Introduction to cartography and maps

By NTUA

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What is a Map;

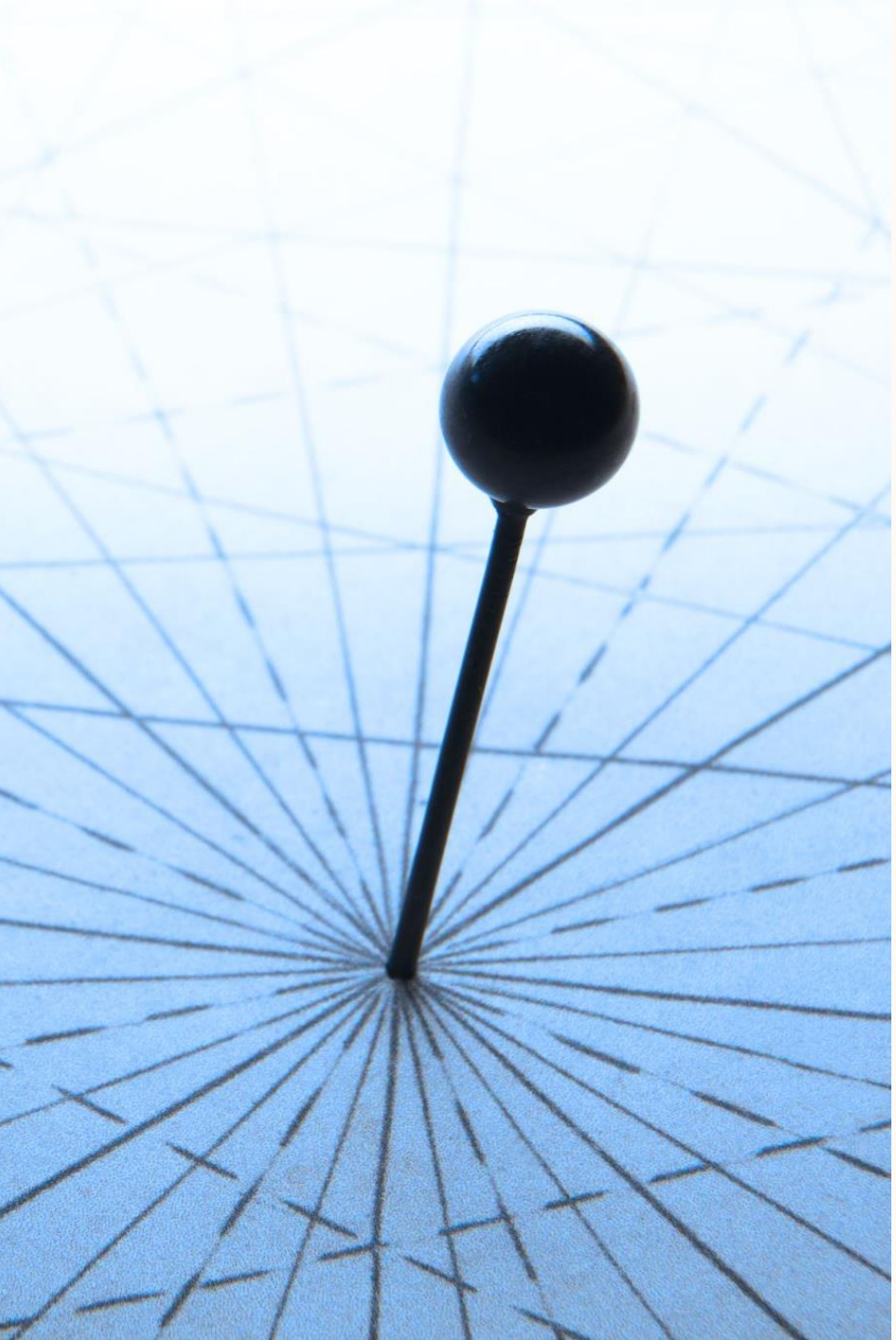
three definitions from the International Cartographic Association (ICA) showing how maps have evolved in the recent years due to technological advancements

ICA, 1973: a usually scaled representation, on a flat medium, of a collection of materials or abstract elements on or in relation to the surface of the Earth or other celestial body

ICA, 1994: a representation or abstraction of geographic reality – a tool for presenting geographic information in a visual (digital or tangible) way.

ICA, 2003: a symbolized representation of geographical reality, representing selected features or characteristics, resulting from the creative effort of its author's execution of choices, and is designed for use when spatial relationships are of primary relevance.

