Introduction to data science & artificial intelligence (INF7100)

Arthur Charpentier

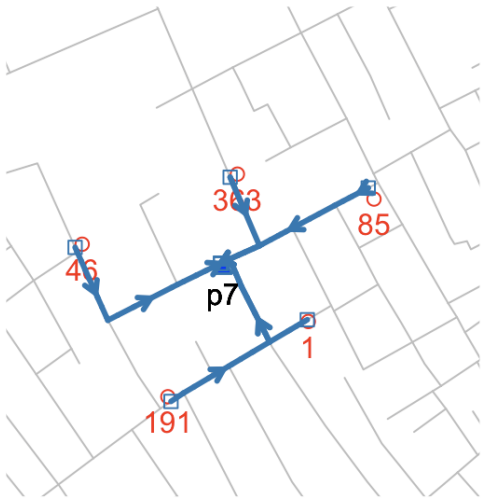
#423 Coordinates

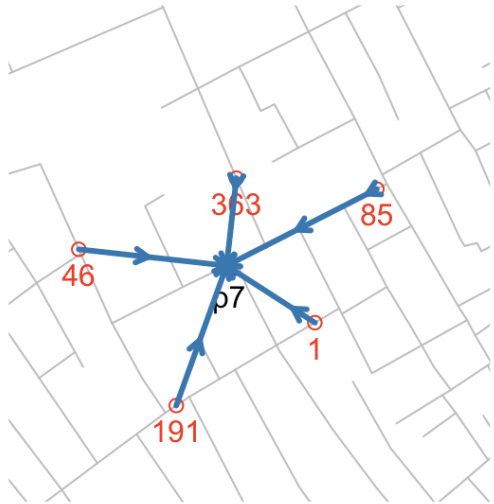
été 2020

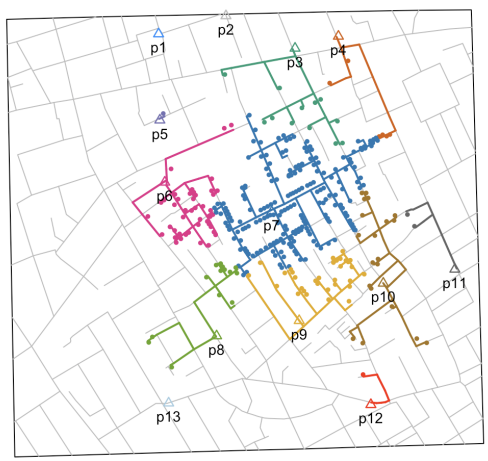
Projection & Spatial Data

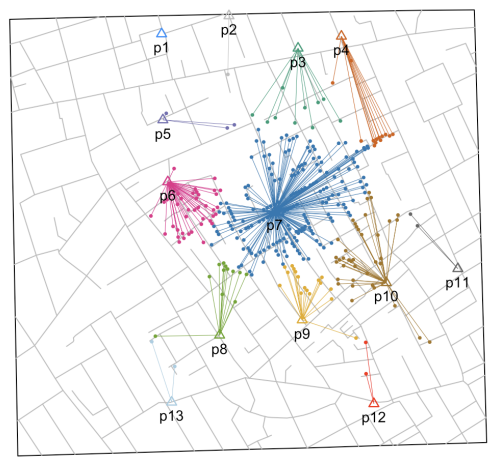
Cholera in London (Snow)

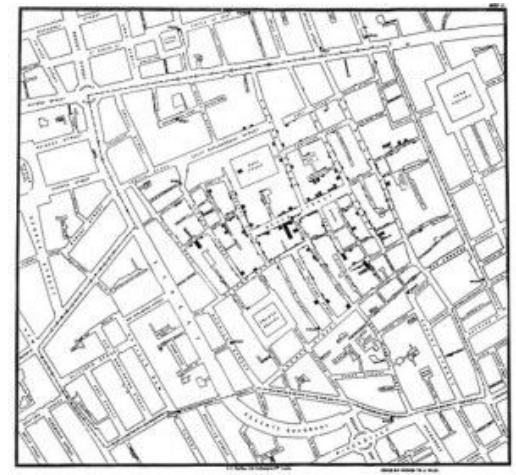
The cholera map that changed the world
(inspired by lindbrook's R codes)

