Tutorial: Geocomputation with R

The basics

Jannes Muenchow, Robin Lovelace

ERUM Budapest, 2018-05-14

Find the slides and code

https://github.com/jannes-m/erum18_geocompr

Please install following packages:

```
install.packages(c("sf", "raster", "spData", "dplyr", "RQGIS"))
```

Or from docker:

```
docker run -d -p 8787:8787 -v ${pwd}:/data robinlovelace/geocompr
```

Contents of the tutorial

1. Basics

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2. Spatial vector data

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2. Spatial vector data
3. Spatial raster data
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6. (Spatial statistical learning)

Who are we

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- Robin Lovelace - Geographer and Environmental Scientist focussing on sustainable transport planning; creator of **stplanr**
- together with Jakub Nowosad we are writing:

Geocomputation

with R

Where are we from

Some definitions

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- Six components of a GIS: software, data, procedures, hardware, people, network
- Typical GIS software packages: QGIS, SAGA-GIS, GRASS-GIS, ArcMap (commercial)

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- Geocomputation
- GIScience
- Geographic data science

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Graphical User Interface (GUI) GIS vs Geocomputation with R

Attribute	**Desktop GIS (GUI)**	**R**
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Further reading: https://geocompr.robinlovelace.net/intro.html#what-is-geocomputation

Geographic data models

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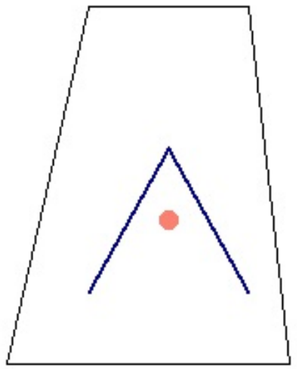
- Geographic data only represents a simplified representation of the world. So we decide what we display for which purpose.
- Geographic data can quickly become big.
- Two data models for representing digitally geographic data: **the vector** and **the raster** data model

Vector data model

- Discrete objects represented by points



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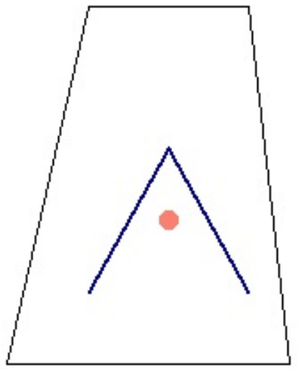

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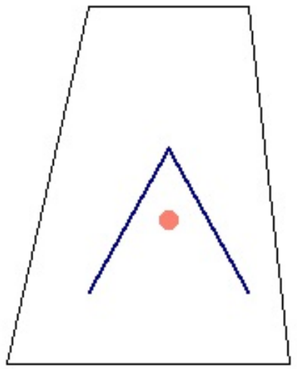

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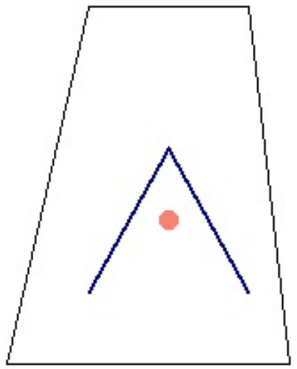
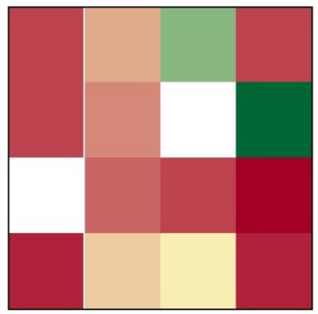


Further reading:
https://geocompr.robinlovelace.net/spatial-class.html#vector-data

Raster data model

- Continous fields represented by pixels (cells)

19	38	72	18
17	31	NA	96
NA	26	16	9
14	45	50	10



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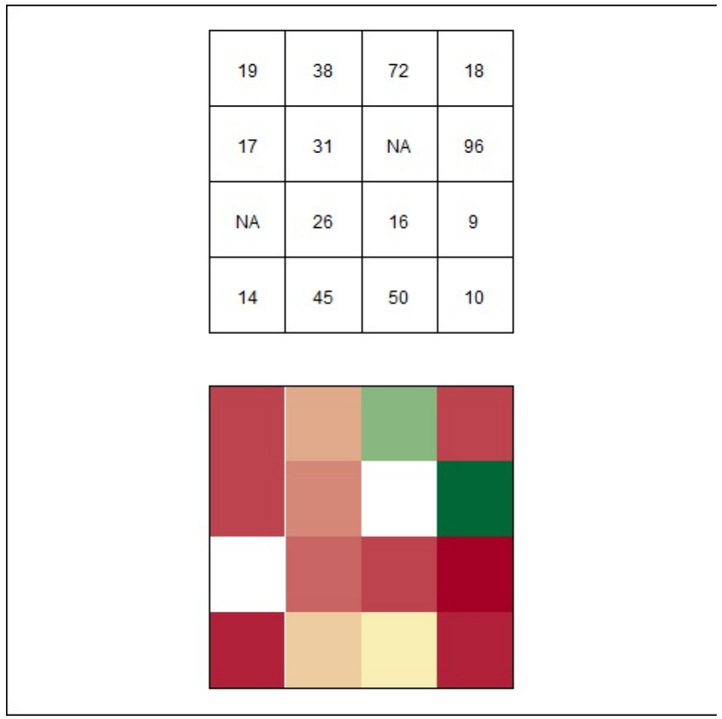

