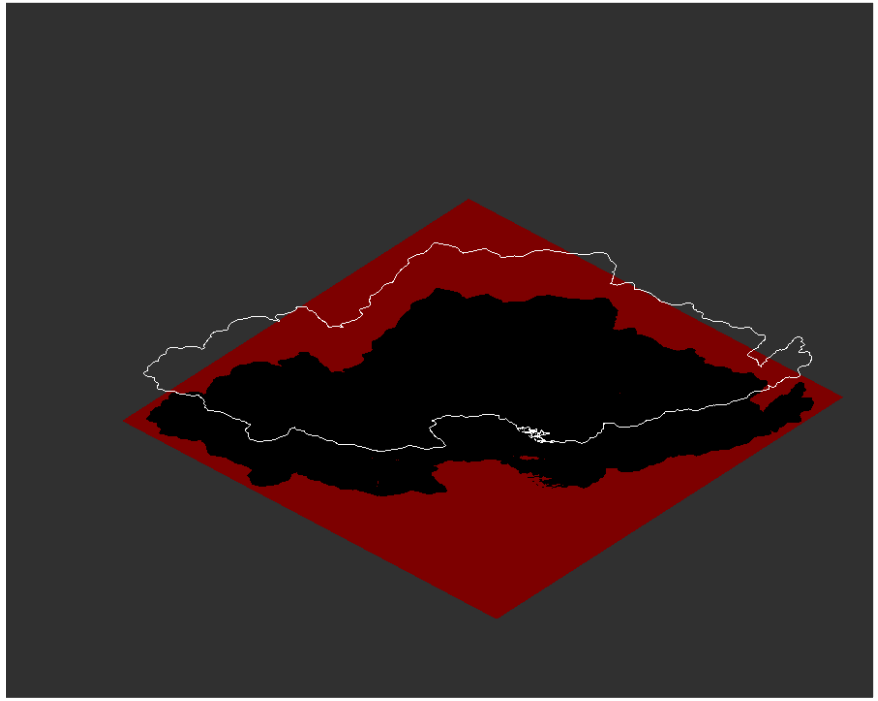
Airborne LIDAR tutorial

Footprint computing

Computing footprint for
a set of airborne LIDAR data



English version - 25/11/2022 - Created by L. Dietz and A. Piboule (ONF)

Contents

Click on the step to go directly to it

OBJECTIVE

Presentation of the steps to compute the footprint of a Airborne LIDAR dataset.

REQUIRES

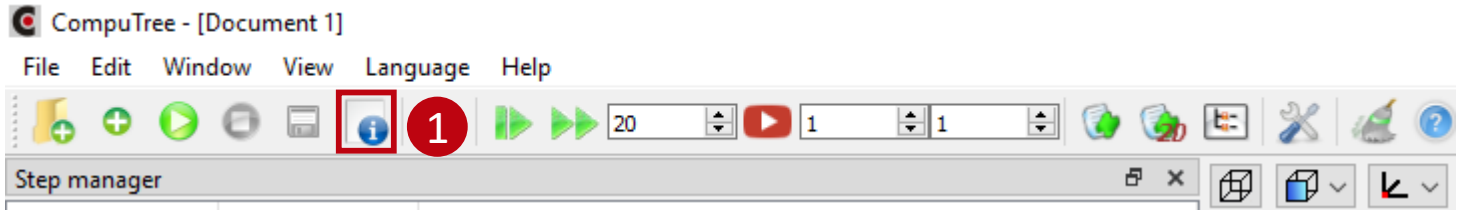
LAS/LAZ files containing the LIDAR point clouds corresponding to the tiles, one file per tile.

RESULTS

A raster and a shapefile of the dataset's footprint

How to cite this processing chain

The software and plugins used in this script are subject to intellectual property. For quoting them, click, at the end of the creation of the script, on 1. This button allows you to export the script as a documented version.



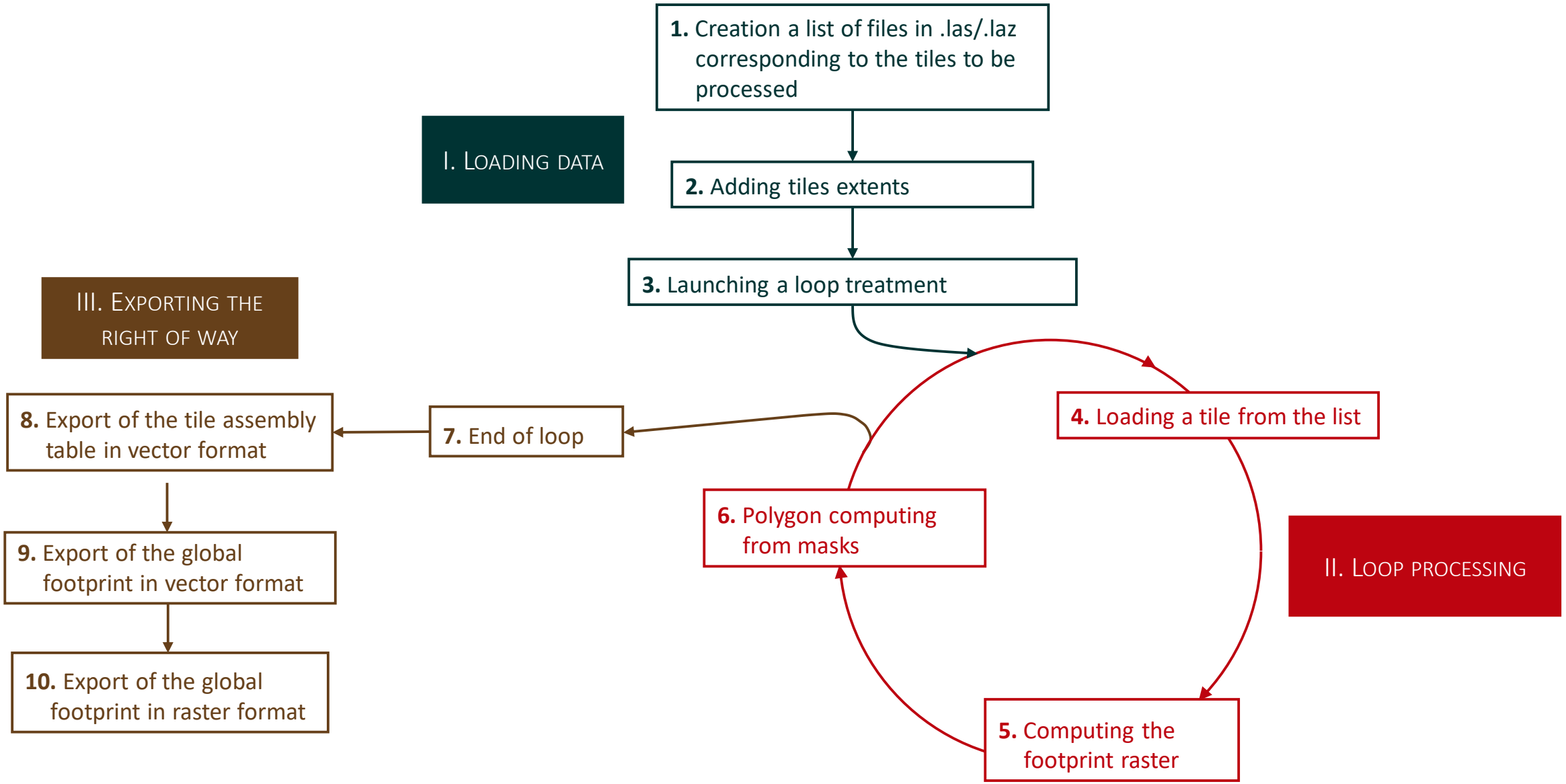
The plugins used here :

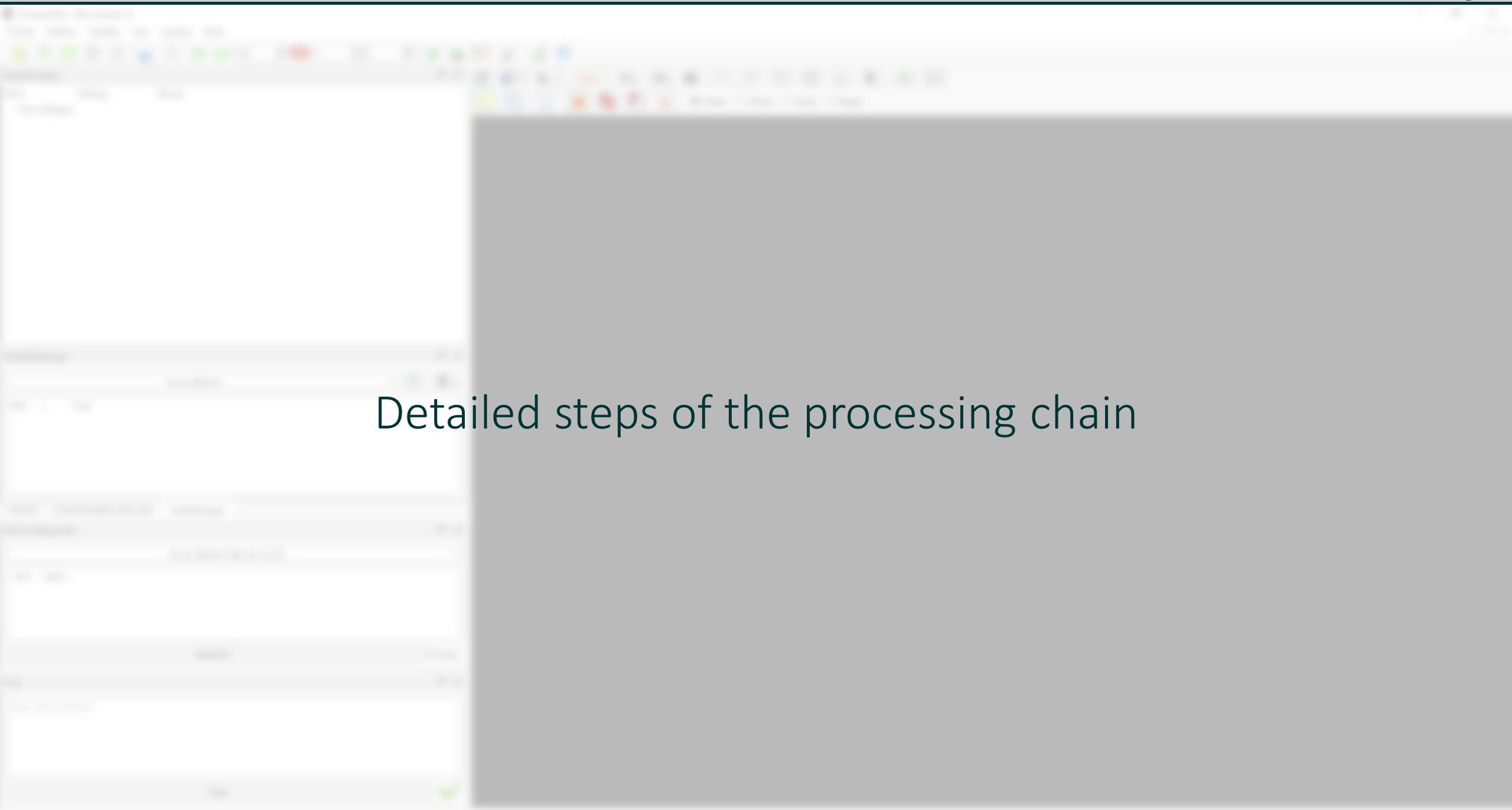
- [**ONF Plugin**]
  Piboule Alexandre.2022. *ONF Plugin for Computree*. Office National des Forêts, RDI Department.
  ONF plugin web page.

Method for computing the footprint

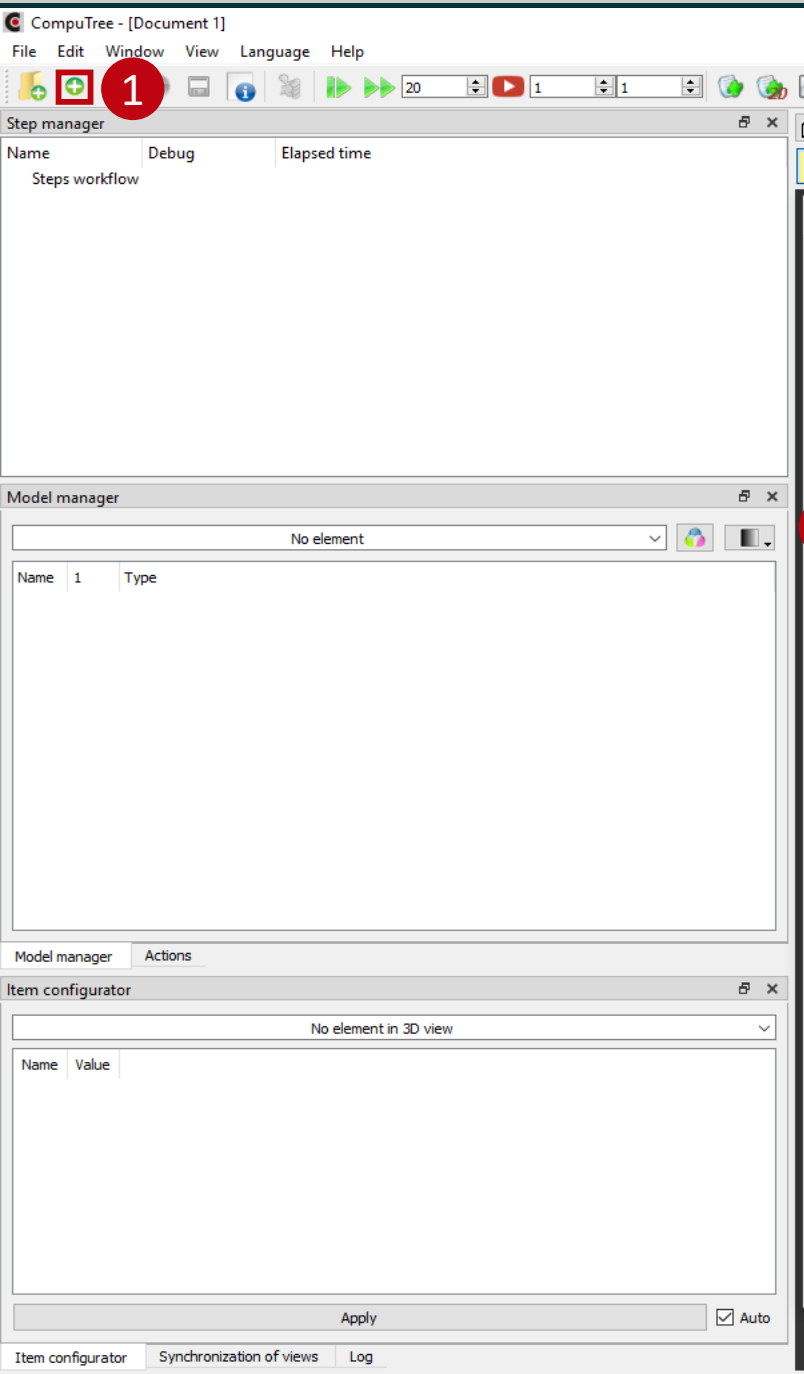
- The footprint is created from the intersection of the theoretical tiling and the 3D point cloud of the tiles.
- For each elementary unit within the theoretical tiling, 10 m by default, but resolution can be modified, the presence of at least one point in the point cloud allows to consider this elementary unit as part of the footprint.
- Thus a TRUE/FALSE footprint raster is obtained. The TRUE pixels correspond to all elementary units with at least one point in the point cloud.
- The vector footprint is a polygon that corresponds to the outline of the raster footprint.

