

Tutorial TLS01

EN

Terrestrial LIDAR

Ground point detection and DTM creation

ONF Plugin: fast but simplistic approach

Goal

In a terrestrial LIDAR point cloud, separate ground points and vegetation points. Use ground points to create a Digital Terrain Model.

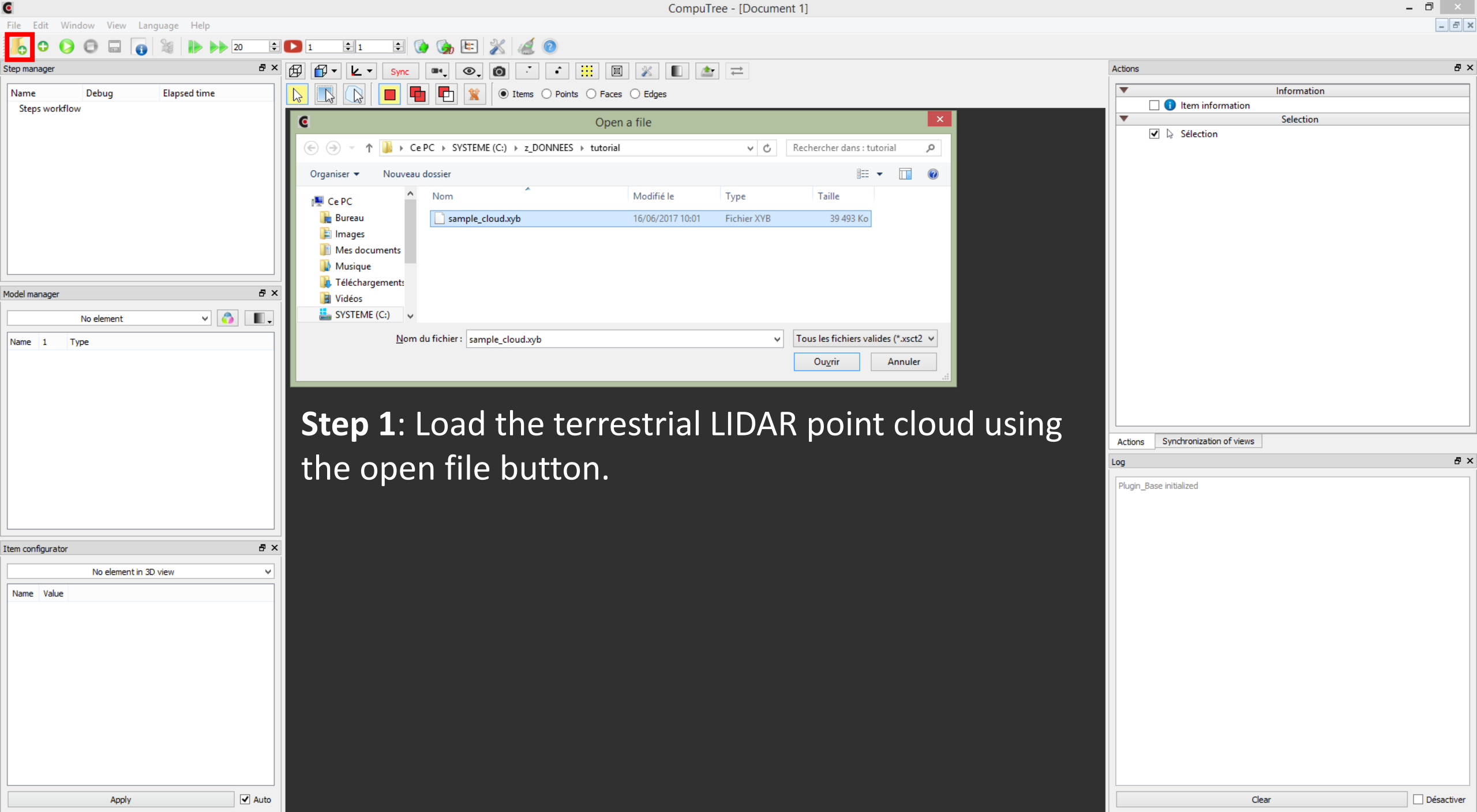
Interest

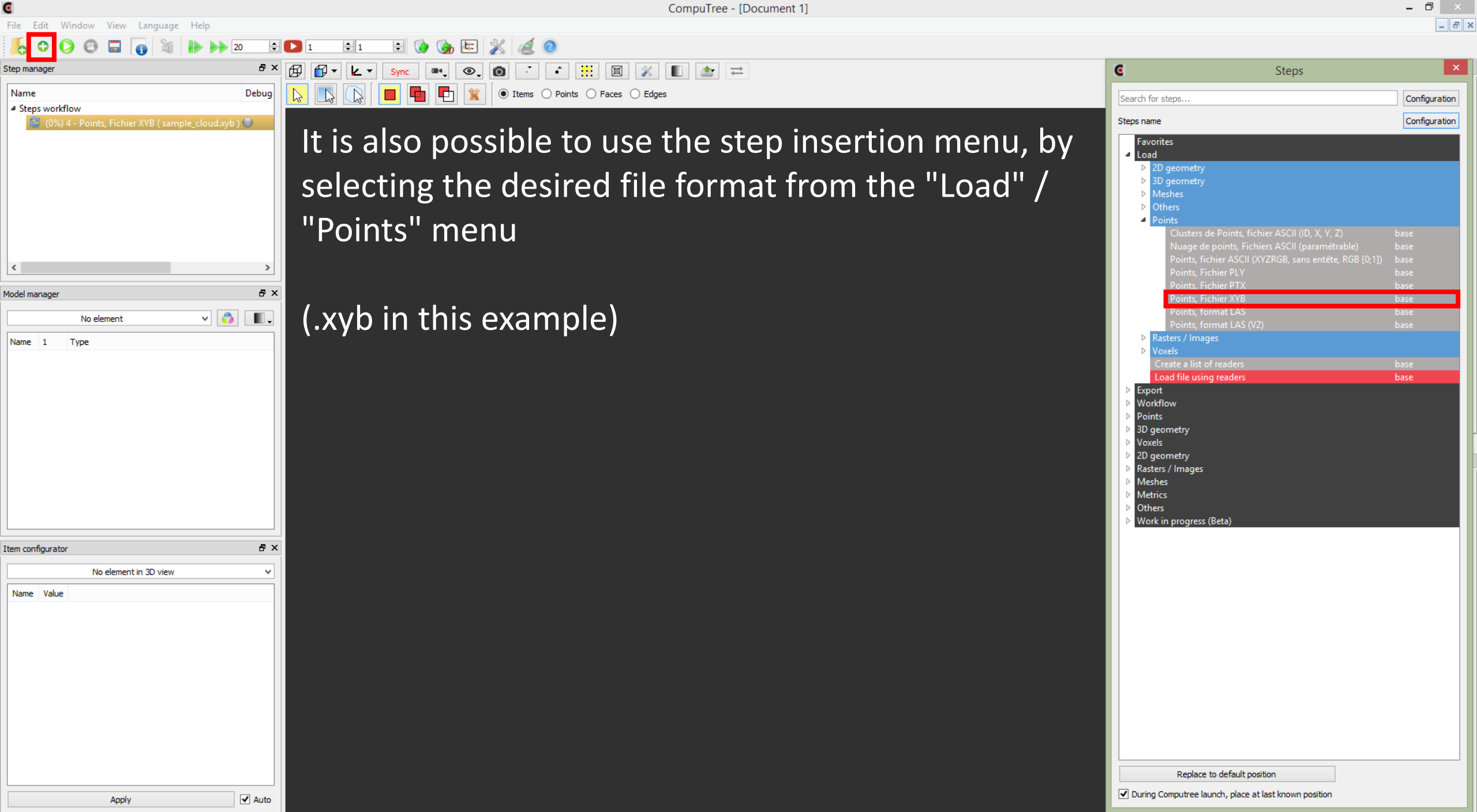
The separation of ground and vegetation points allows:

