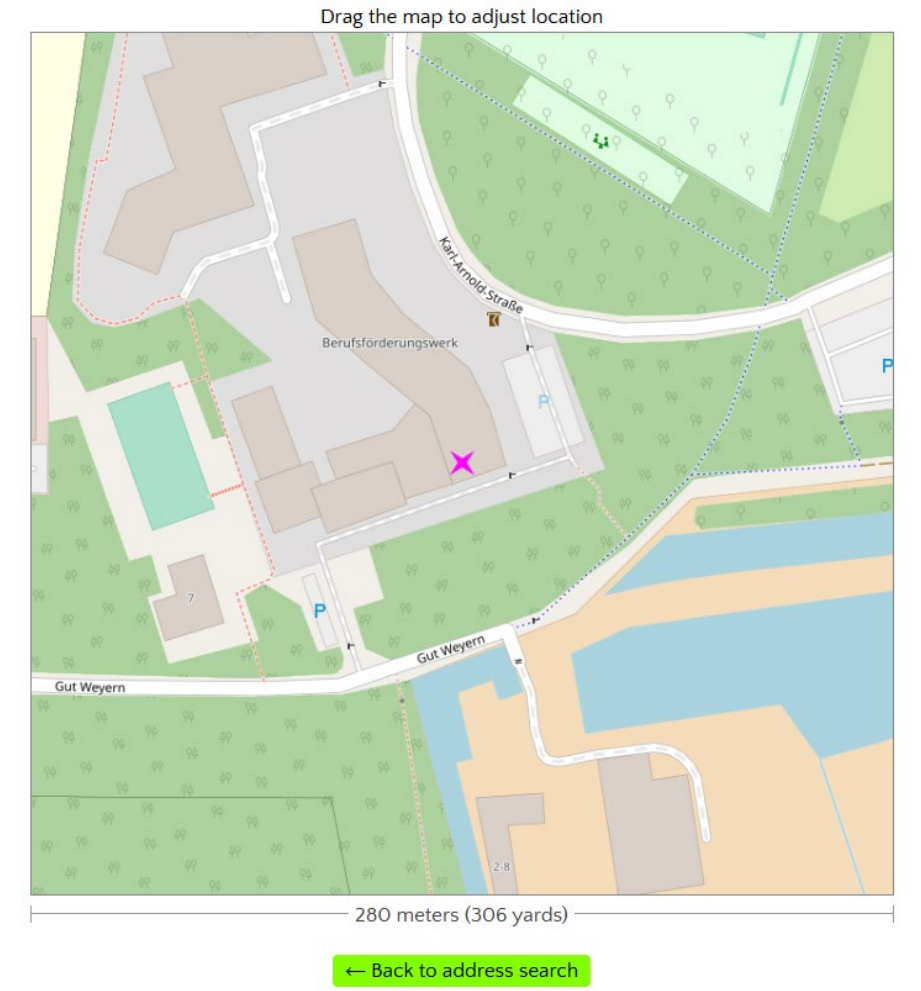

Figure 4 Map View of Touch Mapper

The map can be centred by positioning it with the mouse indicator. A special feature of Touch Mapper is the insertion of a cone that is positioned at the centre of the address entered. This cone can also be easily removed with Meshmixer.
In addition, the programme generates a border around the map square. For orientation, a small palpable cuboid is added to the upper right corner.

By activating the button "Create map", the STL file is created. This file can then be downloaded. To do so, however, the check box "Print map yourself" must be selected first.