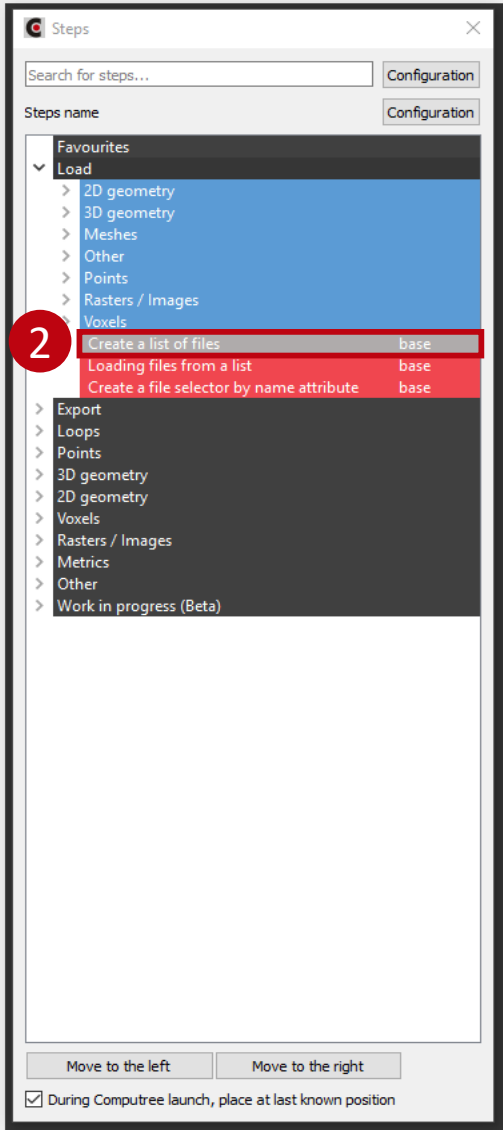
Major steps of the processing chain

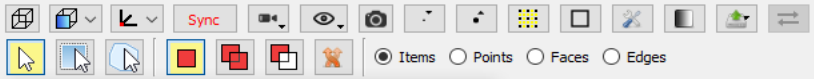




Detailed steps of the processing chain



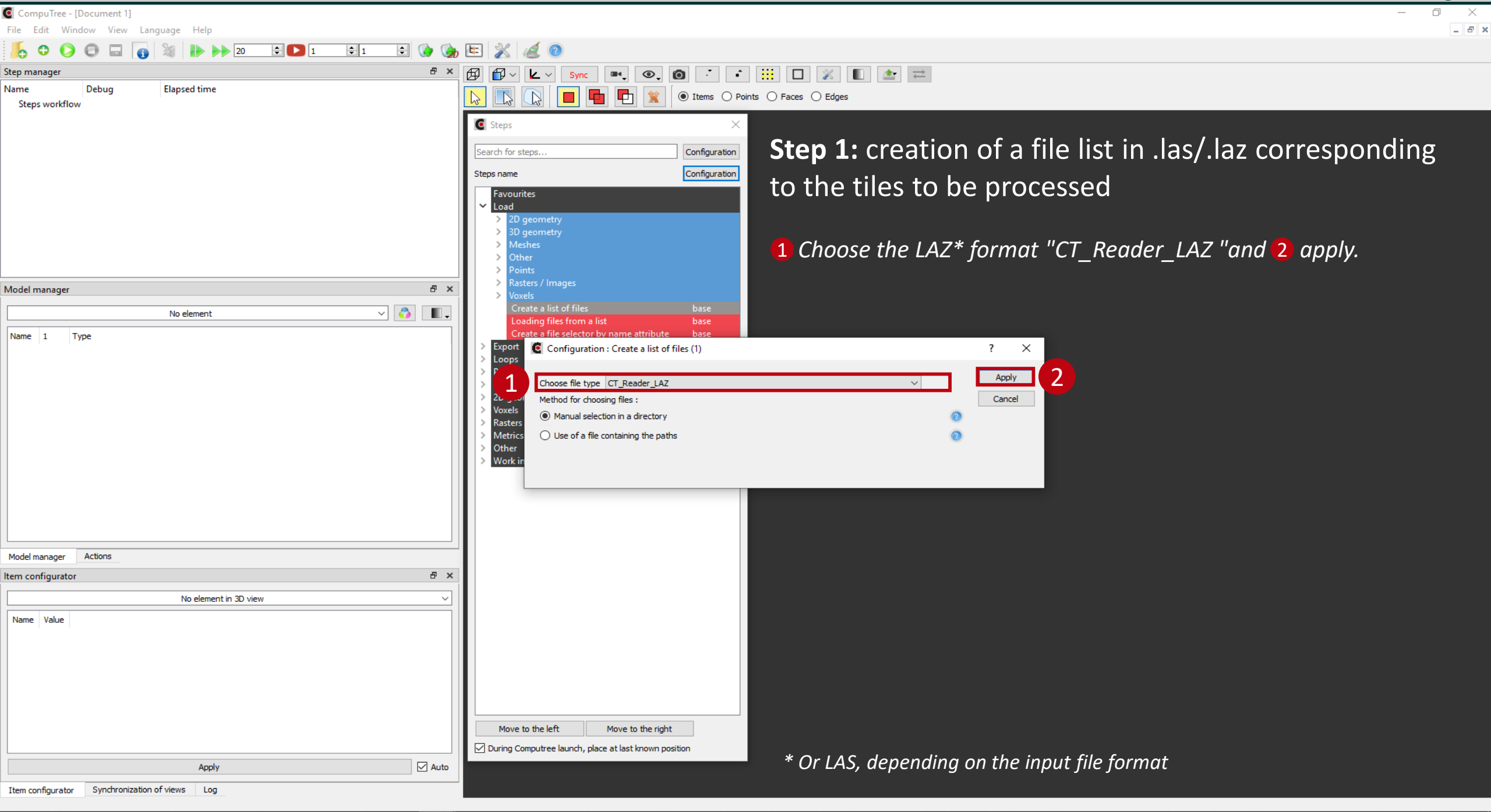




Step 1: creation of a file list in .las/.laz corresponding to the tiles to be processed

1. Open "Add a step".
   Go to the "Load" tab
2. Double click on "Create a list of files".

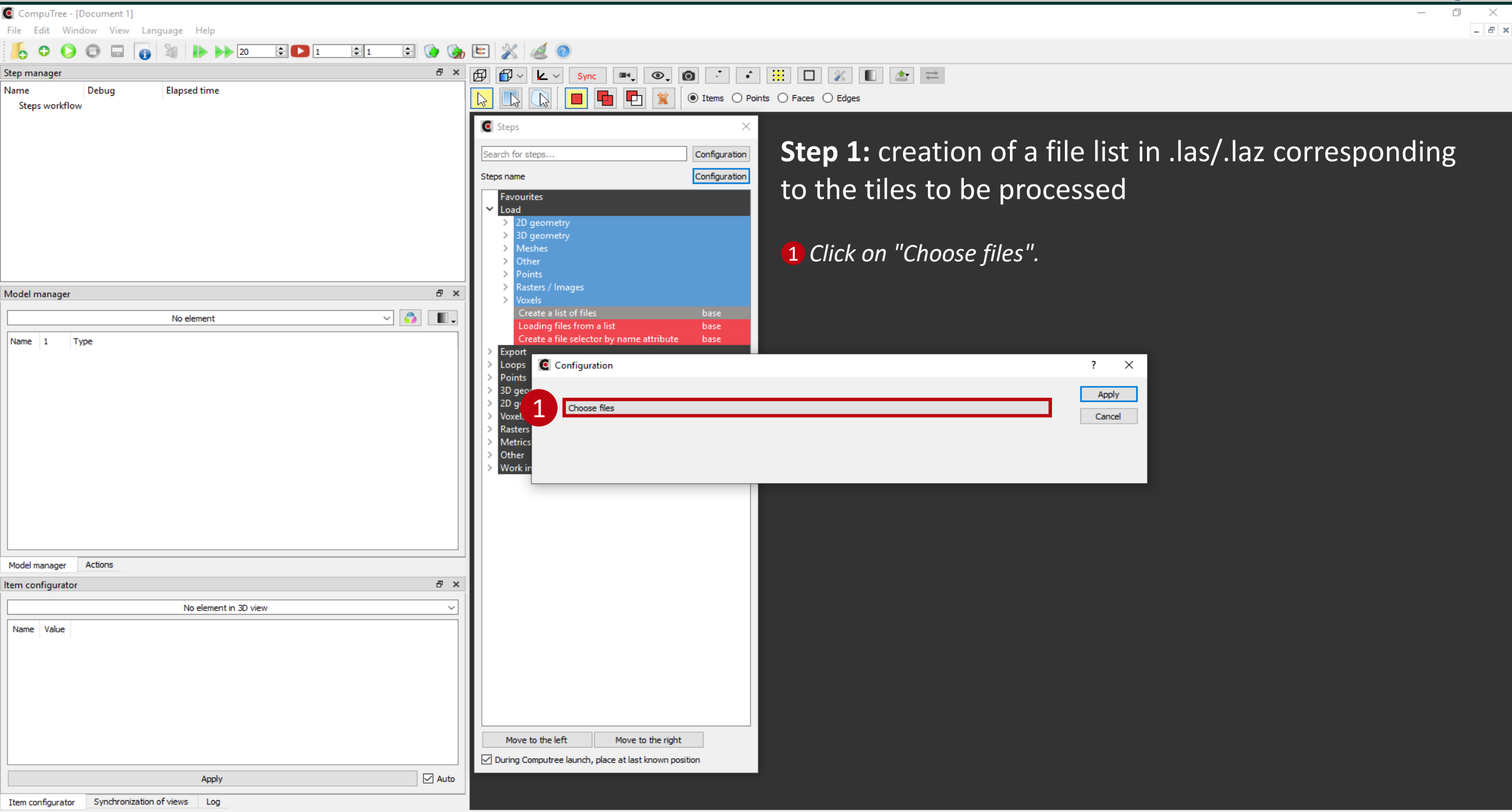
This step loads a list of tiles to be processed. Only the file headers are loaded at this stage.

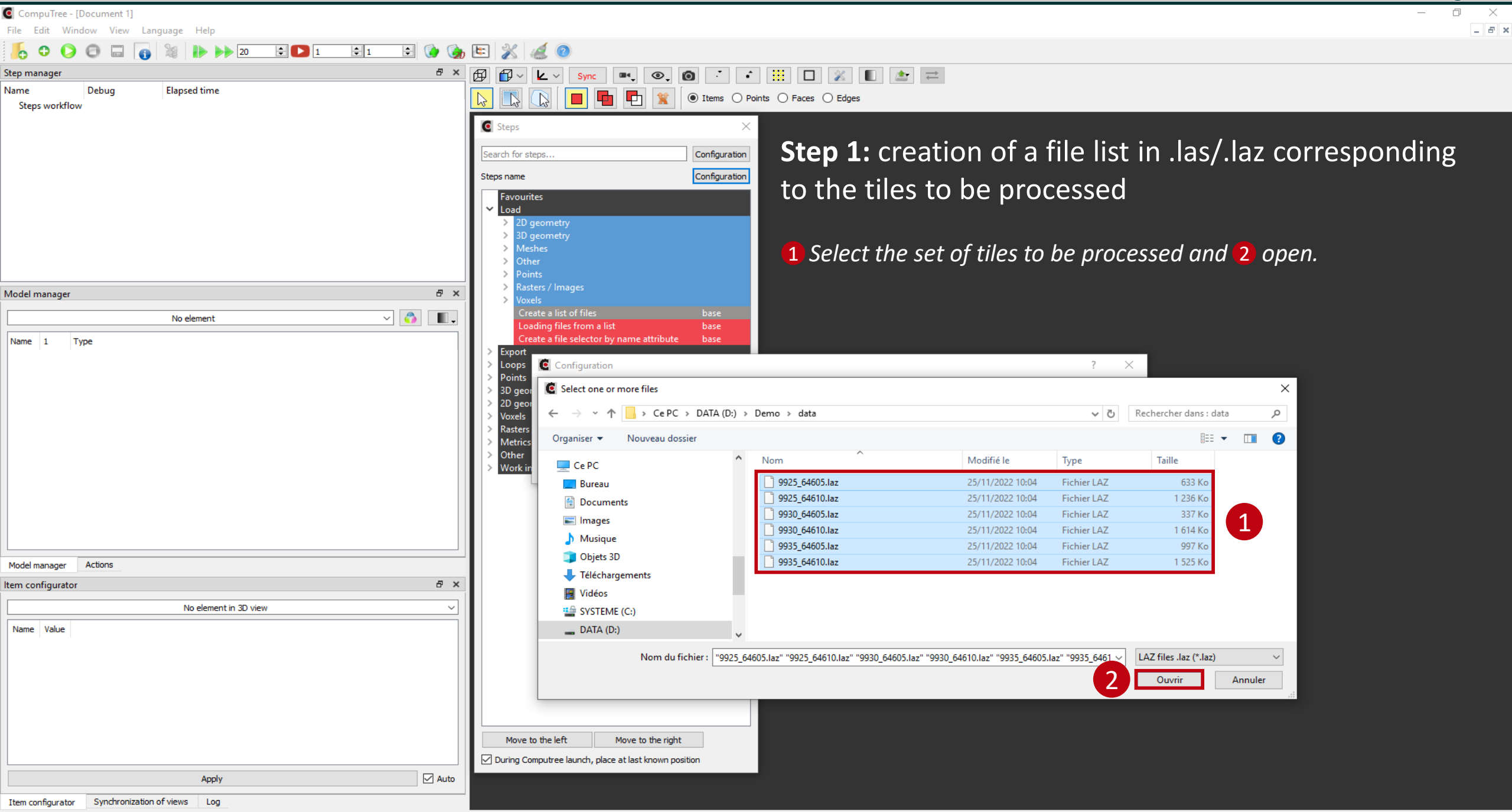


Step 1: creation of a file list in .las/.laz corresponding to the tiles to be processed

1 *Choose the LAZ* format "CT_Reader_LAZ "and* 2 *apply.*

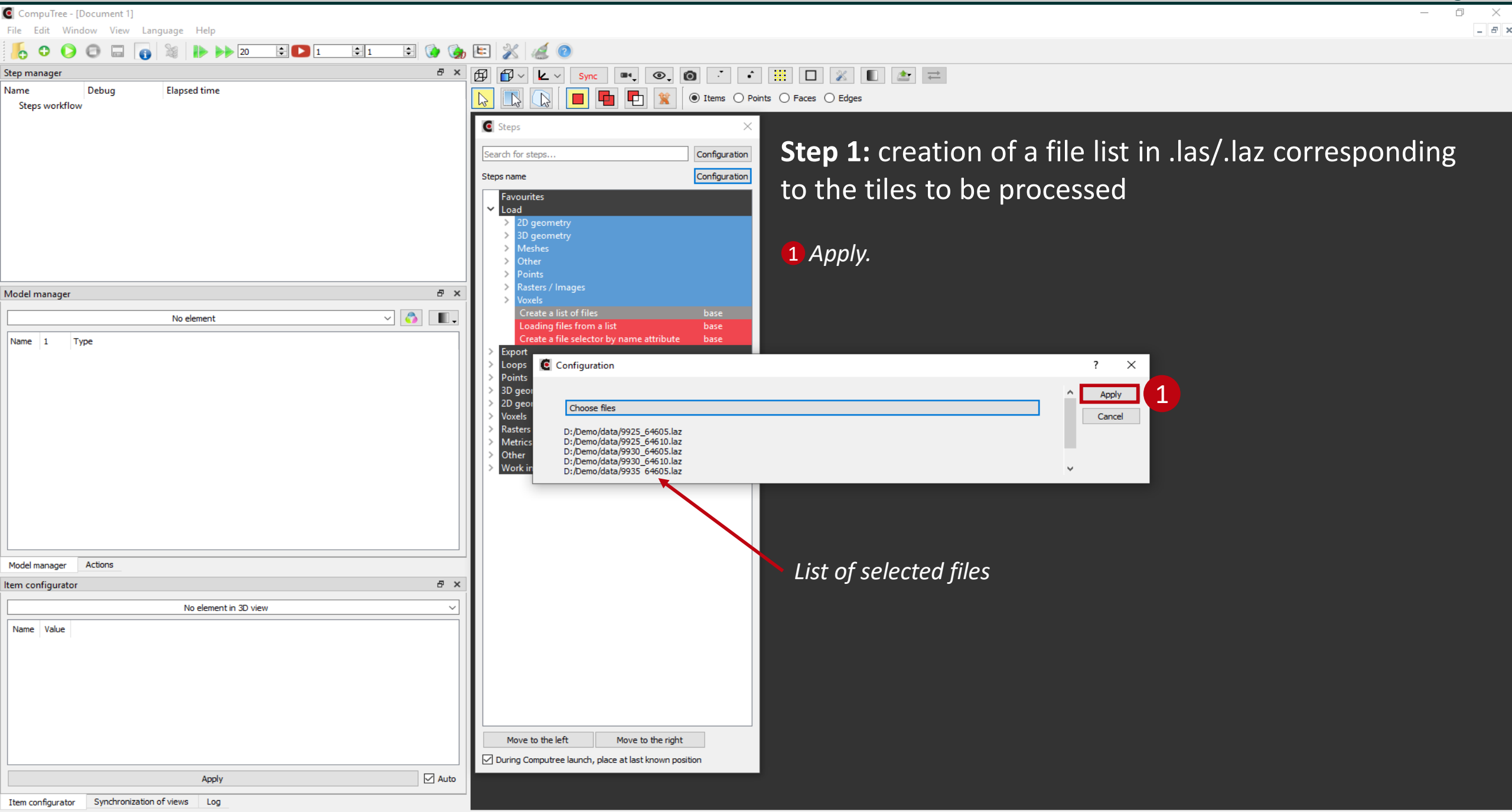
** Or LAS, depending on the input file format*


CompuTree - [Document 1]
File Edit Window View Language Help
Step manager
Name Debug Elapsed time
Steps workflow
Model manager
No element
Name 1 Type
Model manager Actions
Item configurator
No element in 3D view
Name Value
Apply Auto
Item configurator Synchronization of views Log
Sync
Items Points Faces Edges
Steps
Search for steps...
Configuration
Steps name
Configuration
Favourites
Load
2D geometry
3D geometry
Meshes
Other
Points
Rasters / Images
Voxels
Create a list of files base
Loading files from a list base
Create a file selector by name attribute base
Export
Loops
Points
Rasters
Metrics
Other
Move to the left
Move to the right
During Computree launch, place at last known position
Configuration
1
Choose files
Apply
Cancel
Step 1: creation of a file list in .las/.laz corresponding to the tiles to be processed
1 Click on "Choose files".



