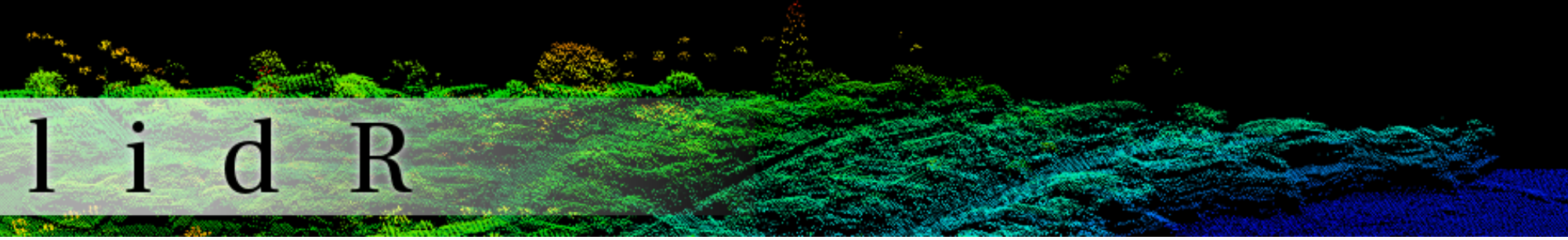
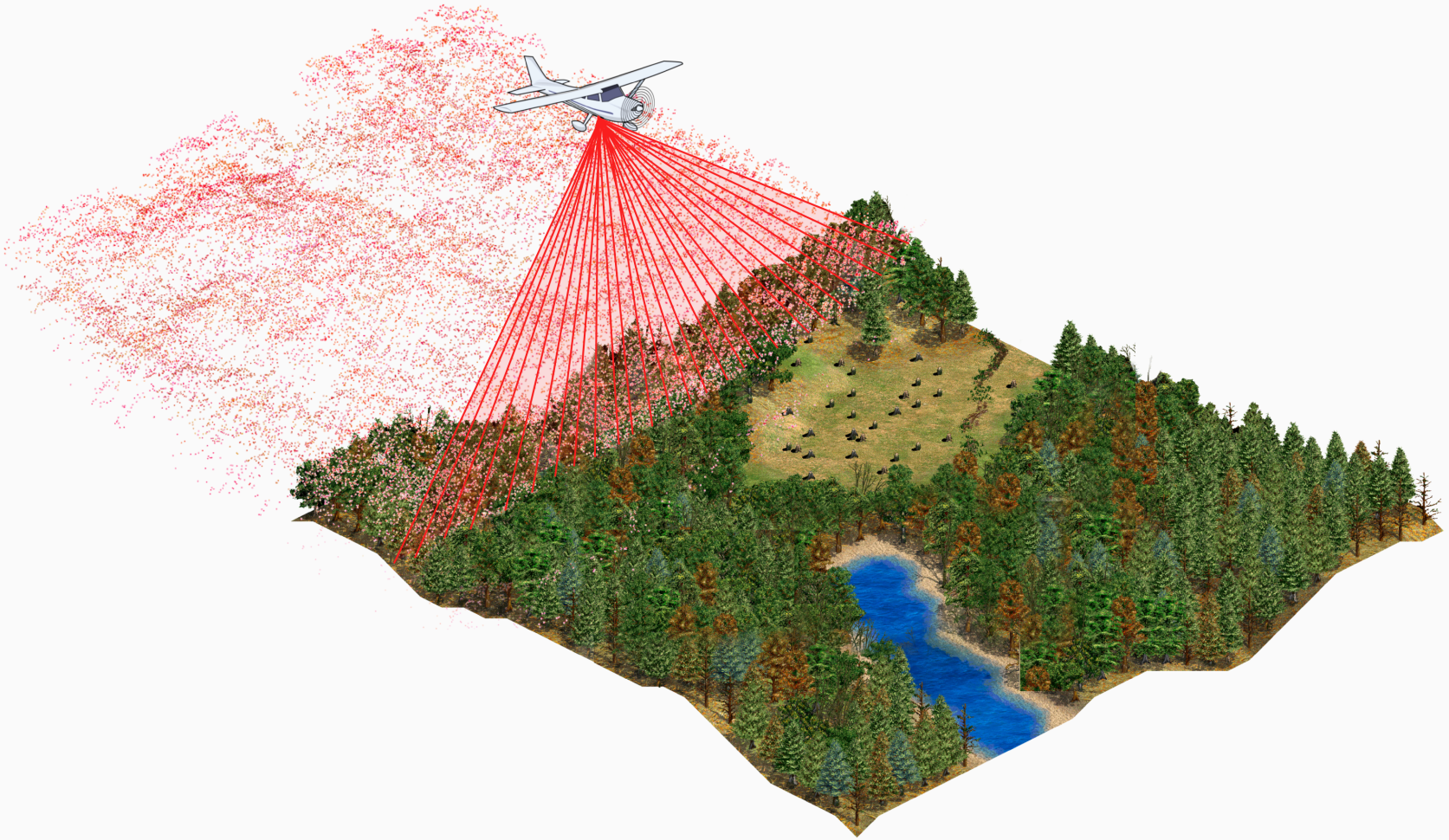


lidR, an R package to work with laser scanning point cloud in forestry and ecology

Roussel Jean-Romain, David Auty

LiDAR data

LiDAR is big data in many ways $\longrightarrow$ need advanced and efficient algorithms to analyse them.



