

Coordinates system- special topic

Rene Maas, 2022

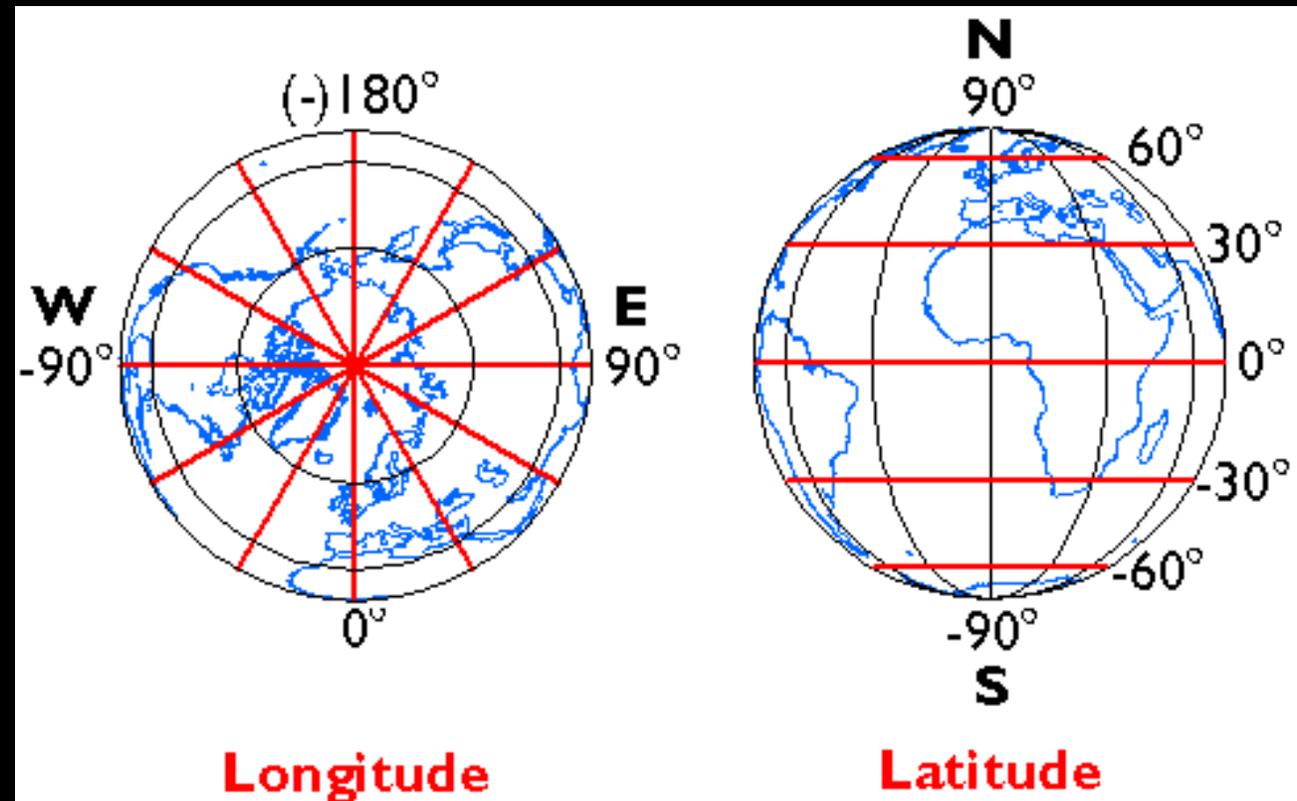
Coordinates

- Coordinates are a numerical system referring point on the Earth
- There are two main coordinate systems based on how the world is modeled
 - Geographic coordinate systems (refers to where on the Earth we are)
 - Projected coordinate systems (how we should show things on the flat map)
- It is important for maps and Computer maps to project the world so things could be shown on the flat surface