Basic Features And Functions of Maps



Map; the Basics

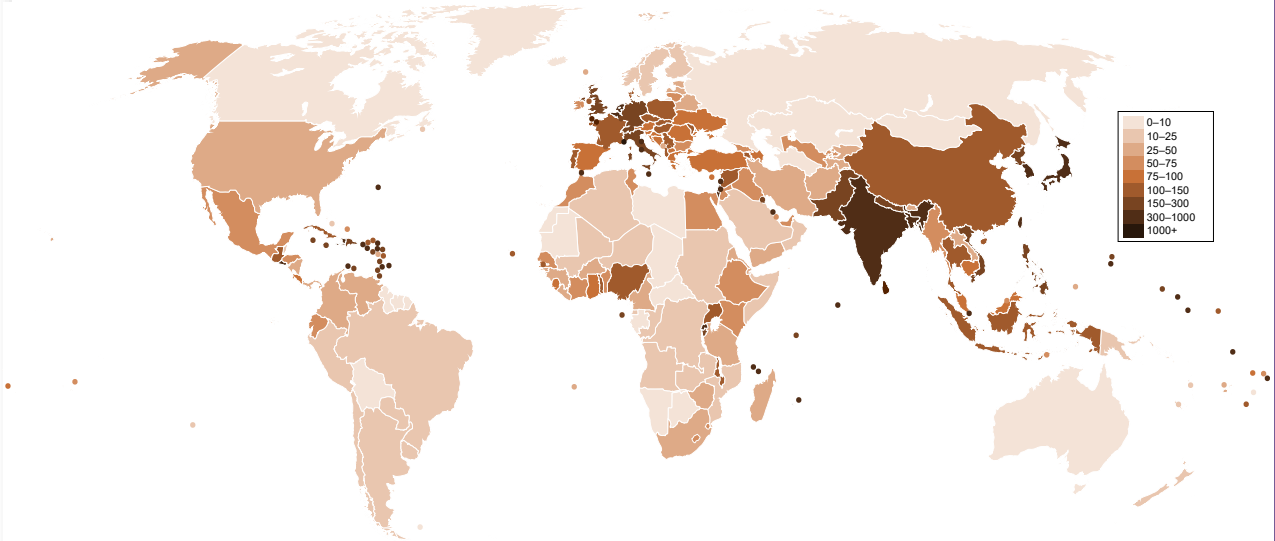
Depicts

1. Locations in geographic space using coordinates.
2. Qualitative or quantitative data, in these locations.
3. Relationships between locations and qualitative or quantitative data such as:
   i. Relationships among geographic locations; distances, directions, etc.
   ii. Relationships between data that refer to the same geographic location, such as land use and temperature.
   iii. Change of the value of a physical quantity across geographic locations such as slope, temperature, humidity, etc.
   iv. Correlations of distributions across geographic locations, such as the correlation of per capita income with educational attainment.

1. Map depicting the location of spatial entities, i.e., the location of countries and cities of Africa.

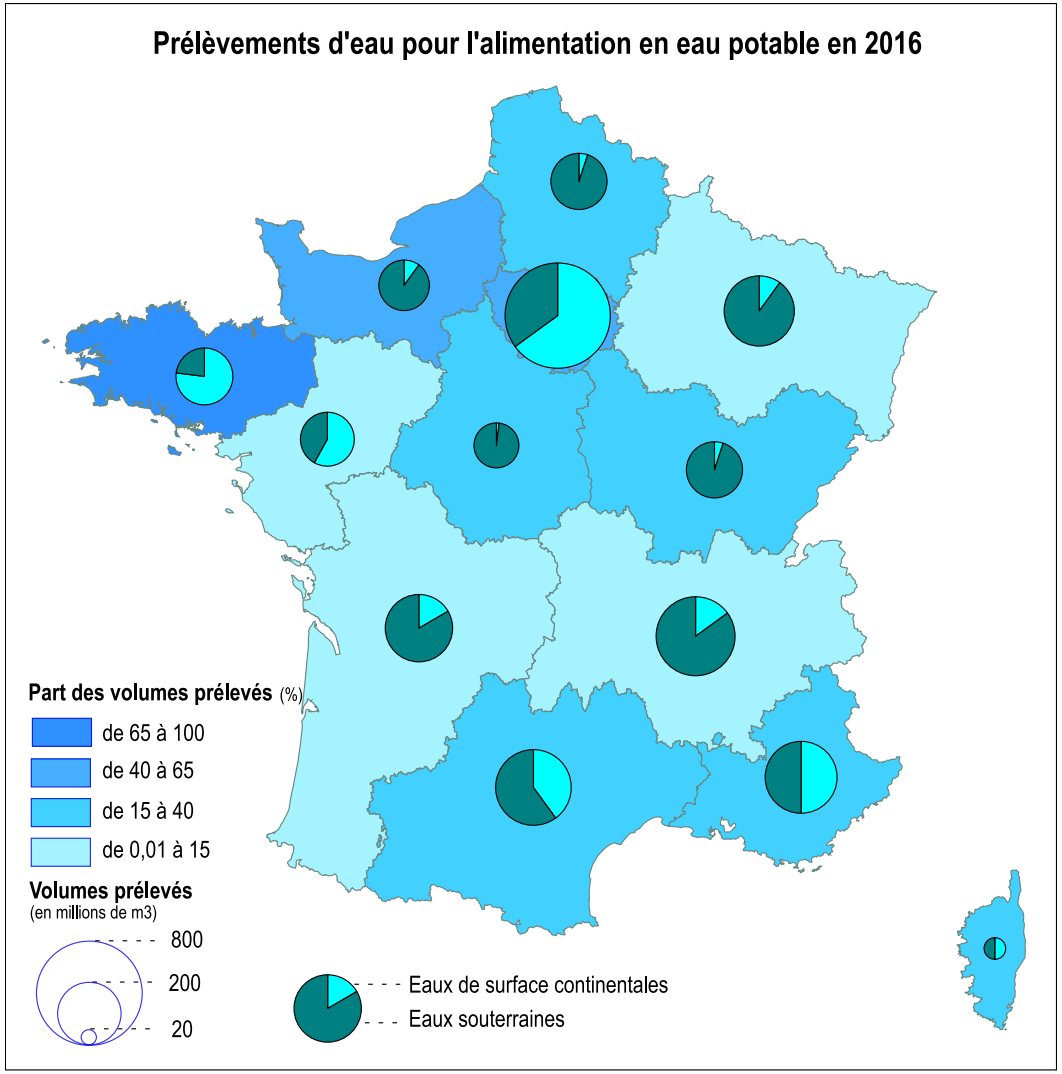
Political map of Africa, from CIA *The World Factbook* in 2021, https://commons.wikimedia.org/wiki/File:Political_Map_of_Africa_(2021).svg