Introduction – why an R package?

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First presentation but...

...already used by several users in USA, Italy, France, Germany, Australia, Canada, Rwanda?, ...

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ALS vs. TLS

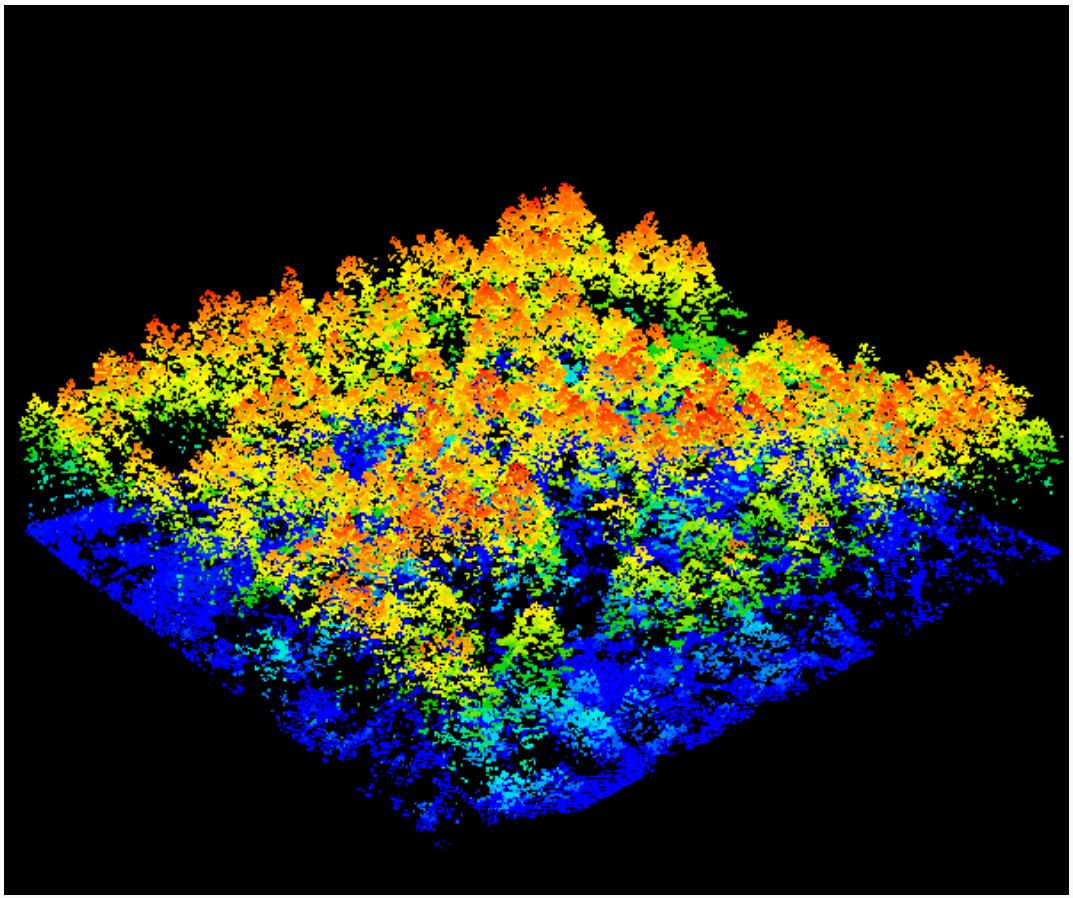
Designed for ALS but already used for TLS

Pre-processing tools

Read and write las and laz file in R

Supports of .las and .laz files in I/0

```
1  data = readLAS("myfile.laz")
2  plot(data)
```