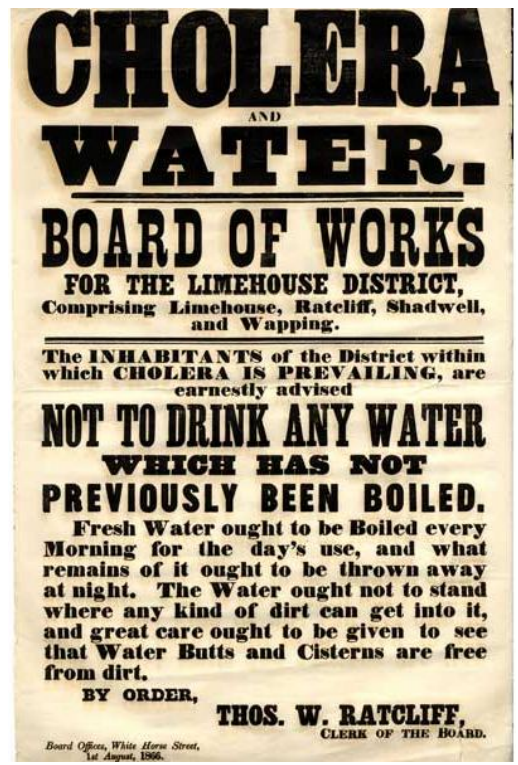












CHOLERA
AND
WATER.

BOARD OF WORKS
FOR THE LIMEHOUSE DISTRICT,
Comprising Limehouse, Ratcliff, Shadwell, and Wapping.

The INHABITANTS of the District within which CHOLERA IS PREVAILING, are earnestly advised

NOT TO DRINK ANY WATER
WHICH HAS NOT
PREVIOUSLY BEEN BOILED.

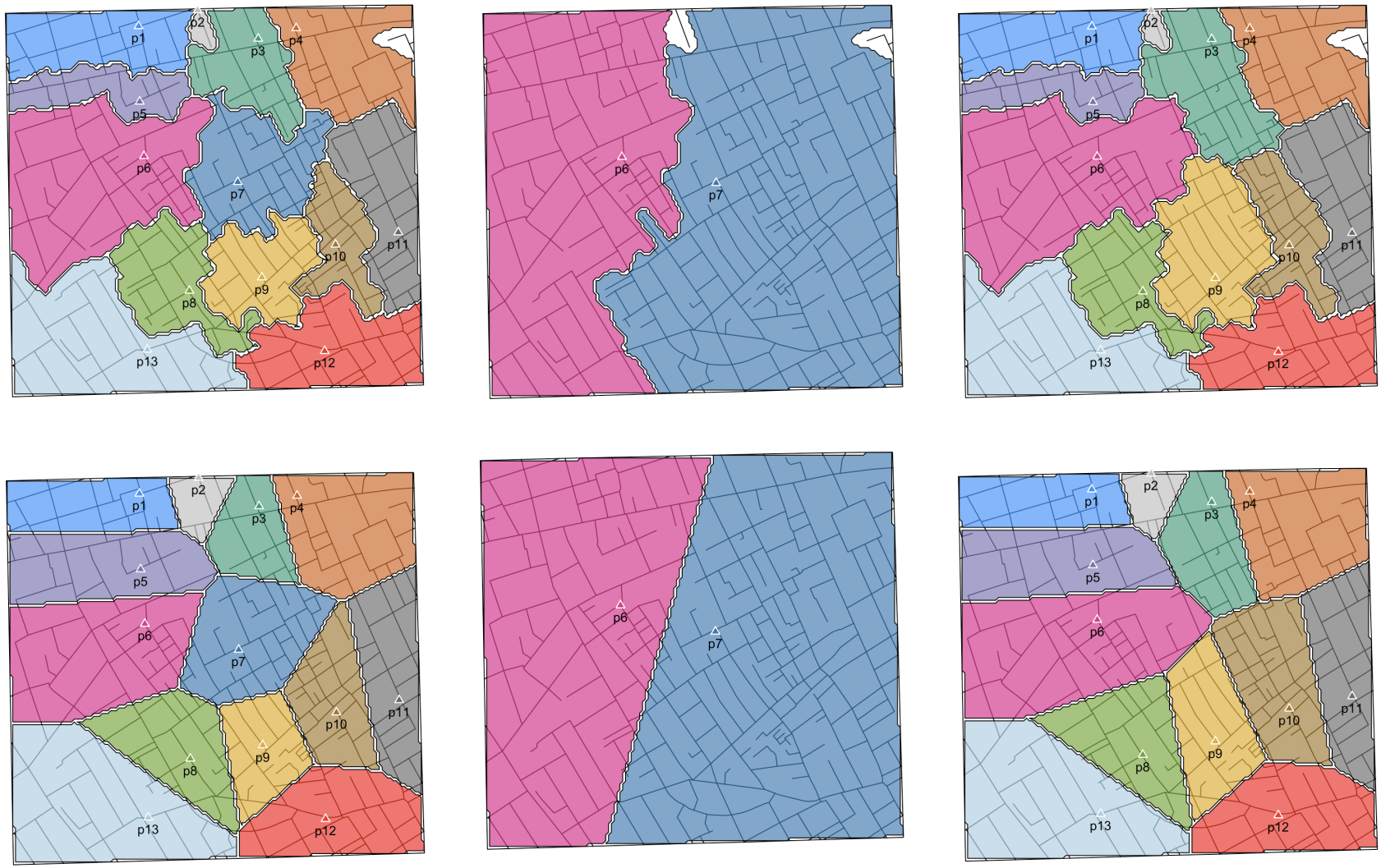
Fresh Water ought to be Boiled every Morning for the day's use, and what remains of it ought to be thrown away at night. The Water ought not to stand where any kind of dirt can get into it, and great care ought to be given to see that Water Butts and Cisterns are free from dirt.

