

# LiDAR data processing with SPDlib in QGIS: ThermoLiDAR plug-in

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## Introduction

The use of LiDAR data has been increasing and is the most commonly used data source for the generation of DEMs. Nowadays, there are many software packages that manage and analyse laser data. Some are distributed as freeware and other as proprietary software with very expensive fees. On the other hand, the existing Free and Open Source Software read and use LiDAR data but they lack of the analysis capabilities necessary to generate sophisticated cartographic products. The free software **SDPLib** covers this gap since it allows both to manipulate and to analyse LiDAR data. It supports aerial and terrestrial data formats, and its data structured is thought to store **full waveform** LiDAR data. SPDlib tools are mainly used by command line, however, a new graphical interface has been integrated into QGIS desktop client as a part of the **ThermoLiDAR** plug-in. ThermoLiDAR is a project aim to provide tools to integrate Thermal and LiDAR information for the assessment of forest health and production. Other functionalities of ThermoLiDAR are a) Spatial statistical tools to analyse biophysical variables of the vegetation based on the integration of LiDAR and Thermal data integration; and b) tools for mapping forest health condition and forest production. Here we present the SPDlib graphical interface of the ThermoLiDAR plug-in, and we show its use to perform basic forest products, such as canopy height models and height metrics.

## LiDAR processing in ThermoLiDAR plug-in

**ThermoLiDAR** software has been developed as a plug-in for **QGIS 2.4 Chugiak** (Figure 1). The LiDAR part of the plug-in serves as a graphical interface to **SDPLib** suite.

A basic LiDAR data processing with **ThermoLiDAR** starts with the classification of points into ground/no-ground (**spdpmfgrd** and **spdmccgrd**). Once ground is known, heights can be normalised (**spddefheight**). In order to obtain digital terrain (DTM), surface (DSM) and canopy height (CHM) models data is interpolated (**spdinterp**). From height information a range of metrics (**spdmetrics**) commonly applied to LiDAR data and specifically to vegetation applications can be calculated. Other capabilities such as merge files (**spdmerge**) or tiling data (**spdtiling**), convert to other LiDAR formats (**spdtranslate**) and to remove noise (**spdrnoise**) have been included in the plug-in too.