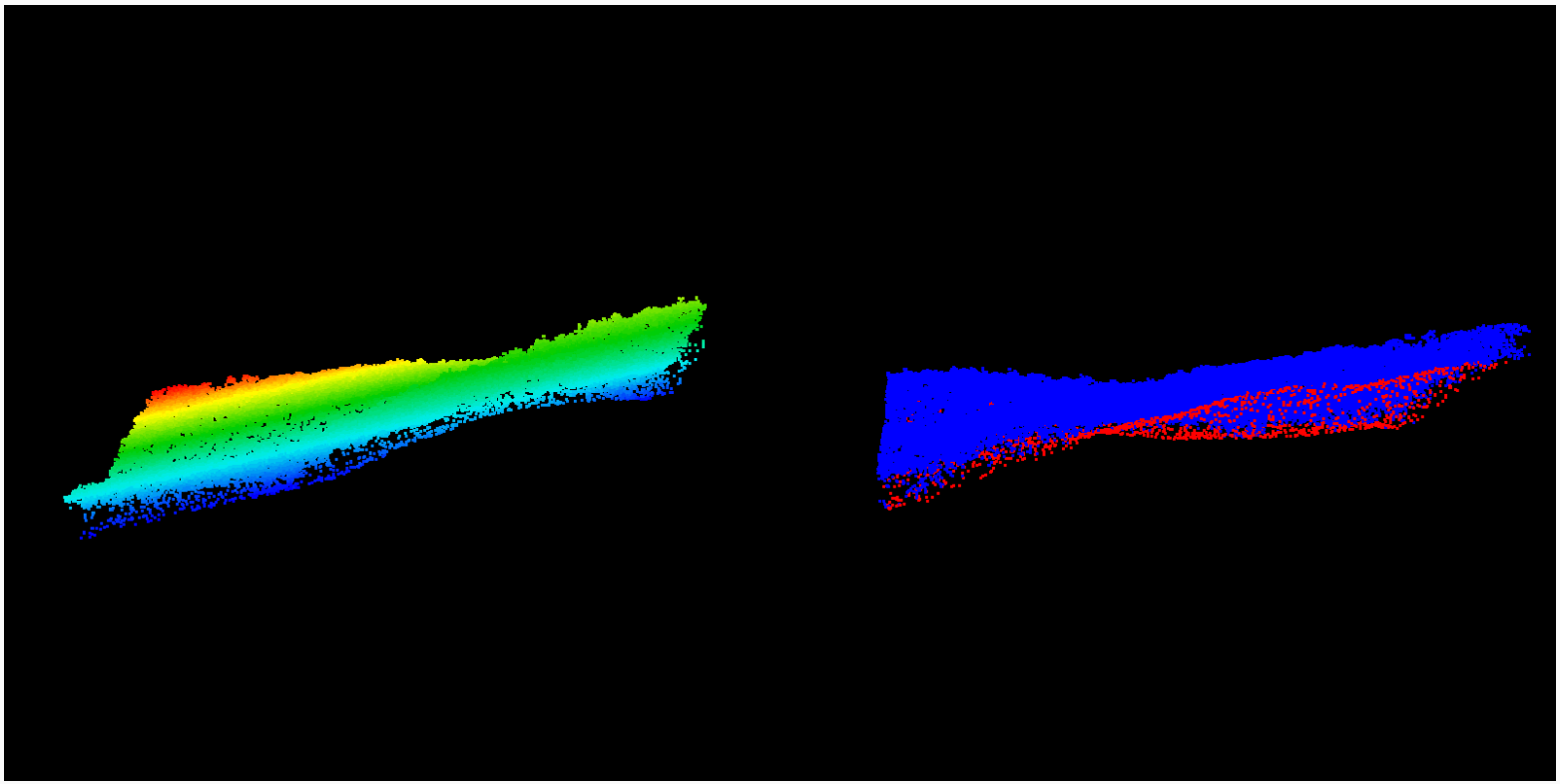


Ground classification

1 algorithm in v1.2.1

- Progressive morphological filter

```
1  lasground(data, ...)
2  plot(data, color = "Classification")
```