- To create a digital terrain model to obtain a height reference at any point in the scene.
- To process vegetation points (insulation of trees ...), without interference of the ground points.

Require

- A terrestrial LIDAR point cloud





CompuTree - [Document 1]

File Edit Window View Language Help

Step manager

Name Debug

Steps workflow

(0%) 4 - Points, Fichier XYB (sample_cloud.xyb)

Model manager

No element

Name 1 Type

Item configurator

No element in 3D view

Name Value

Apply Auto

Step 2: Classify Ground Points

- ➔ Menu Points / Classify
- ➔ Step ID: ONF_StepClassifyGround

This step :

1. Creates a Zmin raster where each pixel contains the Z value of the lowest point
2. Filter this raster by eliminating the aberrant pixels, on two optional criteria:
 - The density of points
 - Coherence with the neighbourhood
3. The points above the unfiltered pixels on a fixed thickness from the minimum Z are considered as ground points.

Steps

Search for steps...

Configuration

Steps name

Configuration

Favorites

Load

Export

Workflow

Points

Ajust

Analyze

Classify

Classify ground points onf

Clusterize

Colorize

Create / Merge

Detect (Crowns)

Extract

Filter

Transform

Normals

3D geometry

Voxels

2D geometry

Rasters / Images

Meshes

Metrics

Others

Work in progress (Beta)

Replace to default position

☒ During Computree launch, place at last known position

CompuTree - [Document 1]

File Edit Window View Language Help

Step manager

Name Debug

Steps workflow

(0%) 4 - Points, Fichier XYB (sample_cloud.xyb)

Model manager

No element

Name 1 Type

Item configurator

No element in 3D view

Name Value

Apply Auto

Configuration (ONF_StepClassifyGround (6))

Grid resolution: 50 cm

Ground thickness: 32 cm

Filter by density ☒

Minimum density: 200.00 pts/m2

Filter by neighbourhood consistency ☒

Neighbourhood (isolated points): 3 Cases

Apply

Cancel

Steps

Search for steps...

Configuration

Steps name

Configuration

Favorites

Load

Export

Workflow

Points

Ajust

Analyze

Classify

Classify ground points onf

Clusterize

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Rasters / Images

Meshes

Metrics

Others

Work in progress (Beta)

Replace to default position

☒ During Computree launch, place at last known position

Step parameters:

- Resolution** of the grid used for the Zmin raster
- Ground Thickness:**
 - For **density filtering**: the density of points is calculated above each pixel, on a vertical extend from Zmin to Zmin + chosen thickness.
 - For each pixel preserved by the filtering, the points between Zmin and Zmin + the chosen thickness are classified as ground.

NB: The thickness should logically be adjusted in proportion to the resolution.

CompuTree - [Document 1]

File Edit Window View Language Help

Step manager

Name Debug

Steps workflow

(0%) 4 - Points, Fichier XYB (sample_cloud.xyb)

Configuration (ONF_StepClassifyGround (6))

Grid resolution: 50 cm

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Filter by density ☒

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Model manager

No element

Name 1 Type

Item configurator

No element in 3D view

Name Value

Apply ☒ Auto

Steps

Search for steps...

Configuration

Steps name

Configuration

Favorites

Load

Export

Workflow

Points

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Normals

3D geometry

Voxels

2D geometry

Rasters / Images

Meshes

Metrics

Others

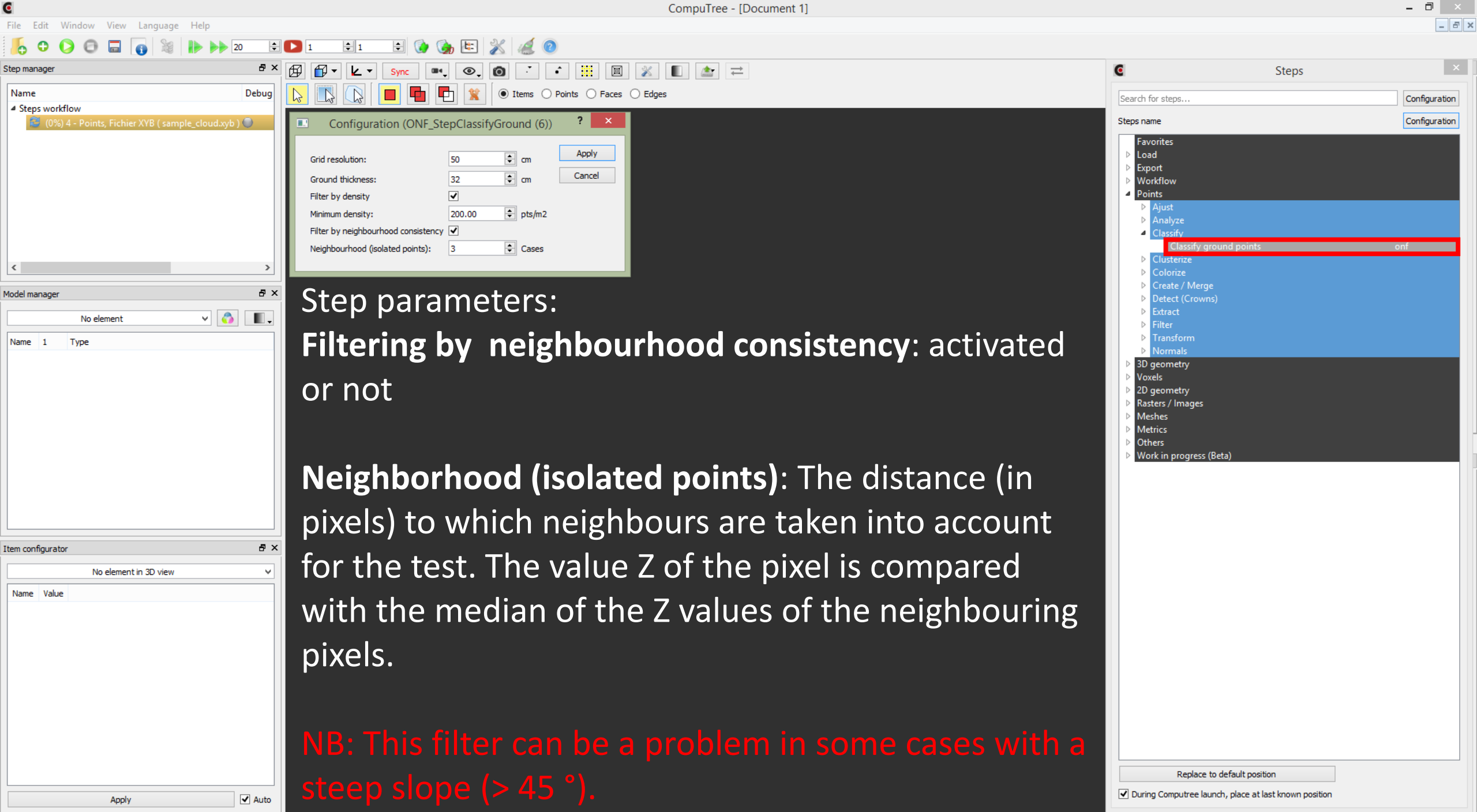
Work in progress (Beta)