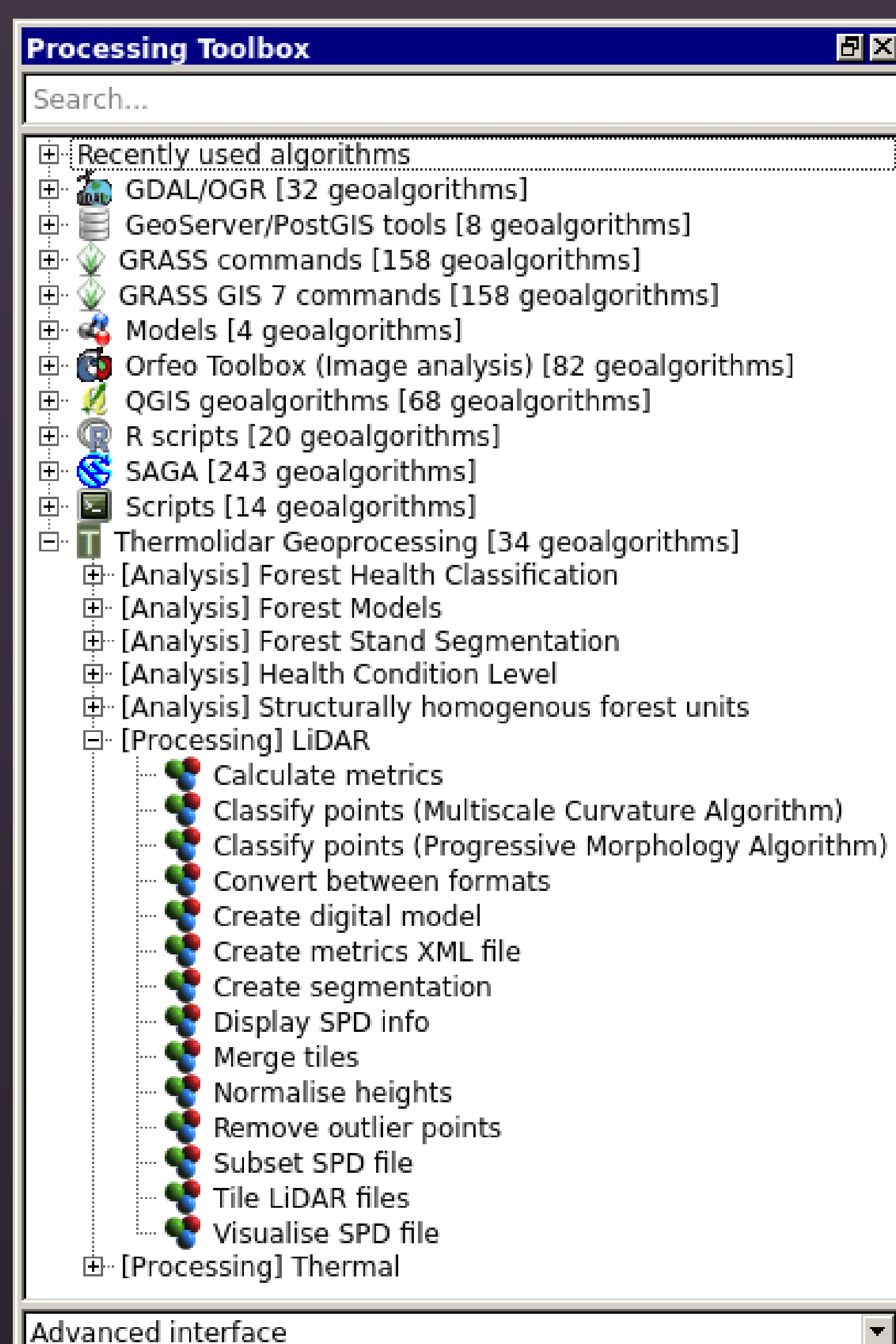


Figure 1: Toolbox of the LiDAR processing tools of ThermoLiDAR

## Calculate height metrics

ThermoLiDAR plug-in calculates different metrics at the same time. Metrics can be simple statistical moments, percentiles of point heights, count ratios, or even mathematical operators. The module supports raster and vector output data formats. Raster option assesses the metrics for each pixel the final raster output and creates as many bands as metrics have been defined. Vector option requires an input shapefile containing polygon entities and calculates metrics for these features. Here is an example of **95<sup>th</sup> percentile** (Figure 4), **Median height** (Figure 5) and **Canopy Cover** (Figure 6) computed from a point cloud with the **CHM** showed in Figure 3.