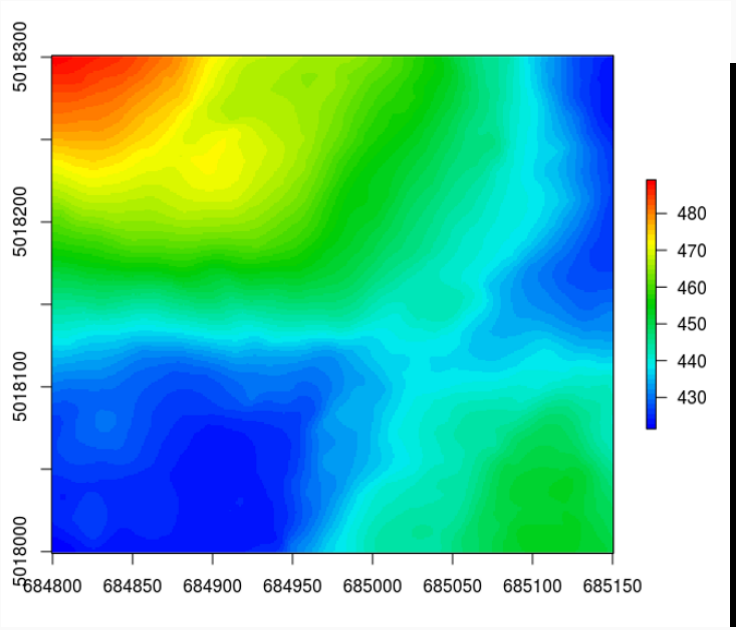


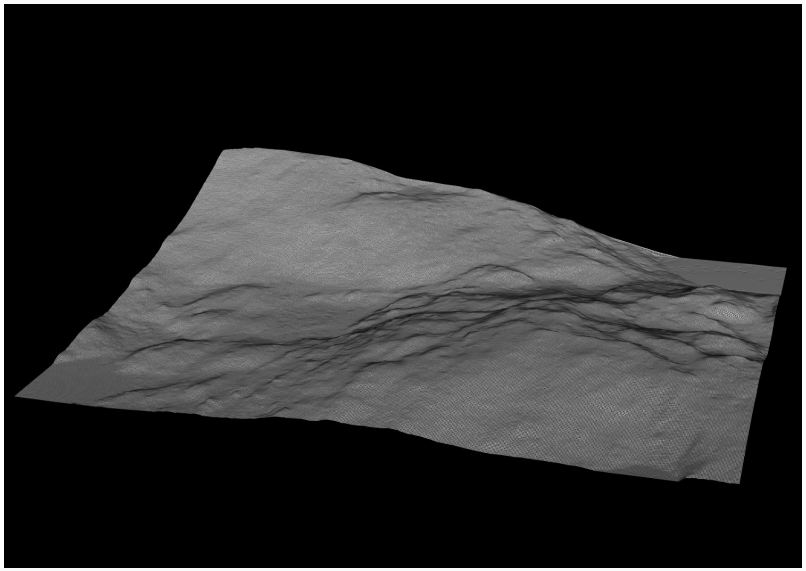
Terrain model

3 algorithms in v1.2.1 (expected 4 in v1.3.0)

- k-nearest neighbours + invert distance weighting
- Delaunay triangulation with linear interpolation
- k-nearest neighbours + kriging

```
1  dtm = grid_terrain(data, ...)
2  plot(dtm)
3  plot3d(dtm)
```



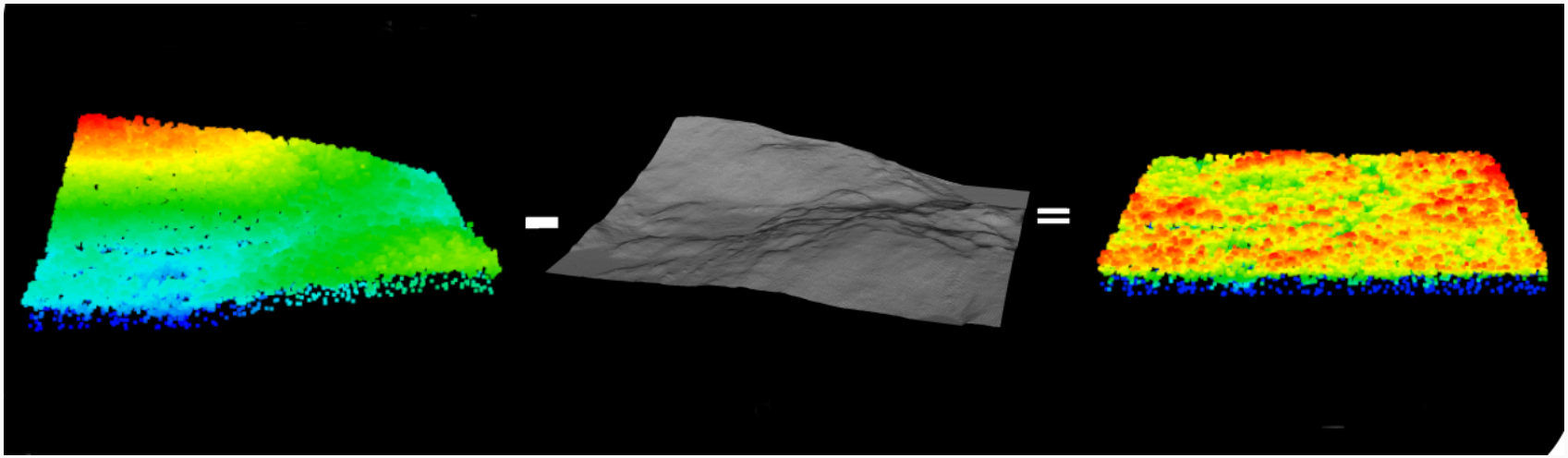


Normalization

2 algorithms in v1.2.1

- Discretized normalization: data - dtm
- True interpolation: interpolation of each point

```
data_norm = lasnormalize(data, ...)
plot(data_norm)
```