Replace to default position

☒ During Computree launch, place at last known position

- **Density filtering:** activated or not
- The **minimum density**, in points per m², makes it possible to determine for each pixel whether the lowest points correspond to the ground or not. The hypothesis is that in case of occlusion of the ground (lowest points are in this case part of the vegetation), the density is reduced compared to the case where the ground is scanned.

NB: The density value must be adjusted according to the entered input data. The value of 200 pts / m² corresponds to a scanning resolution of 6.3 mm between two points at 10 m (20 m radius plot).



CompuTree - [Document 1]

File Edit Window View Language Help

Step manager

Name Debug

Steps workflow

- 4 - Points, Fichier XYB (sample_cloud.xyb)
 - Result
- 5 - Classify ground points
 - Classification raster
 - Result (COPY)

Model manager

Classification raster (5)

Name 1 Type

- Classification raster
 - gmnt
 - DTM (Zmin) ☒ Raster<float>
 - Ground points density ☐ Raster<qint32>

Item configurator

Raster<float>

	Name	Value
1	Bounding Shape	<input type="checkbox"/> Activate
2	Bounding Shape center	<input type="checkbox"/> Activate
3	Points size (Bounding Shape)	10
4	Raster mode	<input checked="" type="checkbox"/> Activate
5	Raster mode: fix Z-level	<input type="checkbox"/> Activate
6	Raster mode: Z-Level (m)	0
7	Raster mode: show grid	<input type="checkbox"/> Activate
8	3D mode	<input type="checkbox"/> Activate

Apply ☒ Auto

Steps

Search for steps...

Configuration

Steps name

Configuration

Favorites

- Load
- Export
- Workflow
- Points
 - Ajust
 - Analyze
 - Classify
 - Classify ground points onf
 - Clusterize
 - Colorize
 - Create / Merge
 - Detect (Crowns)
 - Extract
 - Filter
 - Transform
 - Normals
- 3D geometry
- Voxels
- 2D geometry
- Rasters / Images
- Meshes
- Metrics
- Others
- Work in progress (Beta)

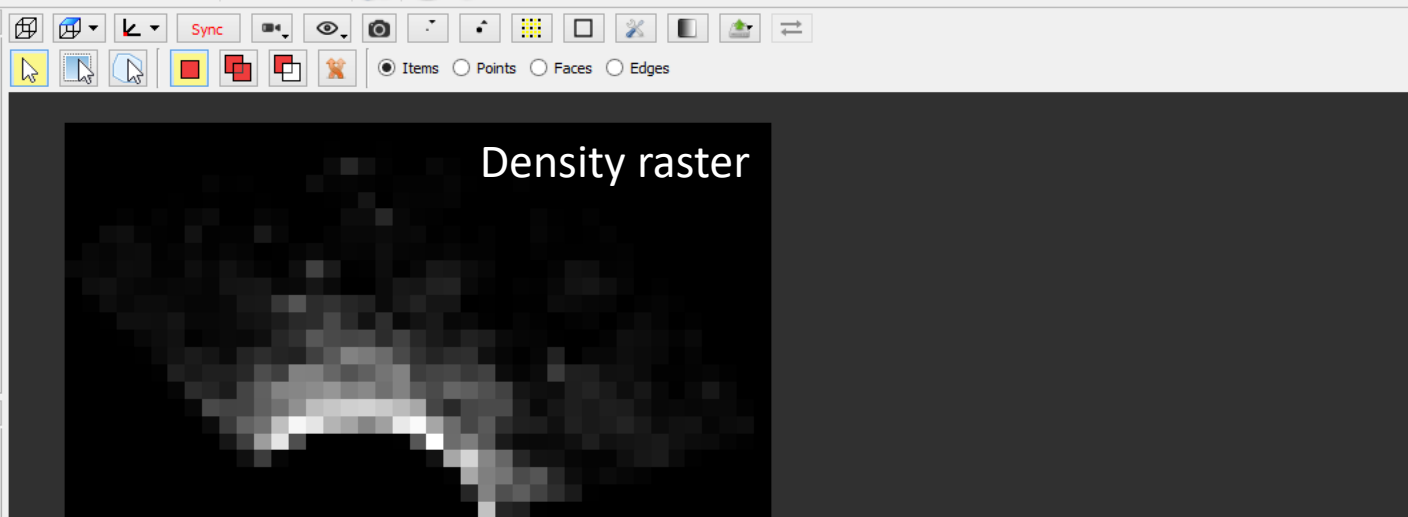
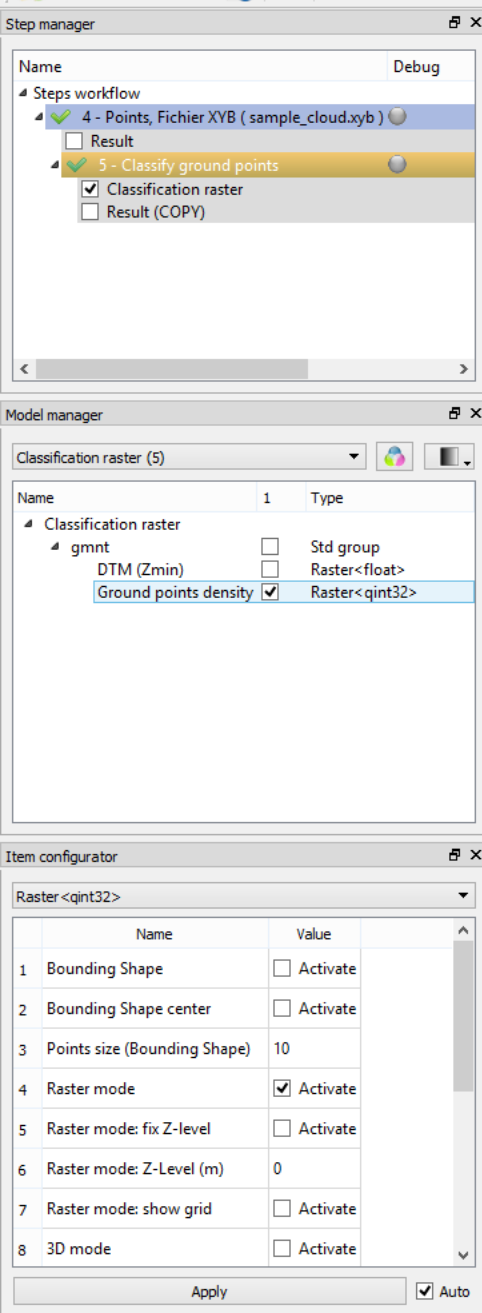
Replace to default position