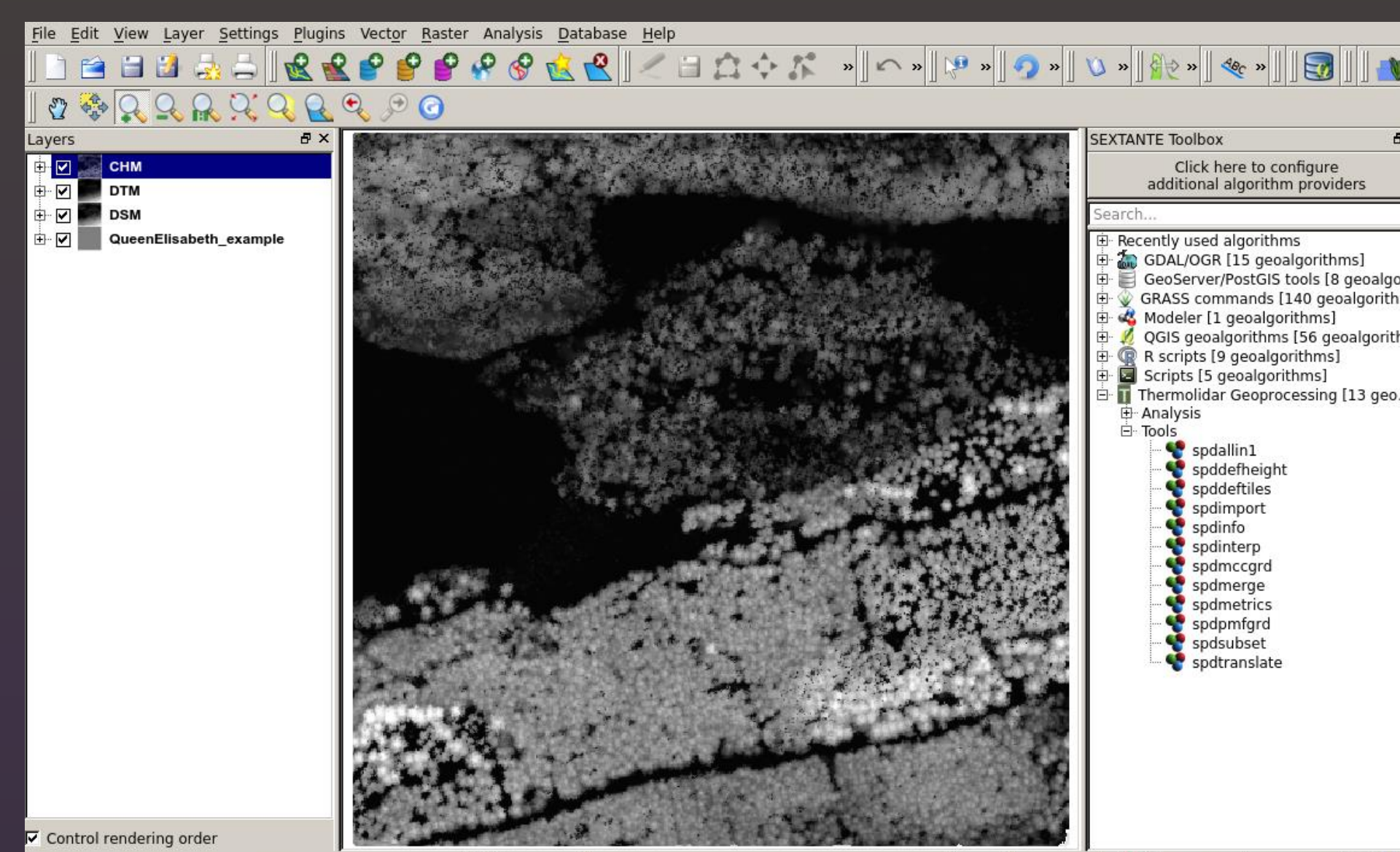


Figure 3: Canopy Height Model (CHM) computed (1m resolution) with the ThermoLiDAR plug-in and visualise within QGIS