Geographic coordinates system

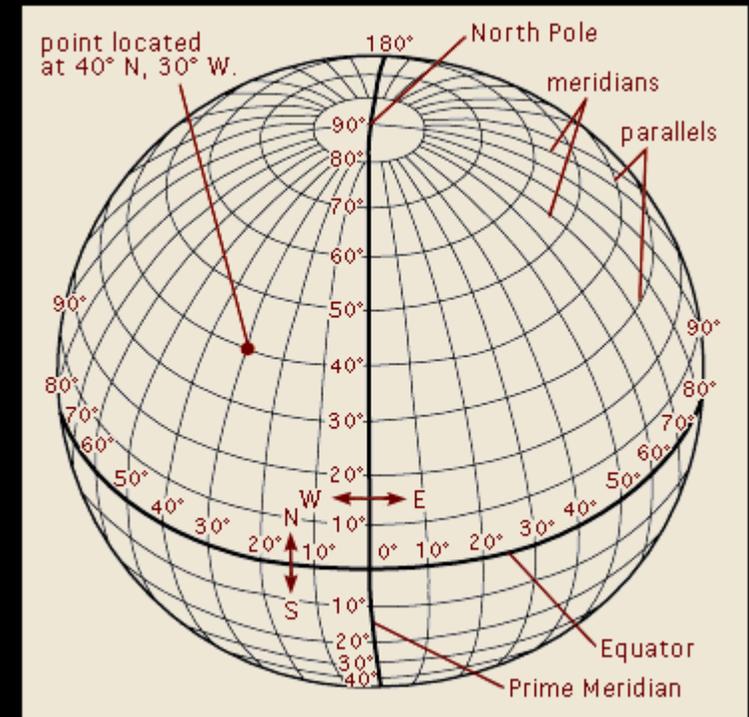
https://www.e-education.psu.edu/natureofgeoinfo/sites/www.e-education.psu.edu/natureofgeoinfo/files/image/long_lat.gif

- Works on 3 dimensional space
- Assume that we have a model from the world- sphere
- No slice sphere from the middle
And divide the cutted edge within 360 degrees
- So you now have geographic Coordinates system presented In degrees



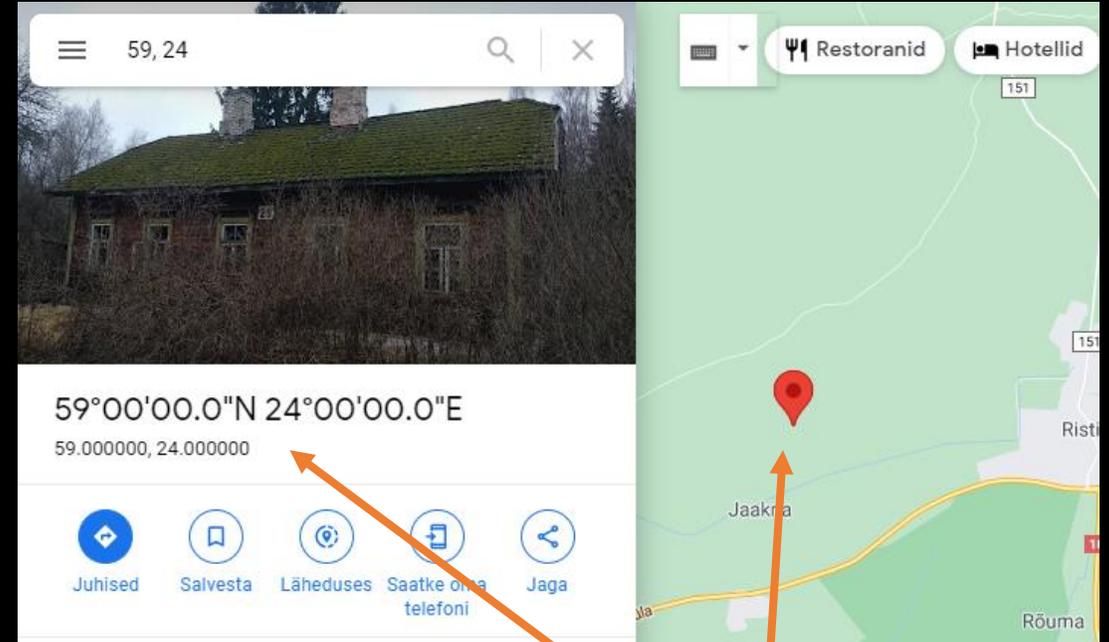
Geographic coordinates system

- Consists of two sets of lines
- Parallels
 - Runs from east to west
- Meridians
 - Runs from north to south