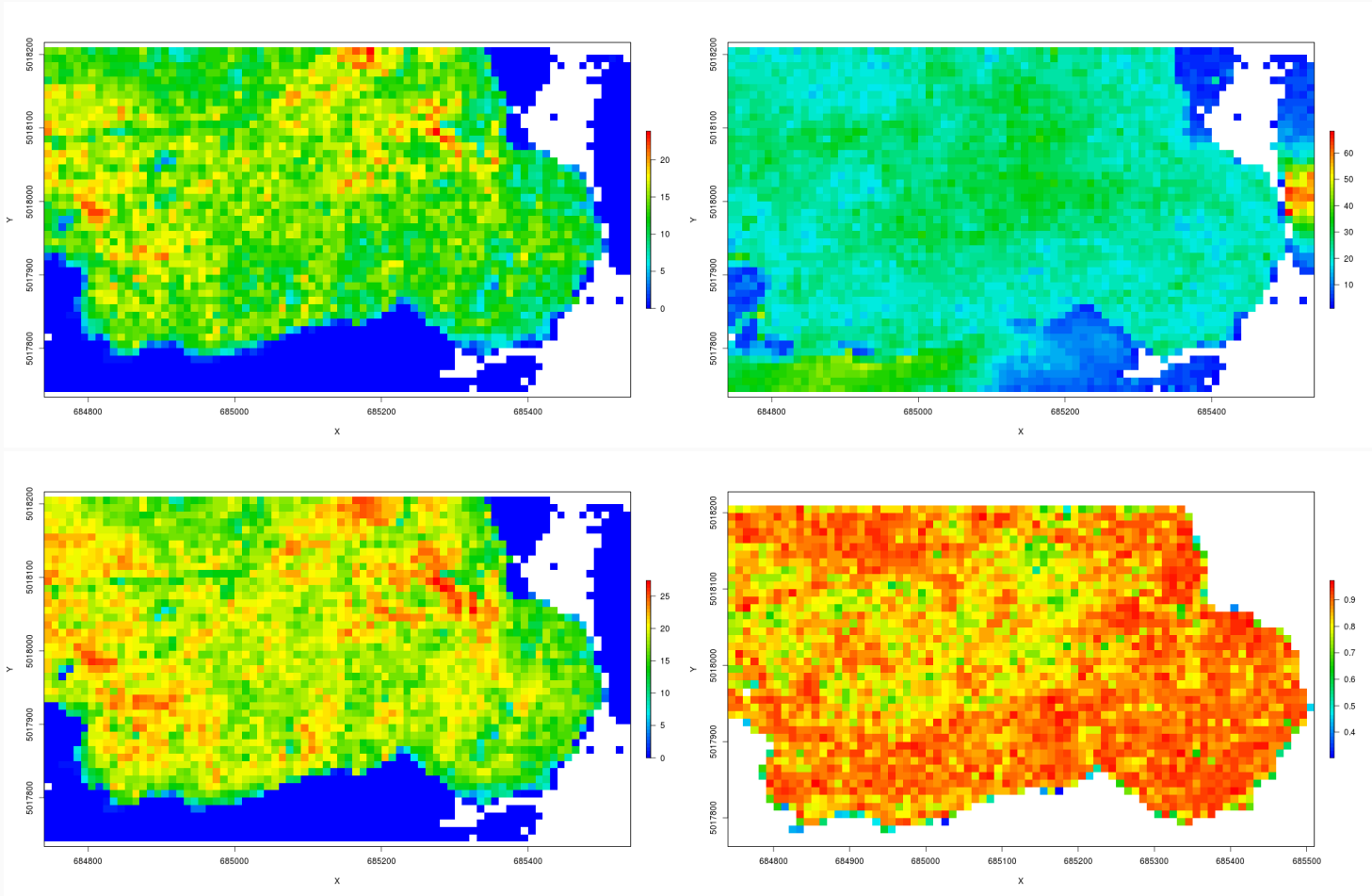


Area-based approach tools

Area-based approach (1)

A general assesment of the forest cover with a low to medium resolution.

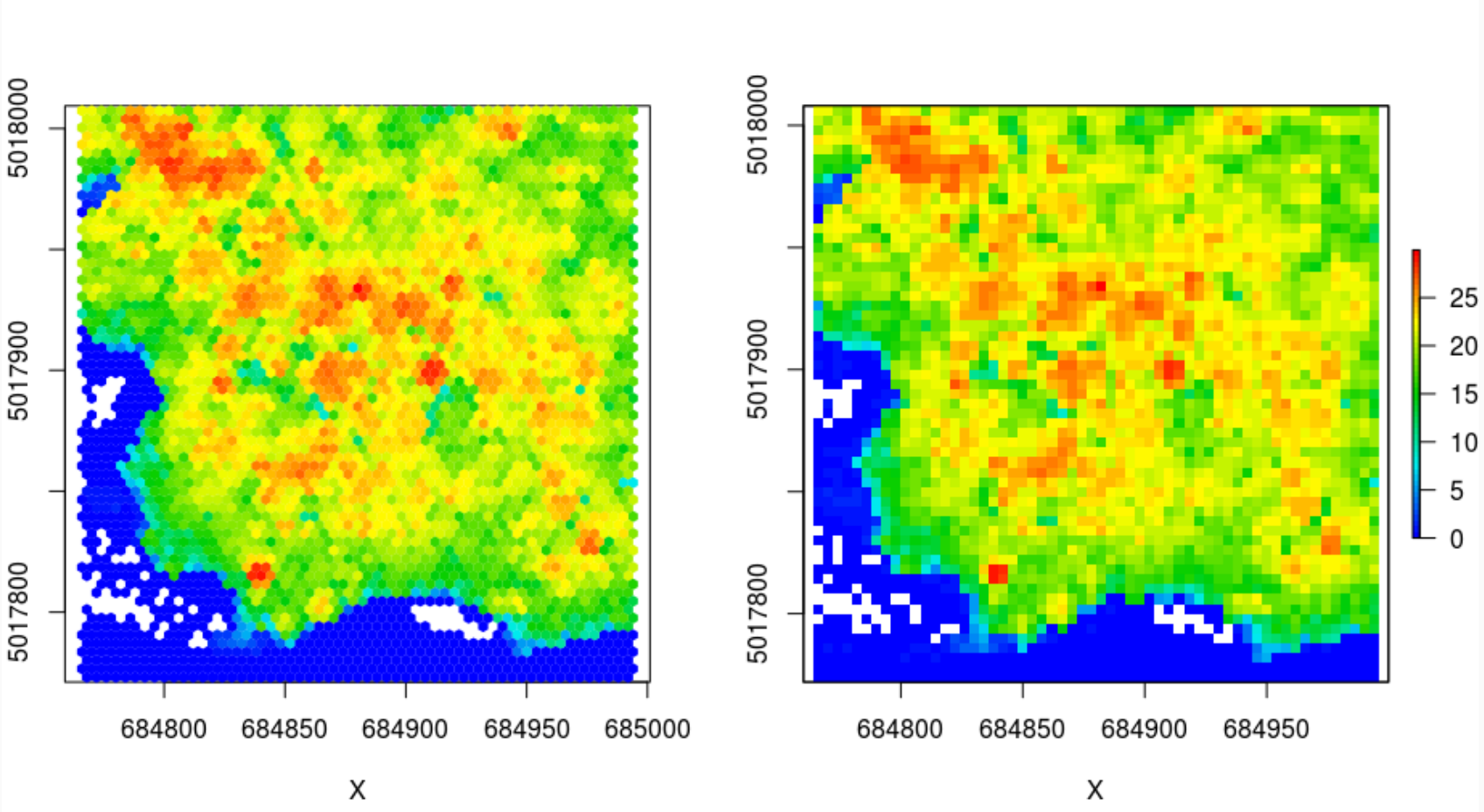
```
1  metrics = grid_metrics(data, ...)
2  plot(metrics)
```