☒ During Computree launch, place at last known position

raster Zmin

This step produces a "Classification raster" result containing the intermediate data:

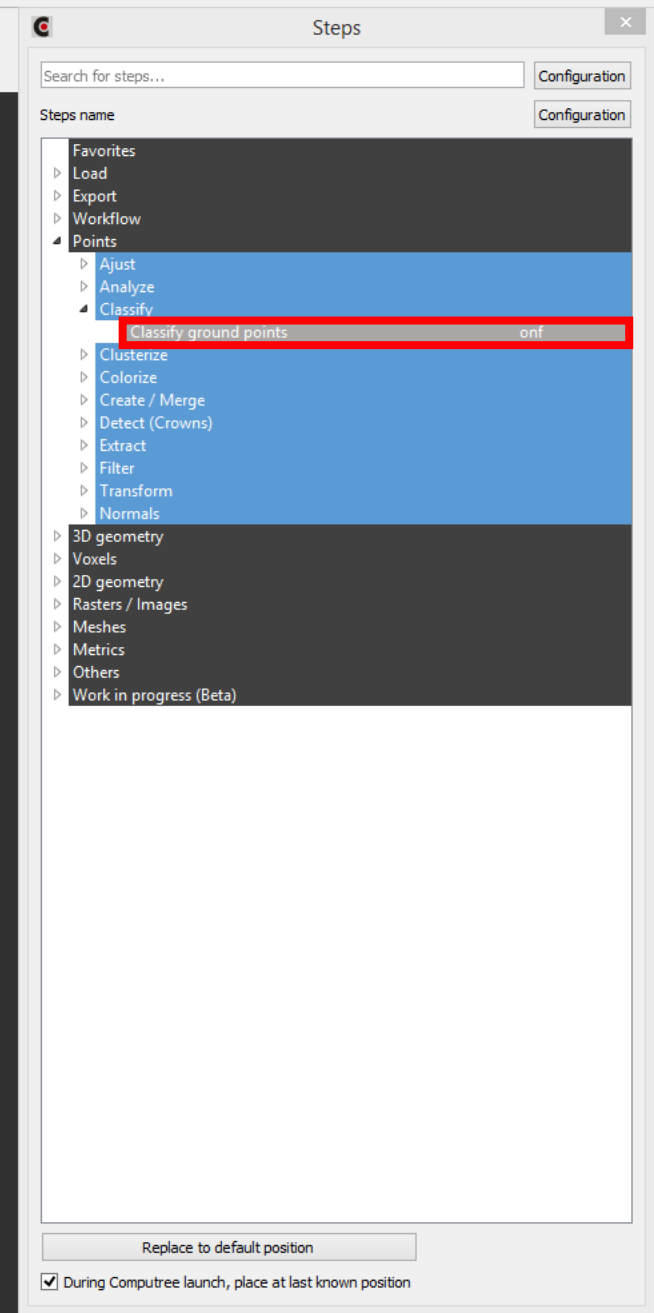
- "DTM (Zmin)": the Zmin raster calculated by the step to determine the zones where there are ground points.



This step produces a "Classification raster" result containing the intermediate data:

- "DTM (Zmin)": the Zmin raster calculated by the step to determine the zones where there are ground points.
- "Ground Point Density": the density raster used for density filtering.

These data are not used in the future, and are only provided for diagnostic purposes.



File Edit Window View Language Help

Step manager

Name

Debug

Steps workflow

- 4 - Points, Fichier XYZ (sample_cloud.xyz)
 - Result
- 5 - Classify ground points
 - Classification raster
 - Result (COPY)

Model manager

Result (COPY) (5)

Name	1	Type
Result		
Group	<input type="checkbox"/>	Std group
Scène	<input type="checkbox"/>	Point scene
Intensité	<input type="checkbox"/>	Point quint16 attributes
Scanner	<input type="checkbox"/>	Scan position
File header	<input type="checkbox"/>	XYZ Header
Vegetation points	<input checked="" type="checkbox"/>	Point scene
Ground points	<input checked="" type="checkbox"/>	Point scene

Item configurator

Item with points

	Name	Value
1	Points	<input checked="" type="checkbox"/> Activate
2	Bounding Shape	<input type="checkbox"/> Activate
3	Bounding Shape center	<input type="checkbox"/> Activate

Apply ☒ Auto

CompuTree - [Document 1]

