

# Tutorial TLS02

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## EN

Terrestrial LIDAR

Ground point detection and DTM creation

IFP-LSIS plugin: refined approach

## **Goal**

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

Plugin web page: <http://rdinnovation.onf.fr/projects/plugin-ifp-lsis/wiki>

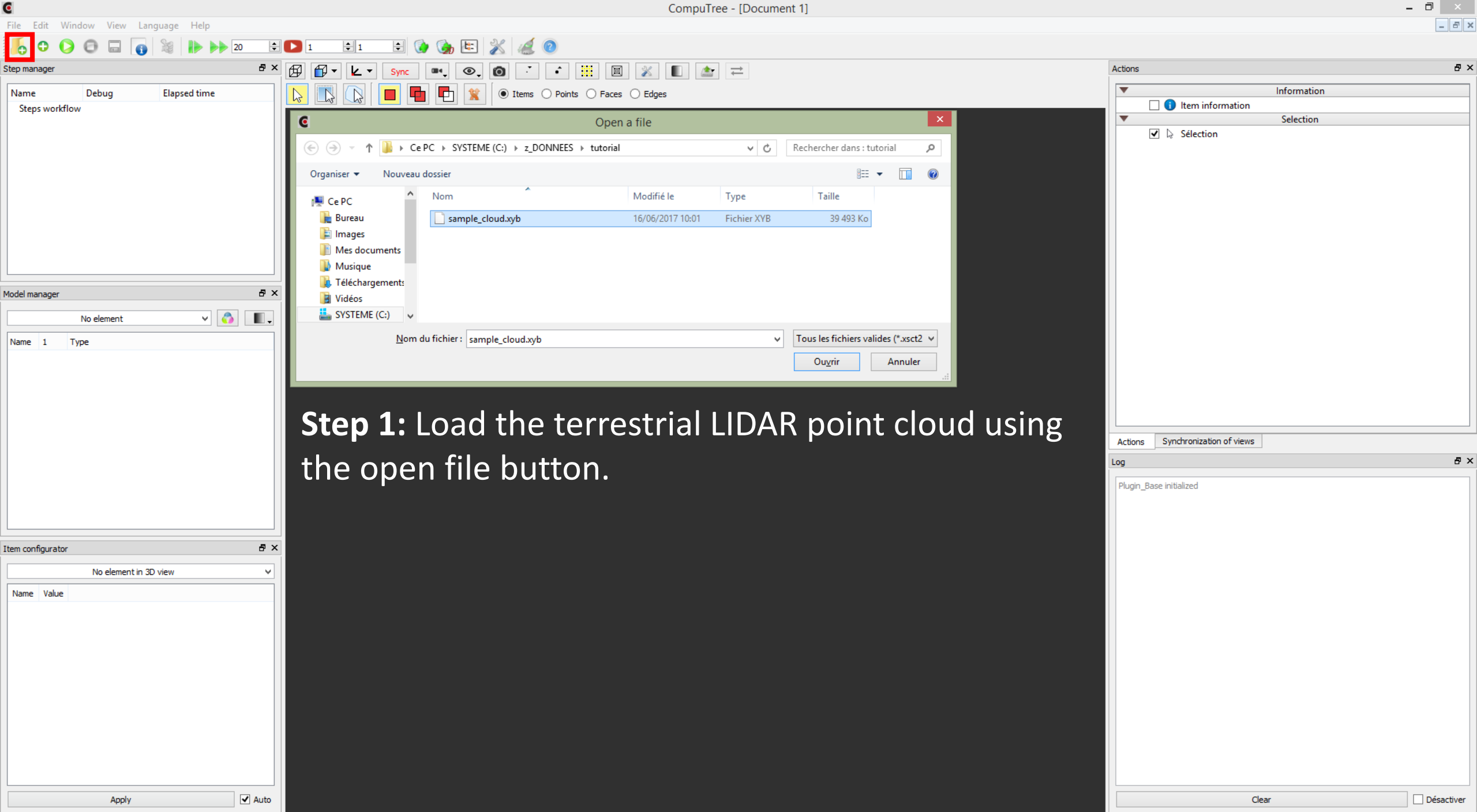
## **Interest**

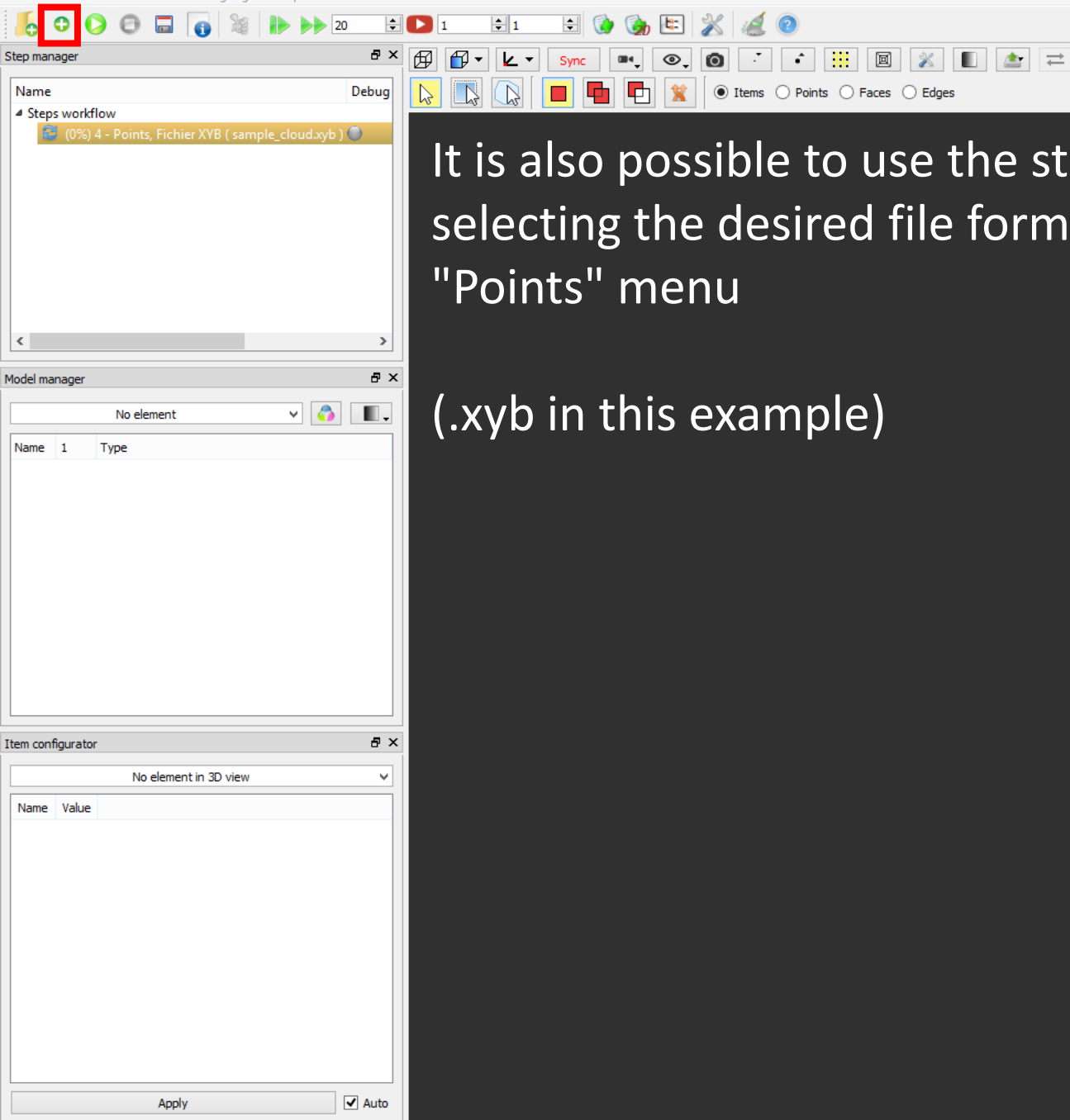
The separation of ground and vegetation points allows:

- To create a Digital Terrain Model to obtain a height reference at any point of the scene.
- To process vegetation points (insulation of trees ...), without interference of the ground points.

## **Require**

A terrestrial LIDAR point cloud.





The screenshot shows the CompuTree software interface. The top menu bar includes File, Edit, Window, View, Language, and Help. Below