Step 1: creation of a file list in .las/.laz corresponding to the tiles to be processed

1 *Select the set of tiles to be processed and* 2 *open.*


CompuTree - [Document 1]
File Edit Window View Language Help
Step manager
Name Debug Elapsed time
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Model manager
No element
Name 1 Type
Model manager Actions
Item configurator
No element in 3D view
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2D geometry
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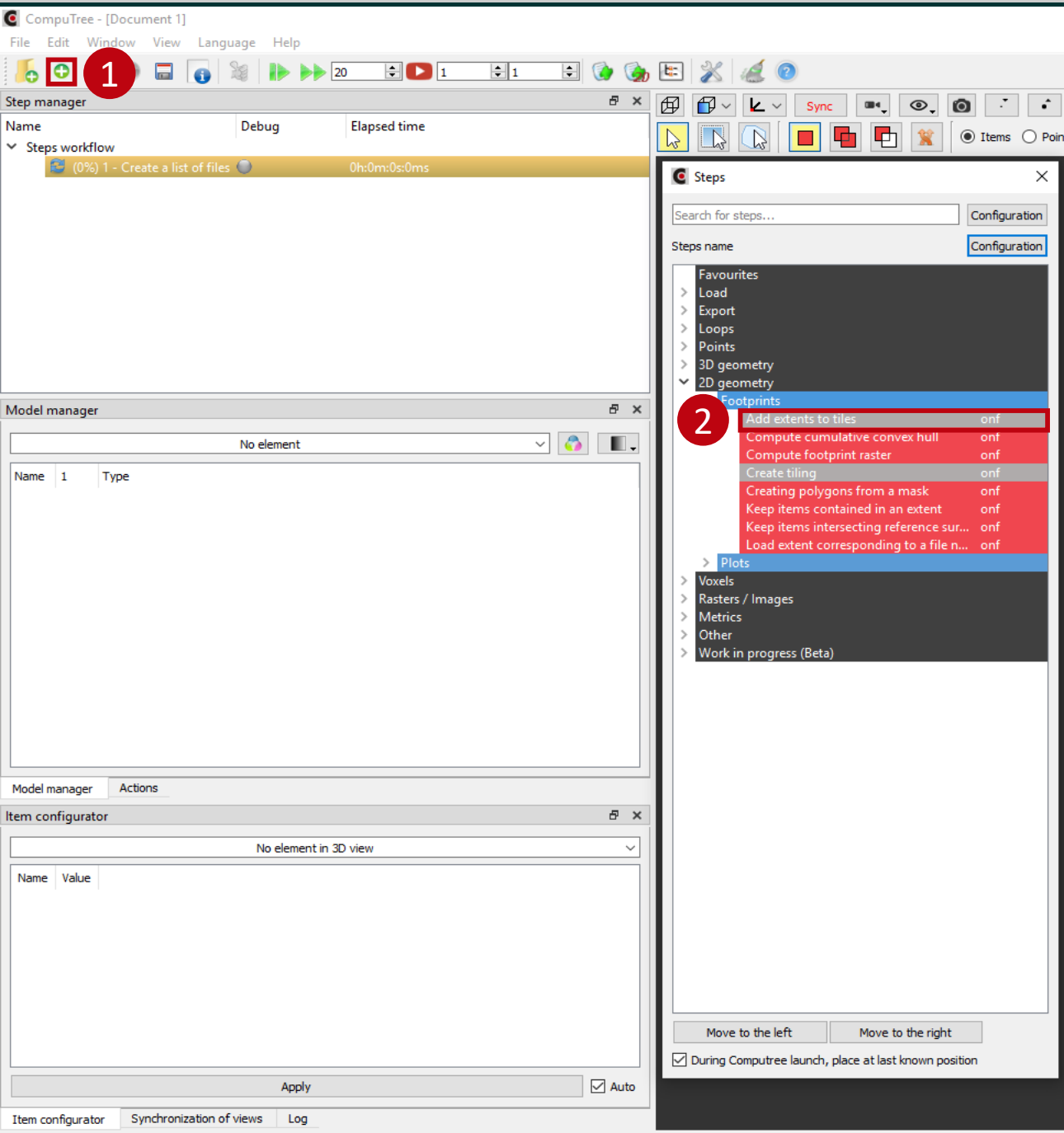
Create a list of files base
Loading files from a list base
Create a file selector by name attribute base
Export
Loops
Points
Rasters
Metrics
Other
Move to the left
Move to the right
During Computree launch, place at last known position
Configuration
Choose files
D:/Demo/data/9925_64605.laz
D:/Demo/data/9925_64610.laz
D:/Demo/data/9930_64605.laz
D:/Demo/data/9930_64610.laz
D:/Demo/data/9935_64605.laz
Apply
Cancel
1
Step 1: creation of a file list in .las/.laz corresponding to the tiles to be processed
1 Apply.
List of selected files



Step 2: Adding tiles extents

1. Open "Add a step".
   Go to the "2D Geometry" tab and then "Footprints".
2. Double-click on "Add extents to tiles".

The LAS files contain the point clouds, but not the theoretical extents used for the tiling.

This step aims at reconstructing this tiling, and creating an extent for each input LAS file. To do this, it must be provided with the size and starting point of the tiles.

In order to facilitate their use later on, the step gives to each extent the name of the corresponding file. To do this, the attribute containing the file name must be selected.

Configuration des résultats d'entrée de l'étape "Ajout des emprises de dalles"

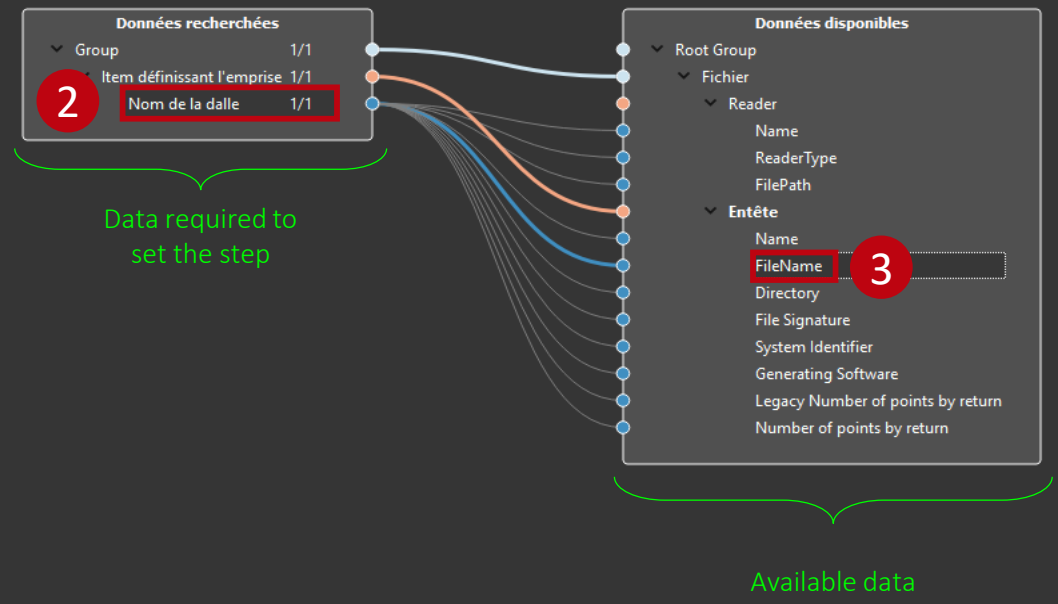
Name of the results	Step	Help
Dalles		
Result	(3) Créer une liste de fichiers	

1

Step 2: Adding tiles extents

This window allows you to select the attribute containing the file name to be used to name the created extent.

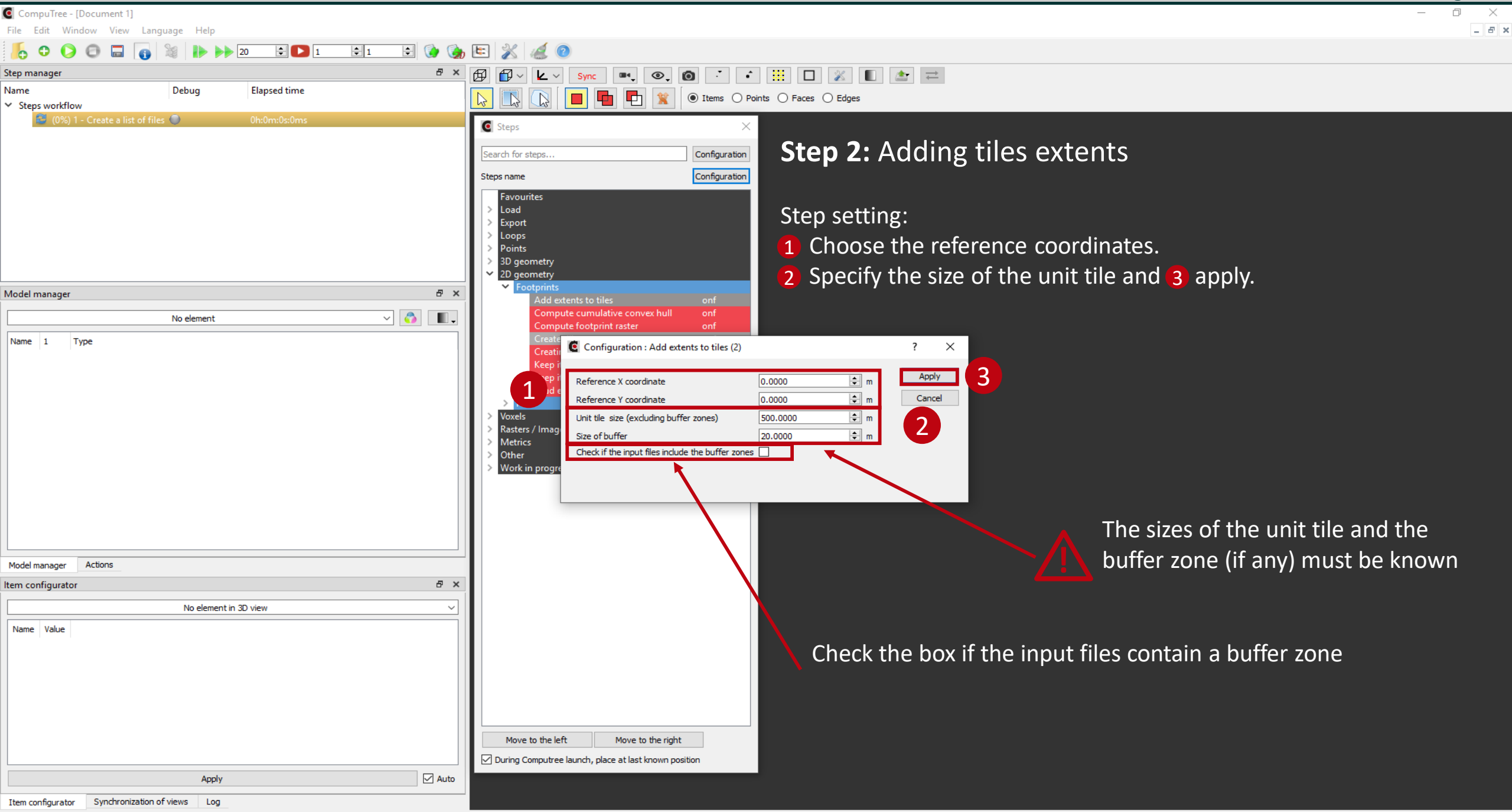
1. Select results (*check the appropriate box*)
2. Select the data you are looking for (*click on the name of the data you are looking for*)
3. Select from the available input data the one to be used (*click on the name of the available data*)
4. Validate



This window appears when there is more than one compatible input data to set up the step.
In this case, the input data to be used must be indicated manually.

4

OK Cancel



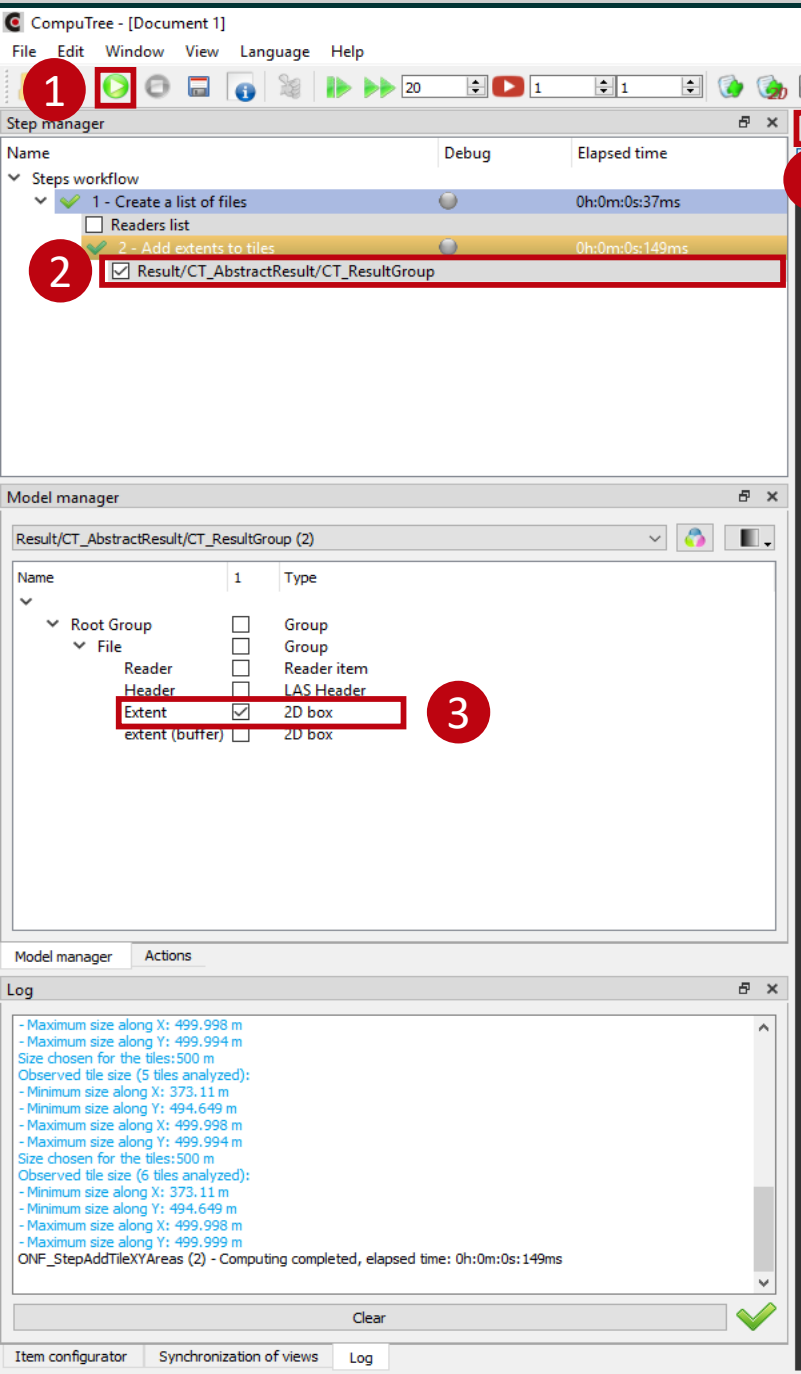
Step 2: Adding tiles extents

Step setting:

1. Choose the reference coordinates.
2. Specify the size of the unit tile and
3. apply.

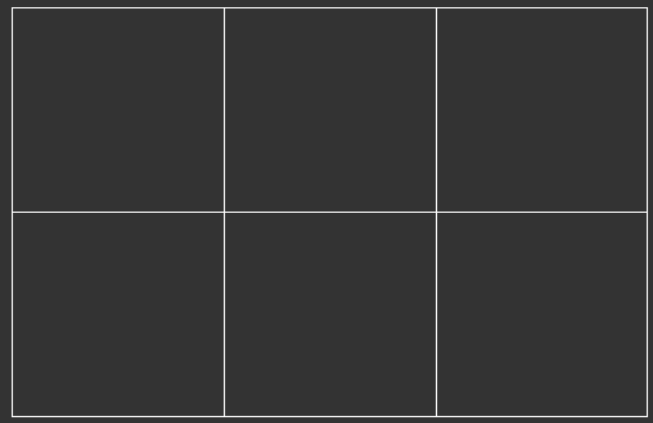
The sizes of the unit tile and the buffer zone (if any) must be known

Check the box if the input files contain a buffer zone



Performing this step loads the data into memory.
It is possible to visualise the theoretical dimensions of the tiles, the steps are :

1. Launch treatments
2. Select results to be viewed
3. Setect Data
4. Focus on data
5. View from above



** The execution of the steps is not mandatory for the creation of the rest of the script*

CompuTree - [Document 1]

File Edit Window View Language Help

Step manager

Name	Debug	Elapsed time
Steps workflow		
1 - Create a list of files		0h:0m:0s:37ms
Readers list		
2 - Add extents to tiles		0h:0m:0s:149ms
Result/CT_AbstractResult/CT_ResultGroup		

Model manager

Result/CT_AbstractResult/CT_ResultGroup (2)

Name	1	Type
Root Group		Group
File		Group
Reader		Reader item
Header		LAS Header
Extent	☑	2D box
extent (buffer)	☑	2D box

1

Model manager | Actions

Log

```
- Maximum size along X: 499.998 m
- Maximum size along Y: 499.994 m
Size chosen for the tiles:500 m
Observed tile size (5 tiles analyzed):
- Minimum size along X: 373.11 m
- Minimum size along Y: 494.649 m
- Maximum size along X: 499.998 m
- Maximum size along Y: 499.994 m
Size chosen for the tiles:500 m
Observed tile size (6 tiles analyzed):
- Minimum size along X: 373.11 m
- Minimum size along Y: 494.649 m
- Maximum size along X: 499.998 m
- Maximum size along Y: 499.999 m
ONF_StepAddTileXYAreas (2) - Computing completed, elapsed time: 0h:0m:0s:149ms
```

Clear

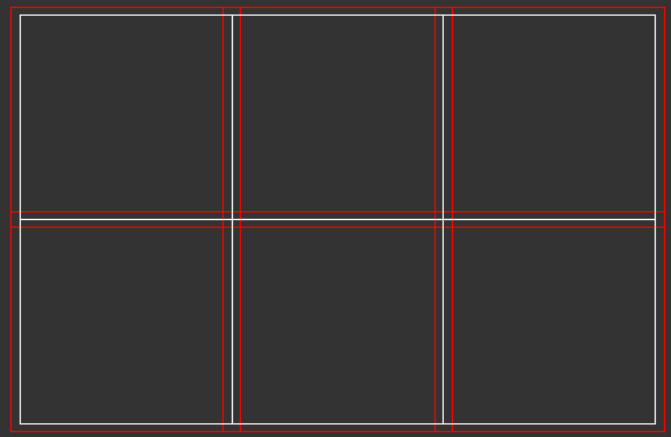
Item configurator | Synchronization of views | Log