How to read geographic coordinates

- It's the same as going to the cinema
- First row (latitude)
- Then seat (longitude)
- Here is one example
 - 59 degrees N (latitude) ja 24 degrees E (longitude)



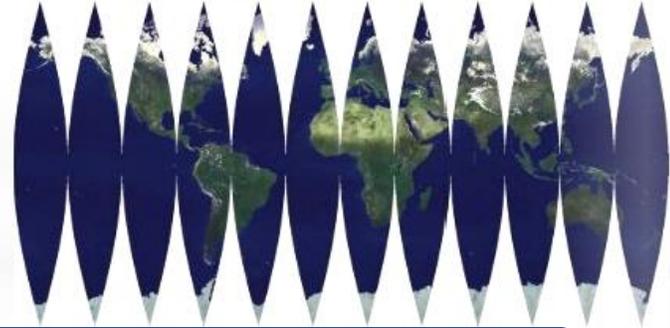
This is the place on the earth

So why we need projected coordinates systems

- When you try to lay out sphere object skin you end up with distortion and empty spaces



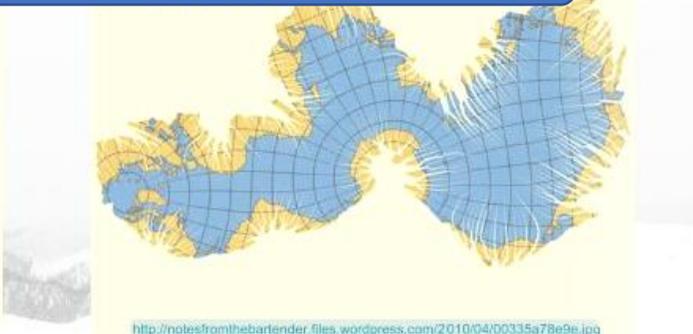
Showing the Earth on the flat surface