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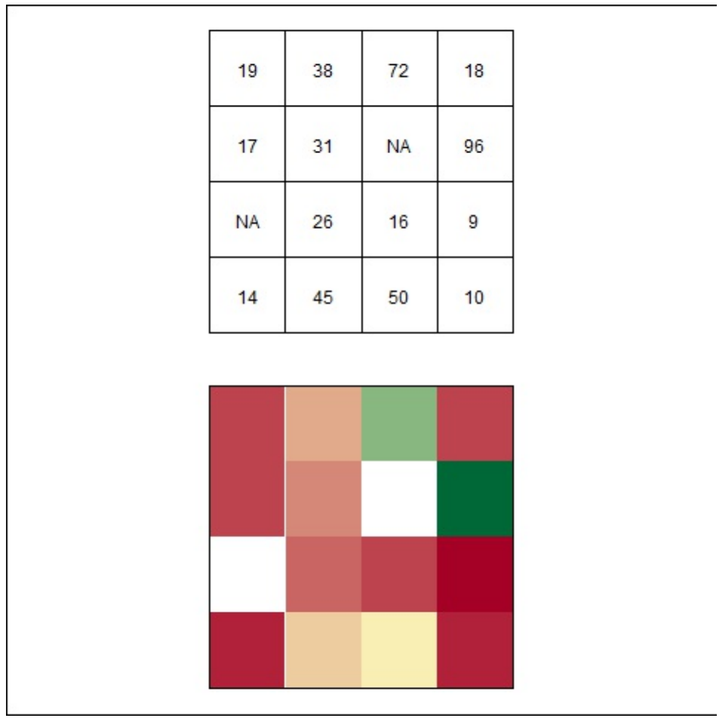

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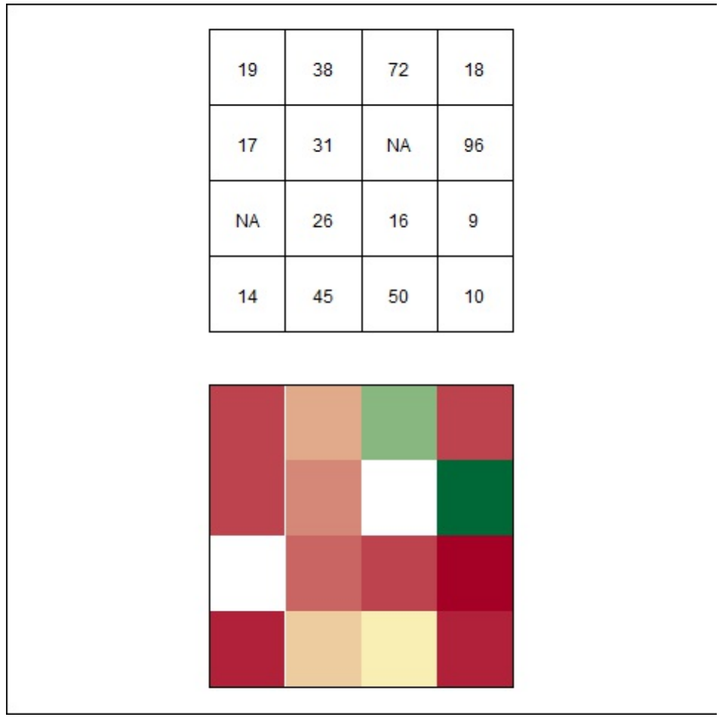