2. Map depicting quantitative characteristics, i.e., population density



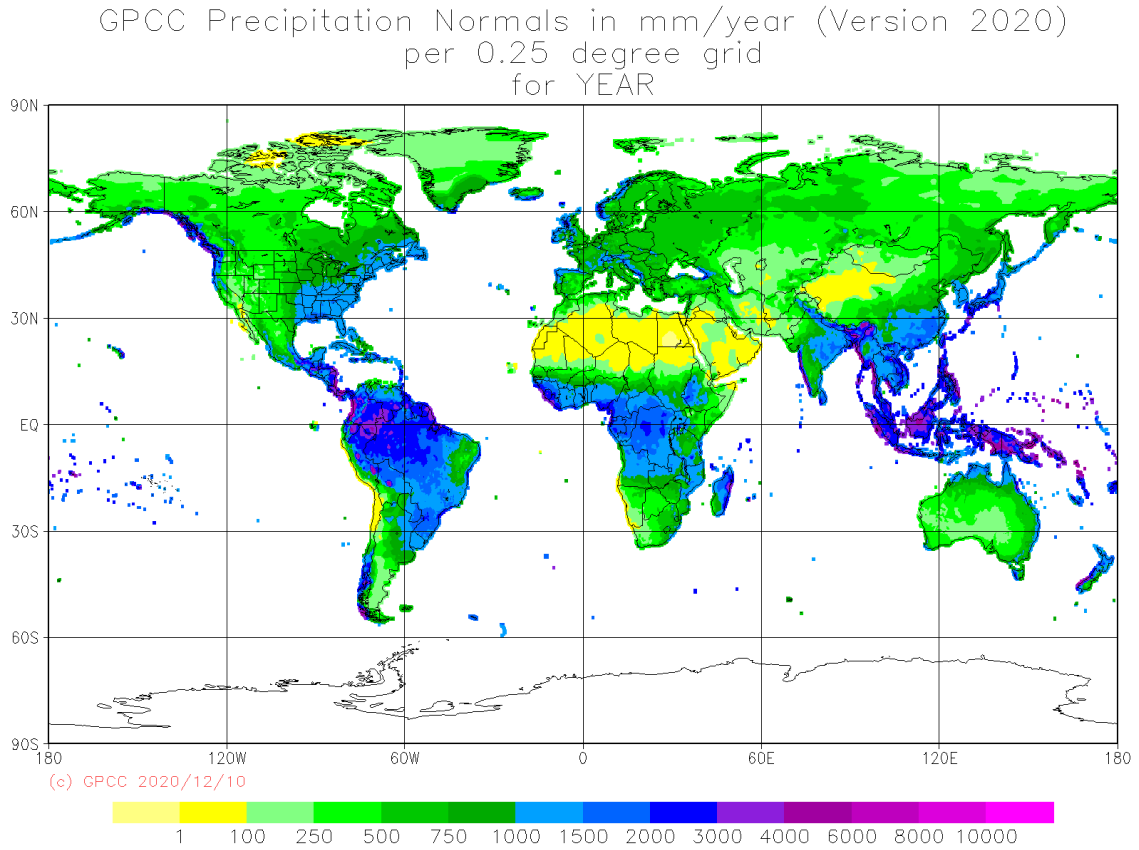
A map of the world, to highlight the population density of each country.
(Numbers on the legend are in people per km^2, and all countries smaller than 20,000 km^2 are represented by a dot),
https://commons.wikimedia.org/wiki/File:Countries_by_population_density.svg

3.ii. Map depicting relationships between various characteristics of the same geographic location, i.e., different information on drinking water withdrawals