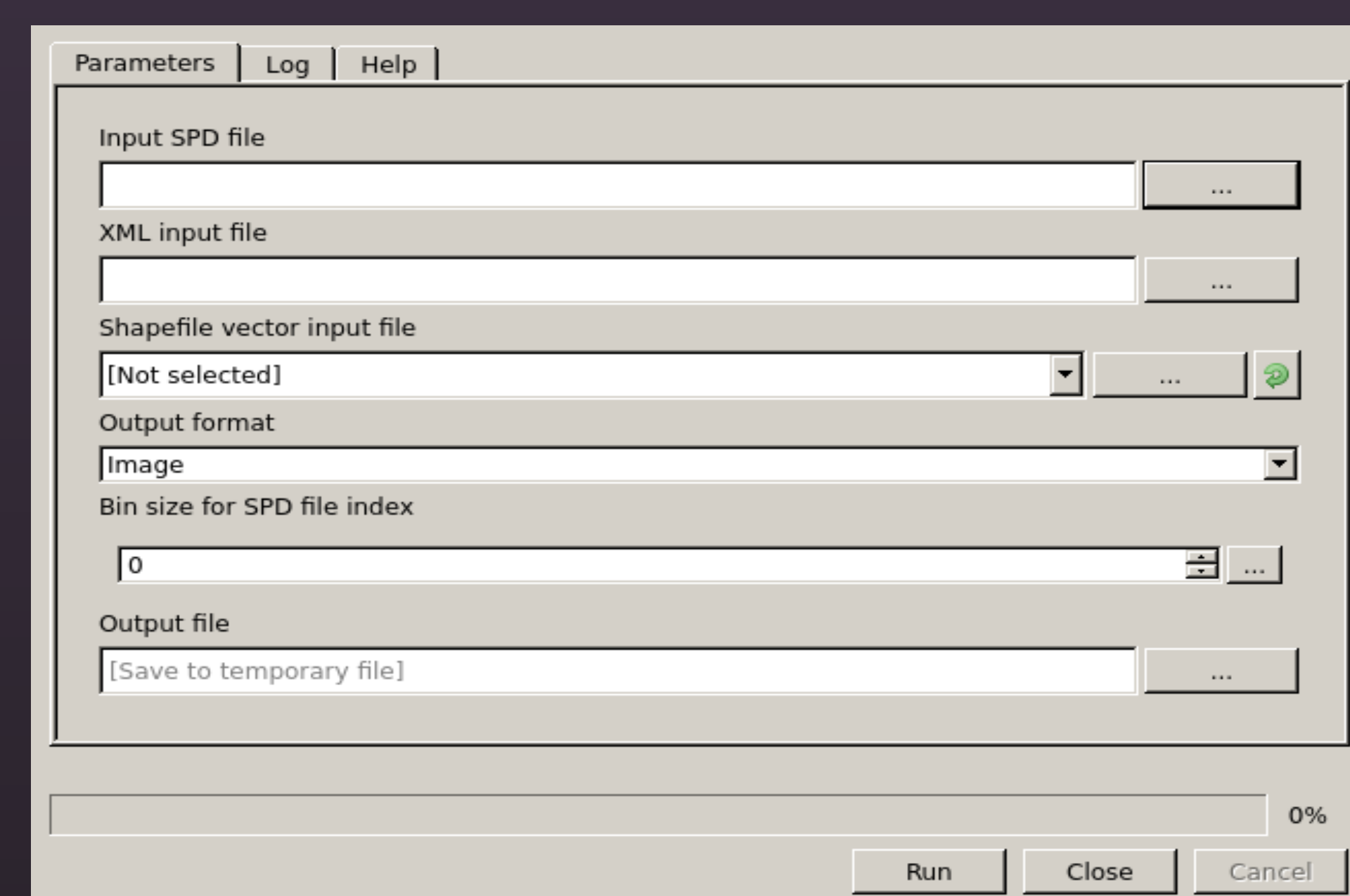


Figure 2: ThermoLiDAR module to calculate metrics