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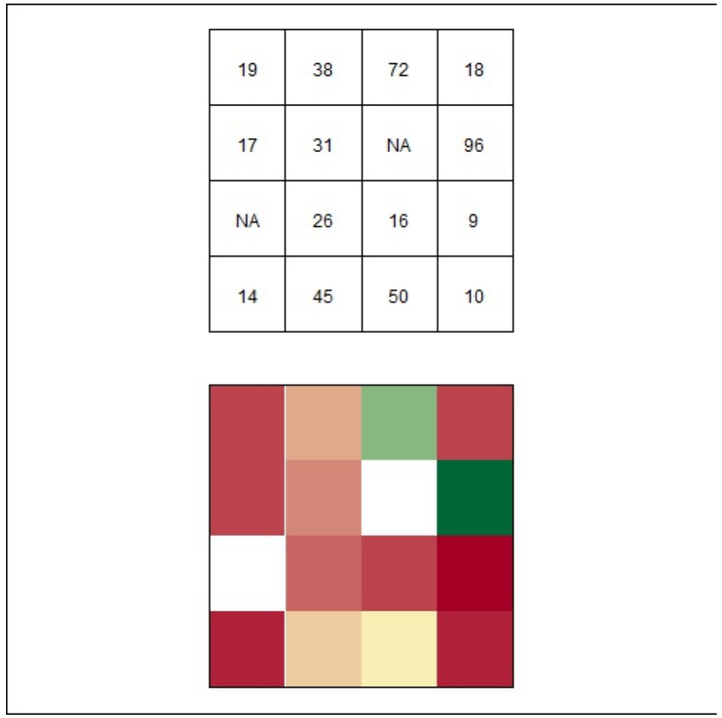

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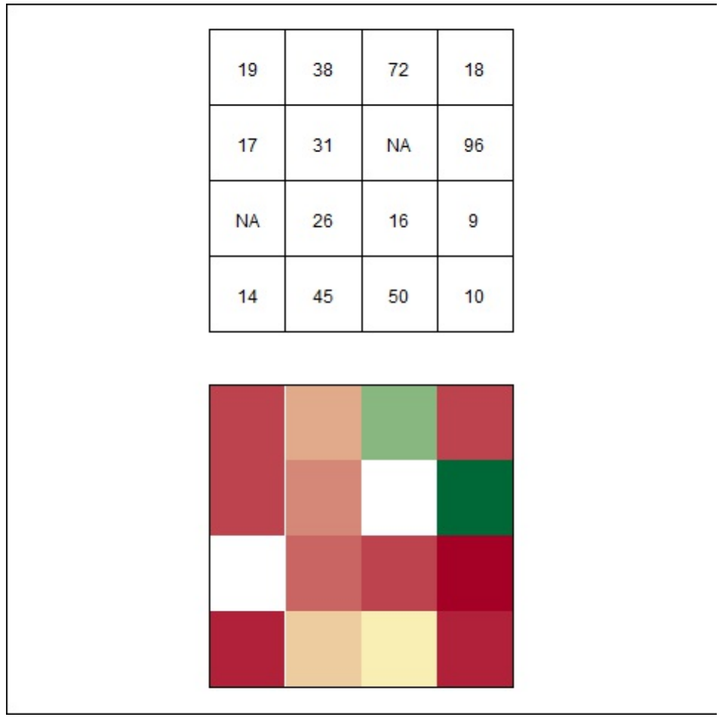

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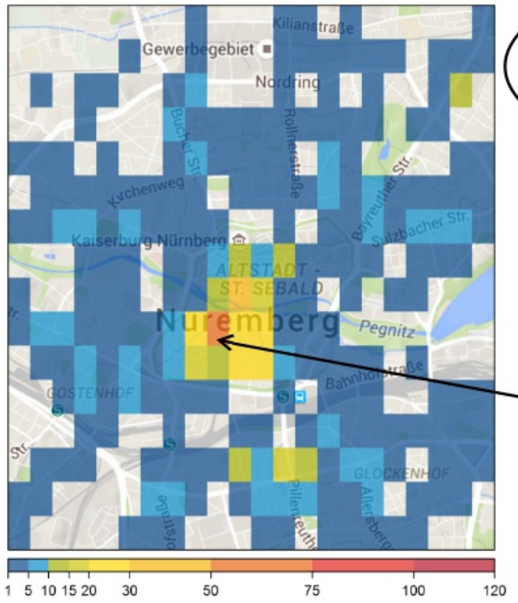
Raster header