Sync

Items Points Faces Edges

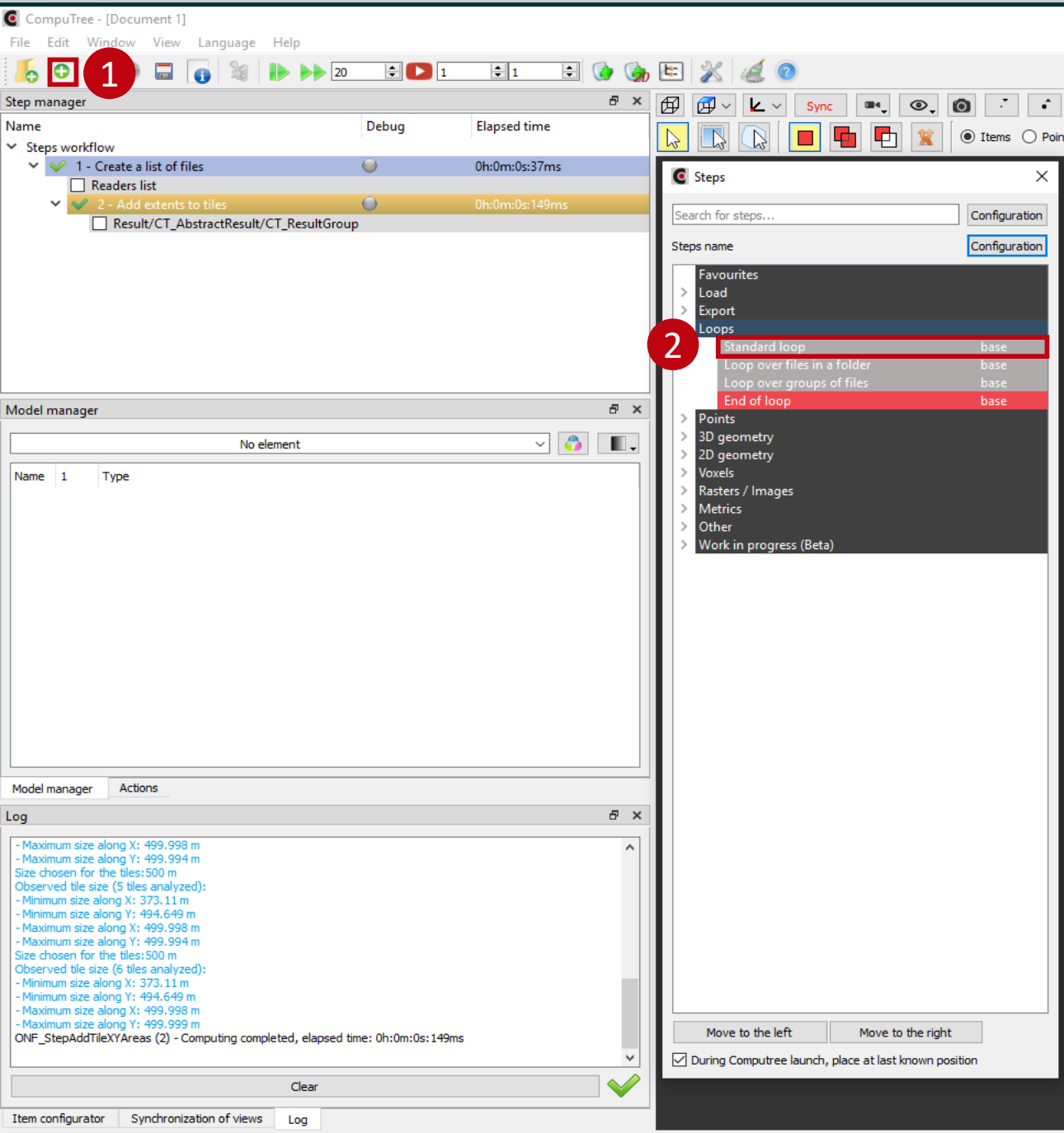
1 The step automatically calculates a buffer zone for each tile (red lines), of the chosen size

2 The log allows you to check whether the size chosen for the tiles corresponds to the size observed



2

** The execution of the steps is not mandatory for the creation of the rest of the script*



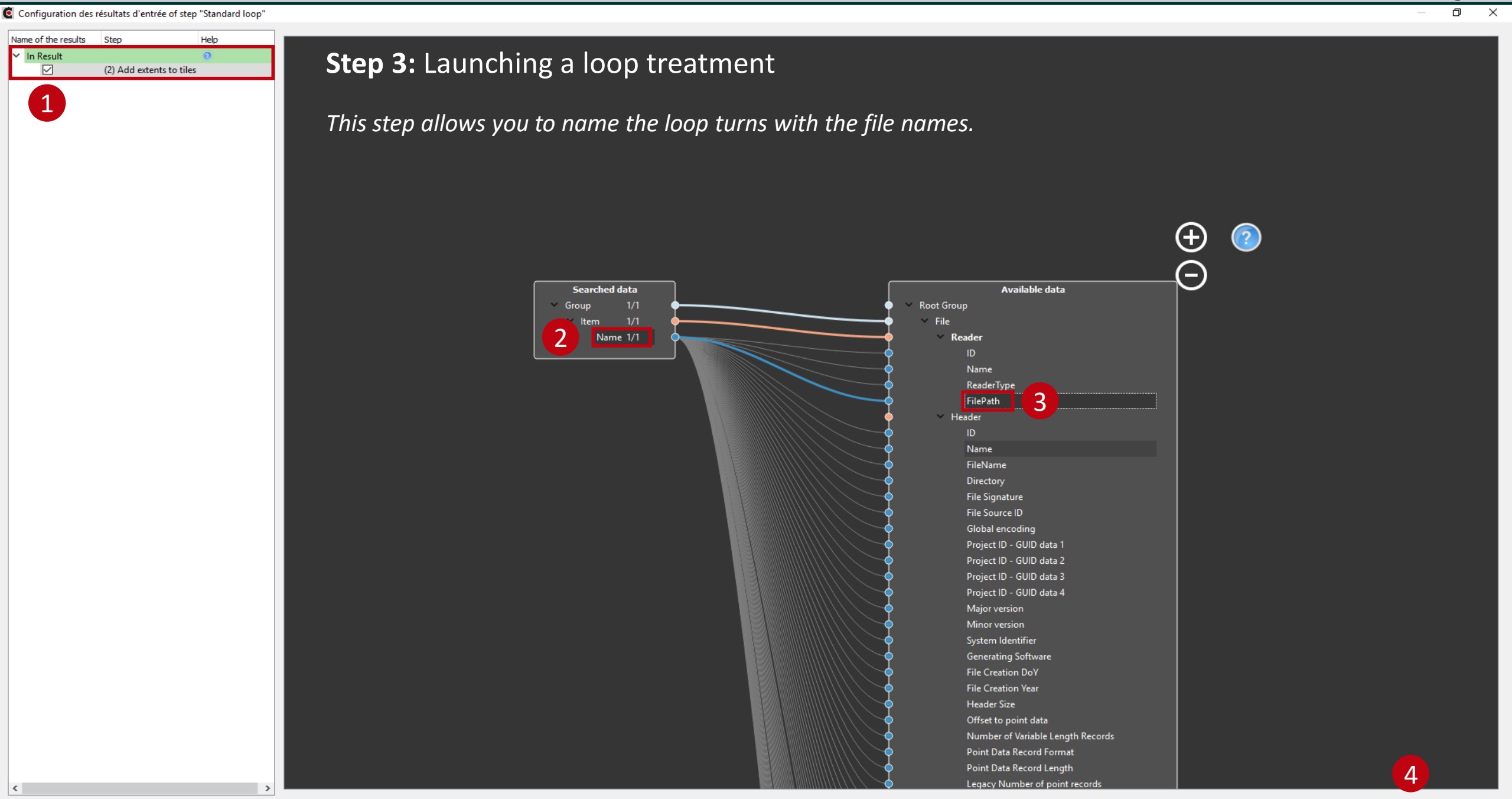
Step 3: Launching a loop treatment

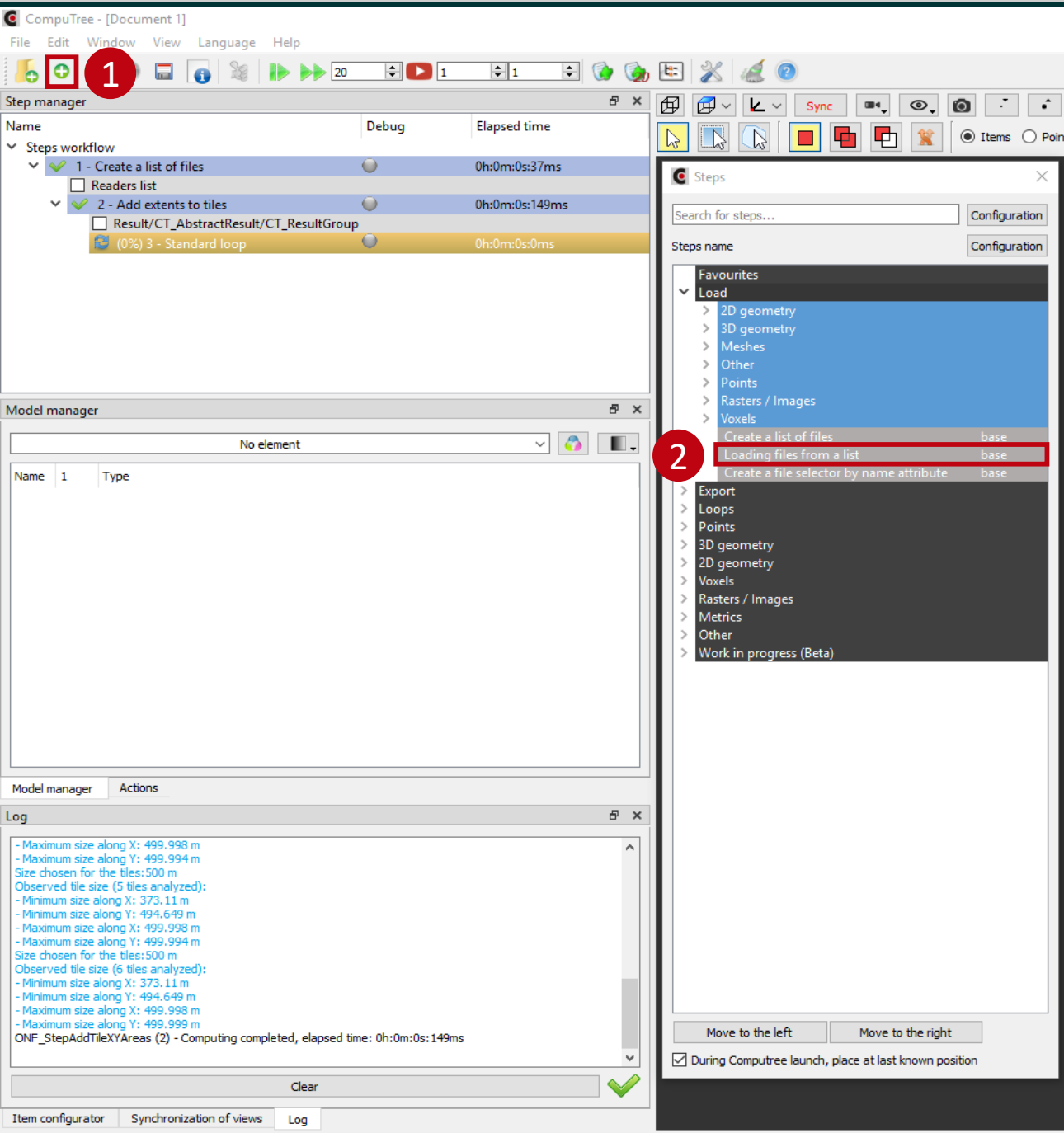
1. Open "Add a step".
   Go to the "Loops" tab
2. Double click on "Standard loop".

Allows to process successively the whole of the LAS tiles selected in the list of files, using a loop.

Step 3: Launching a loop treatment

This step allows you to name the loop turns with the file names.



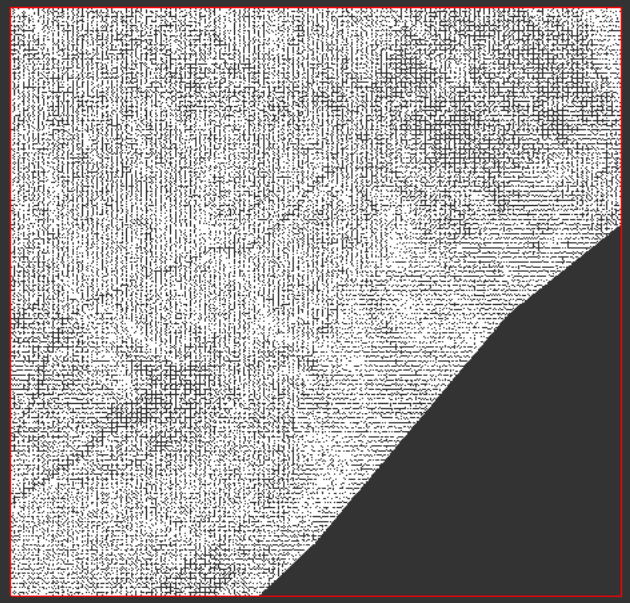


Step 4: Loading a tile from the list

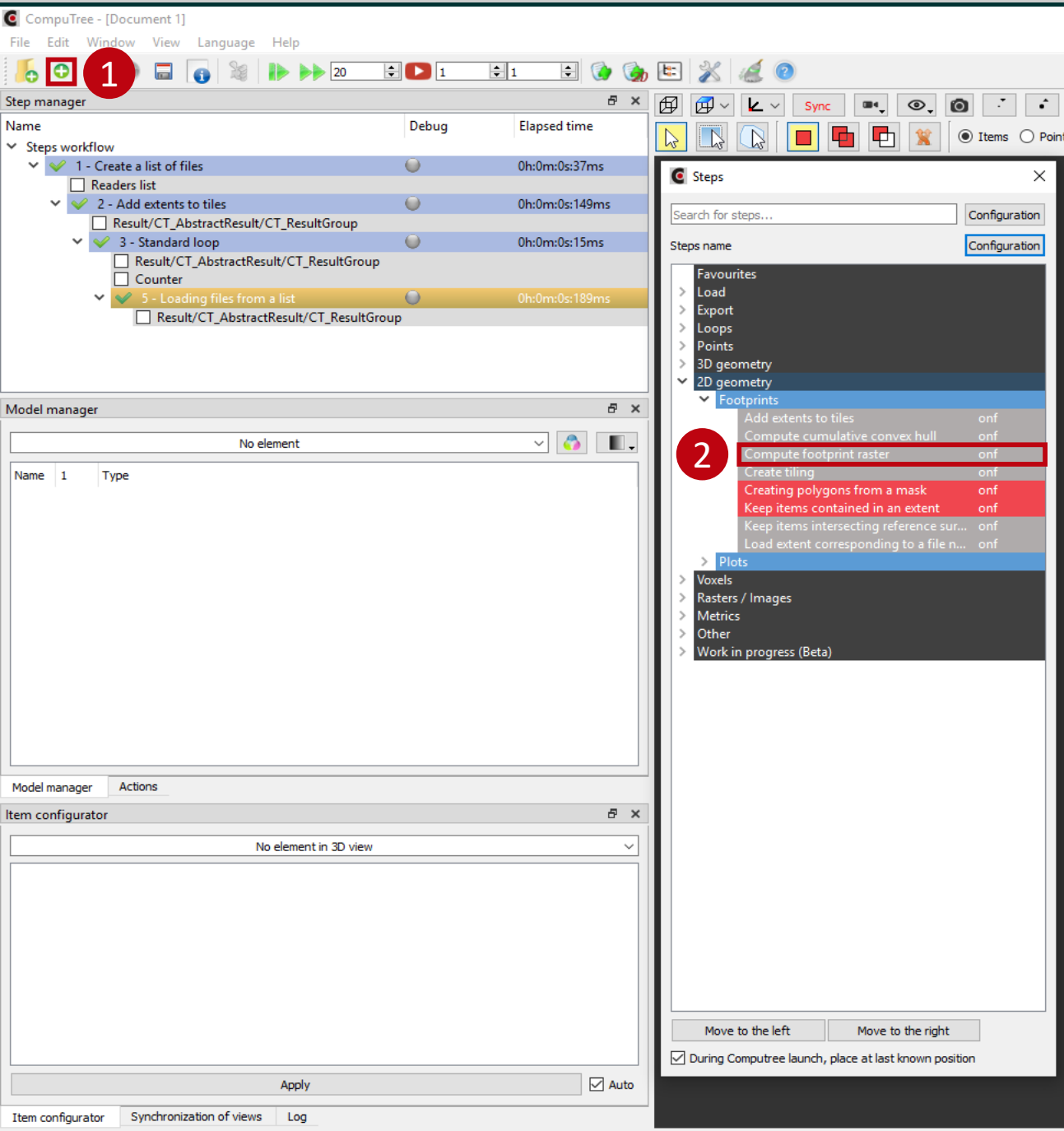
1. Open "Add a step".
   Go to the "Load" tab
2. Double click on "Load files from a list".

This step allows you to load the points of the LAS tiles to be processed for the current turn of the loop.

If the loop is not closed, only the first tile in the list is loaded and can be viewed. The superimposition of the extent (red line) and the point cloud allows a visual control.



** The execution of the steps is not mandatory for the creation of the rest of the script*



Step 5: Computing the footprint raster

1. Open "Add a step".
   Go to the "2D Geometry" tab and then "footprints".
2. Double click on "Compute footprint raster".

This step computes a raster of the global footprint of all the processed tiles.

In the first turn of the loop, the step creates the raster covering the entire theoretical extent of all the selected tiles.

At each loop turn, the step modifies the raster by indicating the cells for which points are present.

Configuration des résultats d'entrée of step "Compute footprint raster"

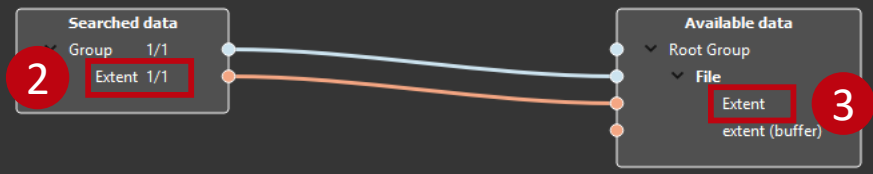
Name of the results	Step	Help
Total footprint (all tiles)		
esult	(5) Loading files from a list	
	(3) Standard loop	
	(3) Standard loop	
☑	(2) Add extents to tiles	
Scene(s)		
☐	(5) Loading files from a list	
Counter result		
☐ Result	(3) Standard loop	

1

Select the step Add extends to tiles, before the loop

Step 5: Computing the footprint raster

Selection of extent (without a buffer zone) to calculate the global extent of all the selected tiles.