Area-based approach (2)

Why do we use square pixels (rasters)?

```
1  metrics = grid_hexametrics(data, .sdtmetrics)
2  plot(metrics, "hmax")
```



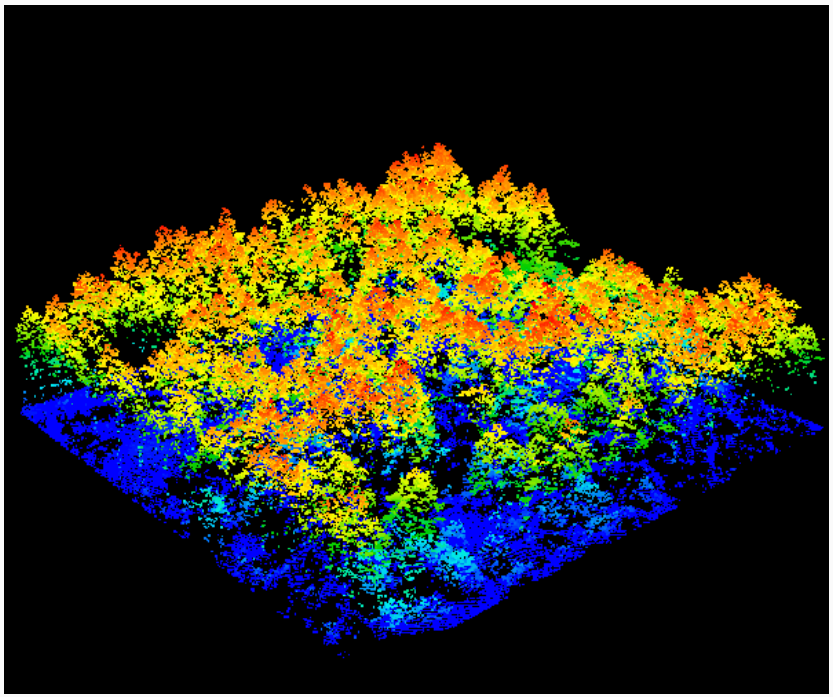
Canopy height models

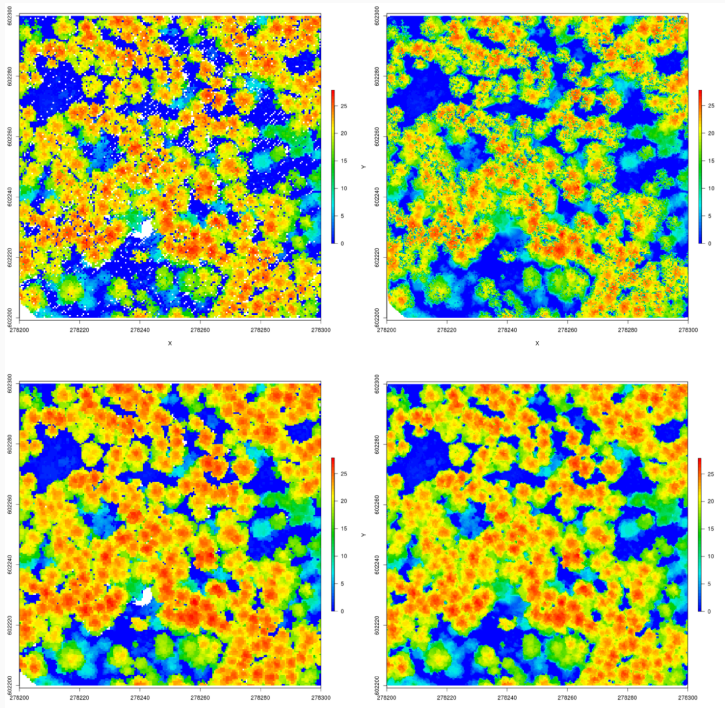
Canopy height models

3 algorithms (+ sugar!) in v1.2.1

- Grid local highest point (+ subcircling + hole filling)
- Triangulation of first returns (+ subcircling)
- Krosvavipour pit-free algorithm (+ subcircling)

```
1  chm = grid_canopy(data, ...)
2  plot(chm)
```