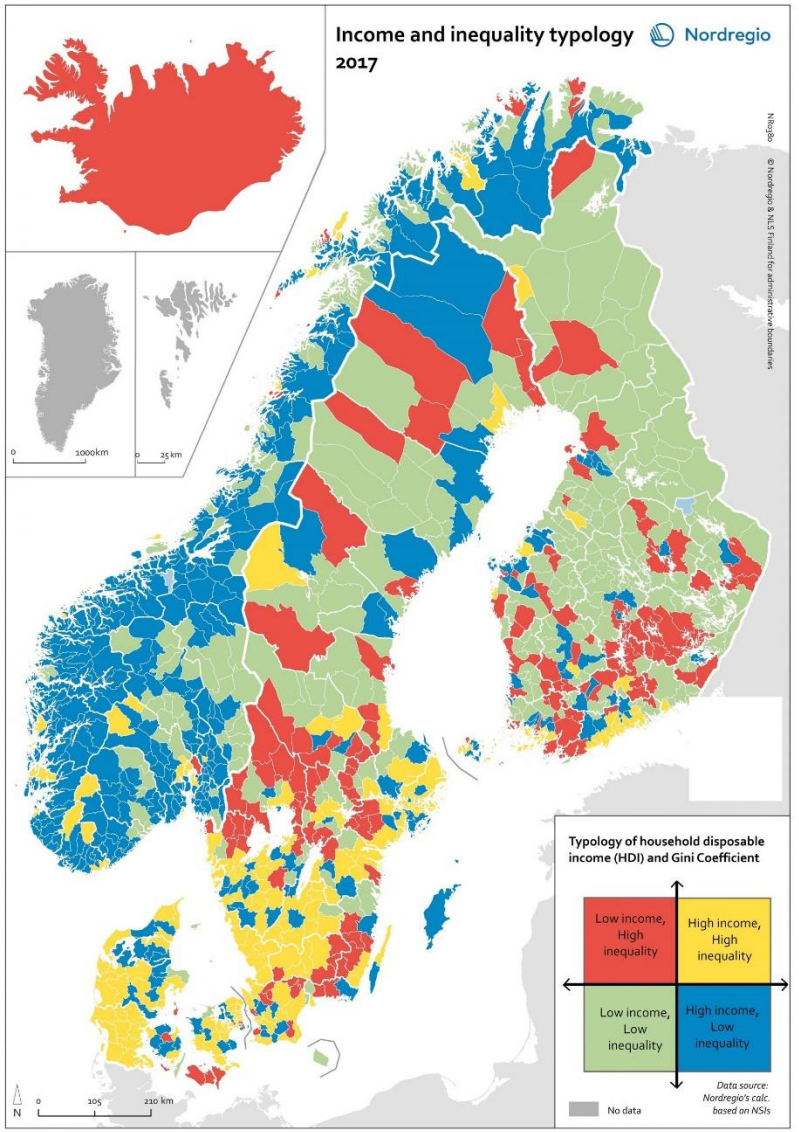
Geographic distribution of drinking water withdrawals in France in 2016. https://commons.wikimedia.org/wiki/Category:Economic_maps_of_France#/media/File:FR-eau-potable-2016.svg

3.iii. Map depicting the differen of the value of a physical quantity across geographic locations, i.e., precipitation among different geographic locations