the menu bar is a toolbar with various icons. The main workspace is dark gray. On the left, there are three panels: Step manager, Model manager, and Item configurator. The Step manager panel shows a workflow with a step named "(0%) 4 - Points, Fichier XYB ( sample\_cloud.xyb )". The Model manager panel shows a table with columns Name, 1, and Type. The Item configurator panel shows a table with columns Name and Value. The text "It is also possible to use the step insertion menu, by selecting the desired file format from the 'Load' / 'Points' menu (.xyb in this example)" is overlaid on the main workspace.

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

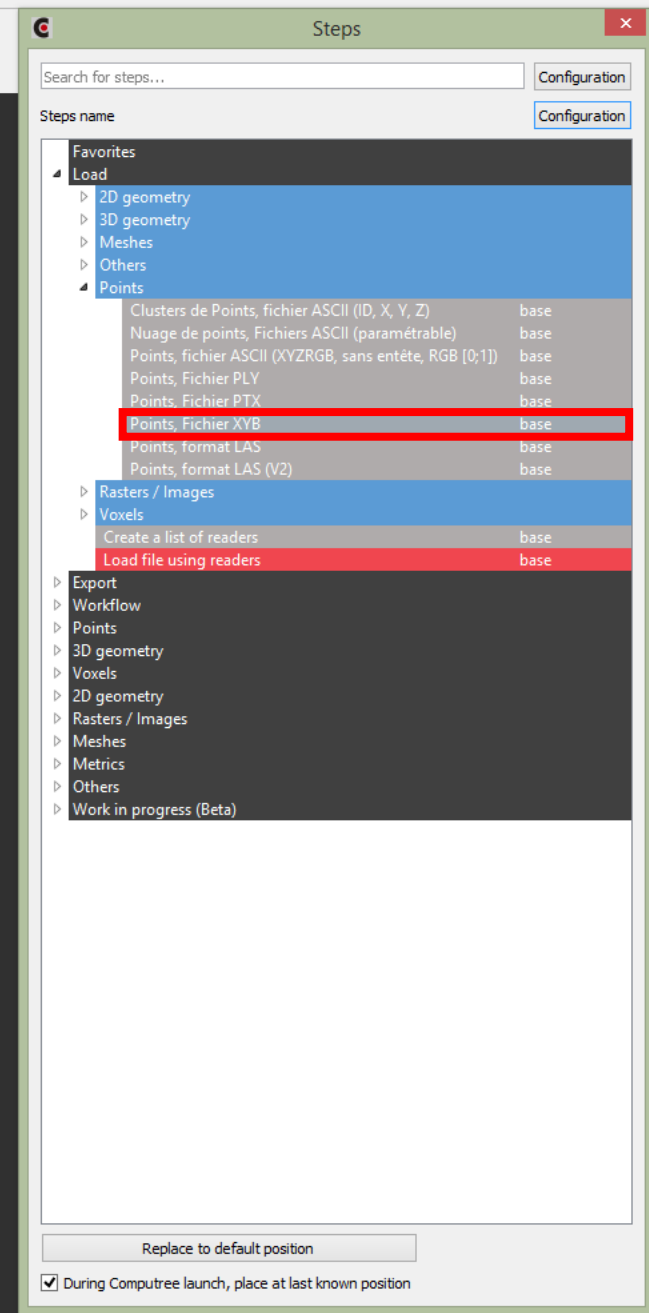
Name Value

Apply

Auto

It is also possible to use the step insertion menu, by selecting the desired file format from the "Load" / "Points" menu