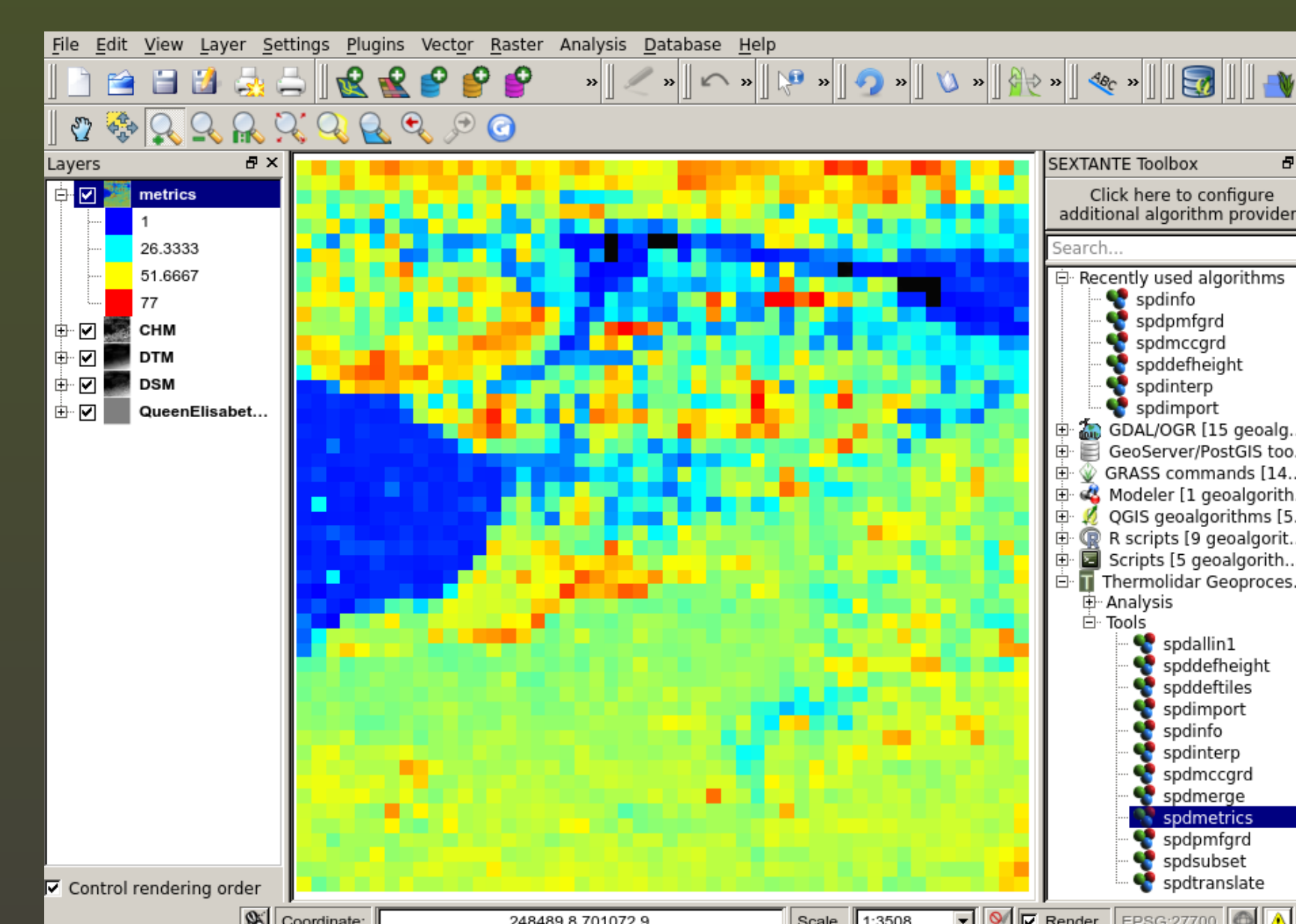


Figure 4: "Height 95th percentile" metric computed into a raster image (10m resolution)