Different cutouts



<http://scenthis.net/tag/jack-van-wijk>

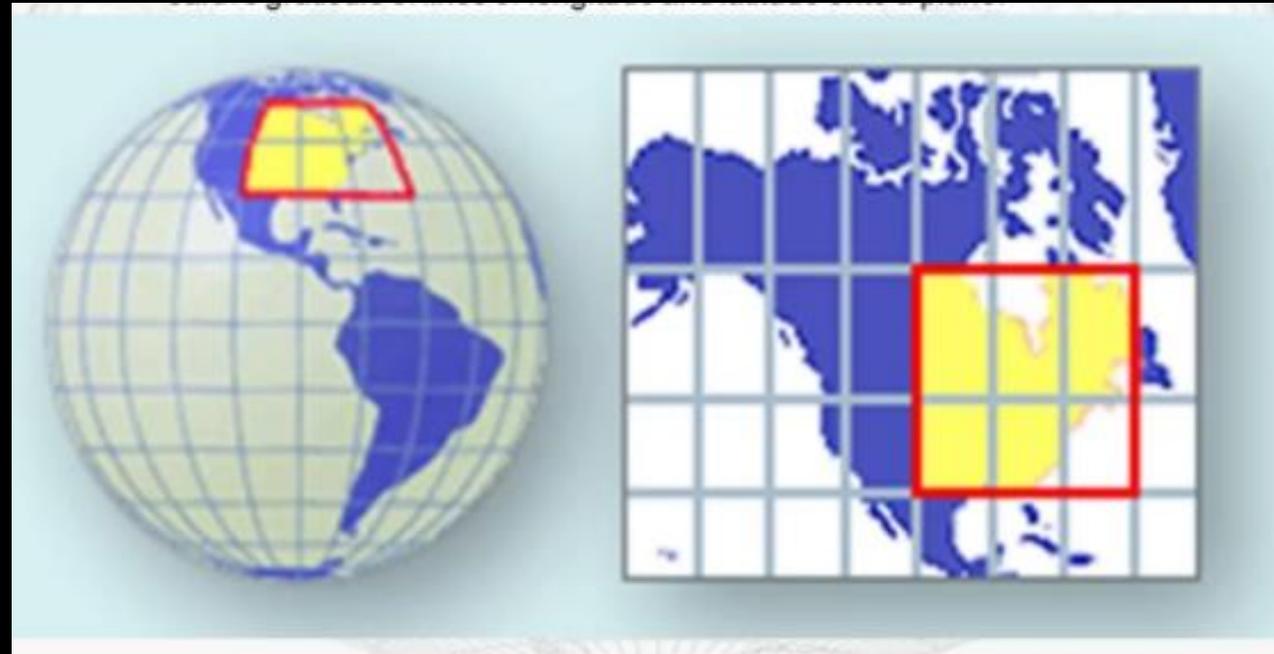


<http://notesfromthebartender.files.wordpress.com/2010/04/00335a78e9e.jpg>

How to avoid distortion and empty spaces

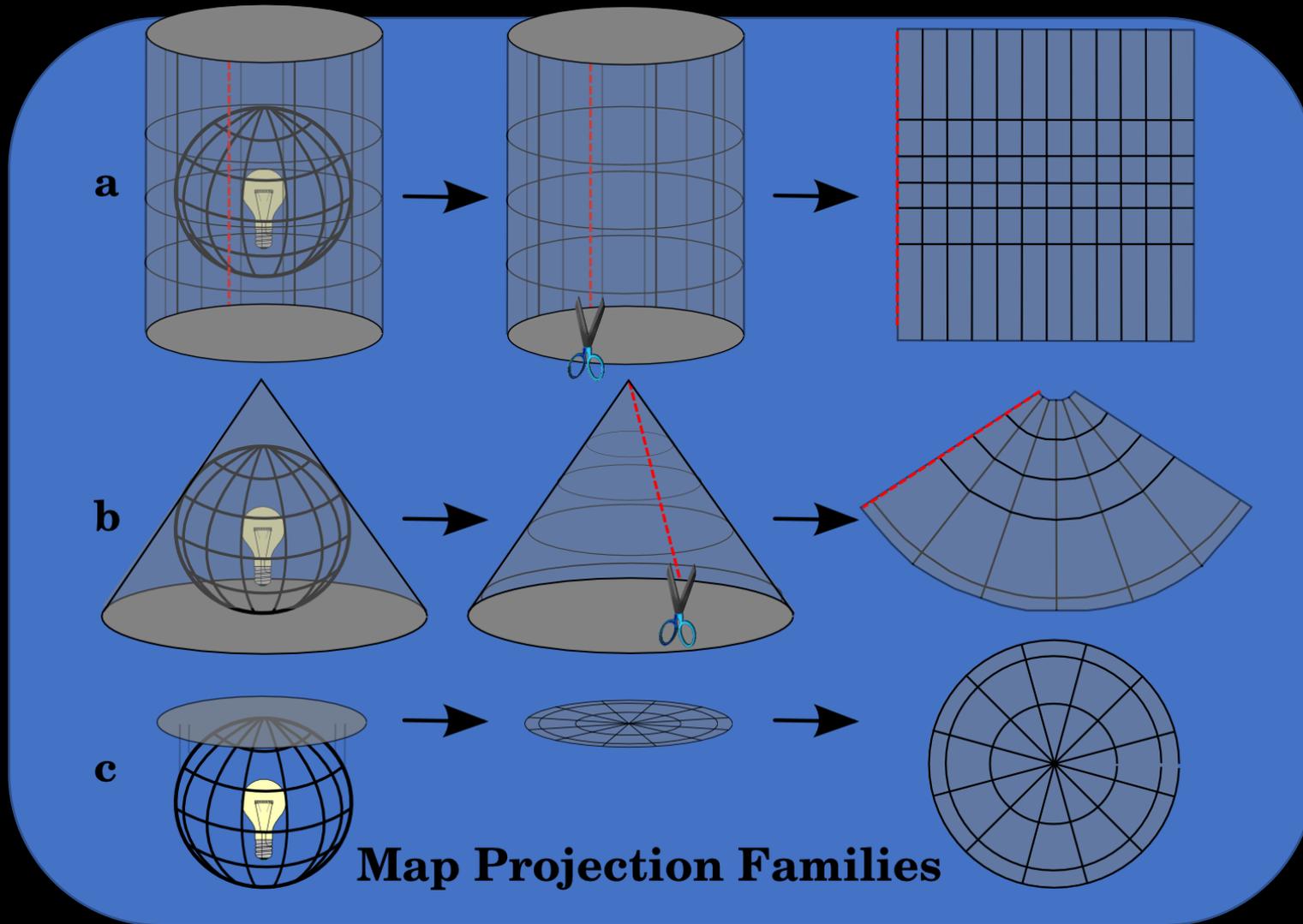
- We need it to show the sphere as it is in 3D in the 2D space
- Projection is the way to show things on the flat surface
- Projections are made on the small area so the distortion could be the smallest