(.xyb in this example)



The screenshot shows the Steps panel in CompuTree. The panel has a search bar and a 'Configuration' button. The 'Steps name' section shows a list of steps. The 'Load' step is expanded, showing a list of file formats. The 'Points, Fichier XYB' option is highlighted with a red box. The 'Load file using readers' option is also highlighted with a red box. The 'Replace to default position' button is at the bottom, and the 'During Computree launch, place at last known position' checkbox is checked.

Steps

Search for steps...

Configuration

Steps name

Configuration

Load

- 2D geometry
- 3D geometry
- Meshes
- Others
- Points
  - Clusters de Points, fichier ASCII (ID, X, Y, Z) base
  - Nuage de points, Fichiers ASCII (paramétrable) base
  - Points, fichier ASCII (XYZRGB, sans entête, RGB [0;1]) base
  - Points, Fichier PLY base
  - Points, Fichier PTX base
  - Points, Fichier XYB base
  - Points, format LAS base
  - Points, format LAS (V2) base
- Rasters / Images
- Voxels
- Create a list of readers base
- Load file using readers base

Export

Workflow

Points

3D geometry

Voxels

2D geometry

Rasters / Images

Meshes

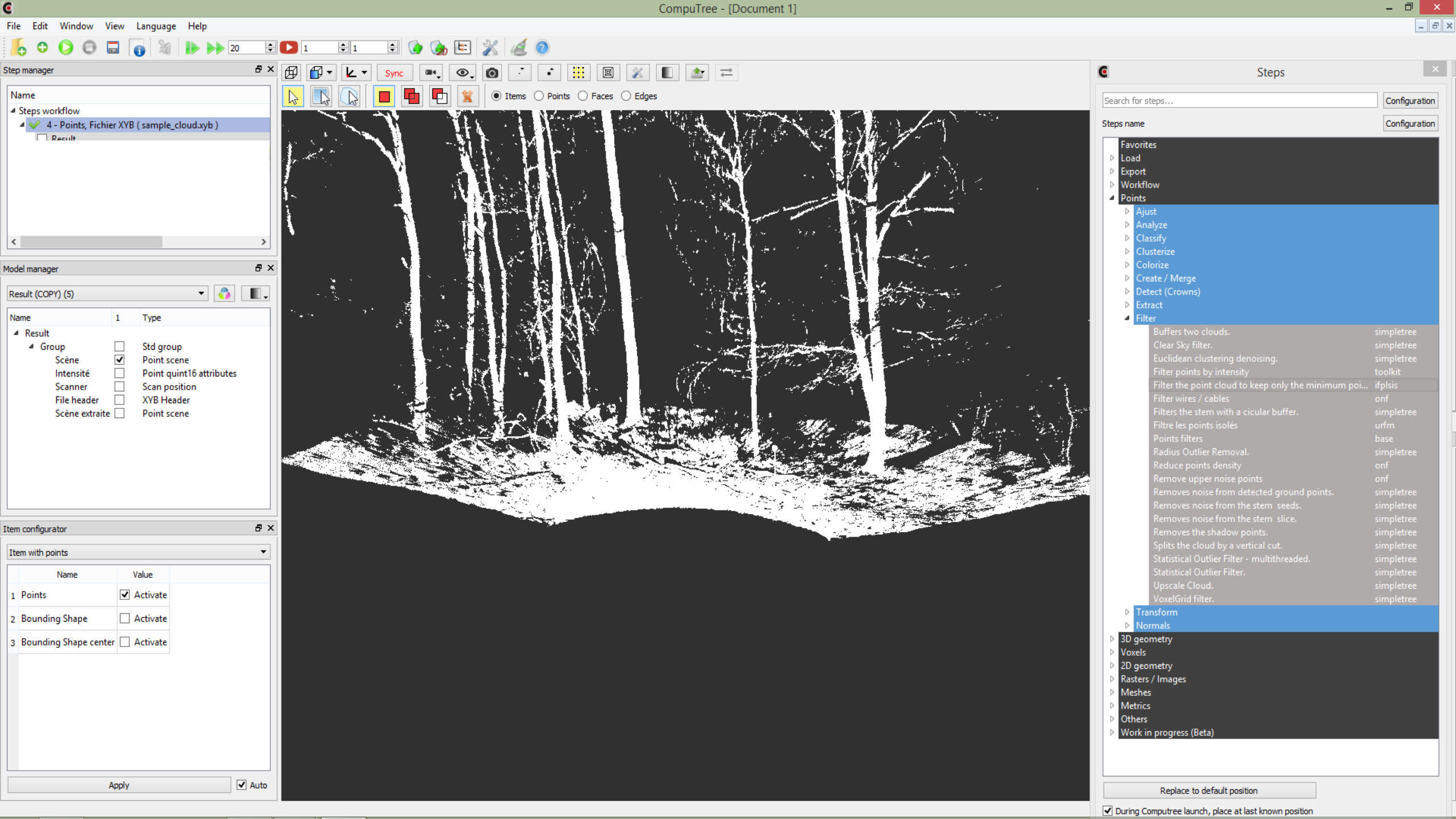
Metrics

Others

Work in progress (Beta)