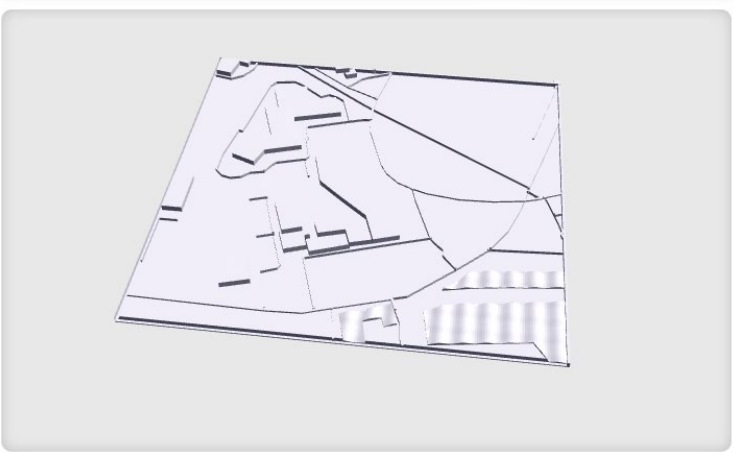

Figure 5 Preview of the STL file

The generated file can subsequently be edited like any ordinary STL file with respective software such as Autodesk Meshmixer ®. This necessary post-processing often consists of deleting or adding paths or buildings.

Figure 6 The printed STL file. Frame and position marker are visible.

However, the STL files can be also edited with CAD programs such as Autodesk Fusion360 so that missing elements are added or adjusted.

3.2 Touch Terrain

Touch Mapper is very good at creating location maps. However, it may be necessary for geography lessons to show the course of the terrain with elevations and valleys. Touch Terrain is available as a free online tool for this purpose.
(https://touchterrain.geol.iastate.edu/)