OK Cancel

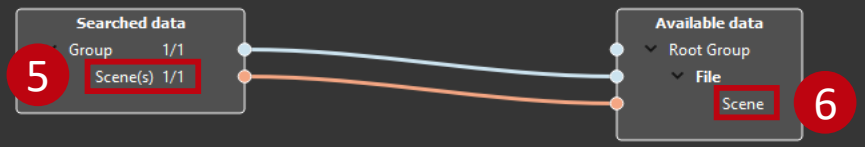
Configuration des résultats d'entrée of step "Compute footprint raster"

Name of the results	Step	Help
Total footprint (all tiles)		
	(5) Loading files from a list	
Result	(3) Standard loop	
	(3) Standard loop	
	(2) Add extents to tiles	
Scene(s)		
	(5) Loading files from a list	
Counter result		
esult	(3) Standard loop	

4

Step 5: Computing the footprint raster

Select the scene (point cloud) loaded from the current turn tile.



OK Cancel

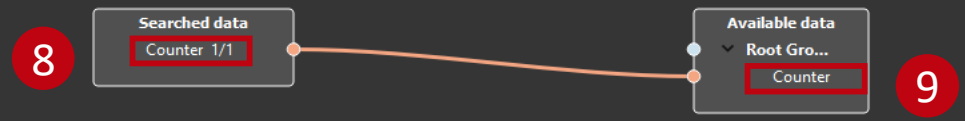
Configuration des résultats d'entrée of step "Compute footprint raster"

Name of the results	Step	Help
Total footprint (all tiles)		
☐	(5) Loading files from a list	
☐ Result	(3) Standard loop	
☐	(3) Standard loop	
☑	(2) Add extents to tiles	
Scene(s)		
☑	(5) Loading files from a list	
Counter result		
☑ Result	(3) Standard loop	

7

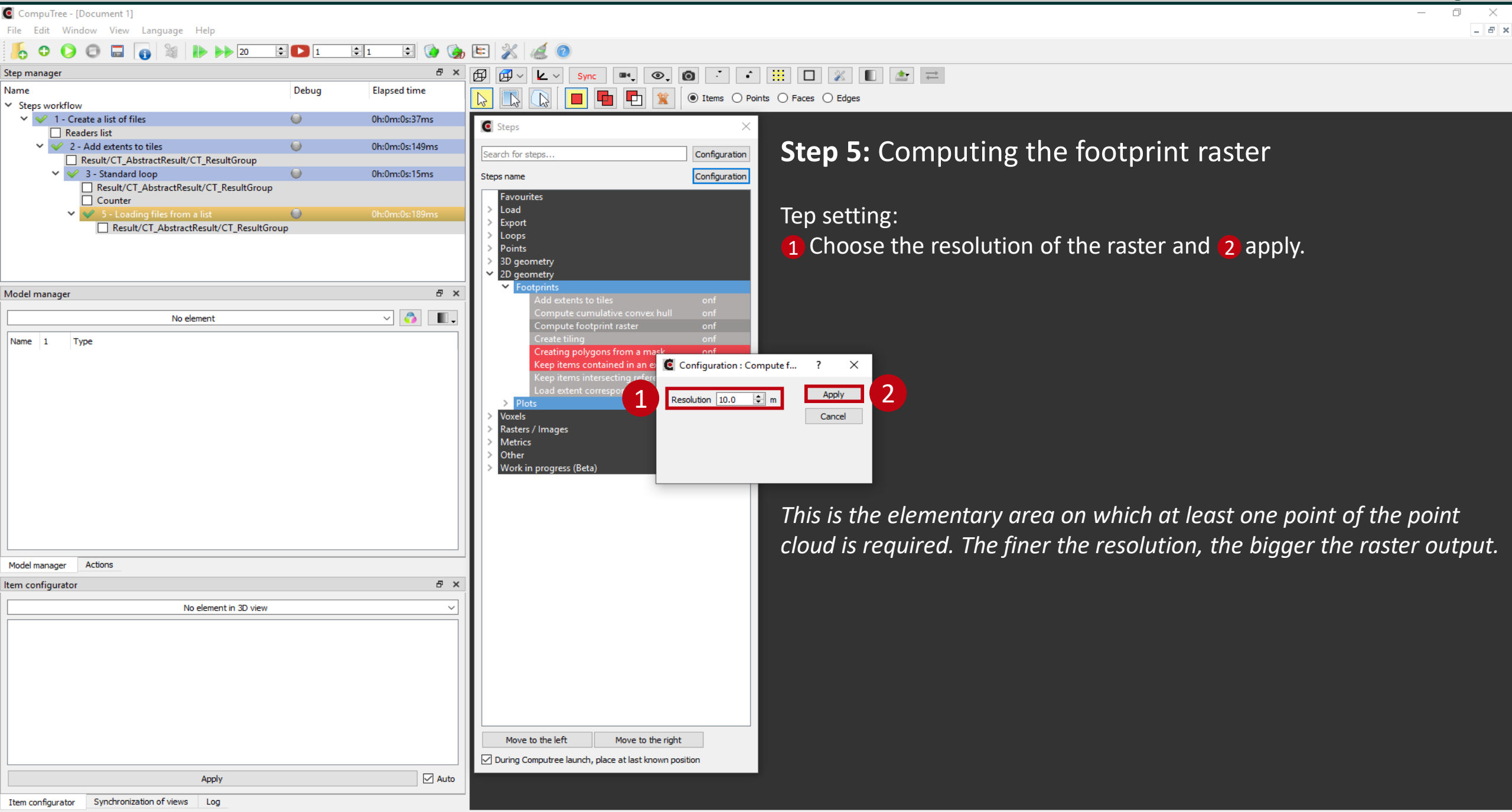
Step 5: Computing the footprint raster

Don't forget to check the counter that allows to follow the turns processed in the loop



10

OK Cancel

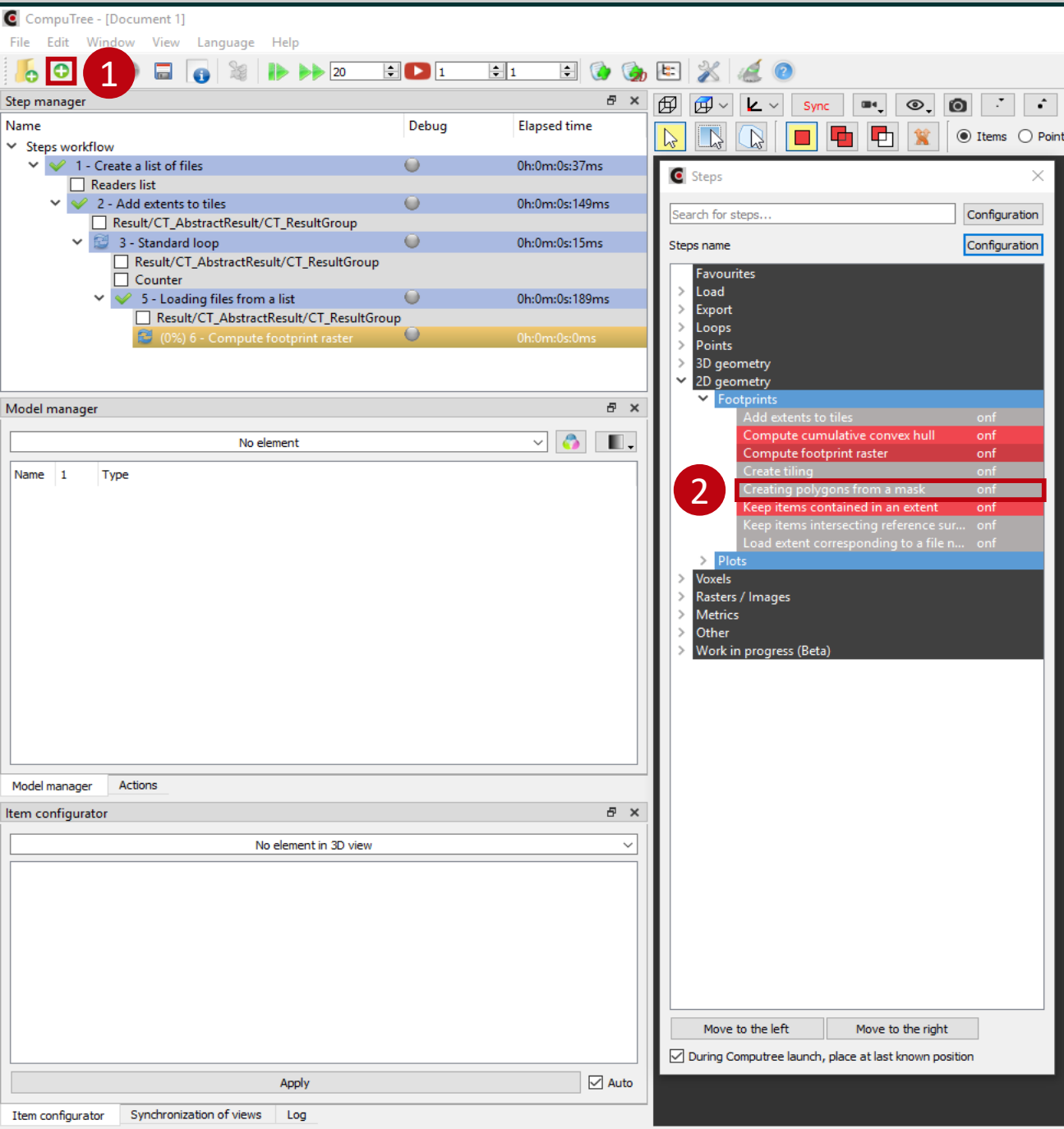


Step 5: Computing the footprint raster

Tep setting:

1 Choose the resolution of the raster and 2 apply.

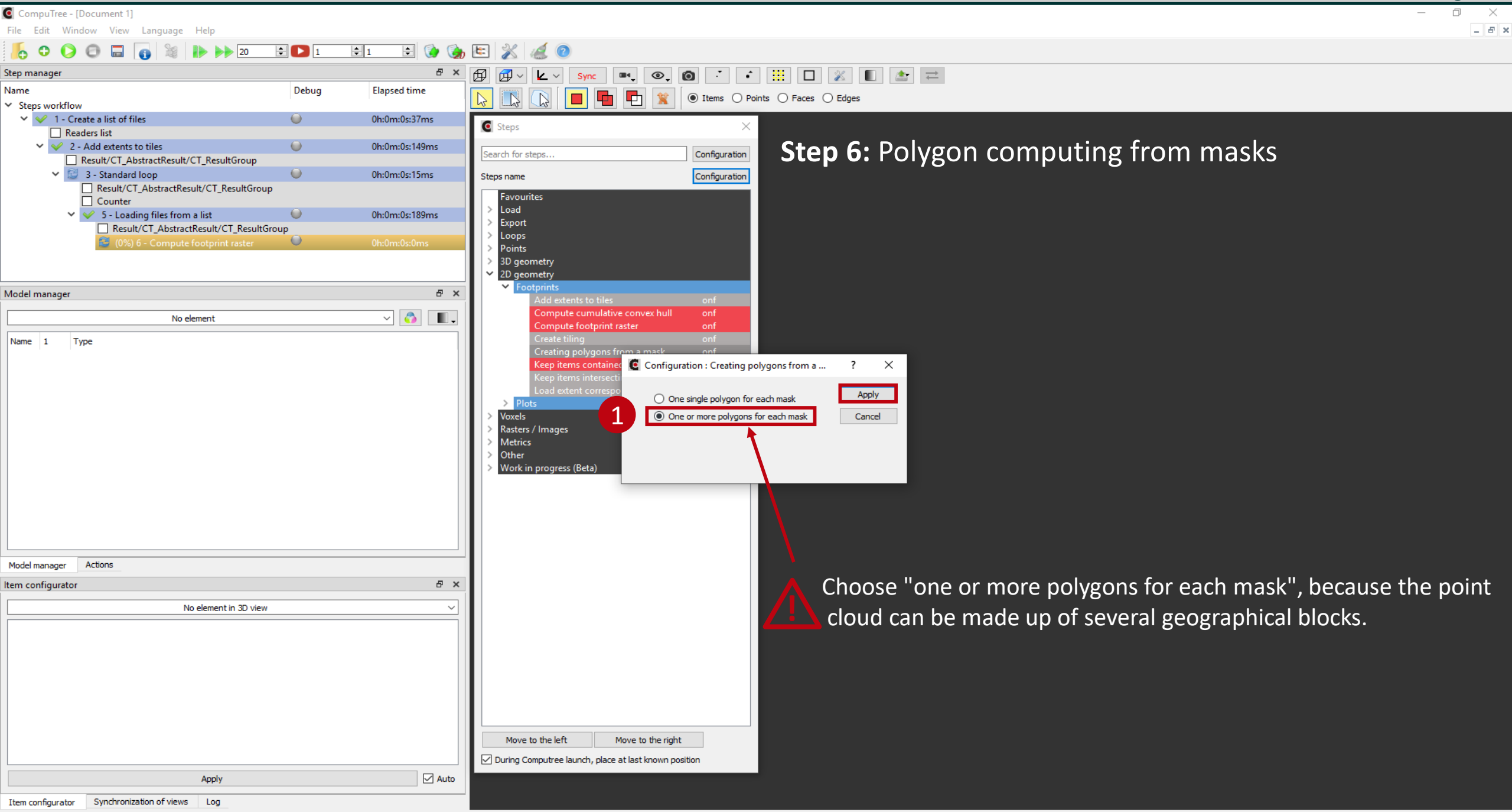
This is the elementary area on which at least one point of the point cloud is required. The finer the resolution, the bigger the raster output.



Step 6: Polygon computing from masks

1. Open "Add a step".
   Go to the "2D Geometry" tab and then "Footprints".
2. Double click on "Creating polygons from a mask".

This step allows the computing of the global footprint in vector format, of all of the tiles, from the previously computed raster.



Step 6: Polygon computing from masks

Choose "one or more polygons for each mask", because the point cloud can be made up of several geographical blocks.

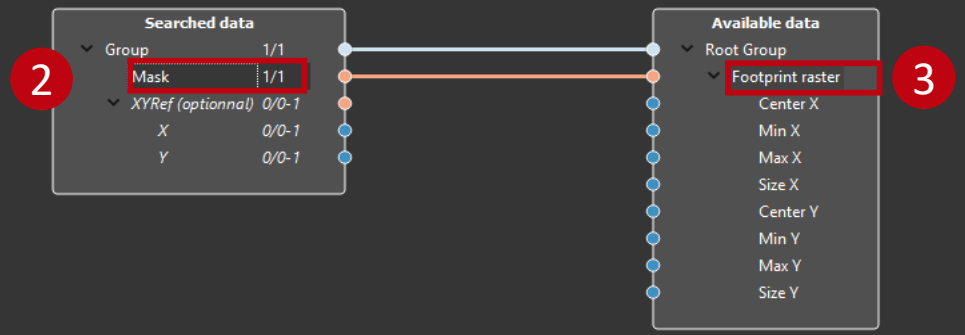
Configuration des résultats d'entrée of step "Creating polygons from a mask"

Name of the results	Step	Help
Tiles		
Result	(6) Compute footprint raster	

1

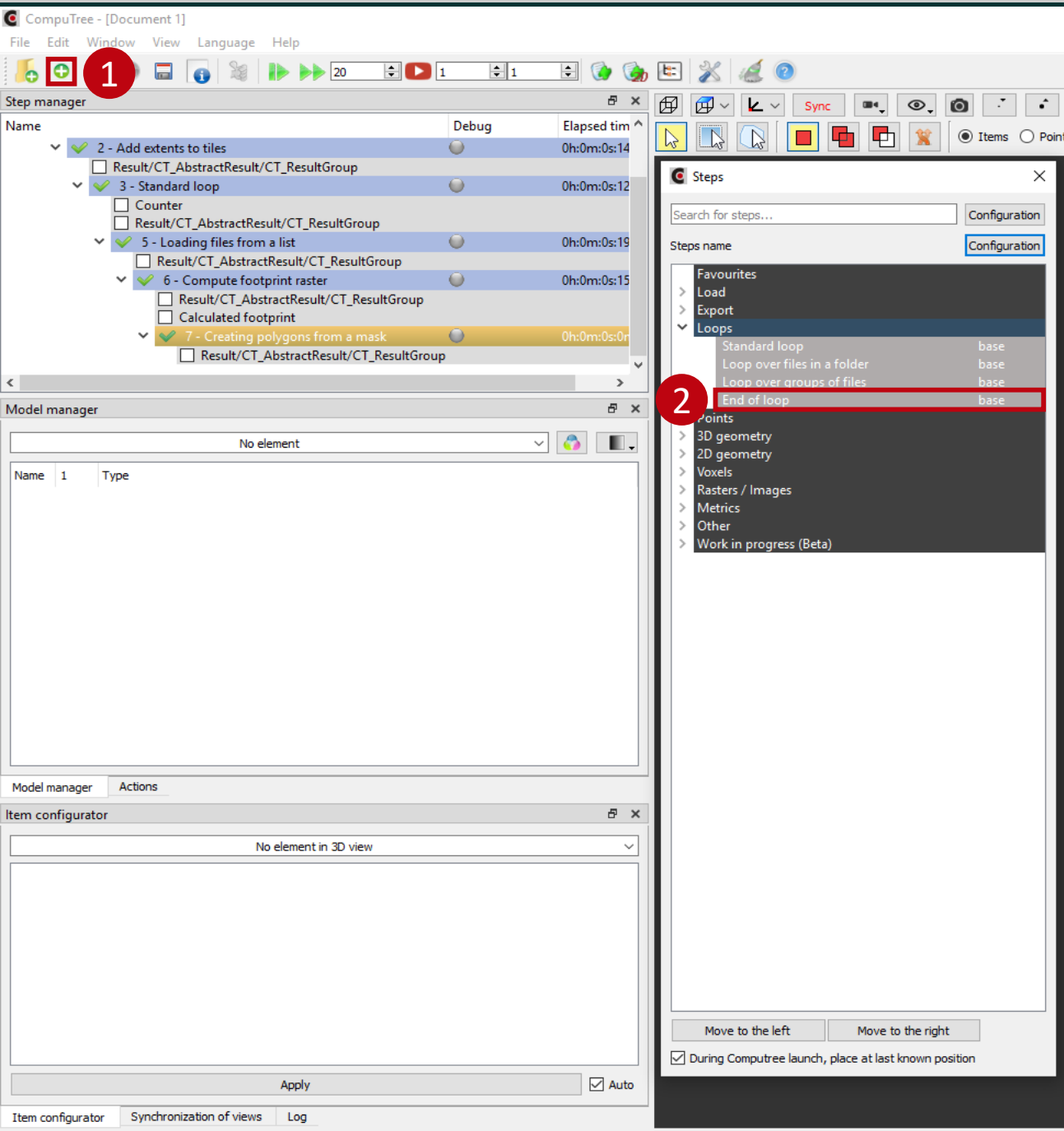
Step 6: Polygon computing from masks

In this step, you must select the raster that will be used as a mask to create the footprint in vector format. N.B.: the XYRef data are of no use in this case, so they are unselected.