Replace to default position

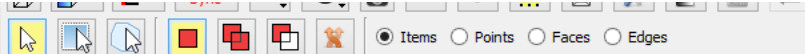
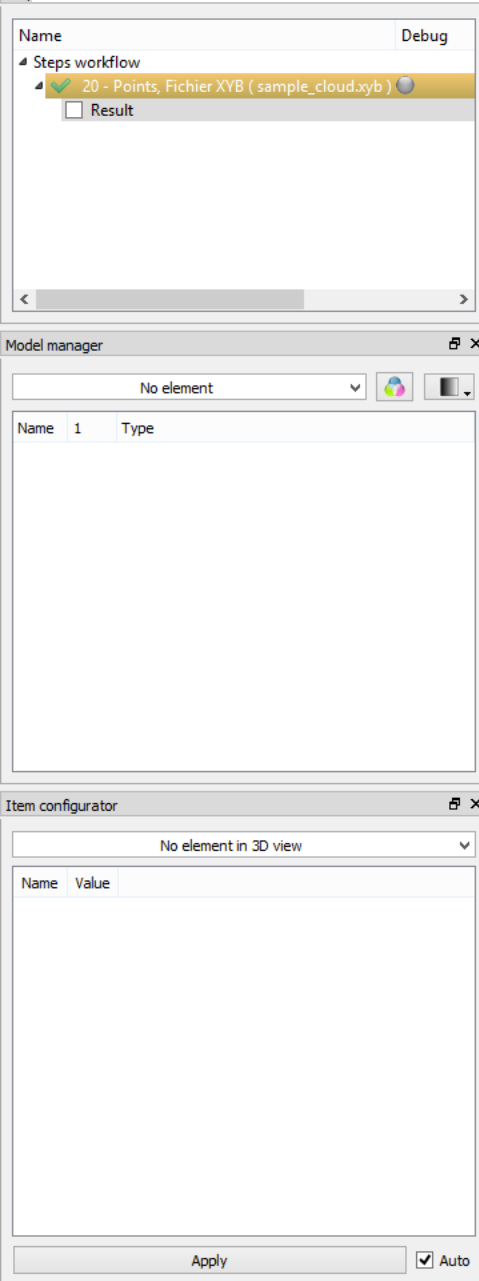
☒ During Computree launch, place at last known position



Th

The approach of this tutorial is therefore more precise. On the other hand, at this stage there is no filtering.