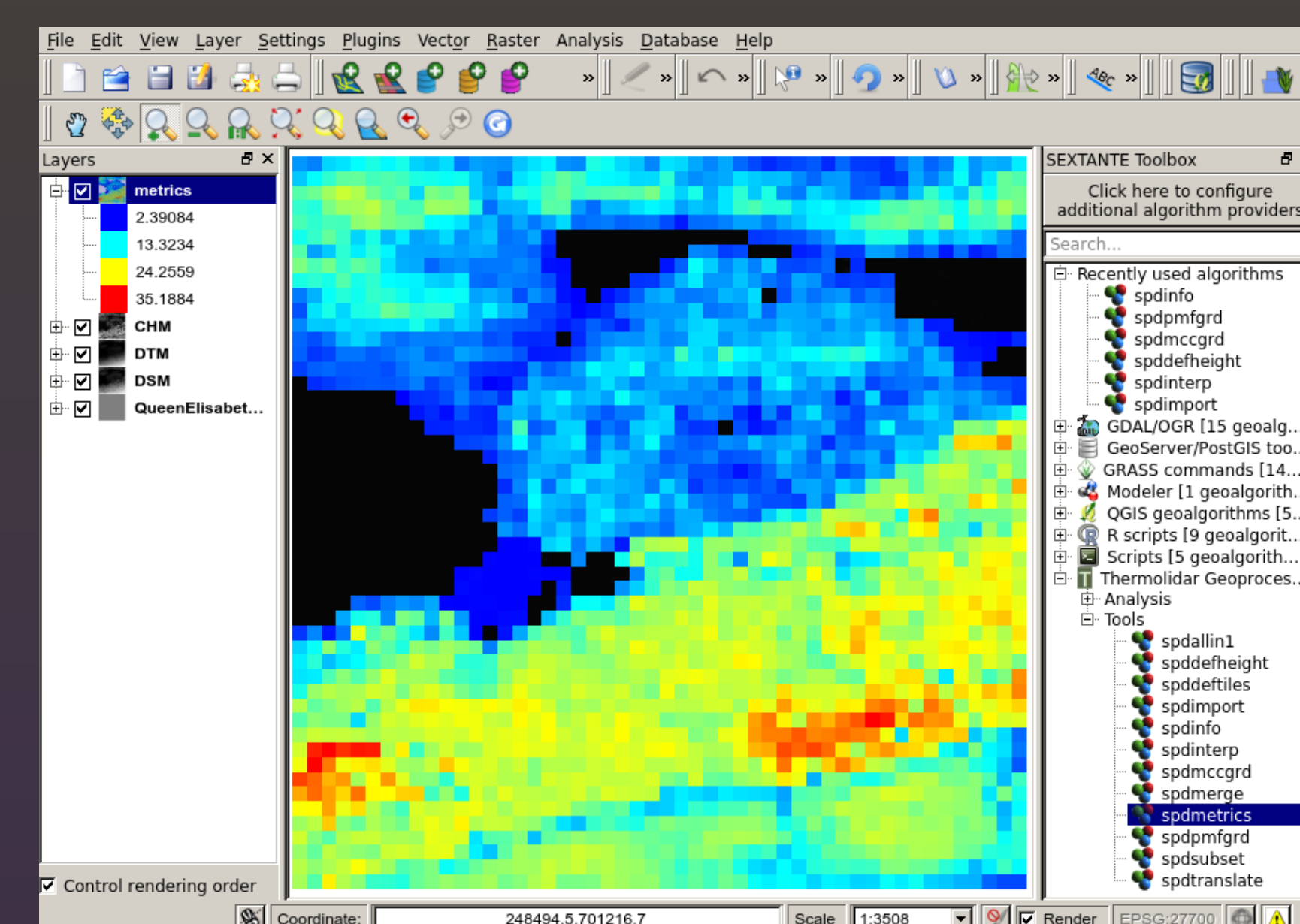


Figure 5: "Median Height" metric computed into a raster image (10m resolution)