4

OK Cancel



Step 7: end of loop

1. Open "Add a step".
   Go to the " Loops" tab.
2. Double click on "End of loop".

This step completes the loop in the treatment.

CompuTree - [Document 1]

File Edit Window View Language Help

Step manager

Name | Debug | Elapsed

3 - Standard loop 0h:0m:0
Result/CT_AbstractResult/CT_ResultGroup
Counter
5 - Loading files from a list 0h:0m:0
Result/CT_AbstractResult/CT_ResultGroup
6 - Compute footprint raster 0h:0m:0
Calculated footprint
Result/CT_AbstractResult/CT_ResultGroup
7 - Creating polygons from a mask 0h:0m:0
Result/CT_AbstractResult/CT_ResultGroup
8 - End of loop 0h:0m:0
Result/CT_AbstractResult/CT_ResultGroup

Model manager

Result/CT_AbstractResult/CT_ResultGroup (7)

Name	1	Type
Root Group	☐	Group
Group	☐	Group
Polygon	☑	2D polygon
Footprint raster	☑	Raster<quint8>

Model manager | Actions

Item configurator

Raster<quint8>

	Name	Value
1	Bounding Shape	☐ Activate
2	Centre of the Bounding Shape	☐ Activate
3	Point size (Bounding Shape)	10
4	Raster mode	☑ Activate
5	Raster mode: Set the Z level	☐ Activate
6	Raster mode: Z level (m)	0

Apply ☑ Auto

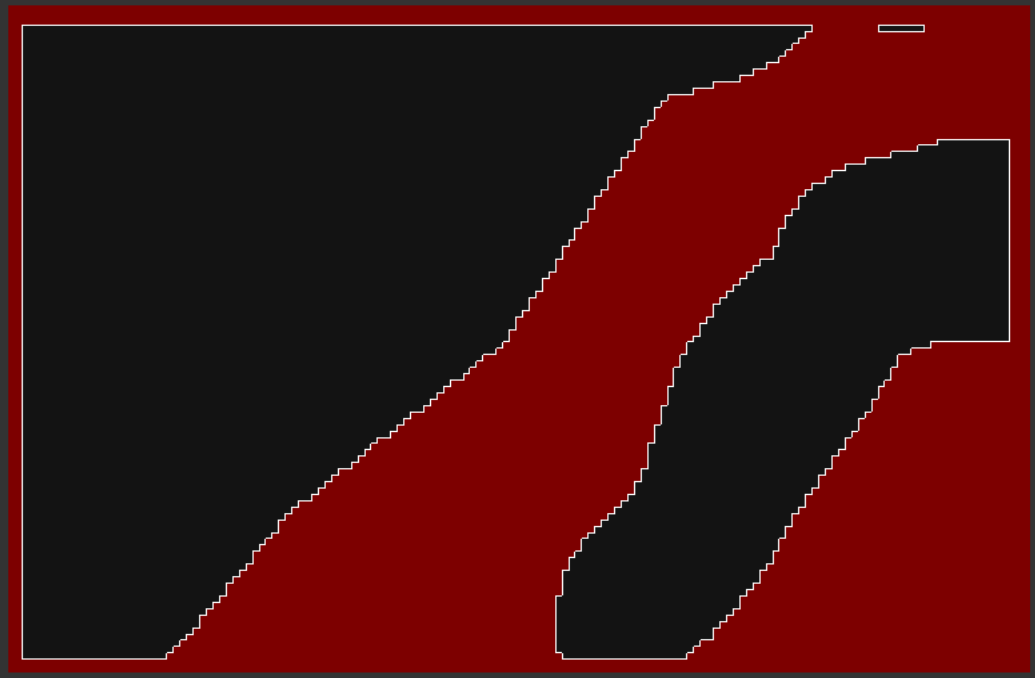
Item configurator | Synchronization of views | Log

Sync

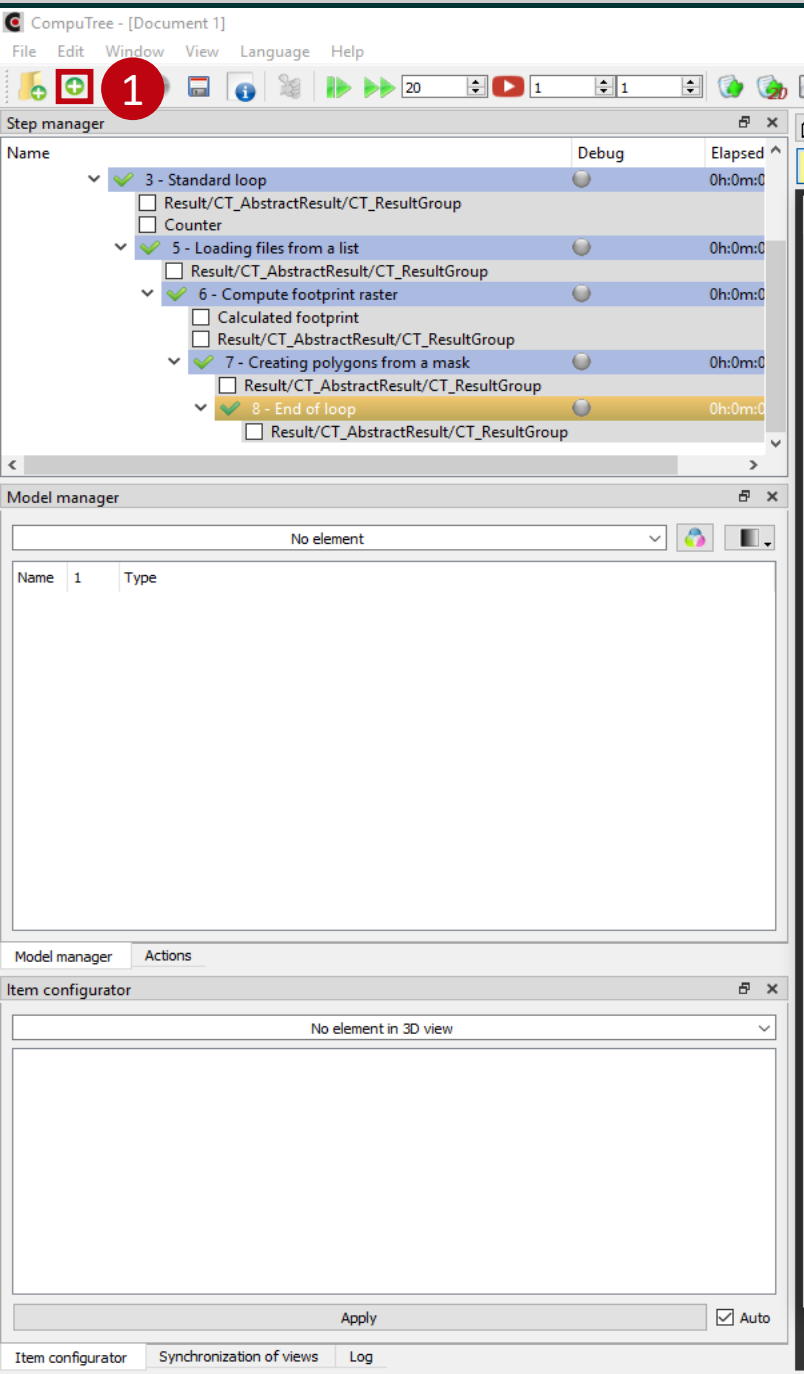
Items Points Faces Edges

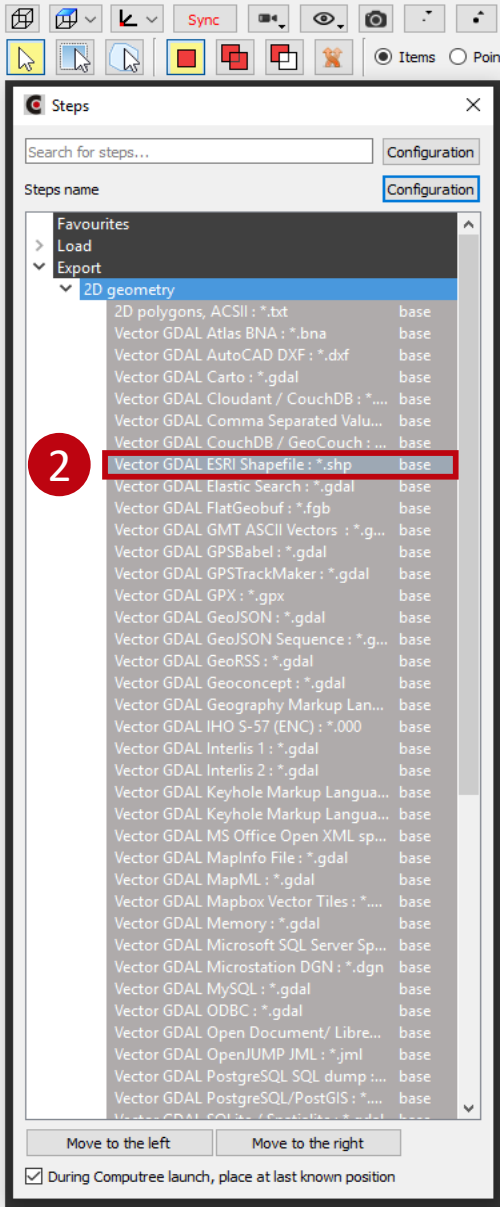
When the loop is closed, if you run the script it is possible to view the footprint raster and polygons created (in white) for the whole of the tiles of the list.

⚠ ***Depending on the number of tiles, treatments can be very long (several hours)***



** The execution of the steps is not mandatory for the creation of the rest of the script*

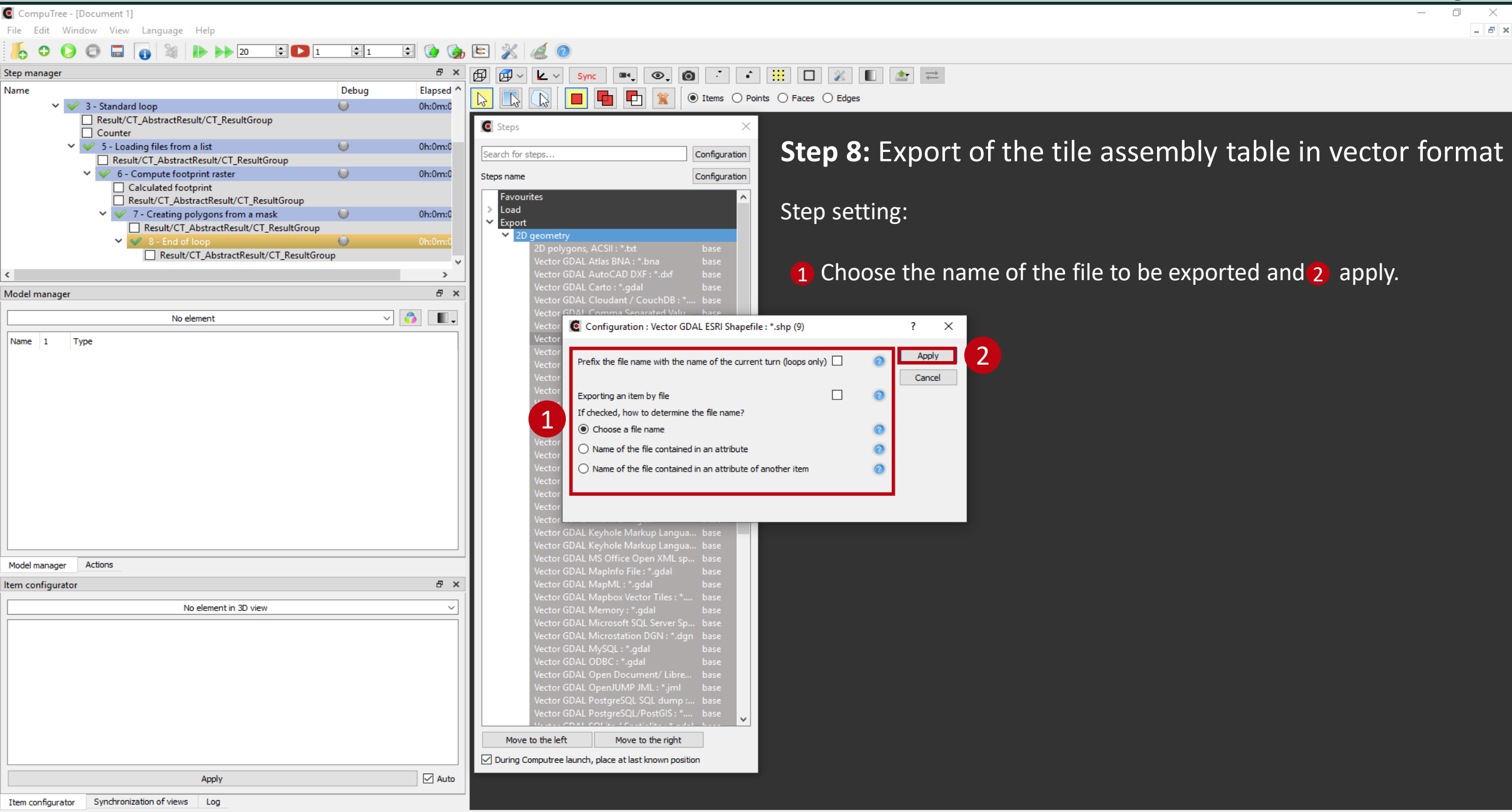




Step 8: Export of the tile assembly table in vector format

1. Open "Add a step".
   Go to the "Export" tab and then "2D Geometry".
2. Double click on "Vector GDAL ESRI Shapefile

Exporting the tile assembly table in shapefile.
These are the theoretical square extent of each tile.



Step 8: Export of the tile assembly table in vector format

Step setting:

1 Choose the name of the file to be exported and 2 apply.

Configuration des résultats d'entrée of step "Vector GDAL ESRI Shapefile : *.shp"

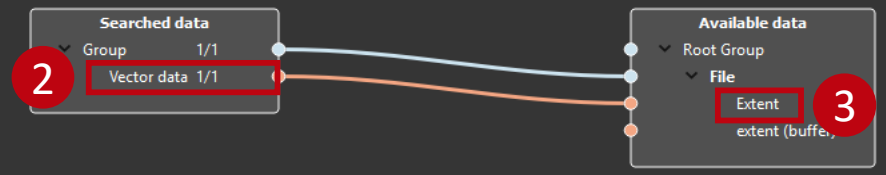
Name of the results	Step	Help
Result (Export: Vector GDAL ESRI Shapefile)		
☐	(7) Creating polygons from a mask	
☐	(6) Compute footprint raster	
☐	(5) Loading files from a list	
☐	(3) Standard loop	
☑	(2) Add extents to tiles	

1

Choose the step Add extents to tiles

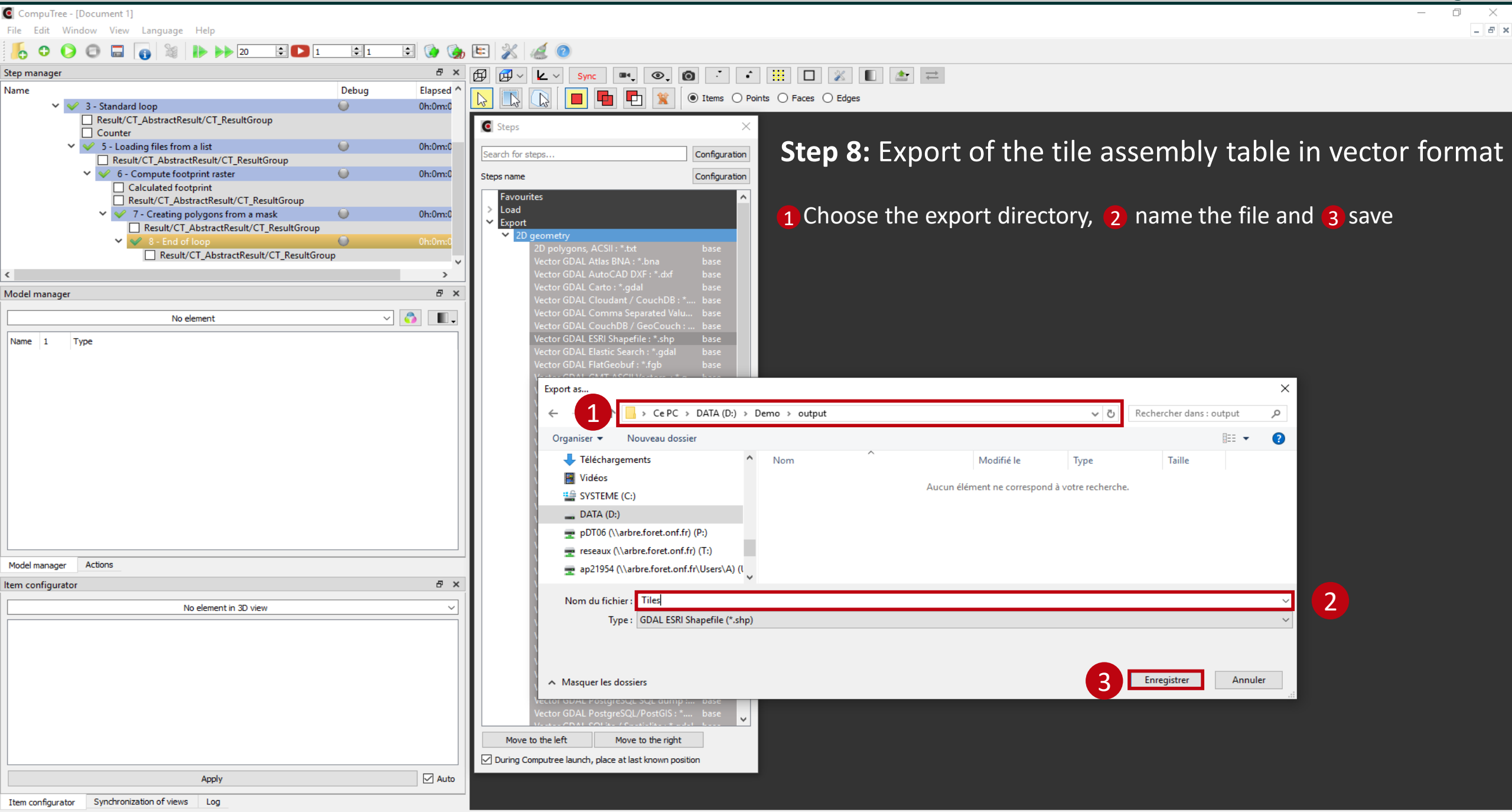
Step 8: Export of the tile assembly table in vector format

Export of the tile assembly table in shapefile format.