3D space vs flat surface

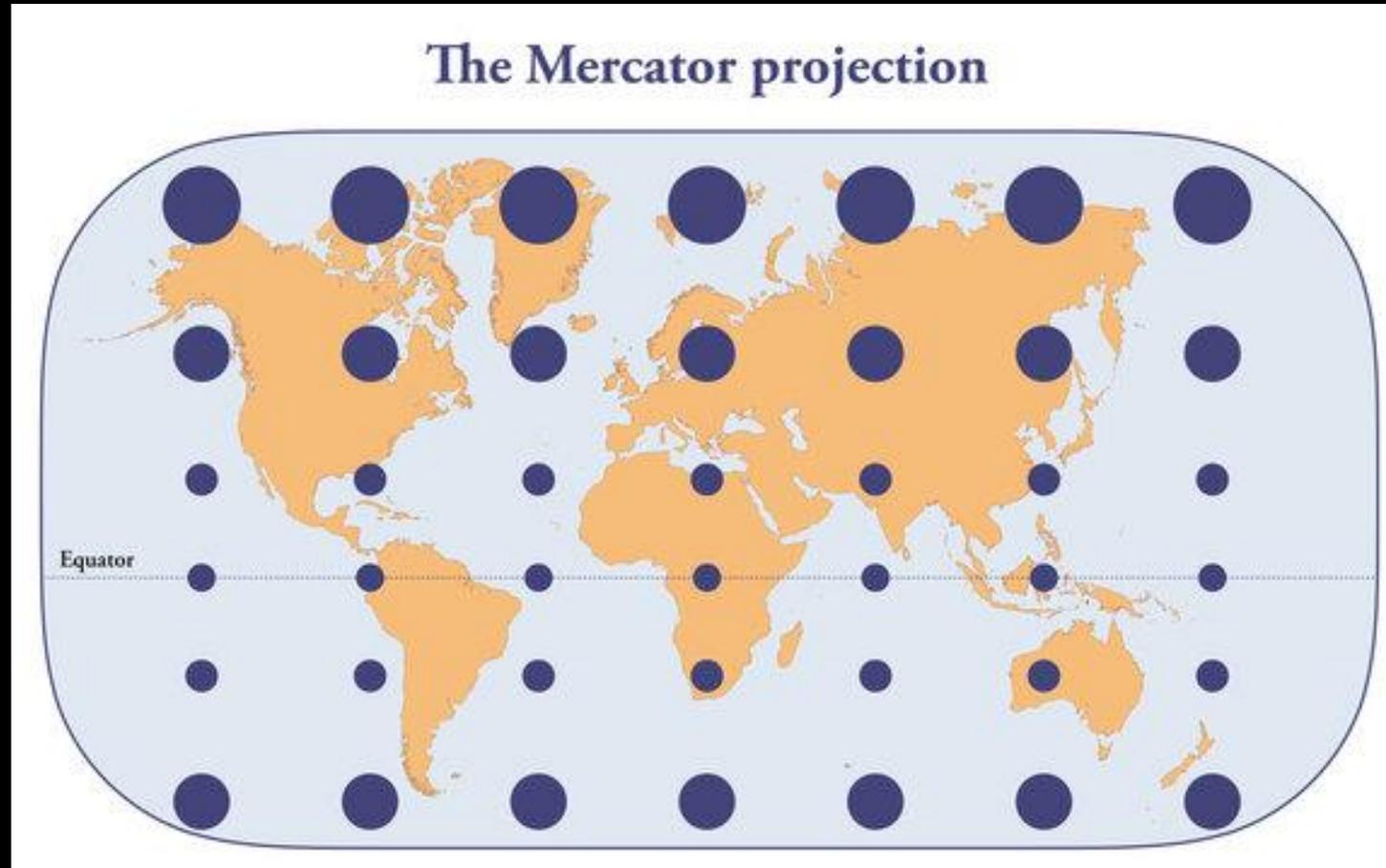


https://i.ytimg.com/vi/-2z_WP7N7to/maxresdefault.jpg

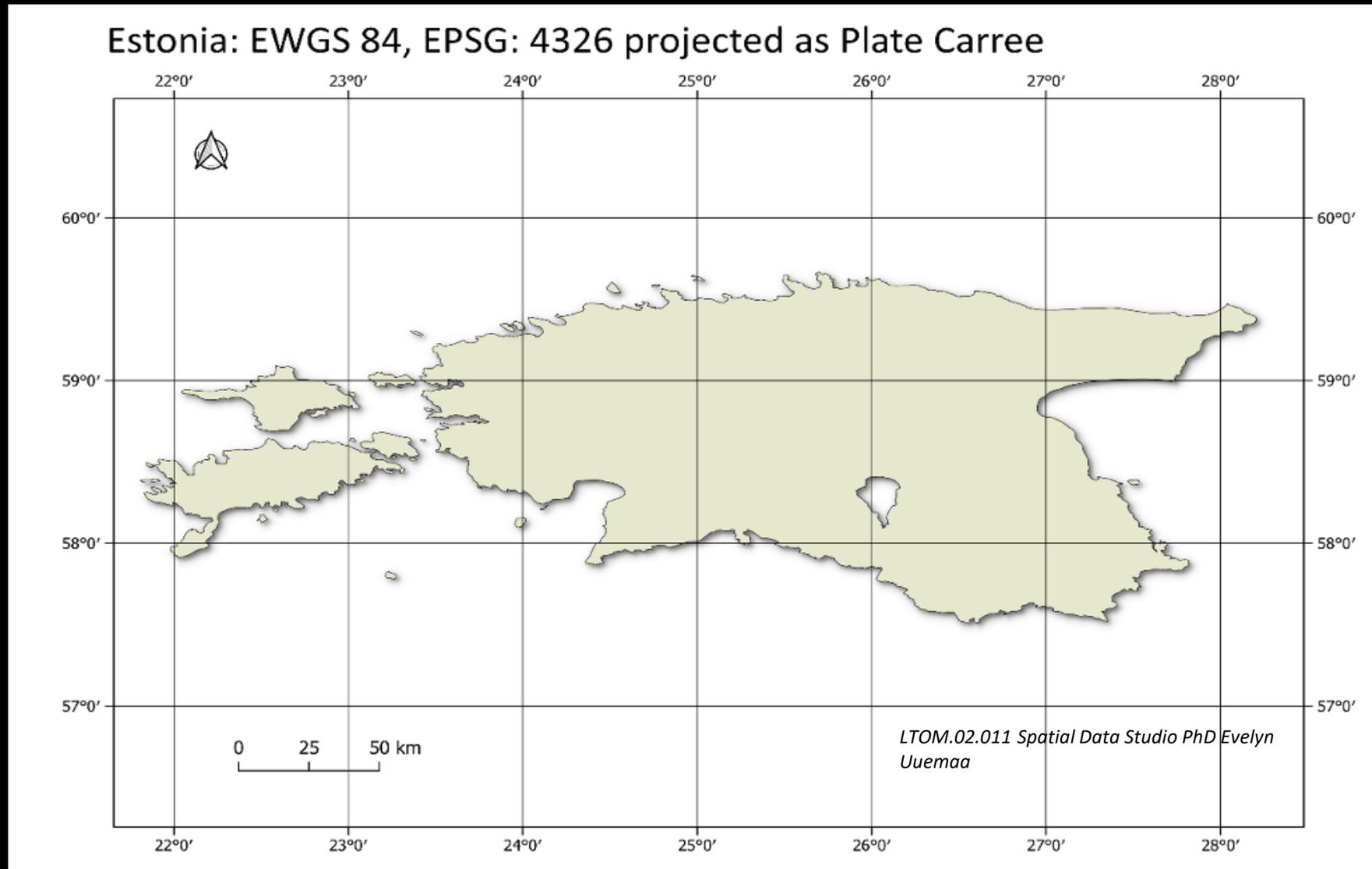
How projections are made



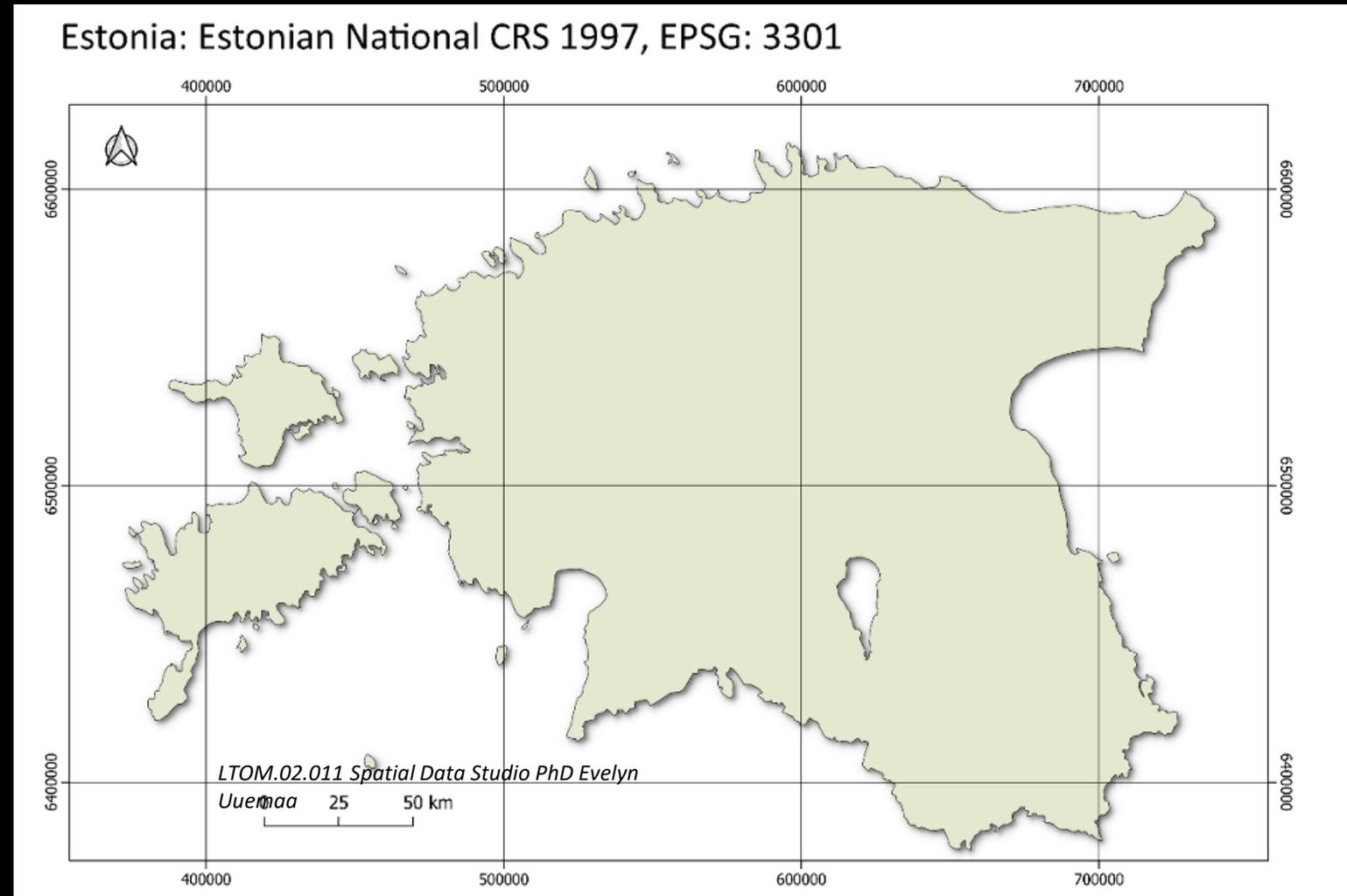
Distortion



Example of geographic coordinates



Example of projected coordinates



QGIS coordinate systems

- Coordinate reference system (CRS)
- Two coordinate systems are applied
 - For the project
 - For the layer itself
- Project and layer coordinate systems could be different but QGIS is capable of transform from one to another