File Edit Window View Language Help

20

1

1

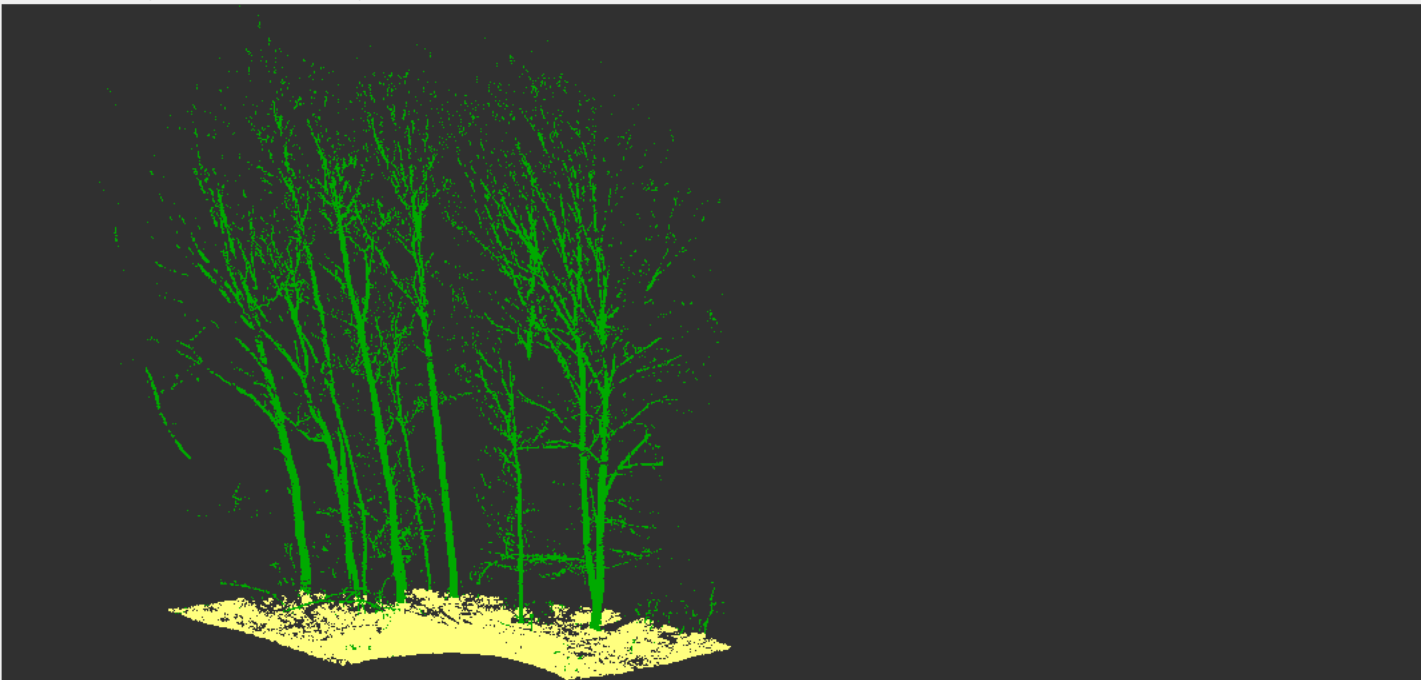
Sync

Items

Points

Faces

Edges



Otherwise, the step completes the input result (containing the full point scene) by:

- A cloud of ground points
- A cloud of vegetation points

Steps

Search for steps...

Configuration

Steps name

Configuration

Favorites

Load

Export

Workflow

Points

- Ajust
- Analyze
- Classify
 - Classify ground points onf
- Clusterize
- Colorize
- Create / Merge
- Detect (Crowns)
- Extract
- Filter
- Transform
- Normals

3D geometry

Voxels

2D geometry

Rasters / Images

Meshes

Metrics

Others

Work in progress (Beta)

Replace to default position

☒ During Computree launch, place at last known position

CompuTree - [Document 1]

File Edit Window View Language Help

Step manager

Name Debug

Steps workflow

- 4 - Points, Fichier XYB (sample_cloud.xyb)
 - Result
- 5 - Classify ground points
 - Classification raster
 - Result (COPY)

Model manager

No element

Name 1 Type

Item configurator

Item with points

	Name	Value
1	Points	<input checked="" type="checkbox"/> Activate
2	Bounding Shape	<input type="checkbox"/> Activate
3	Bounding Shape center	<input type="checkbox"/> Activate

Apply ☒ Auto

Steps

Search for steps...

Configuration

Steps name

Configuration

Favorites

- Load
- Export
- Workflow
- Points
 - Ajust
 - Analyze
 - Classify
 - Classify ground points onf
 - Clusterize
 - Colorize
 - Create / Merge
 - Detect (Crowns)
 - Extract
 - Filter
 - Transform
 - Normals
- 3D geometry
- Voxels
- 2D geometry
- Rasters / Images
- Meshes
- Metrics
- Others
- Work in progress (Beta)

Replace to default position

☒ During Computree launch, place at last known position

The classification of the ground points is based on a thickness above a Zmin raster, the classification is not perfect:

- The bottom of the trunks is attached to the ground points
- Cutting follows the pixel boundary, leading to staircase effects

CompuTree - [Document 1]

File Edit Window View Language Help

Step manager

Name Debug

- Steps workflow
 - 4 - Points, Fichier XYB (sample_cloud.xyb)
 - Result
 - 5 - Classify ground points
 - Classification raster
 - Result (COPY)

Model manager

No element

Name 1 Type

Item configurator

No element in 3D view

Apply Auto

Configuration of input results (ONF_StepComputeDTM02 (7))

Results names	Step	Help
Ground points		
<input checked="" type="checkbox"/> Result	ONF_StepClassifyGround (5)	

Input data selection

Available data	Sel.	Searched data
Result		
Group	<input checked="" type="checkbox"/>	Groupe [Group]
Scène [Point scene]	<input type="checkbox"/>	Ground points [Point scene]
Vegetation points [Point scene]	<input type="checkbox"/>	Ground points [Point scene]
Ground points [Point scene]	<input checked="" type="checkbox"/>	Ground points [Point scene]

OK Cancel

Steps

Search for steps...

Configuration

Steps name

Configuration

- Favorites
 - Load
 - Export
 - Workflow
 - Points
 - 3D geometry
 - Voxels
 - 2D geometry
 - Rasters / Images
 - Create / Merge
 - Digital elevation models
 - Compute hillShade raster onf
 - Compute slope raster onf
 - Convert DEM to point cloud onf
 - Convert TIN to DTM onf
 - Create DSM (Zmax) onf
 - Create DSM and DHM onf
 - Create DTM simletree
 - Create DTM onf
 - Create maxima point cloud onf
 - Create Segmented CHM simletree
 - Filter maxima by neighbourhood onf
 - Gaussian filter optimized by maxima number onf
 - Modify DEM onf
 - Pit filling ignlif
 - Upper outliers removing ignlif
 - SEGMA
 - Map one attribute by cluster (raster) onf
- Meshes
- Metrics
- Others
- Work in progress (Beta)

Replace to default position

☒ During Computree launch, place at last known position

When adding, the input data should be configured:

→ Check the ground point cloud from the previous step.

CompuTree - [Document 1]

File Edit Window View Language Help

Step manager

Name Debug

Steps workflow

- 4 - Points, Fichier XYB (sample_cloud.xyb)
- Result
- 5 - Classify ground points
- Classification raster
- Result (COPY)

Model manager

No element

Name 1 Type

Item configurator

No element in 3D view

Apply Auto

Configuration (ONF_StepComputeDTM02 ... ? x)

Grid resolution: 25 cm Apply

Interpolation ☒ Cancel

Size of interpolation window 10 Cells

Smoothing (mean filter) ☐

Smoothing neighbourhood: 2 Cases

Convert NA values to min(DTM)? ☒

Step parameters:

- Grid resolution:** resolution of the DTM produced.
- Interpolation:** Enables interpolation for missing values. The interpolation is done by the natural neighbours method, taking into account a neighbourhood defined by the size of the interpolation window (square) expressed in pixels. Thus a size of 10, will take into account the non-empty pixels, in a square of 21x21 pixels, centered on the pixel to be interpolated.

It is recommended to always activate the interpolation.