Step



**Step 2: Filter the point clouds to keep only the minimum points**

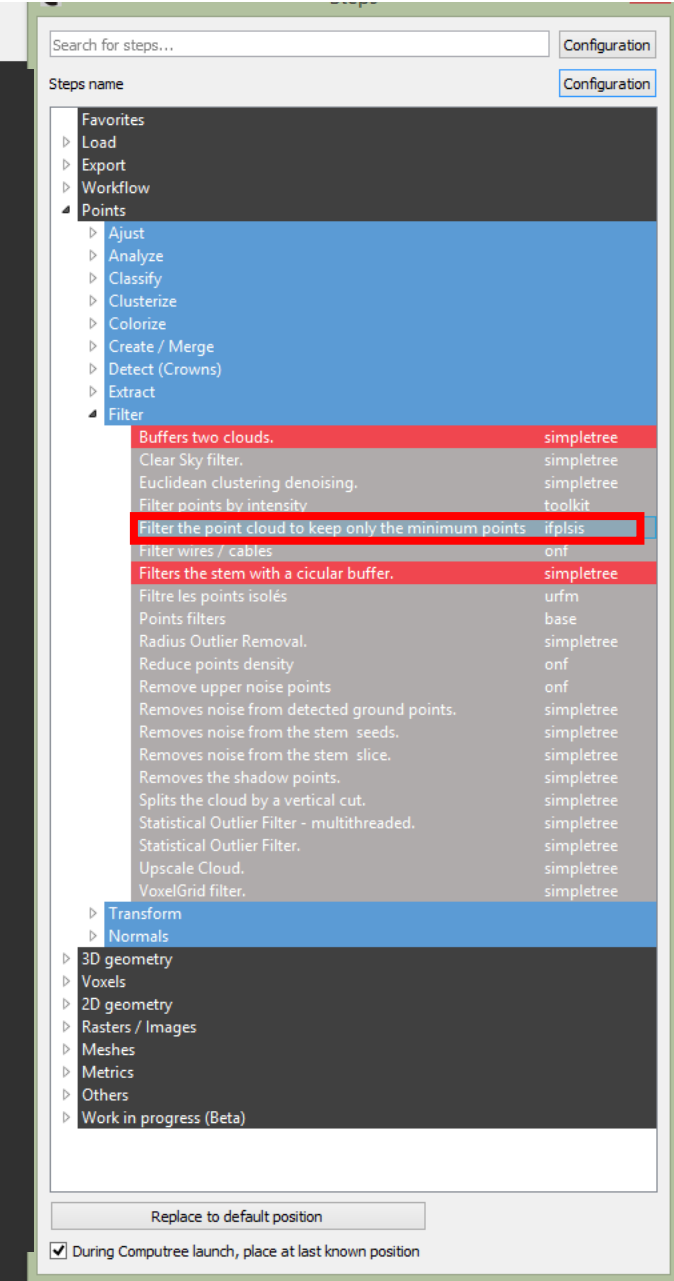
→ Menu Points / Filter

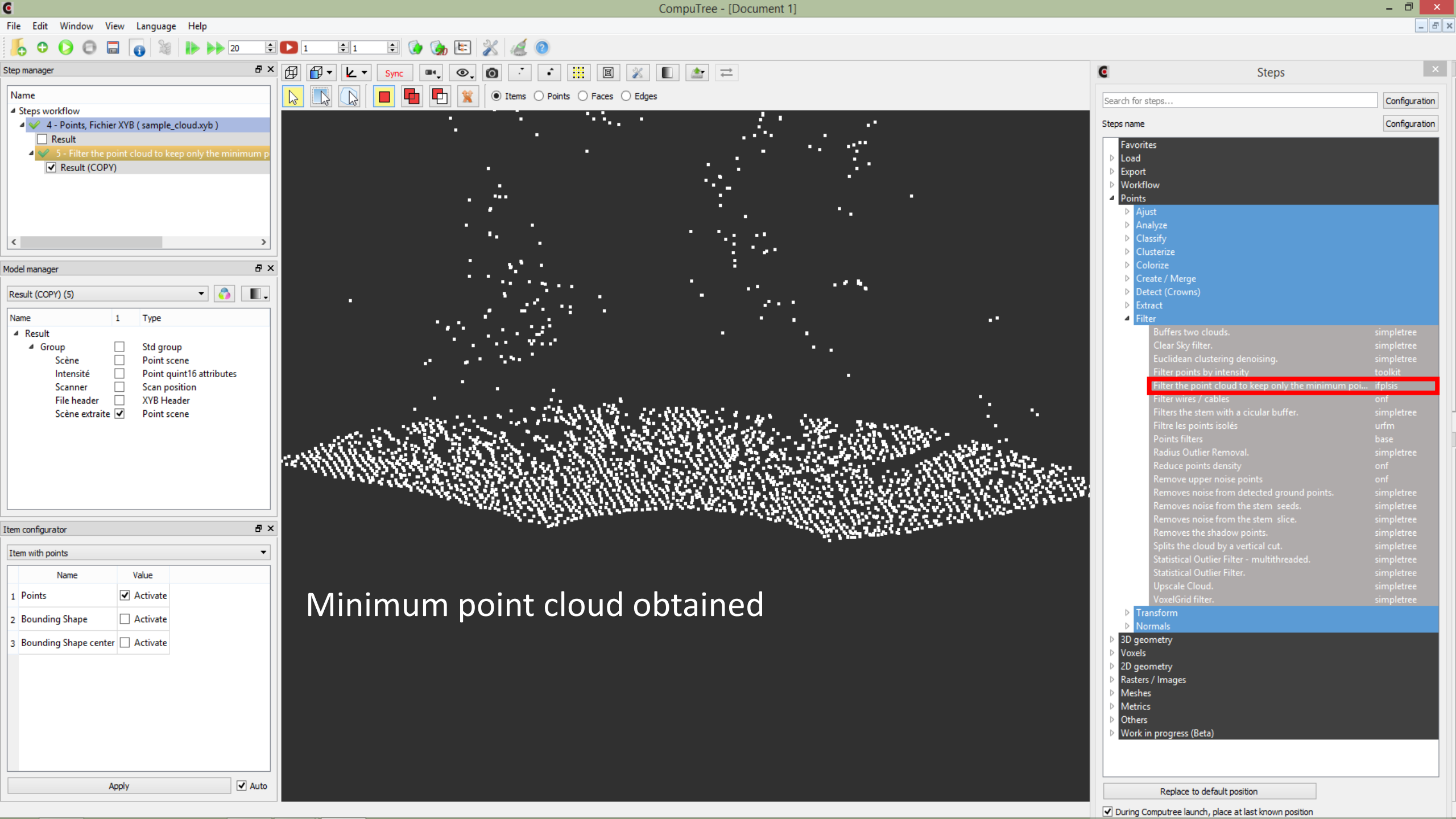
→ Step ID: IFP\_stepGetMinPtsPerSurface

This step creates a 2D grid of chosen **resolution** as a parameter of the step, and keeps for each cell the lowest point of the cloud.



NB: In the TLS01 tutorial, it was the center of the cell that was kept. The approach of the present tutorial is therefore more precise. On the other hand, at this stage there is no filtering.





- Name
- Steps workflow
    - 4 - Points, Fichier XYB ( sample\_cloud.xyb )
      - Result
    - 5 - Filter the point cloud to keep only the minimum p...
      - Result (COPY)

Result (COPY) (5)		
Name	1	Type
Result		
Group		
Scène	<input type="checkbox"/>	Std group
Intensité	<input type="checkbox"/>	Point scene
Scanner	<input type="checkbox"/>	Point quint16 attributes
File header	<input type="checkbox"/>	Scan position
Scène extraite	<input checked="" type="checkbox"/>	XYB Header
		Point scene

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	

Minimum point cloud obtained

- Favorites
- Load
- Export
- Workflow
- Points
  - Ajust
  - Analyze
  - Classify
  - Clusterize
  - Colorize
  - Create / Merge
  - Detect (Crowns)
  - Extract
  - Filter
    - Buffers two clouds. simpletree
    - Clear Sky filter. simpletree
    - Euclidean clustering denoising. simpletree
    - Filter points by intensity. toolkit
    - Filter the point cloud to keep only the minimum poi... ifplsis
    - Filter wires / cables onf
    - Filters the stem with a circular buffer. simpletree
    - Filtre les points isolés urfm
    - Points filters base
    - Radius Outlier Removal. simpletree
    - Reduce points density onf
    - Remove upper noise points onf
    - Removes noise from detected ground points. simpletree
    - Removes noise from the stem seeds. simpletree
    - Removes noise from the stem slice. simpletree
    - Removes the shadow points. simpletree
    - Splits the cloud by a vertical cut. simpletree
    - Statistical Outlier Filter - multithreaded. simpletree
    - Statistical Outlier Filter. simpletree
    - Upscale Cloud. simpletree
    - VoxelGrid filter. simpletree
  - Transform
  - Normals
- 3D geometry
- Voxels
- 2D geometry
- Rasters / Images
- Meshes
- Metrics
- Others
- Work in progress (Beta)