header

NCOLS 22
NROWS 16
XLLCORNER 11.05
YLLCORNER 49.435
CELLSIZE 0.0025
NODATA_value NA

NA NA NA NA NA NA NA NA 1 NA NA NA 1 1 NA 1 NA NA NA NA NA 4
NA NA NA NA NA 1 NA NA 3 NA NA NA 2 1 1 2 1 1 NA 2 1 1
NA 1 NA 1 1 NA NA 3 6 NA NA NA 5 NA 2 NA 1 NA NA 4 12 NA
NA NA NA 3 NA NA NA 9 2 1 1 1 4 1 1 1 2 NA 2 3 NA NA
1 2 1 NA 1 NA NA 3 10 3 1 2 2 NA 7 2 NA NA NA NA 2 3
NA 4 2 5 2 4 4 1 4 NA 3 3 5 4 7 1 6 4 5 2 3 3
2 5 6 6 2 9 3 1 1 2 NA NA 1 NA 1 1 6 1 7 8 10 1
NA NA NA 1 1 1 NA 5 2 8 12 7 11 3 3 1 1 NA 4 2 2 NA
2 NA NA 2 3 3 NA 3 2 13 33 20 4 2 NA 1 NA 1 1 NA NA NA
3 6 7 3 3 1 2 6 26 **58** 30 25 5 4 1 NA NA NA NA NA NA NA
NA 5 3 7 5 7 5 8 20 12 22 28 10 2 2 2 1 NA 1 NA NA NA
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A brief word on CRS

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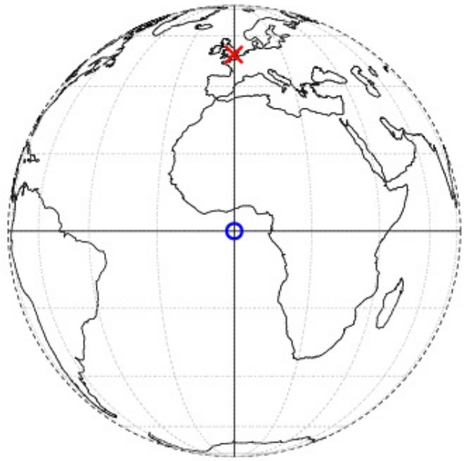
We use Coordinate Reference Systems (CRS) to locate our geographic data on Earth.

We distinguish between:

- Geographical CRS span the entire world
- Projected CRS are (usually) localized to minimize visual distortion in a particular region (use a specific ellipsoid which is especially suitable for a this particular part of the Earth)

Geographic CRS

- Usually in decimal degrees
- Used by many people/institutions (GPS)
- Great for locating a place on Earth
- Best for global analysis
- Less suitable if you want to measure distance



Source: Geocomputation with R.

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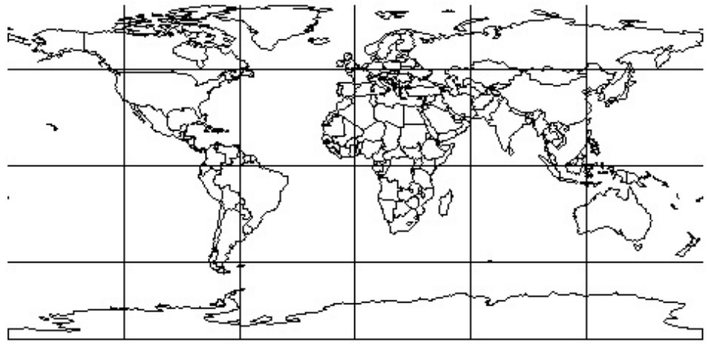
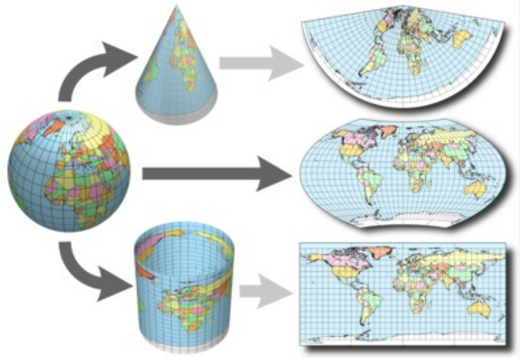


Projected CRS

- Spatial projections flatten the 3D shape of the Earth onto a 2D plane
- Especially suitable for "local" analysis



Source: progonos.com/furuti/

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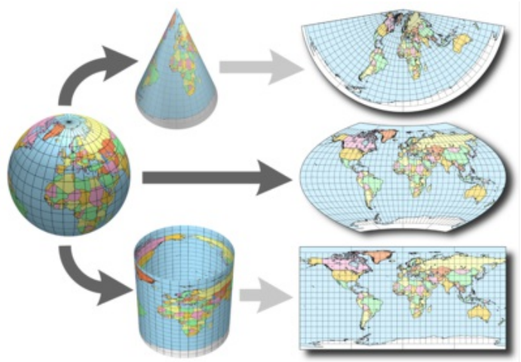

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Further reading:

- Gecomputation with R - Projections
- QGIS CRS documentation
- Earth Data Science CRS

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Further reading: https://geocompr.robinlovelace.net/intro.html#the-history-of-r-spatial

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References

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