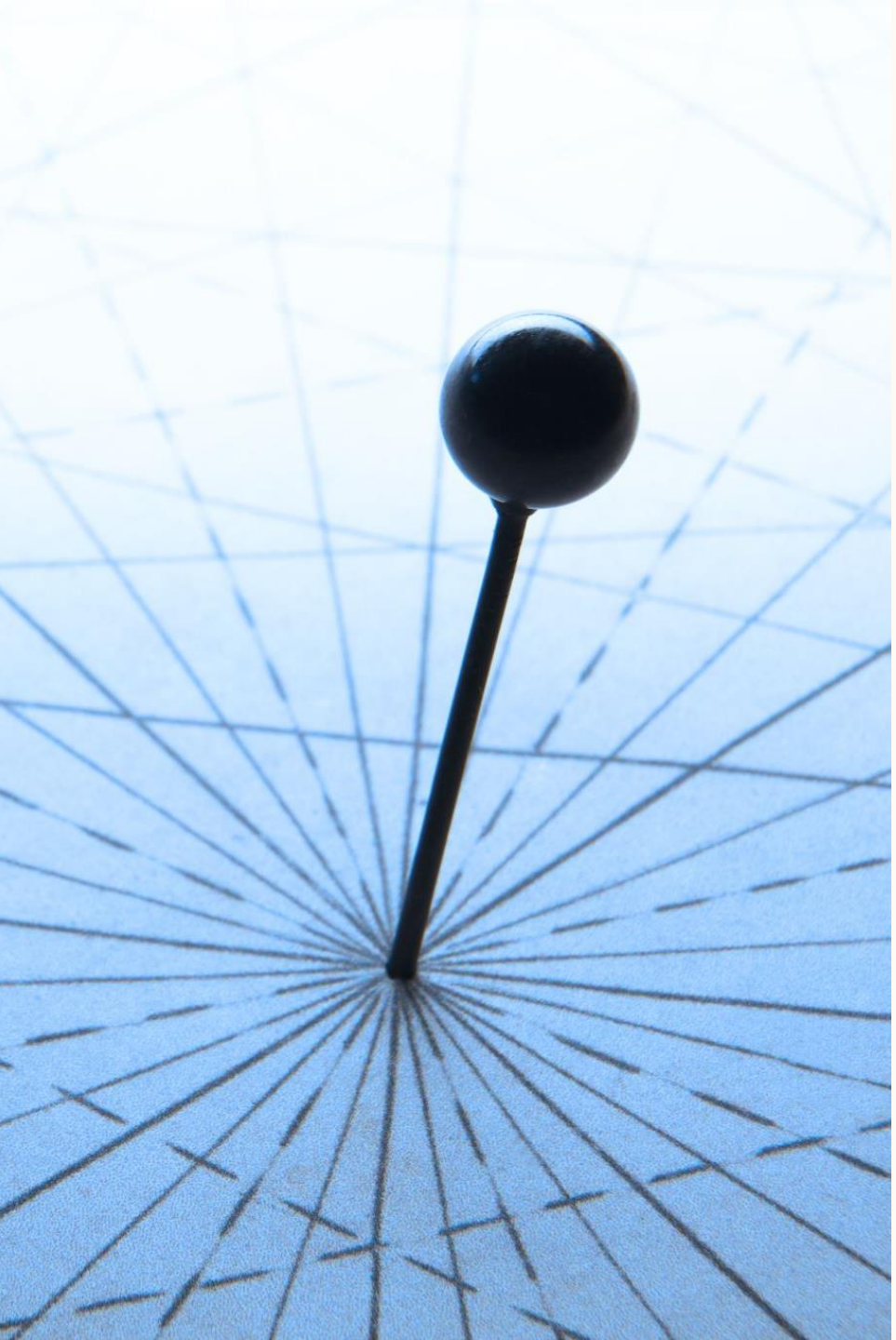


World precipitation normals for 1951-2000. Source: Deutscher Wetterdienst
https://www.dwd.de/EN/service/copyright/copyright_node.html

3.iv. Map depicting correlations of distributions across geographic locations, i.e., combinations of the household disposable income (HDI) and the Gini Index (inequality index)