Morel Jules, Alexandra Bac, Vega Cedric, 2017. **Digital terrain model reconstruction from terrestrial LiDAR data using compactly supported radial basis.** IEEE Computer Graphics and Applications.

Steps

Search for steps...

Configuration

Steps name

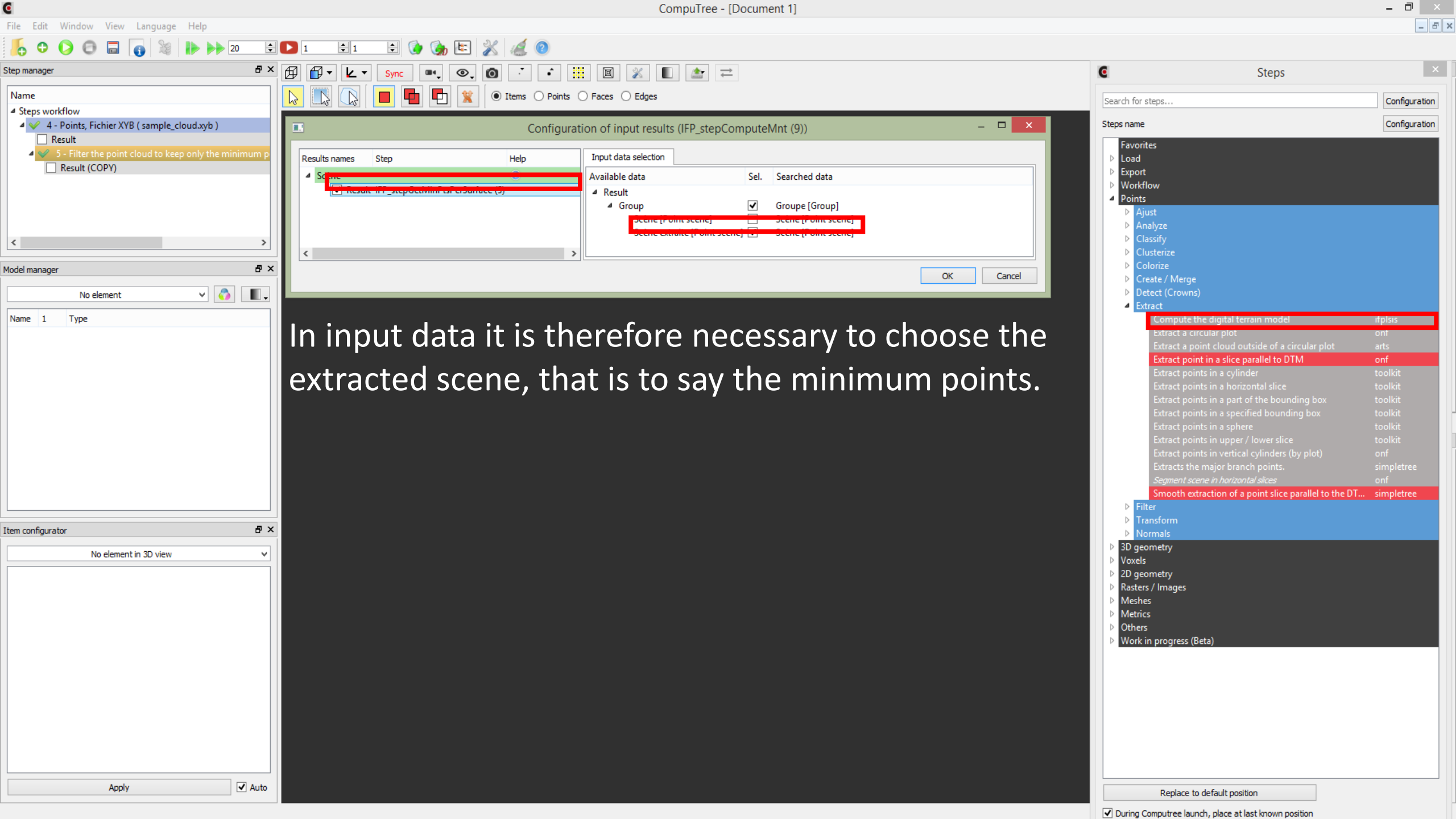
Configuration

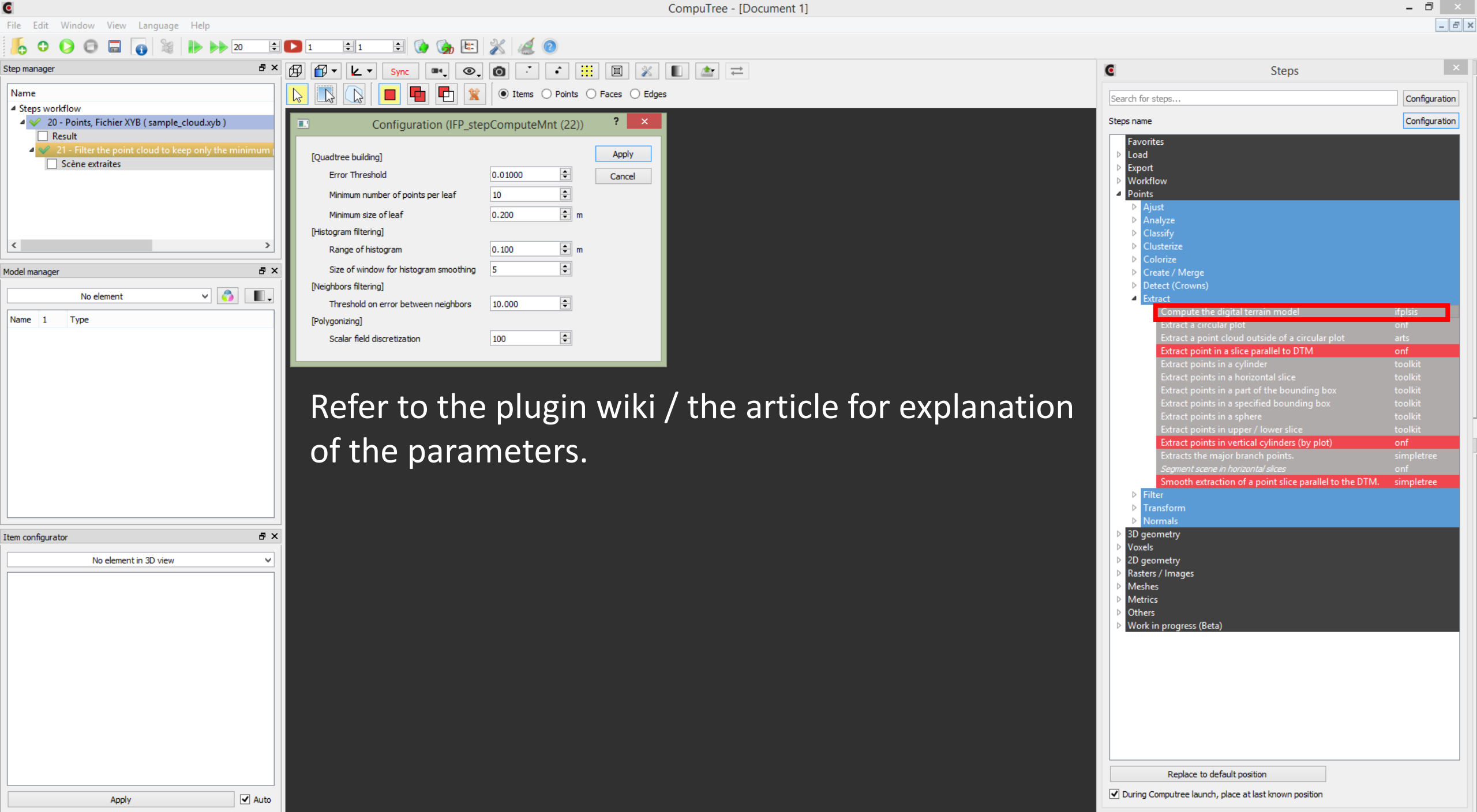
- ▶ Favorites
- ▶ Load
- ▶ Export
- ▶ Workflow
- ▶ Points
  - ▶ Adjust
  - ▶ Analyze
  - ▶ Classify
  - ▶ Clusterize
  - ▶ Colorize
  - ▶ Create / Merge
  - ▶ Detect (Crowns)
  - ▶ Extract
    - Compute the digital terrain model ifplsis
    - Extract a circular plot onf
    - Extract a point cloud outside of a circular plot arts
    - Extract point in a slice parallel to DTM onf
    - Extract points in a cylinder toolkit
    - Extract points in a horizontal slice toolkit
    - Extract points in a part of the bounding box toolkit
    - Extract points in a specified bounding box toolkit
    - Extract points in a sphere toolkit
    - Extract points in upper / lower slice toolkit
    - Extract points in vertical cylinders (by plot) onf
    - Extracts the major branch points. simpletree
    - Segment scene in horizontal slices onf
    - Smooth extraction of a point slice parallel to the DTM. simpletree
  - ▶ Filter
  - ▶ Transform
  - ▶ Normals
- ▶ 3D geometry
- ▶ Voxels
- ▶ 2D geometry
- ▶ Rasters / Images
- ▶ Meshes
- ▶ Metrics
- ▶ Others
- ▶ Work in progress (Beta)