- In one project there could be layers with many projections but project projection is translating them into one. Final result we show on the canvas

Project coordinate system in QGIS

Project Properties — CRS

Project Coordinate Reference System (CRS)

No CRS (or unknown/non-Earth projection)

Filter

Recently Used Coordinate Reference Systems

Coordinate Reference System	Authority ID
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Predefined Coordinate Reference Systems Hide deprecated CRSs

Coordinate Reference System	Authority ID
WGS 72	EPSG:4322
WGS 72	EPSG:4985
WGS 72BE	EPSG:4324
WGS 72BE	EPSG:4987
WGS 84	EPSG:4326
WGS 84	EPSG:4979

WGS 84

WKT

```
GEOGCRS["WGS 84",  
  DATUM["World Geodetic System  
1984",  
    ELLIPSOID["WGS 84",  
6378137,298.257223563,  
    LENGTHUNIT["metre",  
1]],,  
  PRIMEM["Greenwich", 0
```



Coordinate Scale Magnifier Rotation Render

Layer projection systems

- Mostly we are not changing them from the options
- When wanting to change it is done by exporting the layer and saving in another projection

How to identify layer projection

- There is a system: EPSG that identifies projections in numerical
- It is a more convenient way to talk about projections

Encoding	UTF-8
Geometry	Line (MultiLineString)
CRS	EPSG:3301 - Estonian Coordinate System of 1997 - Projected
Extent	531002.0196336581138894,6579928.2556907450780272 : 550885.1810680219205096,6591186.6530109783634543
Unit	meters
Feature count	90



Conclusion

- Geographic coordinates are used to identify points in the Earth
- To map the world on a flat surface, we use projected coordinates
- Projected coordinates are easy to calculate distances using trigonometry
- QGIS has layer and project view projections
- Mostly we change only project projection, but layer projection could be also changed by exporting and saving in another projection