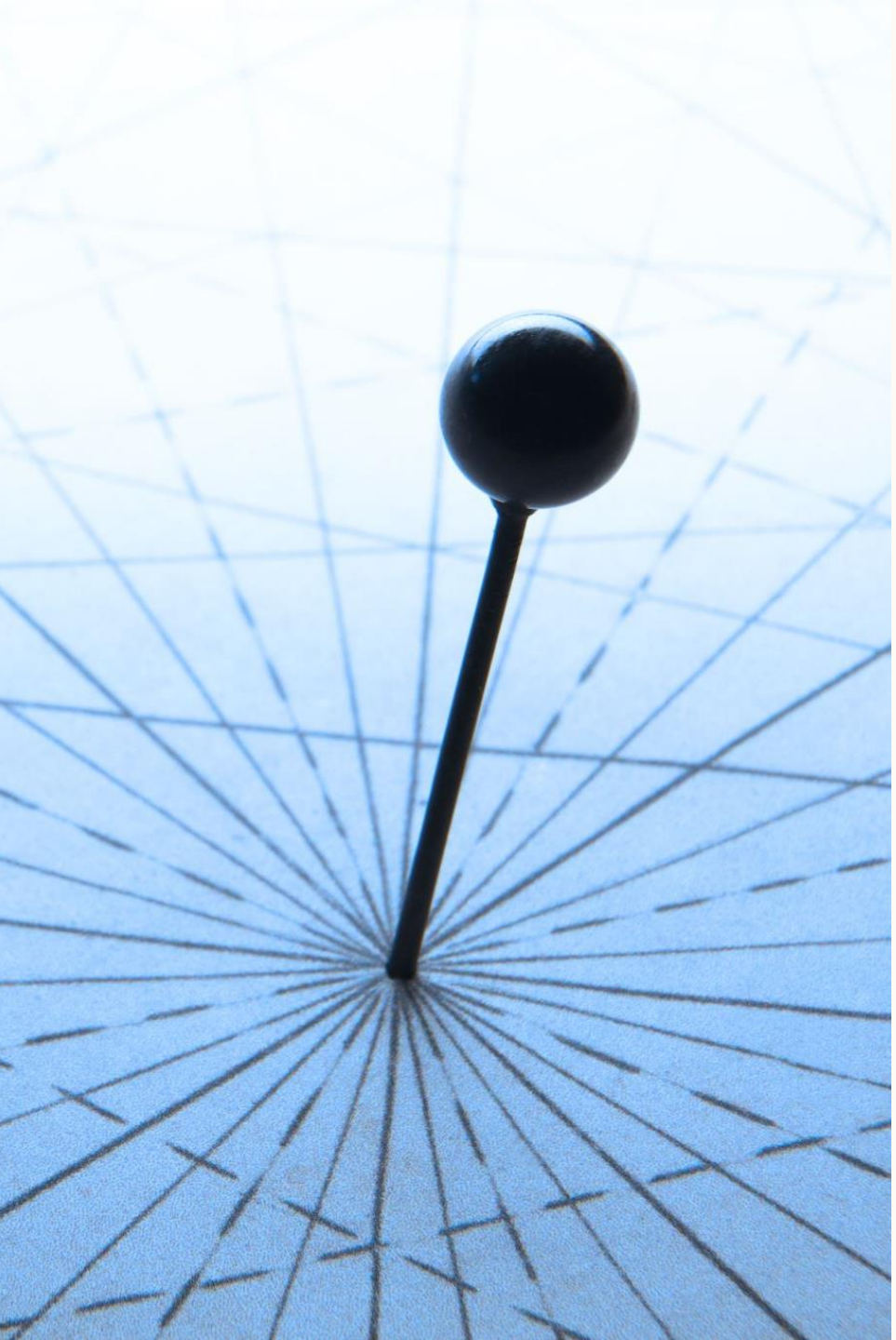


Income and inequality in Scandinavian countries. Source: Nordregio at www.nordregio.org. Cartographer: Gustaf Norlén
https://nordregio.org/maps/income-and-inequality-typology-2017/



Map; the Basics

- They display reality in a smaller scale
- They are a subtraction of reality – they depict a subset of information that has undergone processing, e.g., classification and simplification
- They are based on map projections to transform geographic coordinates (latitude and longitude) that refer to the surface of a sphere or an ellipsoid to plane coordinates on a flat surface
- They use symbols that consist of various types of graphical elements to represent spatial and non-spatial information



Functions of Maps

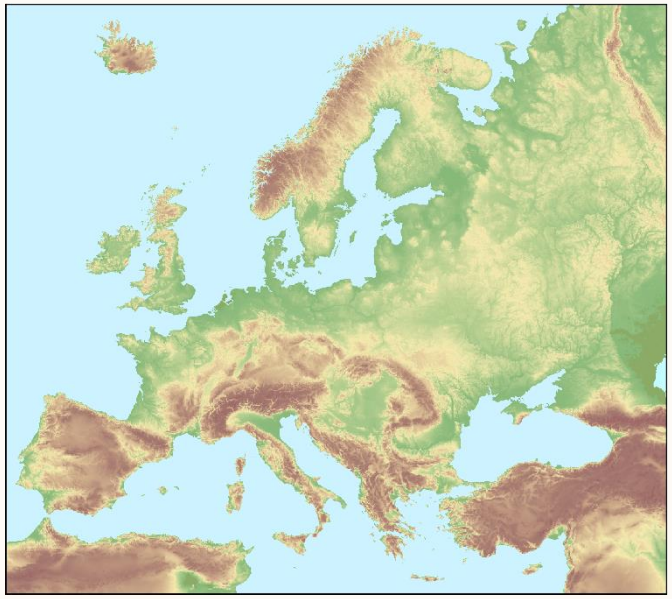
- Storing geospatial data
- Measurements and calculations
- Navigation
- Summary of large volumes of statistical data - interpretation of spatial phenomena
- Visualization of non-visible "phenomena", e.g., temperature, population, poverty

Map Types

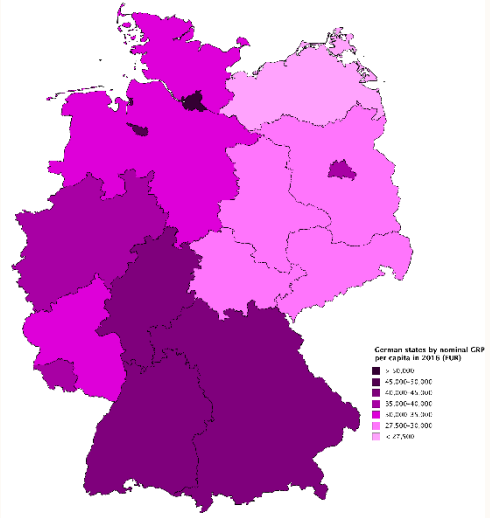
Map Types - I

- Depending on their function:
  - General reference maps show the locations of features, such as bodies of water, coastline, roads, plots, etc.
  - Thematic maps show the distribution of a phenomenon or the correlation between several phenomena.
  - Charts serve navigational needs, e.g., course planning, positioning, etc.
- Based on content: cadastral, soil, geological, statistical, etc.