Steps

Search for steps... Configuration

Steps name Configuration

Favorites

- Load
- Export
- Workflow
- Points
- 3D geometry
- Voxels
- 2D geometry
- Rasters / Images
 - Create / Merge
 - Digital elevation models
 - Compute hillShade raster onf
 - Compute slope raster onf
 - Convert DEM to point cloud onf
 - Convert TIN to DTM onf
 - Create DSM (Zmax) onf
 - Create DSM and DHM onf
 - Create DTM simpletree
 - Create DTM onf
 - Create maxima point cloud onf
 - Create Segmented CHM simpletree
 - Filter maxima by neighbourhood onf
 - Gaussian filter optimized by maxima number onf
 - Modify DEM onf
 - Pit filling ignlif
 - Upper outliers removing ignlif
- SEGMA
 - Map one attribute by cluster (raster) onf
- Meshes
- Metrics
 - Analyze
 - Compute Schutz competition index (1989) onf
 - Points metrics (XYZ) base
 - Rasters metrics base
- Others
- Work in progress (Beta)

Replace to default position

☒ During Computree launch, place at last known position

CompuTree - [Document 1]

File Edit Window View Language Help

Step manager

Name Debug

Steps workflow

- 4 - Points, Fichier XYB (sample_cloud.xyb)
- Result
- 5 - Classify ground points
- Classification raster
- Result (COPY)

Model manager

No element

Name 1 Type

Item configurator

No element in 3D view

Apply Auto

Configuration (ONF_StepComputeDTM02 ... ? x)

Grid resolution: 25 cm Apply

Interpolation ☒ Cancel

Size of interpolation window 10 Cells

Smoothing (mean filter) ☐

Smoothing neighbourhood: 2 Cases

Convert NA values to min(DTM)? ☒

- **Smoothing (medium filter):** Enables the smoothing of the terrain (after interpolation). This smooths the irregularities of the DTM, at the price of a reduction in its accuracy. Each pixel is replaced by the average of the neighbouring pixels. The neighbours taken into account are defined by the **Smoothing neighborhood** (in pixels). Thus a size of 2, will take into account the non-empty pixels, in a square of 5x5 pixels, centered on the pixel to be smoothed.
- Unless specifically required, it is preferable to disable this option.