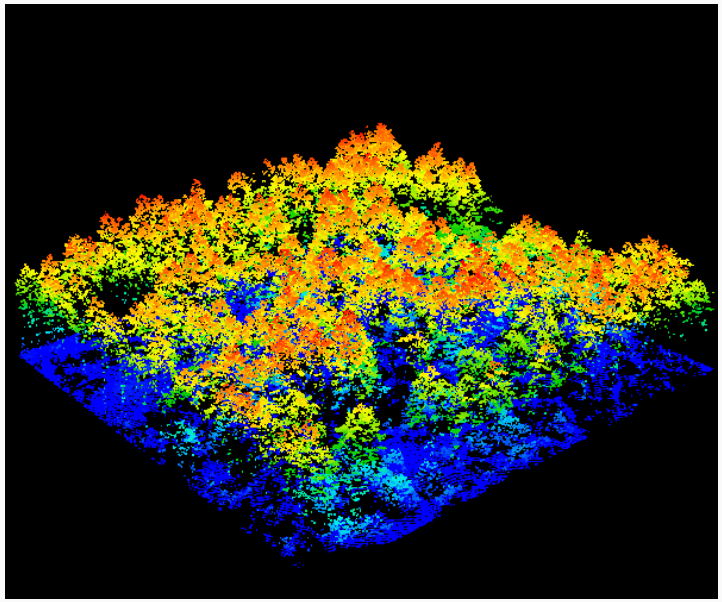
Individual tree segmentation tools

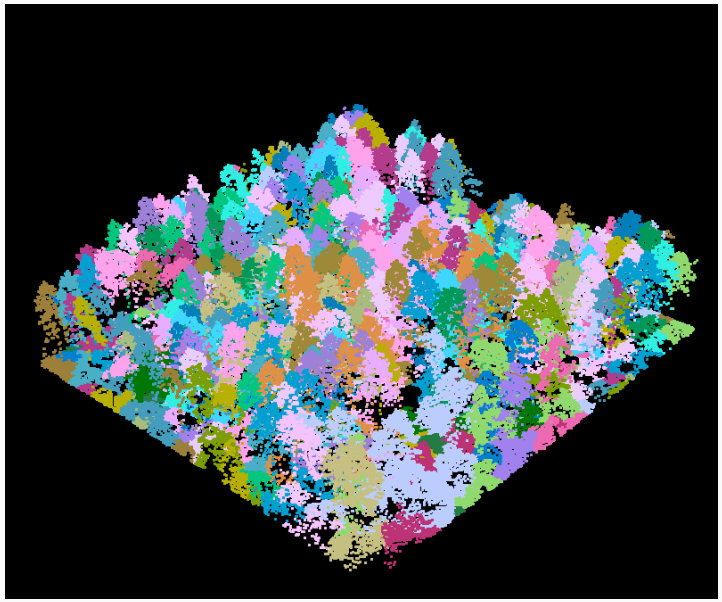
Individual tree segmentation (ITS)

3 algorithms in v1.2.1 (expected 4 in v1.3.0)

- Dalponte 2016 (canopy height model)
- Watershed (canopy height model)
- Li 2012 (point cloud level)

```
lastrees(data, ...)
plot(tree, color = "treeID", palette = pastel.colors(100))
```





Project management tools

Catalog tools

How to deal with an entire project? Use `catalog_*` tools.

```
ctg = catalog("<path to a folder>")
plot(ctg)
```

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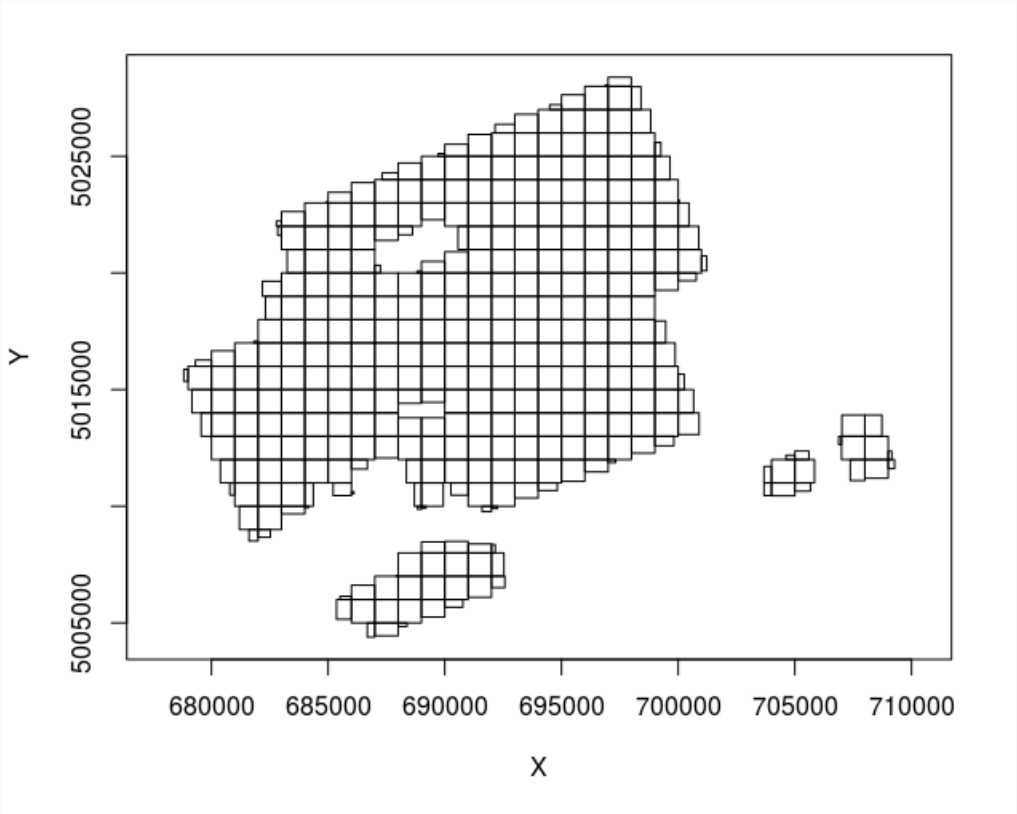