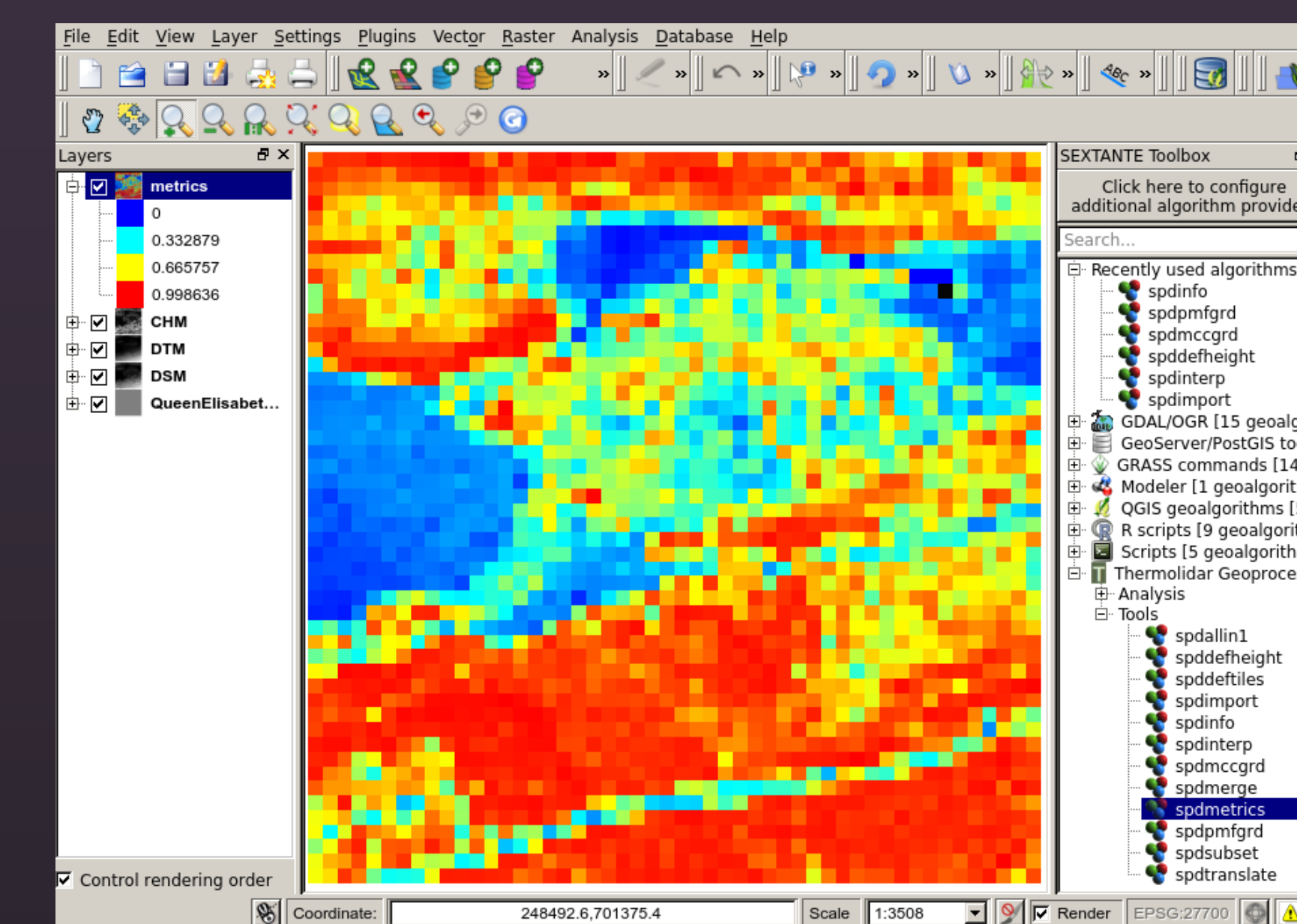


Figure 6: "Canopy Cover" metric computed into a raster image (10m resolution)

## Conclusions

- SPDlib is the one of the most complete set of tools for LiDAR processing.
- A GUI has been developed as part of the ThermoLiDAR plug-in for QGIS 2.4.
- A completely workflow of LiDAR data that can be performed with the plugin.
- The calculation of height LiDAR metrics for forestry with the ThermoLiDAR plug-in has been presented.

## References

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- Quantum GIS Development Team, 2014. *Quantum GIS Geographic Information System*. Open Source Geospatial Foundation Project. <http://qgis.osgeo.org>

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