Steps

Search for steps... Configuration

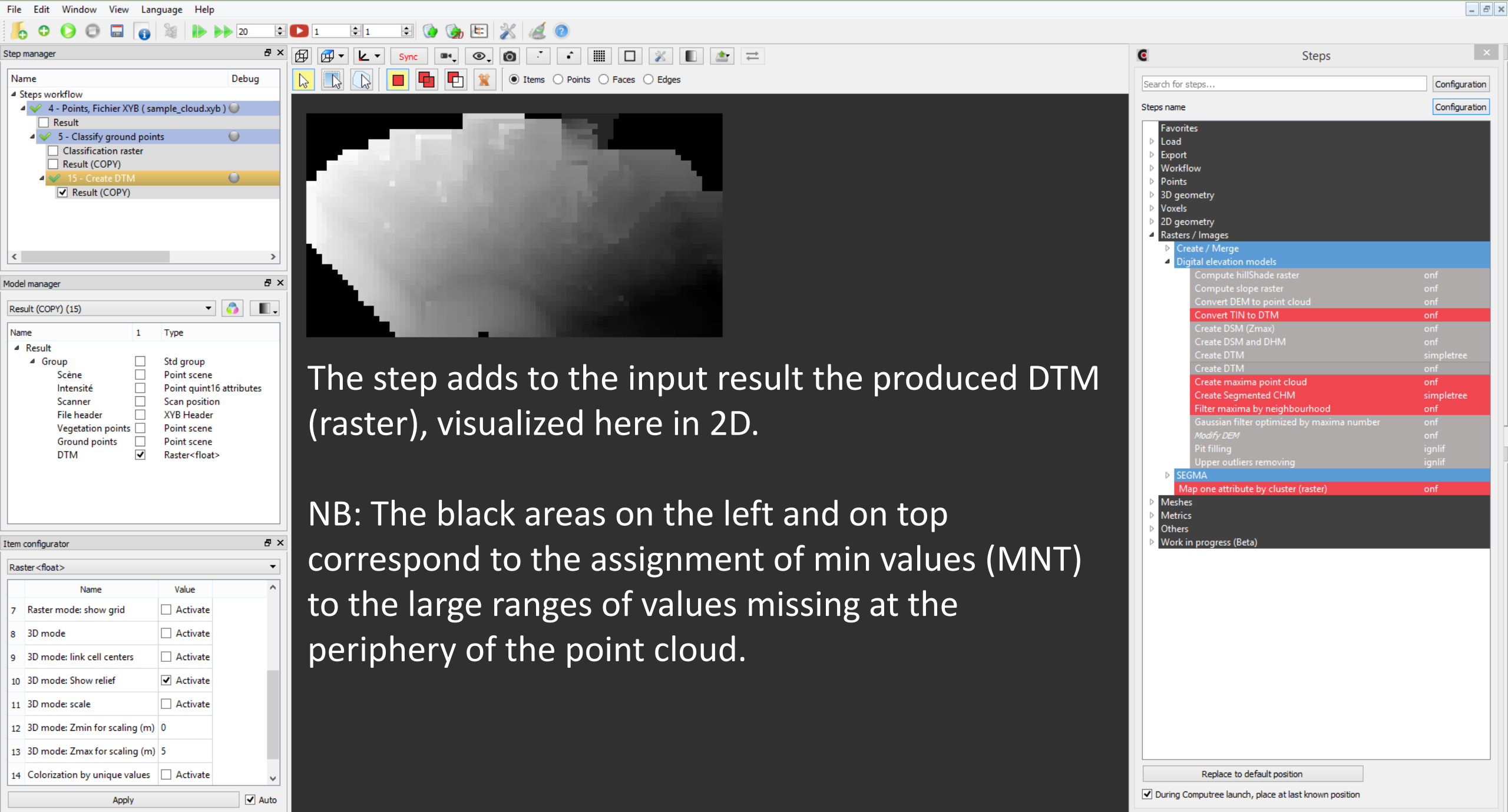
Steps name Configuration

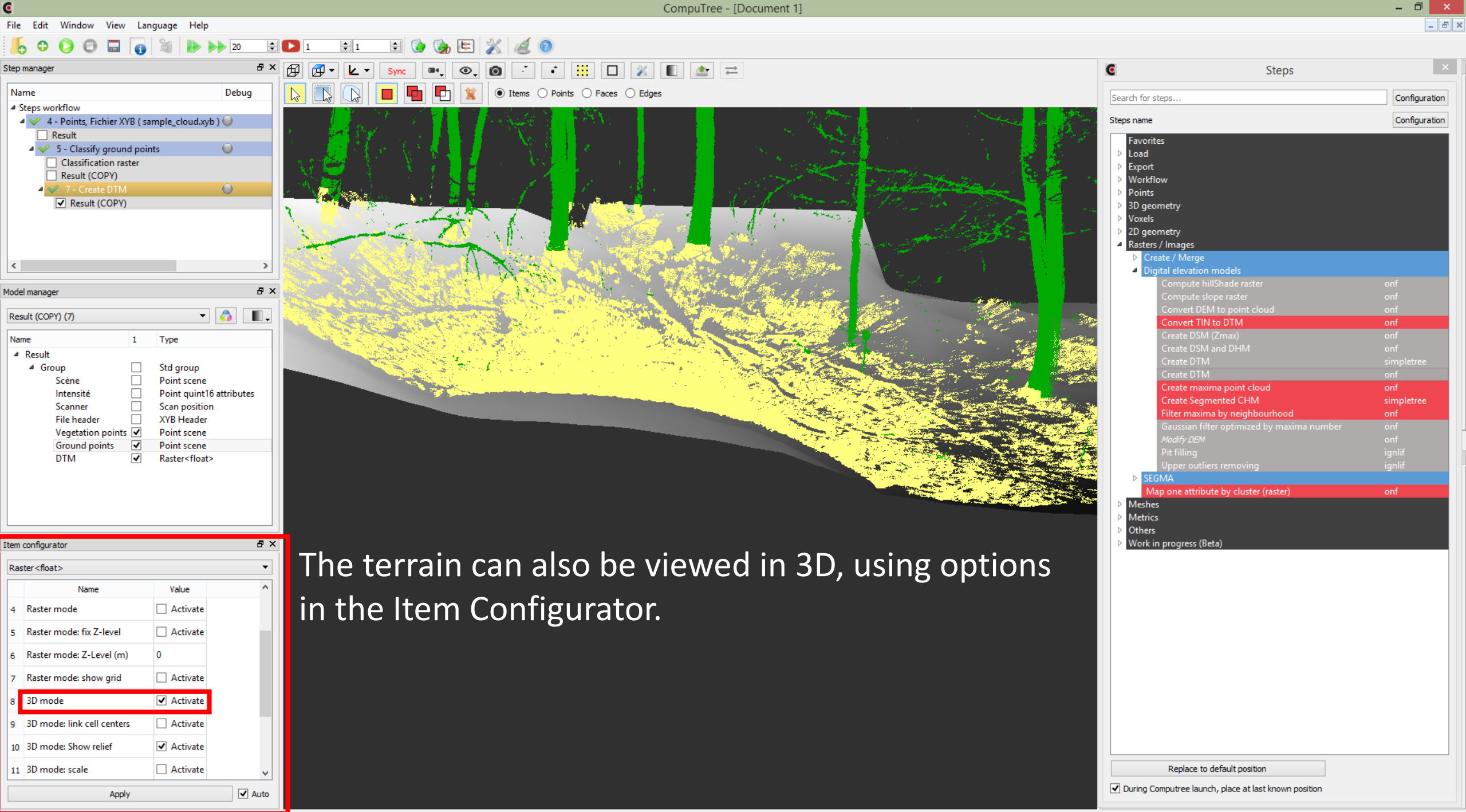
Favorites

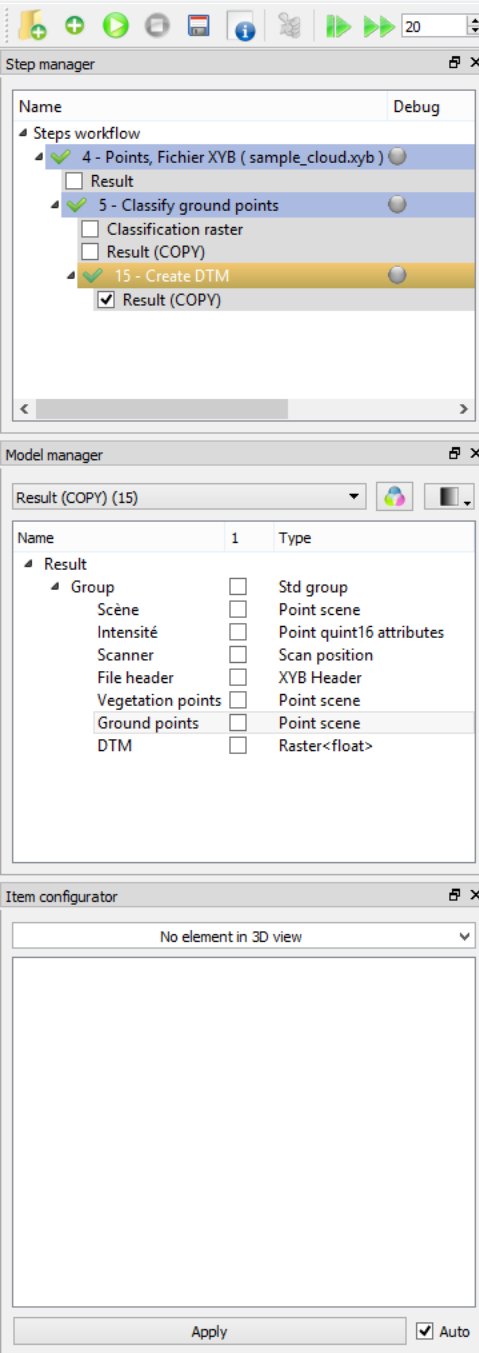
- Load
- Export
- Workflow
- Points
- 3D geometry
- Voxels
- 2D geometry
- Rasters / Images
 - Create / Merge
 - Digital elevation models
 - Compute hillShade raster onf
 - Compute slope raster onf
 - Convert DEM to point cloud onf
 - Convert TIN to DTM onf
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 - Create DSM and DHM onf
 - Create DTM simpletree
 - Create DTM onf
 - Create maxima point cloud onf
 - Create Segmented CHM simpletree
 - Filter maxima by neighbourhood onf
 - Gaussian filter optimized by maxima number onf
 - Modify DEM onf
 - Pit filling ignlif
 - Upper outliers removing ignlif
 - SEGMA
 - Map one attribute by cluster (raster) onf
- Meshes
- Metrics
 - Analyze
 - Compute Schutz competition index (1989) onf
 - Points metrics (XYZ) base
 - Rasters metrics base
- Others
- Work in progress (Beta)