Extract ground inventories

And many other uses...

```
1  rois = catalog_queries(ctg, x, y, r)
```

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And many other uses...

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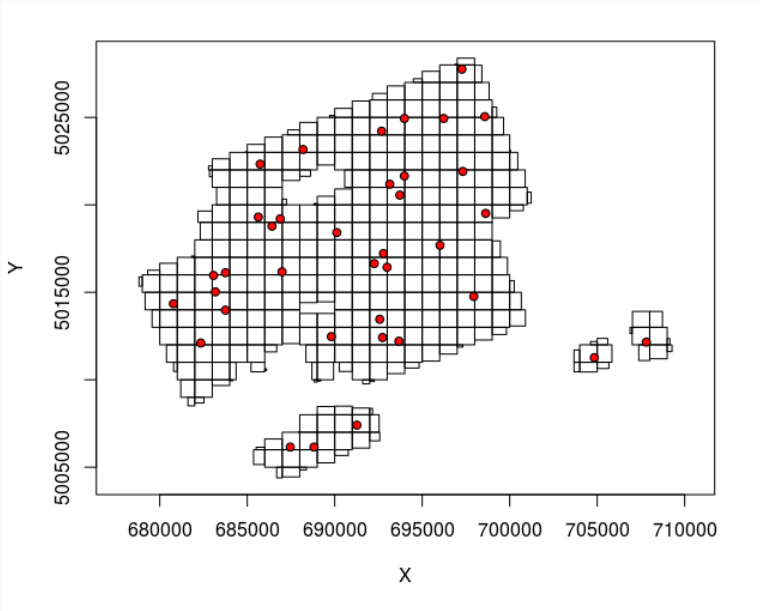

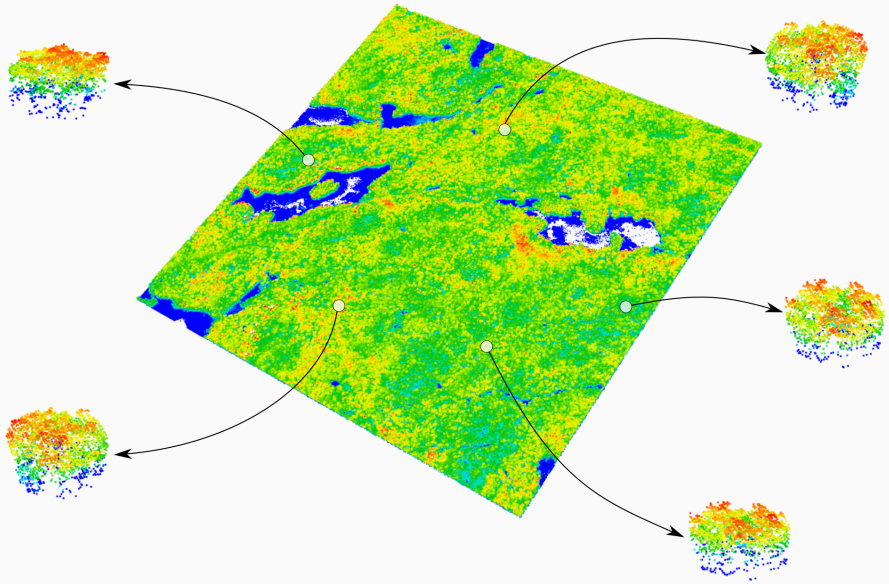

Other tools

Other tools

- Merge geographic data (raster, shapefile) at the point cloud level
- Retrieve individual flightlines
- Filters
- Colourize a point cloud
- Leaf area density, Rumple index (surface roughness), ...
- Grid point density
- Point decimation and homogenization
- Voxelization and metrics
- Streaming filters
- ...

`lidR` does not aim to provide predefined processes, it is designed to enable users to build their own.

Resources, bug reports, feature requests, colaborations

- https://github.com/Jean-Romain/lidR/
- https://github.com/Jean-Romain/lidR/wiki
- https://CRAN.R-project.org/package=lidR