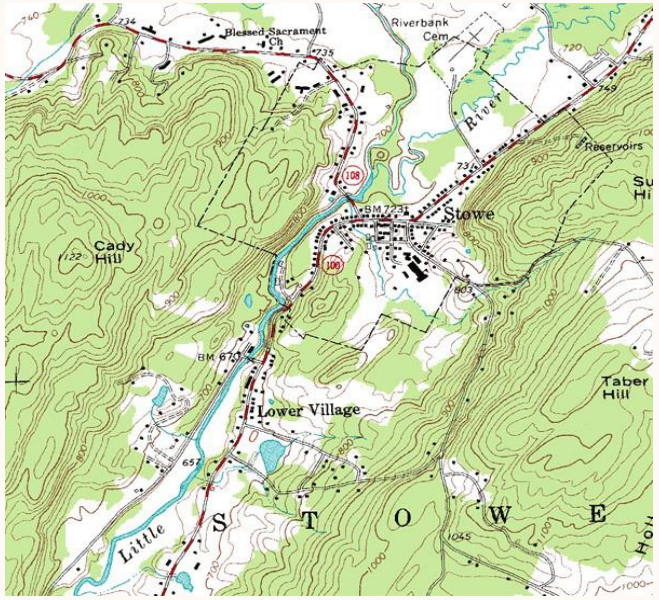
Map Types based on Function; Examples



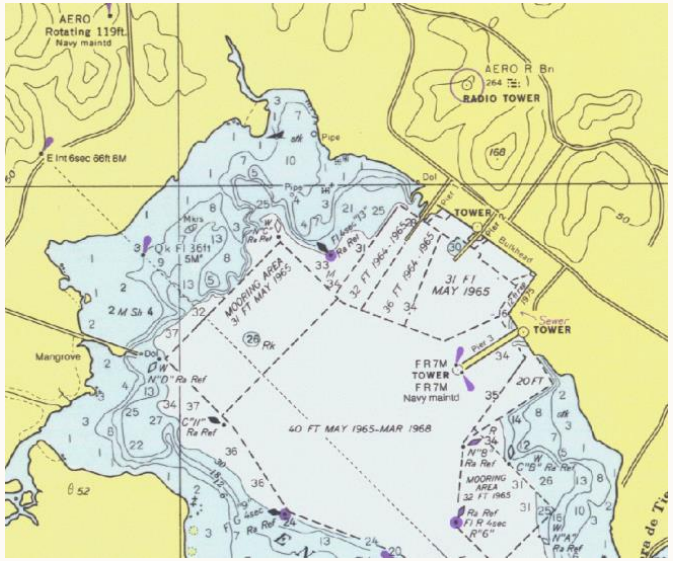
Elevation map of Europe, Copyright holder: European Environment Agency (EEA)
General reference map (a)



German states by nominal gross regional product (GRP) per capita in 2016 in euros, by JackintheBox - Own work, CC BY-SA 4.0,
Thematic map

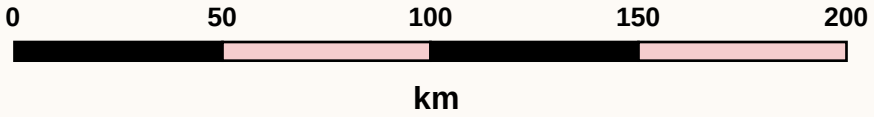


A topographic map of Stowe, Vermont with contour lines, USGS
General reference map (b)



Detail of a United States NOAA chart, showing a harbour area, NOOA
Chart

Map Types - II



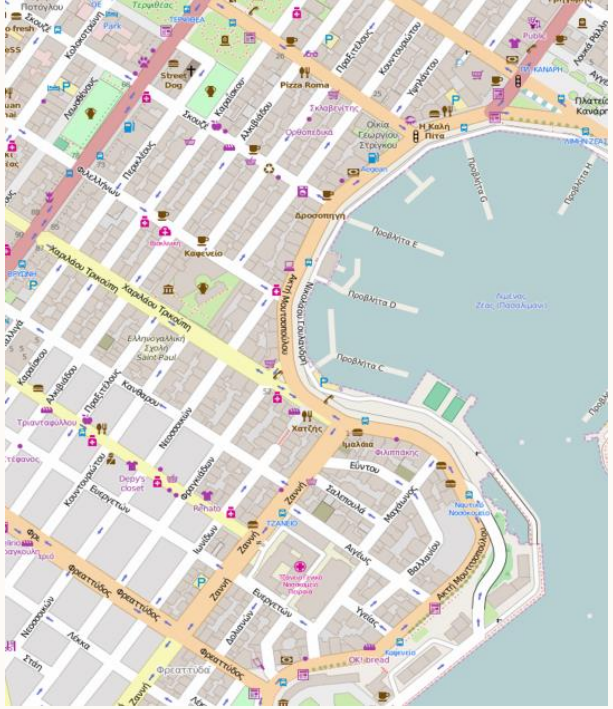
- Based on scale; refers to the relationship (or ratio) between distance on a map and the corresponding distance on the ground.