Replace to default position

☒ During Computree launch, place at last known position



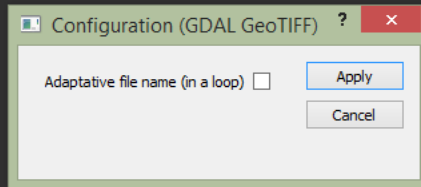




Step 4: Export the DTM

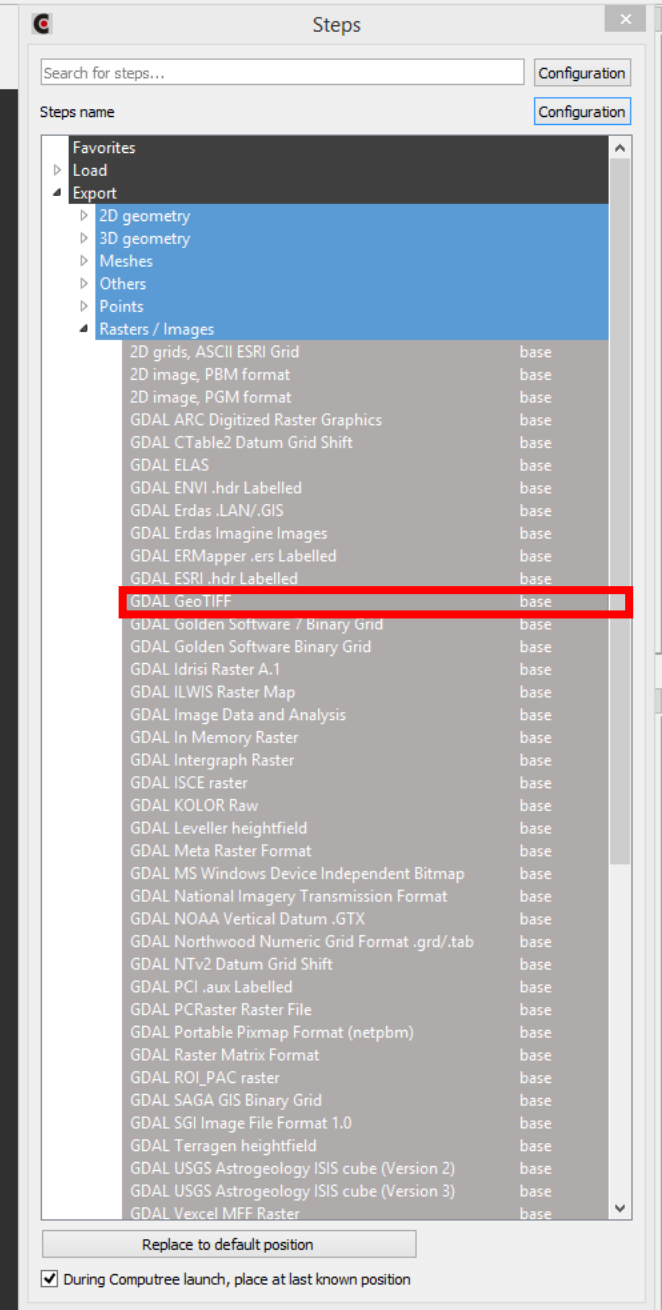
➔ Menu Export / Raster

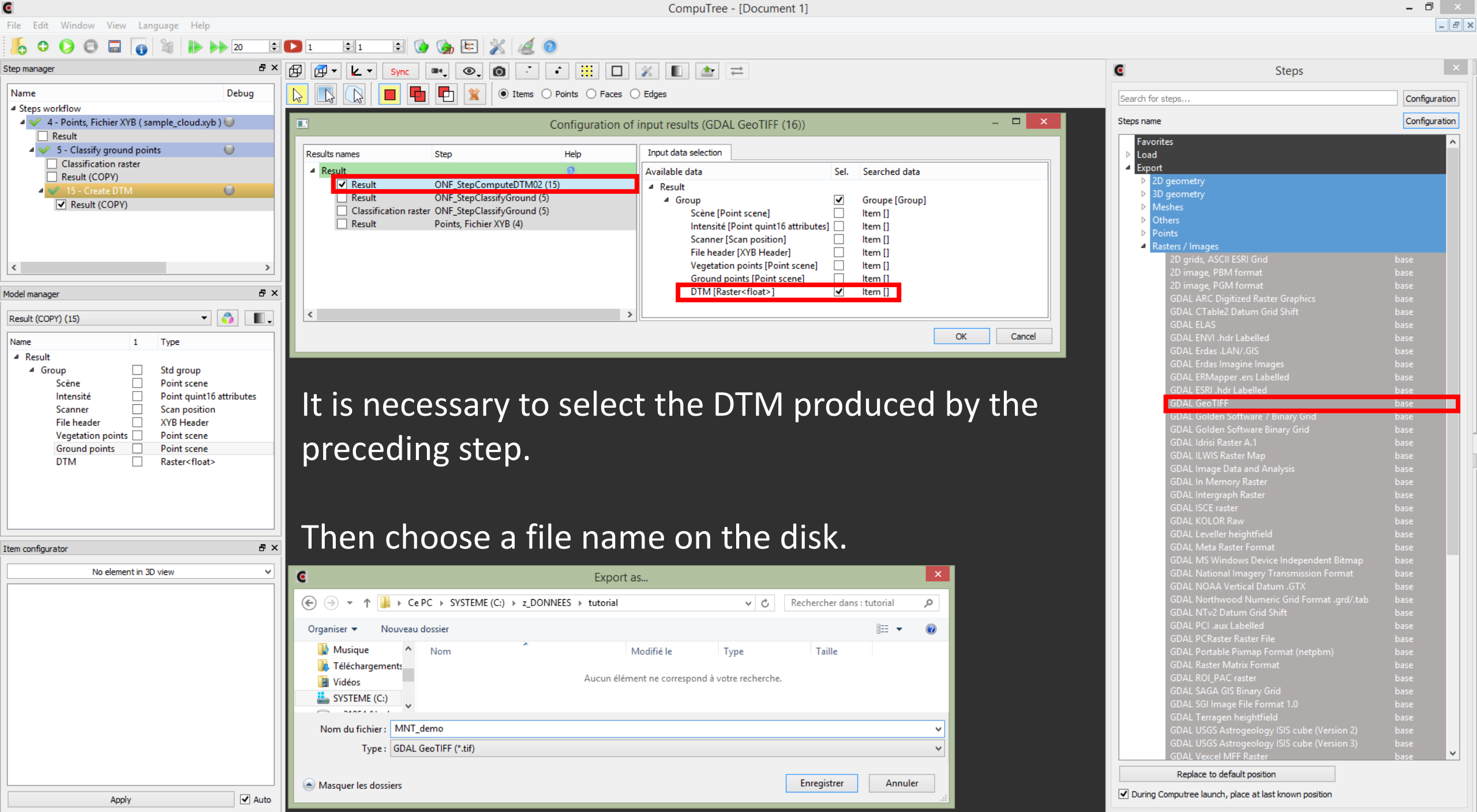
It is possible to export the raster into a large number of formats, for example the GeoTiff.



The **Adaptive file name (in a loop)** check box should be left unchecked, allowing you to choose a file name manually.

The use of scripting loops and adaptive name exports will be discussed in another tutorial.





Step manager

Name Debug

Steps workflow

- 4 - Points, Fichier XYB (sample_cloud.xyb)
 - Result
- 5 - Classify ground points
 - Classification raster
 - Result (COPY)
- 15 - Create DTM
 - Result (COPY)
 - 17 - GDAL GeoTIFF

Model manager

Result (COPY) (15)

Name	1	Type
Result		
Group	<input type="checkbox"/>	Std group
Scène	<input type="checkbox"/>	Point scene
Intensité	<input type="checkbox"/>	Point quint16 attributes
Scanner	<input type="checkbox"/>	Scan position
File header	<input type="checkbox"/>	XYB Header
Vegetation points	<input type="checkbox"/>	Point scene
Ground points	<input type="checkbox"/>	Point scene
DTM	<input type="checkbox"/>	Raster<float>

Item configurator

No element in 3D view

Apply ☒ Auto

The actual export will occur when the script is executed, using the play button.

Steps

Search for steps...

Configuration

Steps name

Configuration

Favorites

- Load
- Export
- Workflow
- Points
- 3D geometry
- Voxels
- 2D geometry
- Rasters / Images
- Meshes
- Metrics
- Others
- Work in progress (Beta)

Replace to default position

☒ During Computree launch, place at last known position