BY ORDER,

THOS. W. RATCLIFF,
CLERK OF THE BOARD.

Board Offices, White Horse Street, 1st August, 1866.

Cholera in London (Snow)



See also Optimal transport on large networks: a practitioner guide

Angles

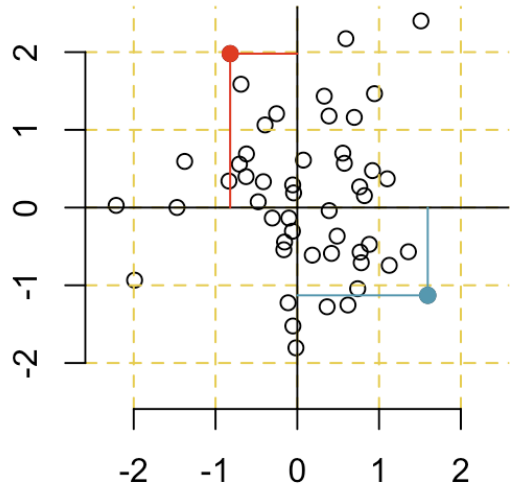
Classical reprensentation,

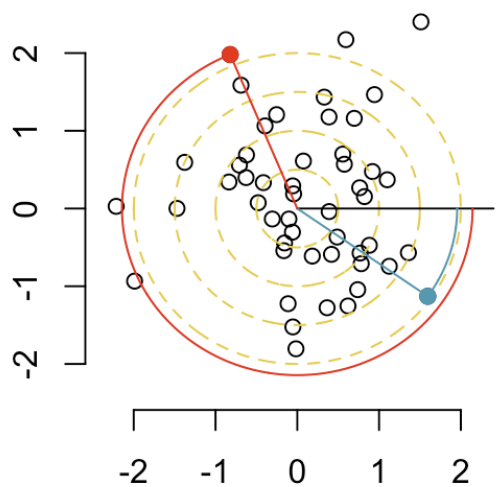
$$\boldsymbol{z} = \begin{pmatrix} x \\ y \end{pmatrix}$$ in the cartesian coordinate system

Alternatively, use polar coordinates

$$\boldsymbol{z} = \begin{pmatrix} r\cos(\theta) \\ r\sin(\theta) \end{pmatrix}$$