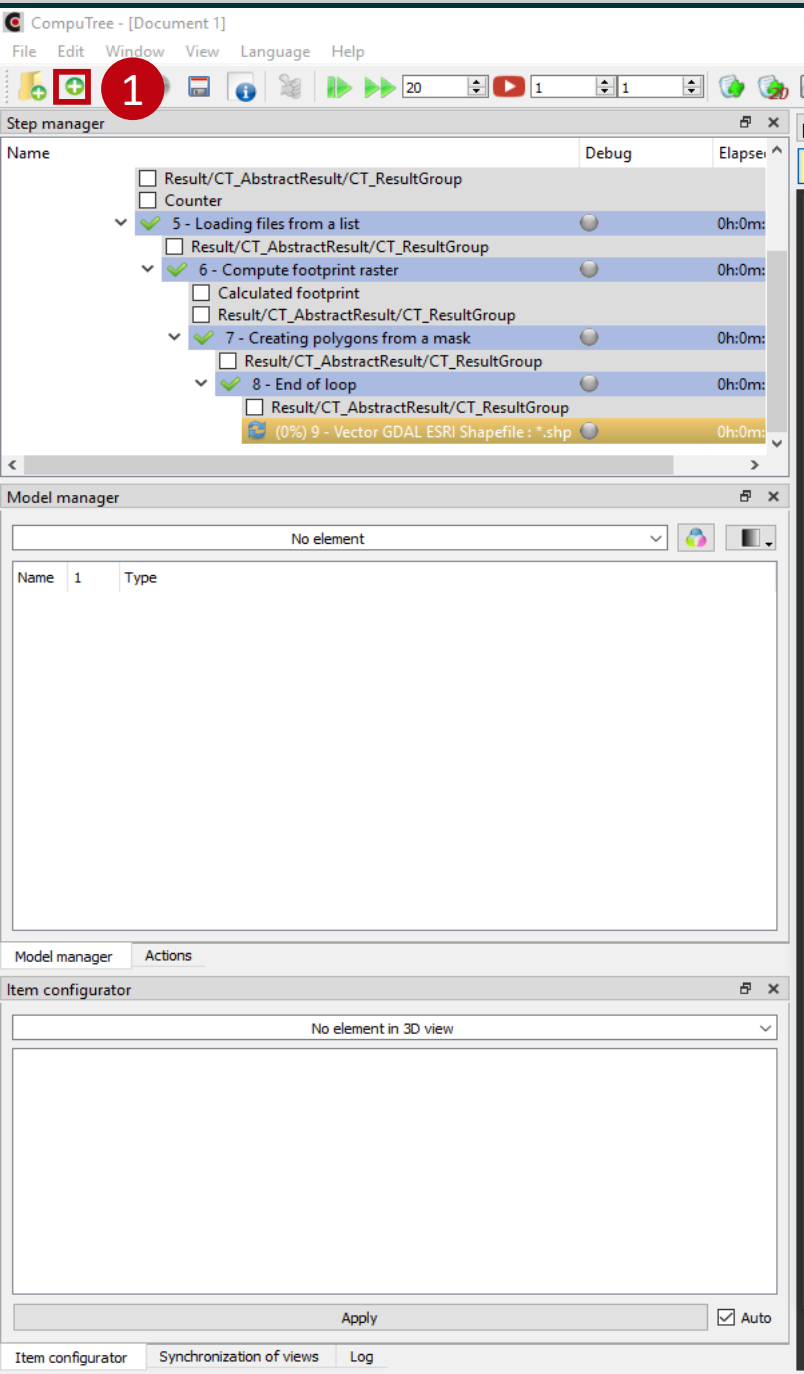
4

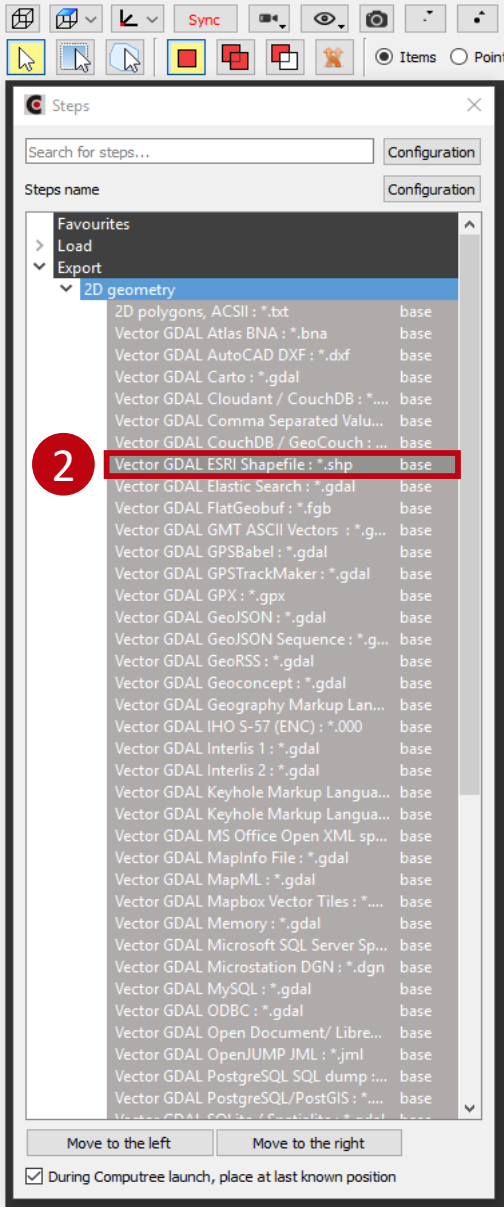
OK Cancel



Step 8: Export of the tile assembly table in vector format

1 Choose the export directory, 2 name the file and 3 save

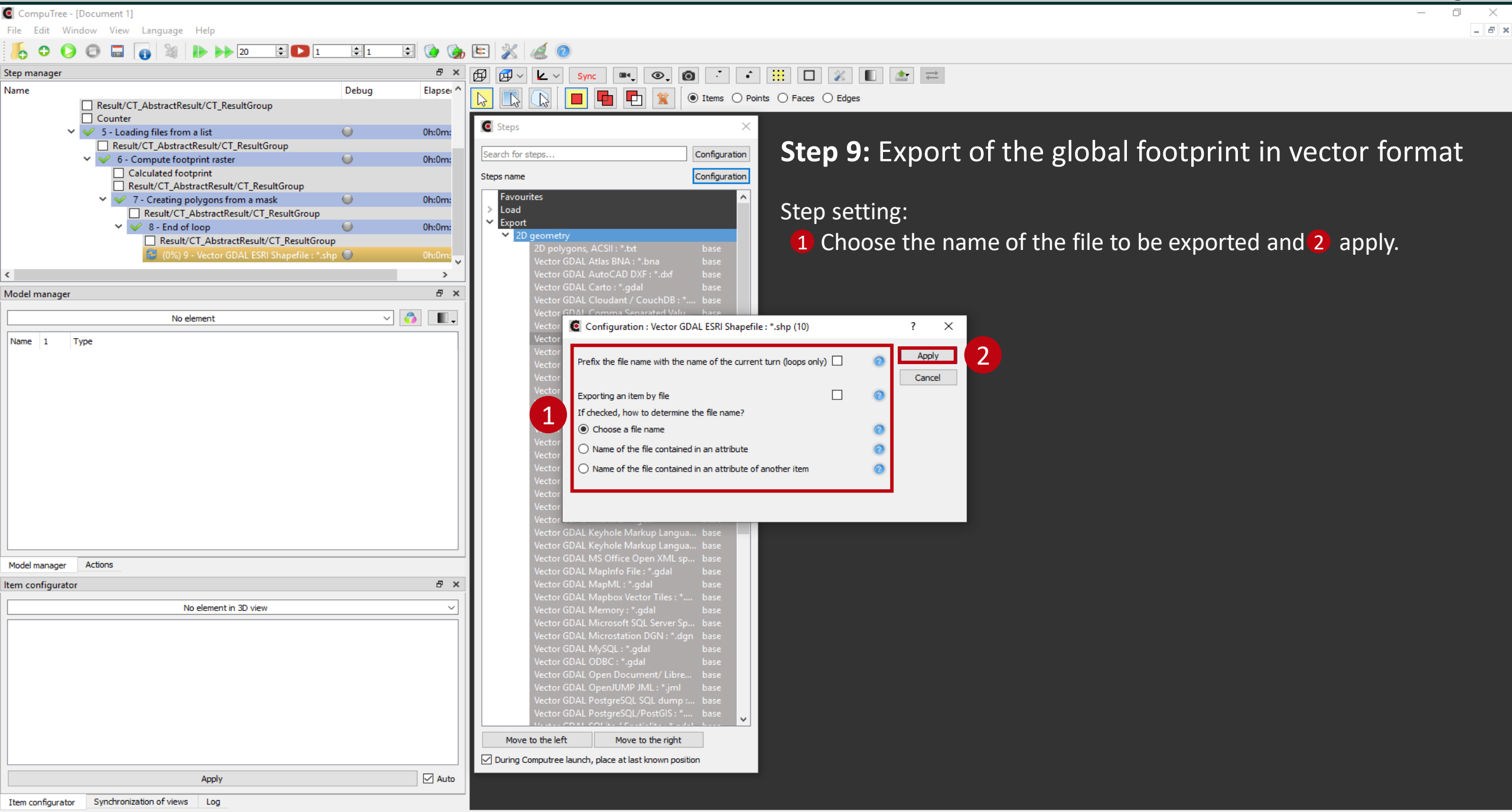




Step 9: Export of the global footprint in vector format

1. Open "Add a step".
   Go to the "Export" tab and then "2D Geometry".
2. Double click on "Vector GDAL ESRI Shapefile

Export of the global footprint in shapefile format.



Step 9: Export of the global footprint in vector format

Step setting:

1 Choose the name of the file to be exported and 2 apply.

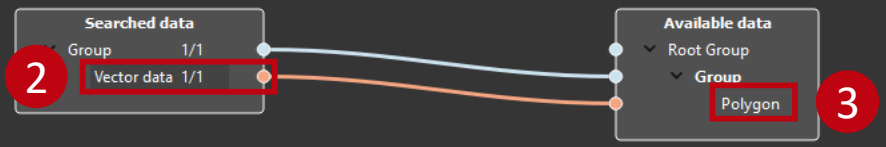
Configuration des résultats d'entrée of step "Vector GDAL ESRI Shapefile : *.shp"

Name of the results	Step	Help
Result (Export: Vector GDAL ESRI Shapefile)		
☑	(7) Creating polygons from a mask	
☐	(6) Compute footprint raster	
☐	(5) Loading files from a list	
☐	(3) Standard loop	
☐	(2) Add extents to tiles	

1

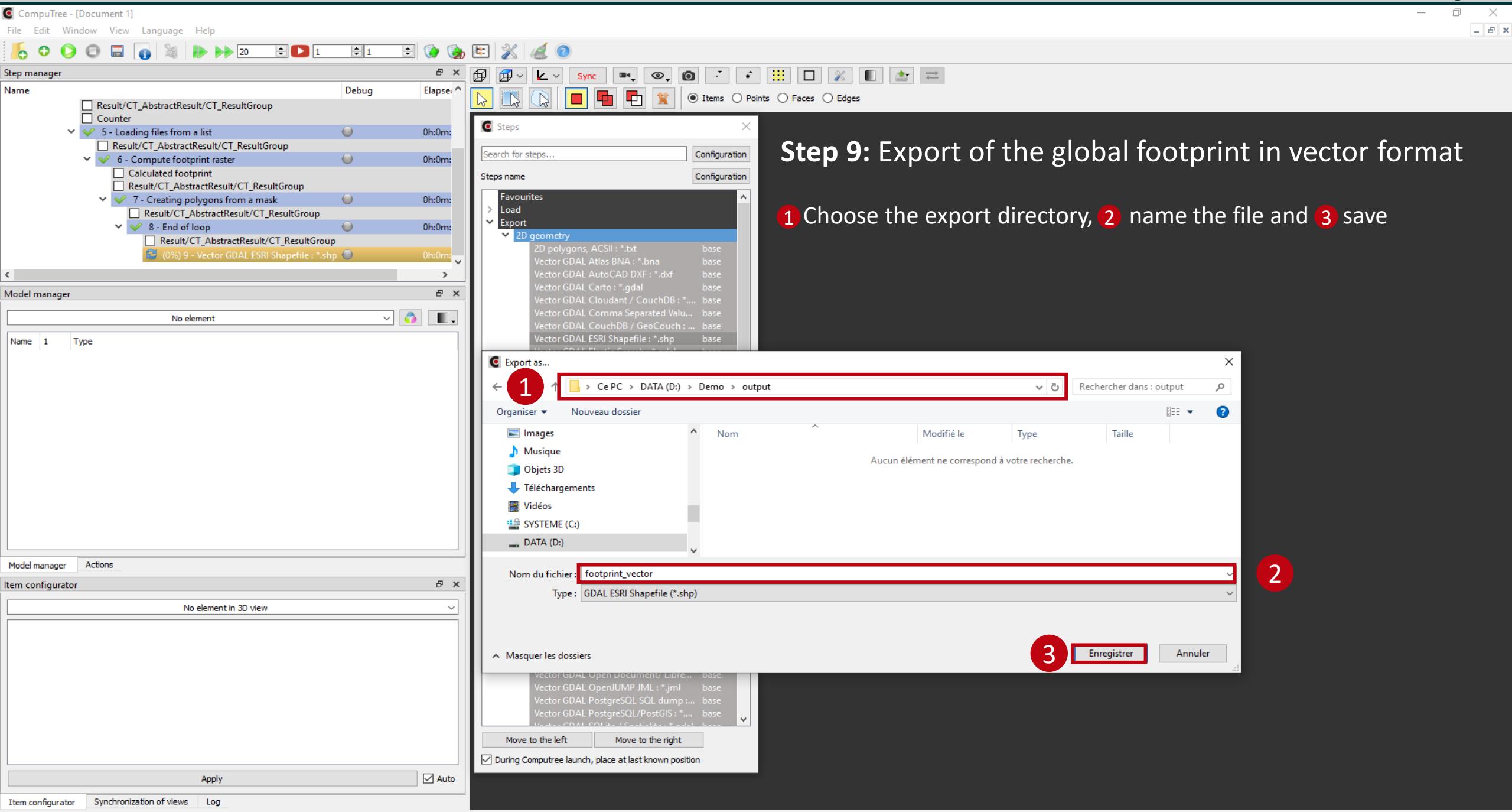
Select the step creating polygons from a mask