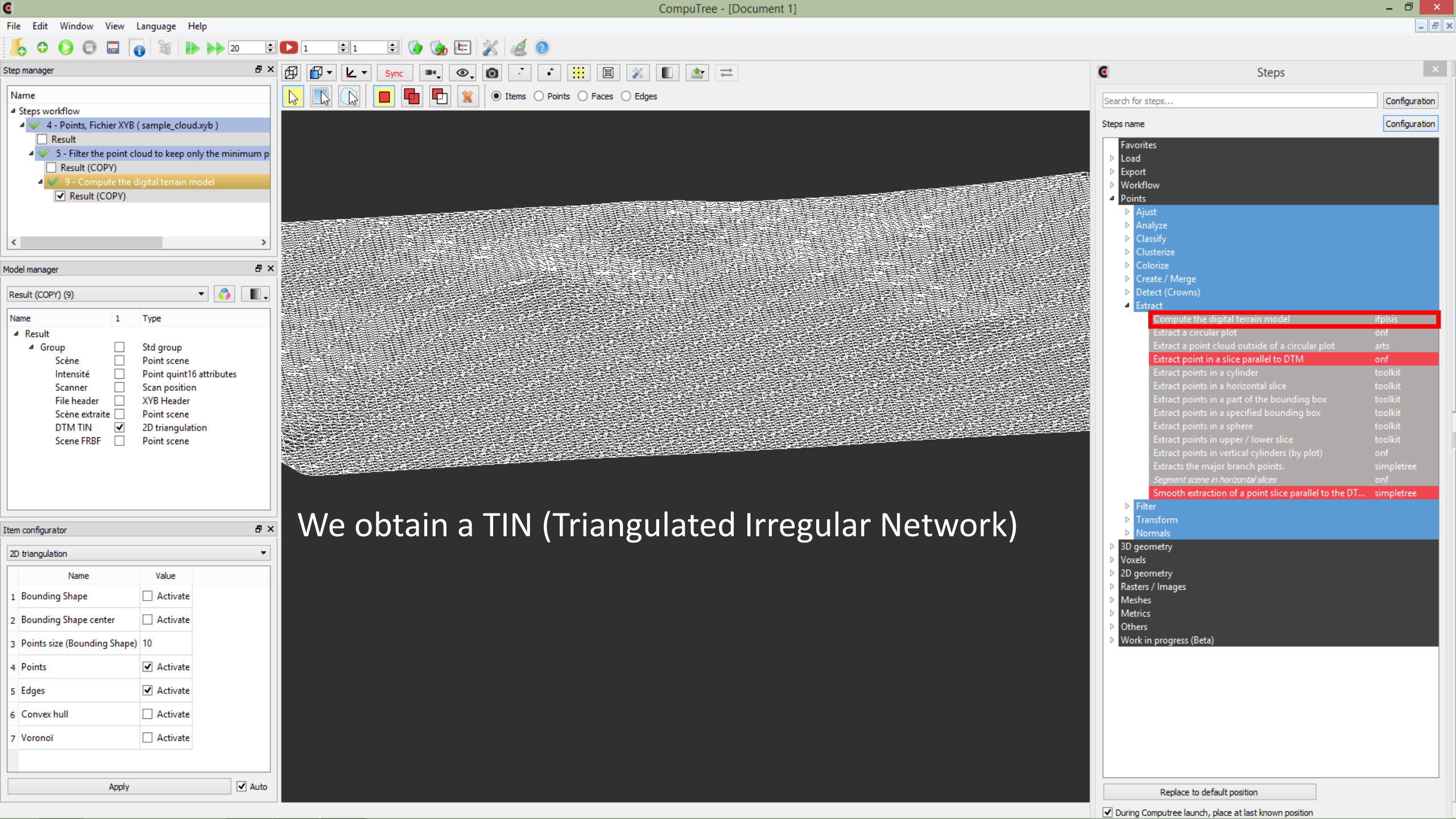
Replace to default position

☒ During Computree launch, place at last known position









We obtain a TIN (Triangulated Irregular Network)

**Step 4: Convert a TIN to DTM**

→ Menu Raster / Elevation Digital Models

→ Step ID: ONF\_StepConvertTINtoDTM

This step creates a DTM by projection of the TIN in each cell center.

**Step manager**

Name

- Steps workflow
  - 20 - Points, Fichier XYB ( sample\_cloud.xyb )
    - Result
  - 21 - Filter the point cloud to keep only the minimum
    - Scène extraites
  - 22 - Compute the digital terrain model
    - Surfaces extraites

**Model manager**

Surfaces extraites (22)

Name	1	Type
Surfaces extraites		
grpOut	<input type="checkbox"/>	Std group
FRBF surface	<input type="checkbox"/>	Item without points
DTM TIN	<input type="checkbox"/>	2D triangulation

**Item configurator**

No element in 3D view

Apply ☒ Auto

**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

Step manager

Name

- Steps workflow
  - 20 - Points, Fichier XYB ( sample\_cloud.xyb )
    - Result
  - 21 - Filter the point cloud to keep only the minimum
    - Scène extraites
  - 22 - Compute the digital terrain model
    - Surfaces extraites

Model manager

Surfaces extraites (22)

Name	1	Type
Surfaces extraites		
grpOut	<input type="checkbox"/>	Std group
FRBF surface	<input type="checkbox"/>	Item without points
DTM TIN	<input type="checkbox"/>	2D triangulation

Item configurator

No element in 3D view

Apply ☒ Auto

Configuration of input results (ONF\_StepConvertTINtoDTM (23))

Results names	Step	Help
TIN		
Surfaces extraites IFP_stepComputeMnt (22)		

Input data selection

Available data	Sel.	Searched data
Surfaces extraites		
grpOut	<input checked="" type="checkbox"/>	Groupe [Group]
DTM TIN [2D triangulation]	<input checked="" type="checkbox"/>	TIN [2D triangulation]

OK Cancel

The TIN should be selected as input.

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
- Others
- Work in progress (Beta)

Replace to default position

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Step manager

Name

- Steps workflow
  - 20 - Points, Fichier XYB ( sample\_cloud.xyb )
    - Result
  - 21 - Filter the point cloud to keep only the minimum
    - Scène extraites
  - 22 - Compute the digital terrain model
    - Surfaces extraites

Model manager

Surfaces extraites (22)

Name	1	Type
Surfaces extraites		
grpOut	<input type="checkbox"/>	Std group
FRBF surface	<input type="checkbox"/>	Item without points
DTM TIN	<input type="checkbox"/>	2D triangulation

Item configurator

No element in 3D view

Apply ☒ Auto

Configuration (ONF\_StepConvertTINtoDTM (23))

Grid resolution: 25 cm

Apply Cancel

The only parameter is the resolution of the output DTM.

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