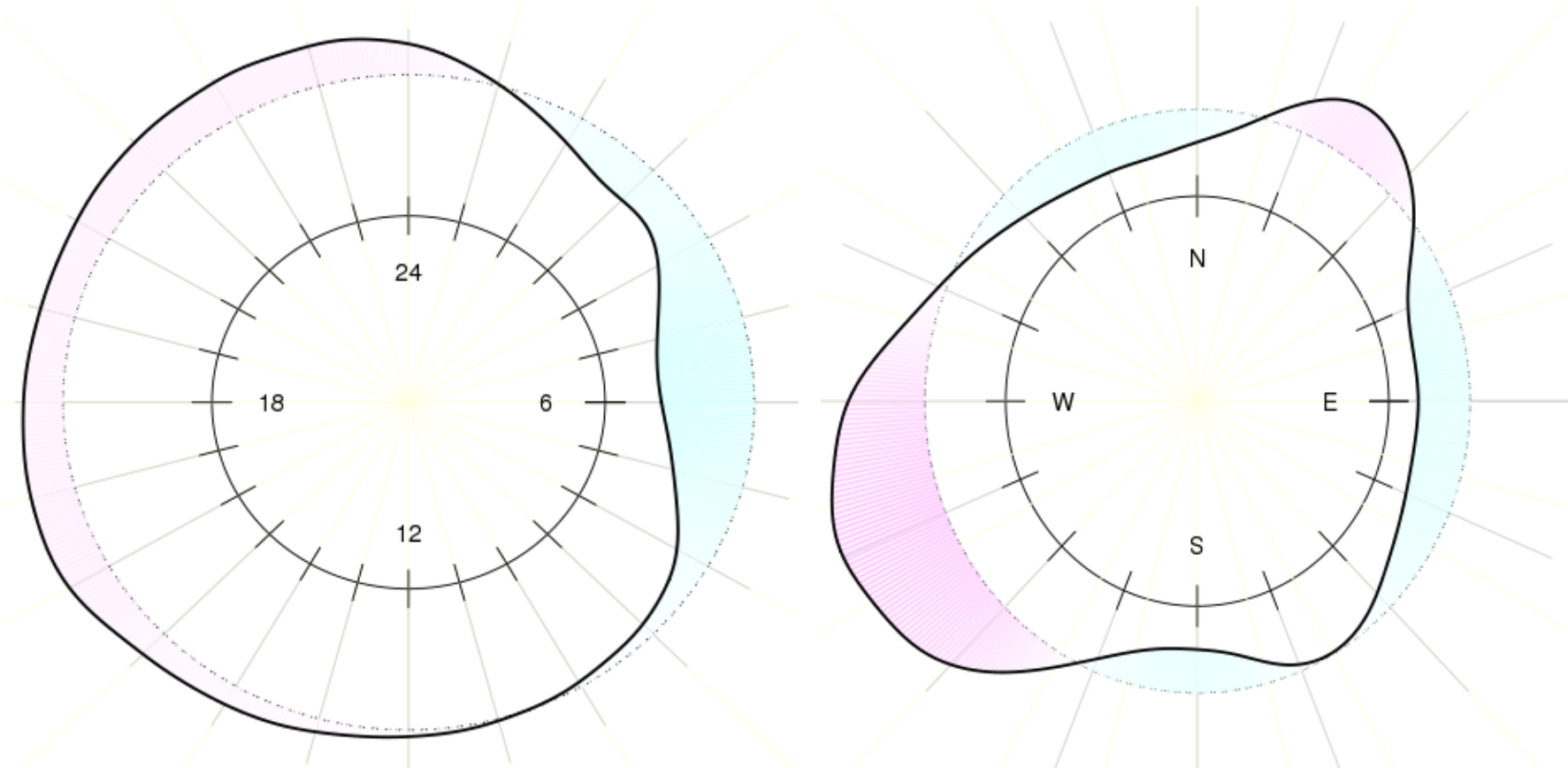
see circular data





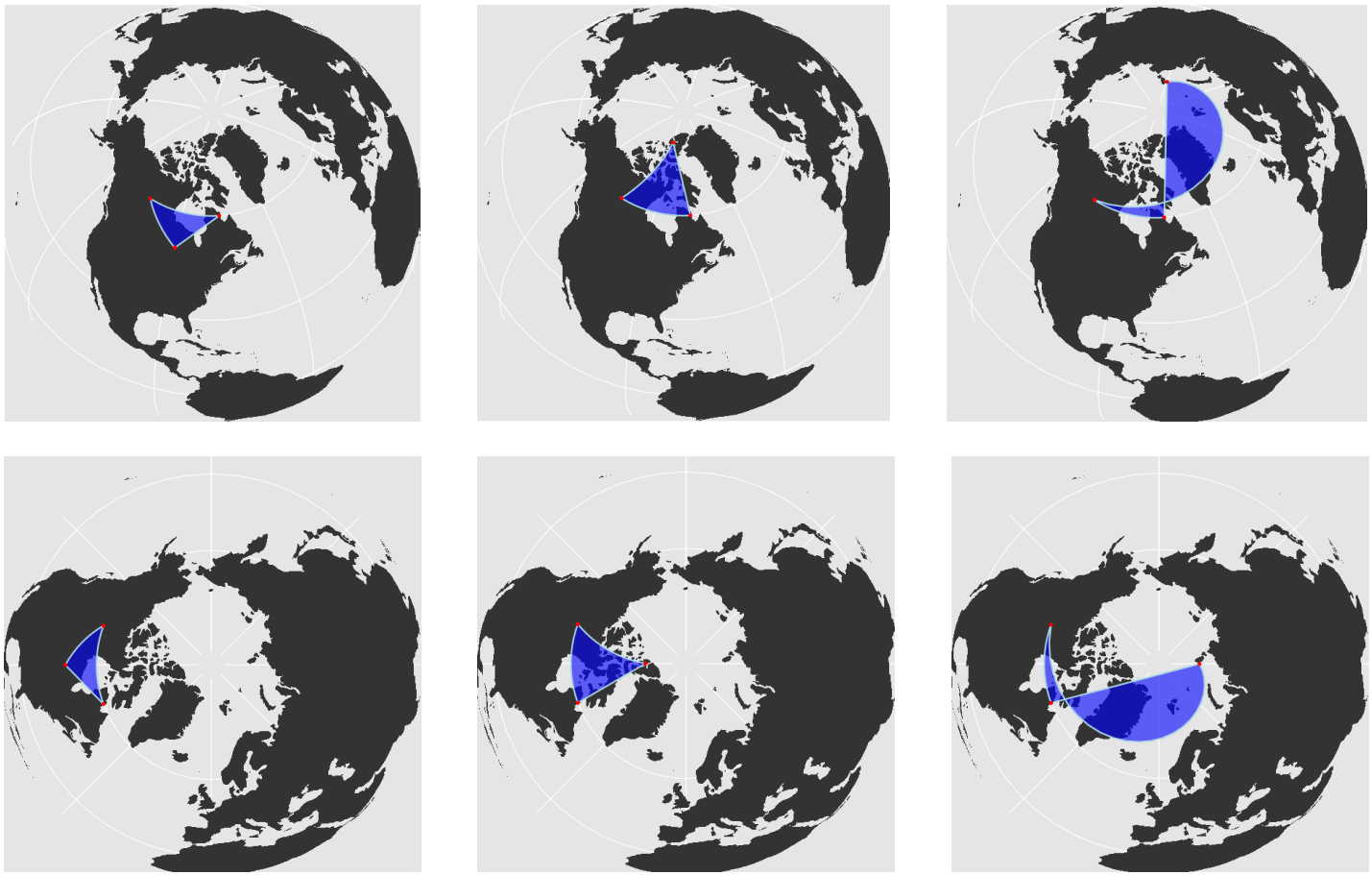
Circular Data

E.g. phone calls at 911, time of the day (left) and wind direction in Montréal (right)



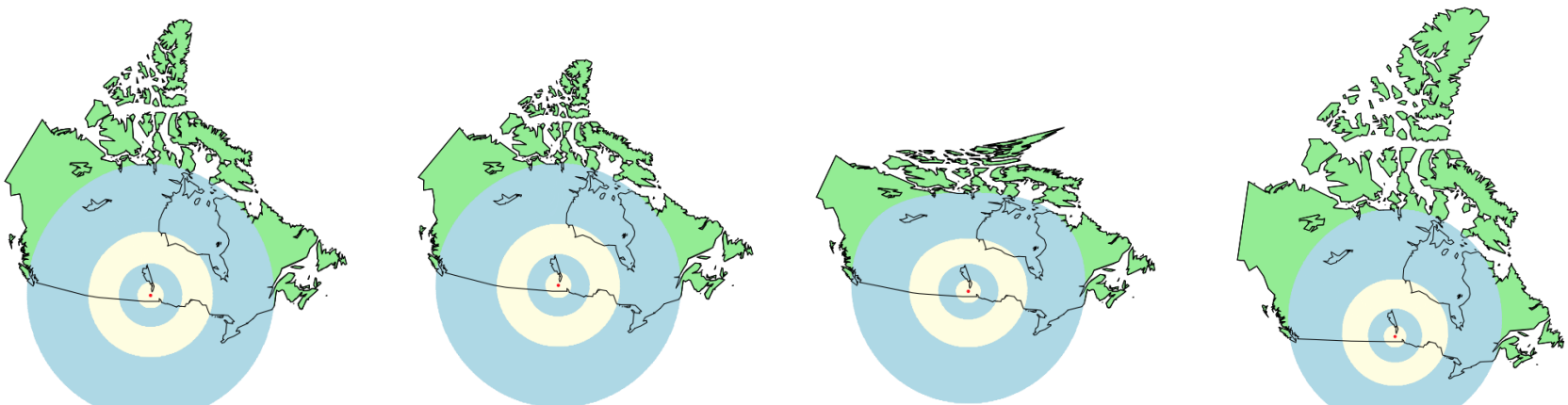
Spatial Data

Problem of circular/spherical data expressed in cartesian coordinates (latitude, longitude): singularity of the poles.



Projections

CRS (Coordinate Represenation Systems) can get complicated



Maps: Dots, Lines and Polygons

See minimalist maps (with R codes)
with dots (cities), lines (rivers, roads) and polygons (lakes)