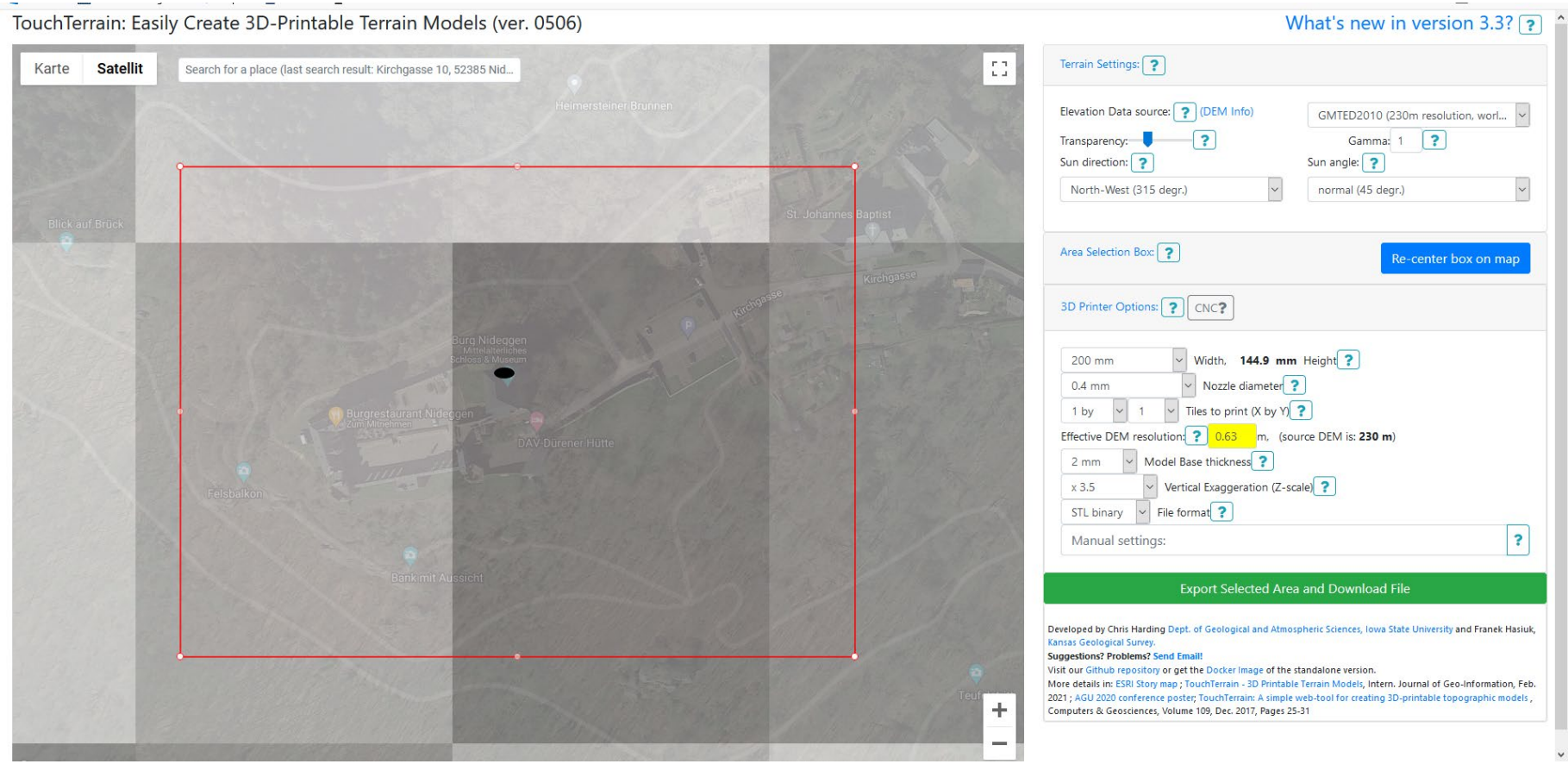

Figure 7 User Interface of Touch Terrain

The operation of Touch Terrain is similar to Touch Mapper. After entering an address and the respective country name in English, the location is searched for. It seems that the online tool is based on available GIS files. These are not always available for every country. Therefore, error messages may occur.

If the geographical area is found, it is displayed in a red rectangle in the main window. The terrain can be displayed in map or satellite view. On the right side of the screen you can find the settings for the map section and the default settings for the 3D printer. Here you can set the nozzle size and thickness of the base plate for printing.

By activating the button "Export selected area and download file", the terrain model is created. An editing window will appear.