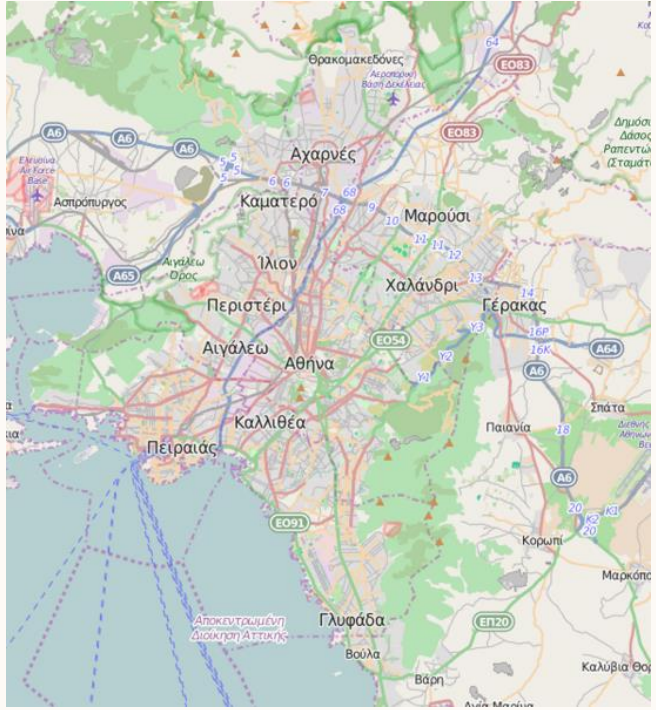
Expressions of scale:

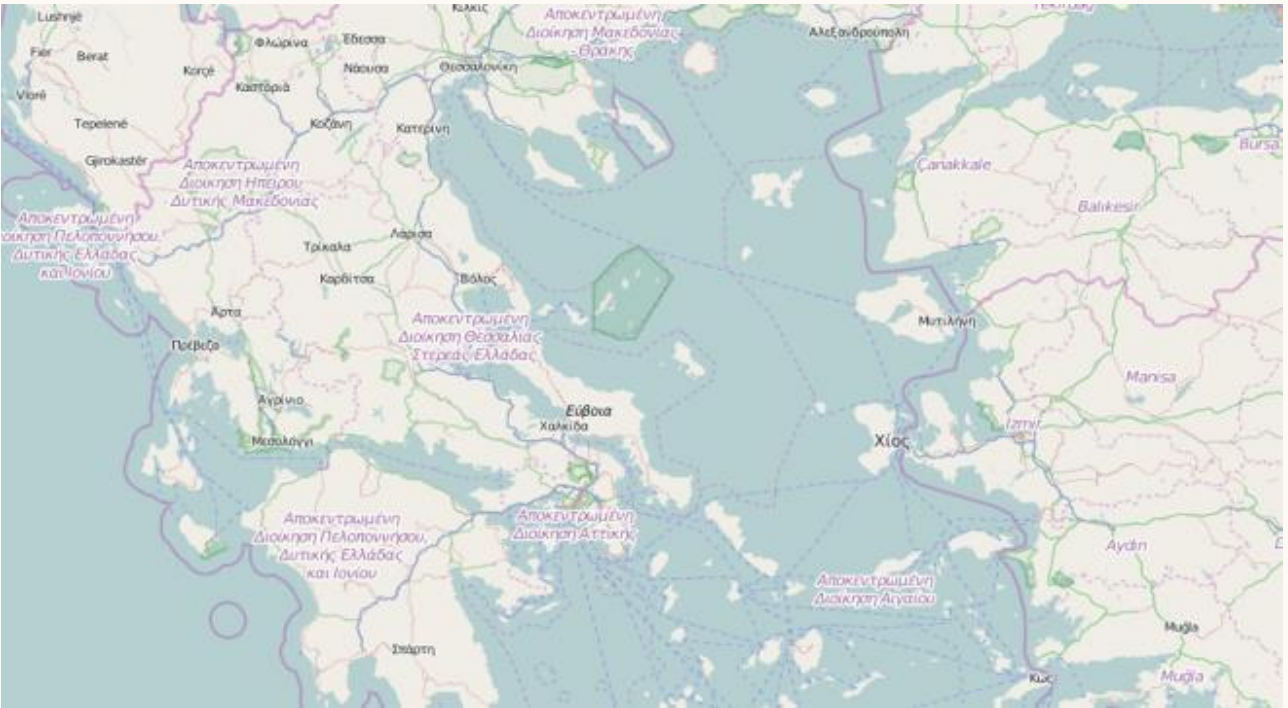
- Verbal Scale: "1 centimeter on the map represents 500 m on the ground"
- Representative function or ratio scale, e.g., 1:10.000 (one unit on the map corresponds to 10,000 units on the Earth's surface)
- Bar scale or graphic scale

Map categories:

- Small-(< 1:500,000)
- Medium- (1:500,000 < scale < 1:50,000)
- Large-scale (> 1:50,000)







Scale
“Zooming in and out”

Greece (bottom), Athens metropolitan area (top right), Pasalimani, Pireaus, Greece(top left) as seen from OpenStreetMap