Step 9: Export of the global footprint in vector format



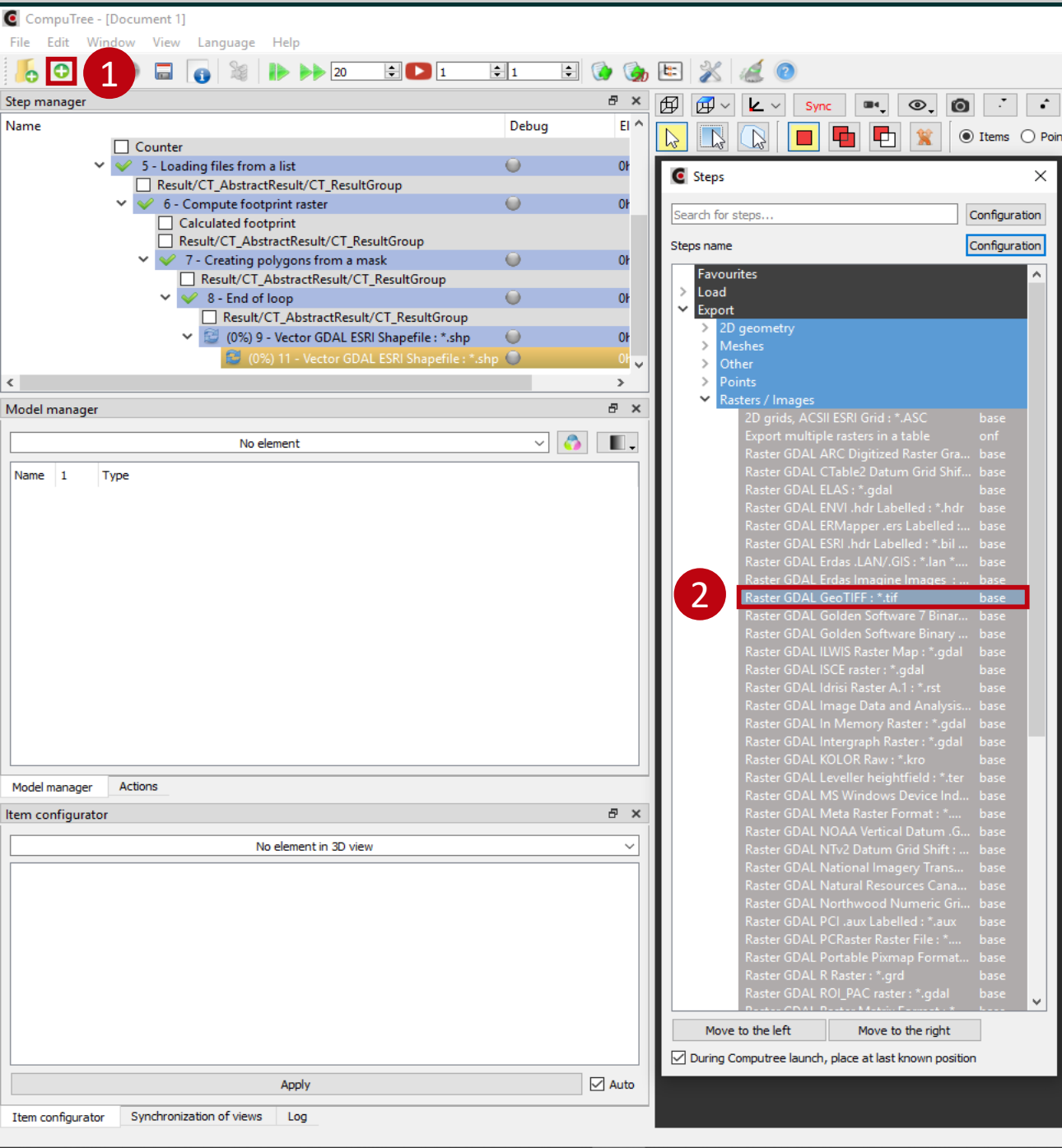
4

OK Cancel



Step 9: Export of the global footprint in vector format

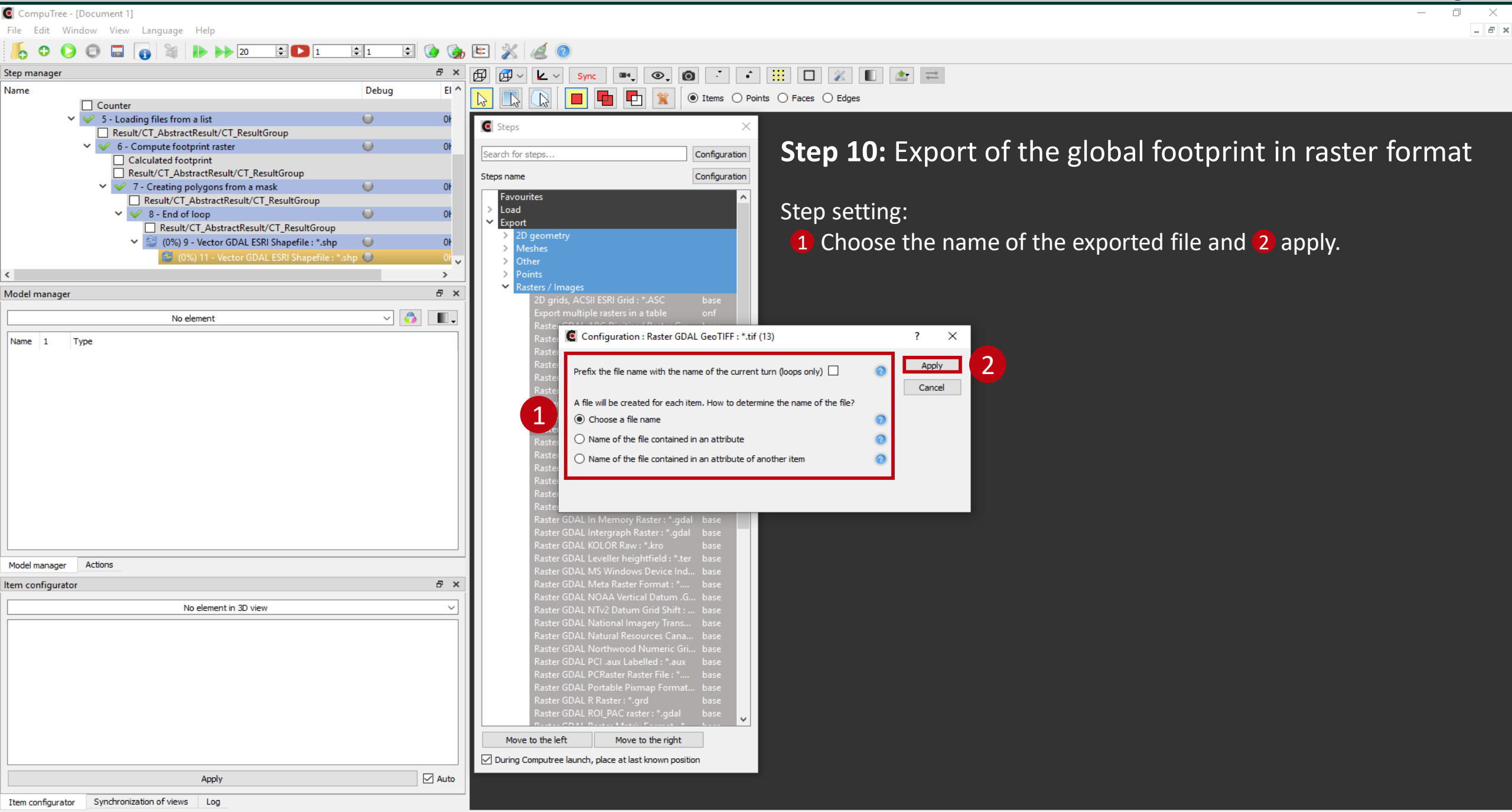
1 Choose the export directory, 2 name the file and 3 save



Step 10: Export of the global footprint in raster format

1. Open "Add a step".
   Go to the "Export" tab and then "Raster / Images".
2. Double click on "Raster GDAL GeoTIFF "

Export of the global LIDAR data footprint in GeoTIFF (raster).



Step 10: Export of the global footprint in raster format

Step setting:

1 Choose the name of the exported file and 2 apply.

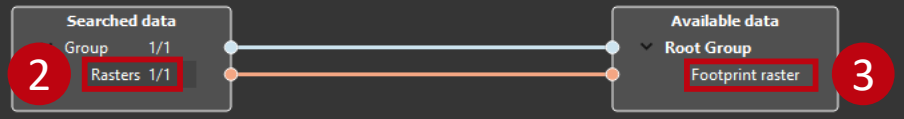
Configuration des résultats d'entrée of step "Raster GDAL GeoTIFF : *.tif"

Name of the results	Step	Help
Result (Export: Raster GDAL GeoTIFF)		
☑	(7) Creating polygons from a mask	
☐ Result	(6) Compute footprint raster	

1

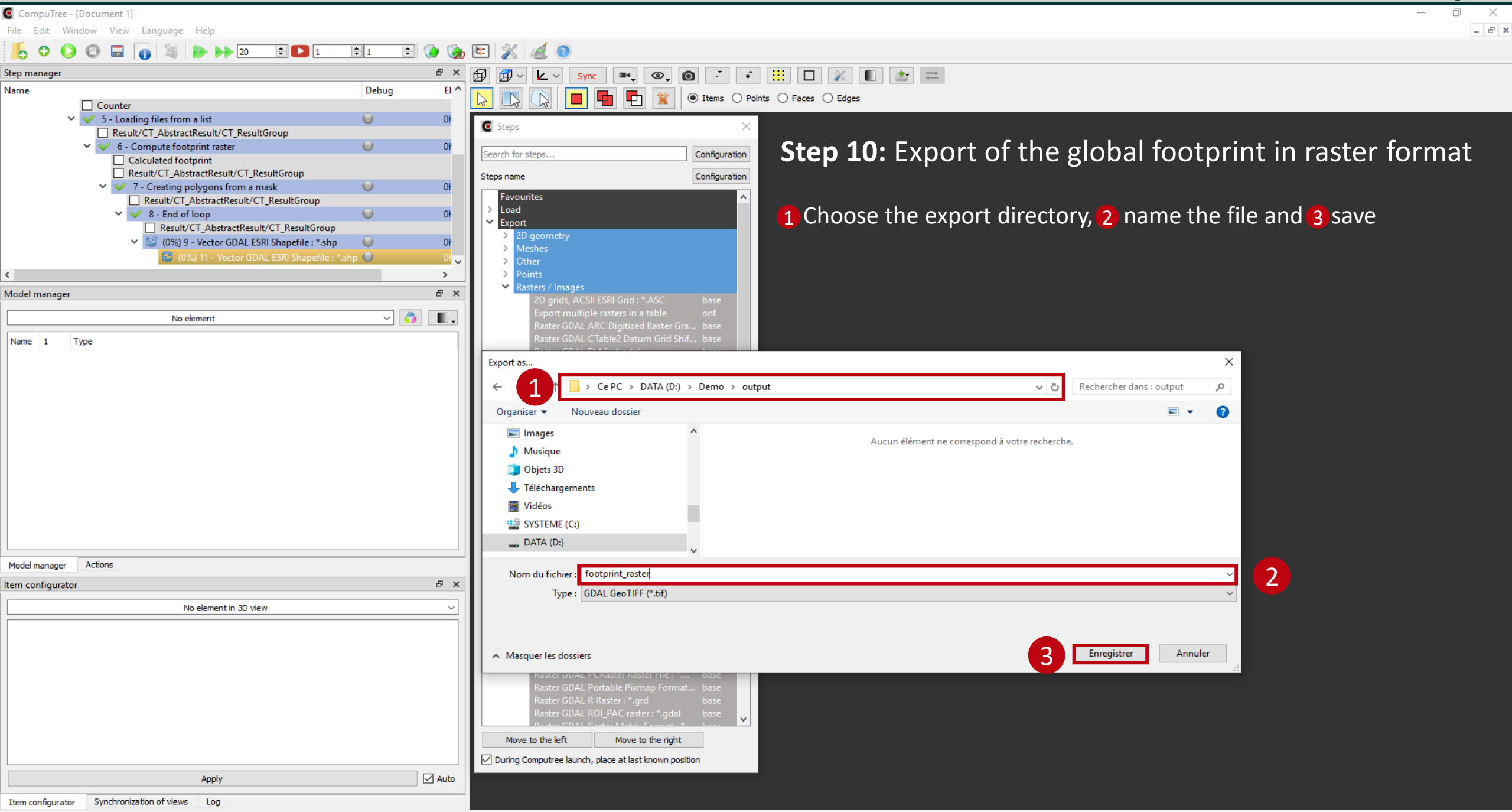
Step 10: Export of the global footprint in raster format

Select the footprint raster



4

OK Cancel

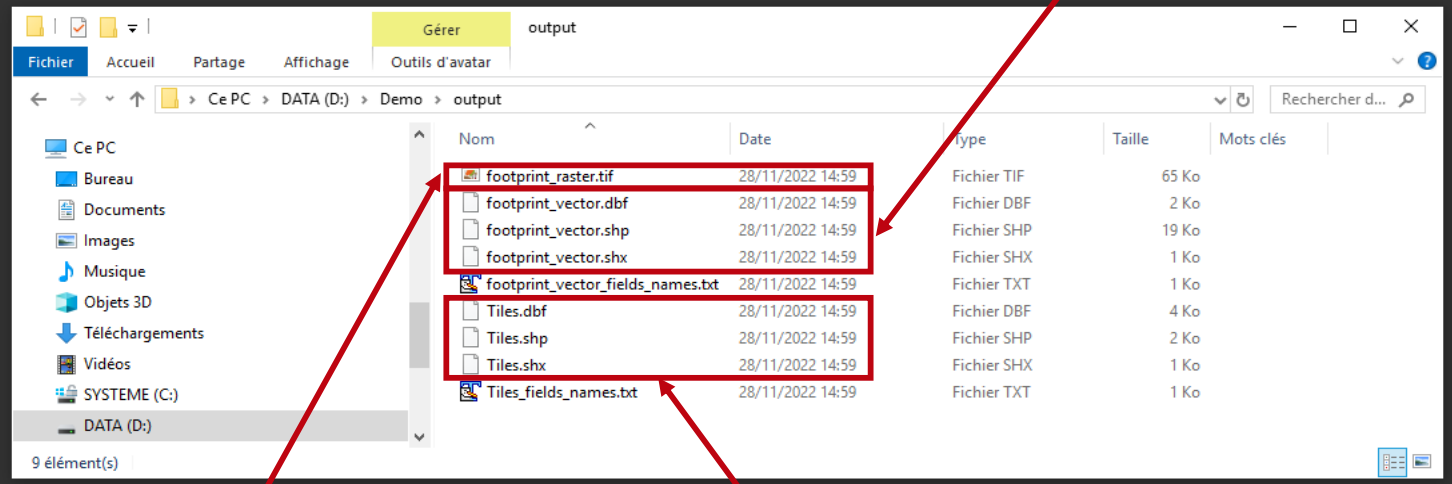


Step 10: Export of the global footprint in raster format

1 Choose the export directory, 2 name the file and 3 save

Created files (viewed in a file explorer)

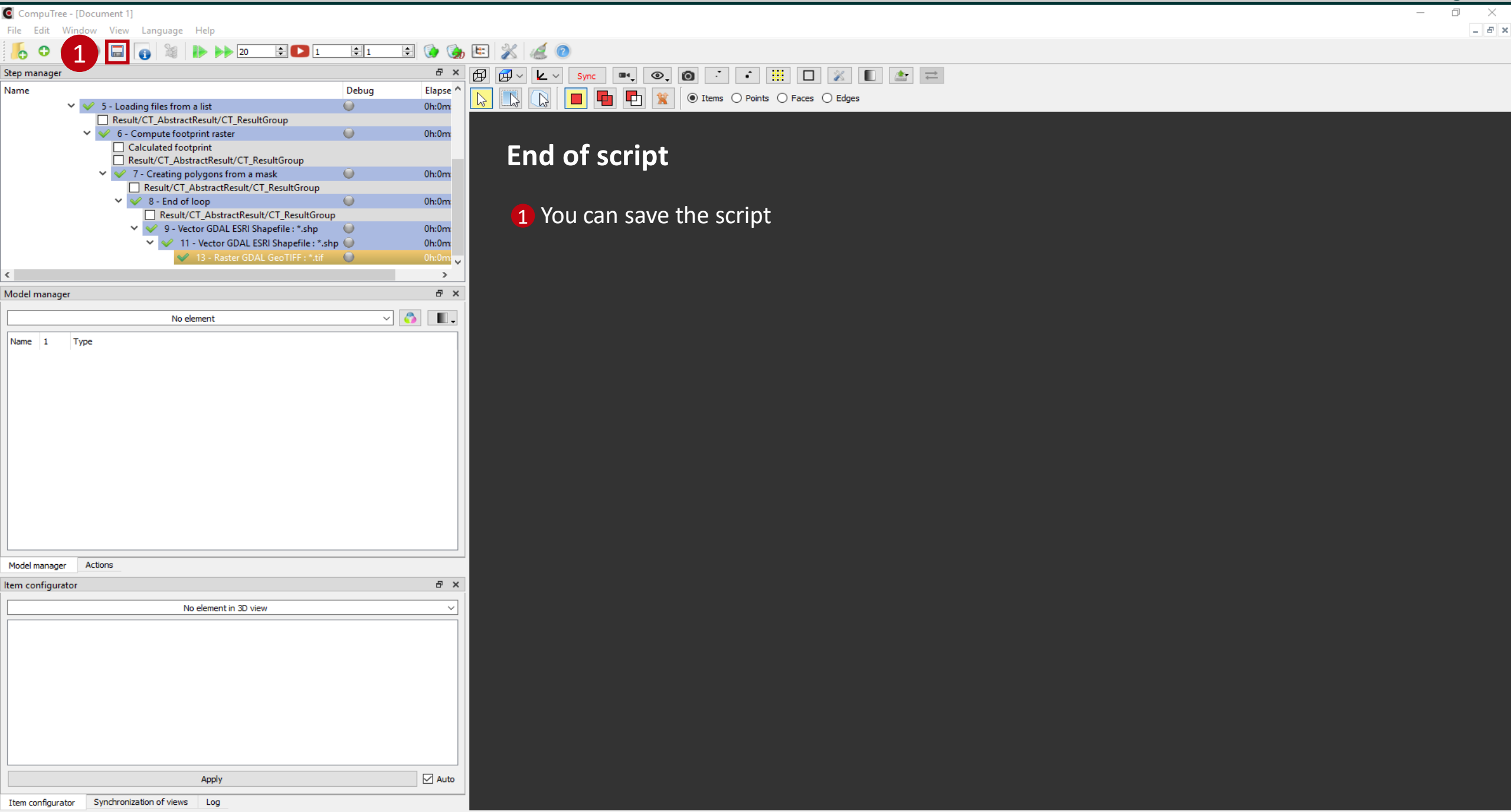
1 Shapefile containing the data footprint in vector format



3 Shapefile containing the (square) tile extents

2 Raster file containing the data at 10m resolution

N.B.: the two text files list the fields of the shapefiles. They are of no use in this case.


CompuTree - [Document 1]
File Edit Window View Language Help
1
Step manager
Name Debug Elapse
5 - Loading files from a list 0h:0m
Result/CT_AbstractResult/CT_ResultGroup
6 - Compute footprint raster 0h:0m
Calculated footprint
Result/CT_AbstractResult/CT_ResultGroup
7 - Creating polygons from a mask 0h:0m
Result/CT_AbstractResult/CT_ResultGroup
8 - End of loop 0h:0m
Result/CT_AbstractResult/CT_ResultGroup
9 - Vector GDAL ESRI Shapefile : *.shp 0h:0m
11 - Vector GDAL ESRI Shapefile : *.shp 0h:0m
13 - Raster GDAL GeoTIFF : *.tif 0h:0m
Model manager
No element
Name 1 Type
Model manager Actions
Item configurator
No element in 3D view
Apply Auto
Item configurator Synchronization of views Log
Sync
Items Points Faces Edges
End of script
1 You can save the script

Summary of steps