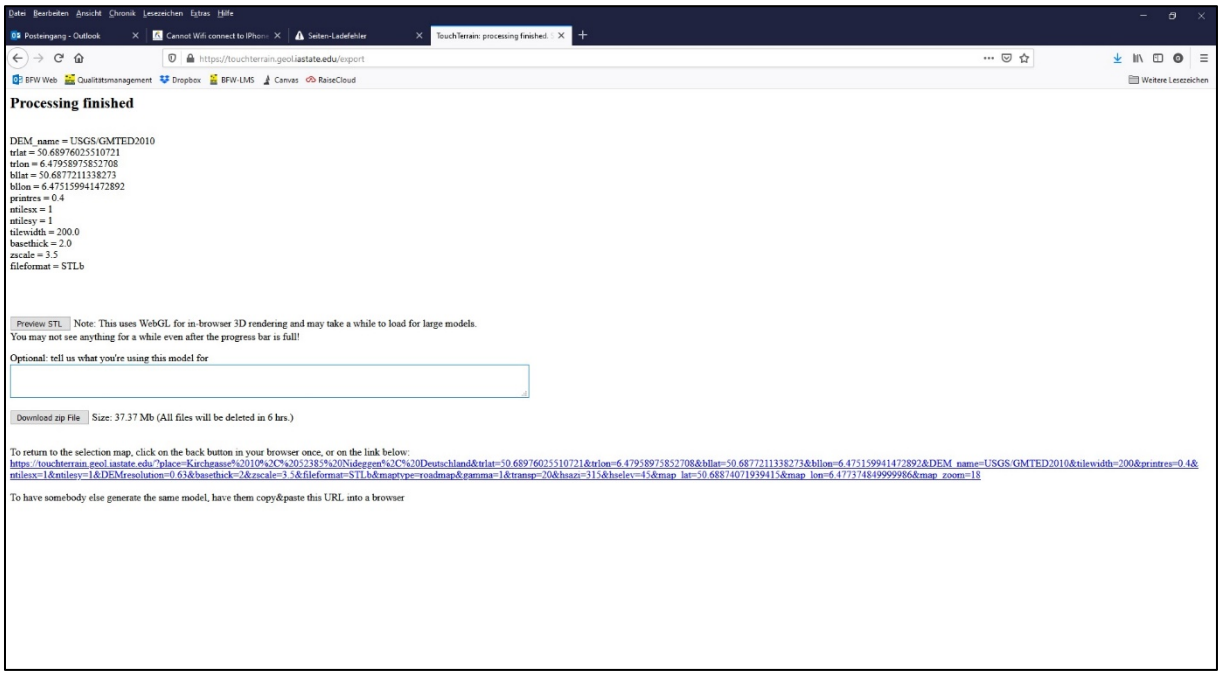

Figure 8 Processing window with download button

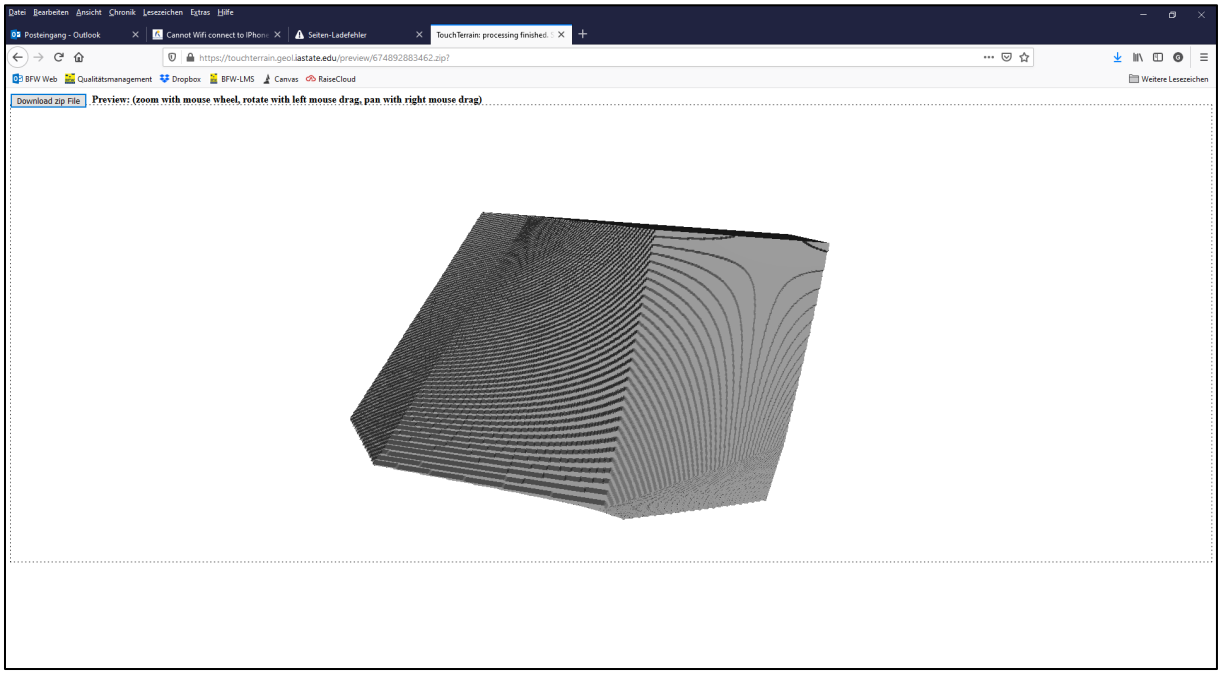

Figure 9 Generated terrain model

The terrain models are generated as STL files. In principle, these can also be processed with CAD software or correction software such as Meshmixer.

4 List of illustrations

5 Bibliography

Fachverband Faltschachtel-Industrie e.V. (Publ.); (2006). *Technische Richtlinien Blindenschrift in der Faltschachtel-Herstellung*. Frankfurt