Using R to find the most central points in object data

Vida Zamani
University of Turku, Finland

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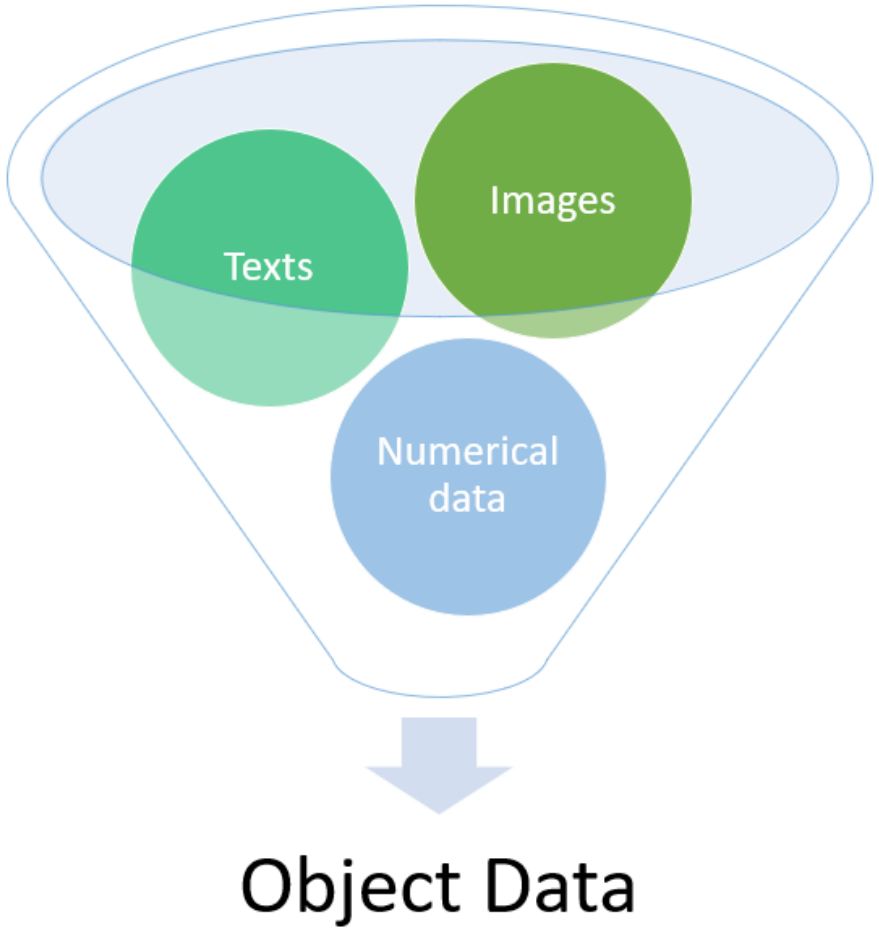
Object Data



Importance of Analyzing Object Data

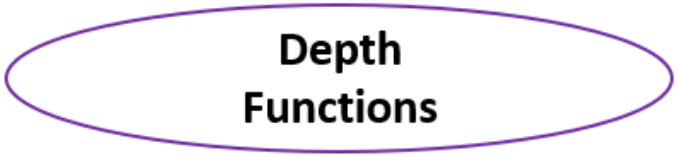
$$\begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix} \quad \begin{bmatrix} 1 & 0 & 0 \\ 0 & 0 & 1 \\ 0 & 1 & 0 \end{bmatrix}$$

$$\begin{bmatrix} 0 & 1 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 1 \end{bmatrix} \quad \begin{bmatrix} 0 & 1 & 0 \\ 1 & -1 & 1 \\ 0 & 1 & 0 \end{bmatrix} \quad \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ 1 & 0 & 0 \end{bmatrix}$$

$$\begin{bmatrix} 0 & 0 & 1 \\ 1 & 0 & 0 \\ 0 & 1 & 0 \end{bmatrix} \quad \begin{bmatrix} 0 & 0 & 1 \\ 0 & 1 & 0 \\ 1 & 0 & 0 \end{bmatrix}$$

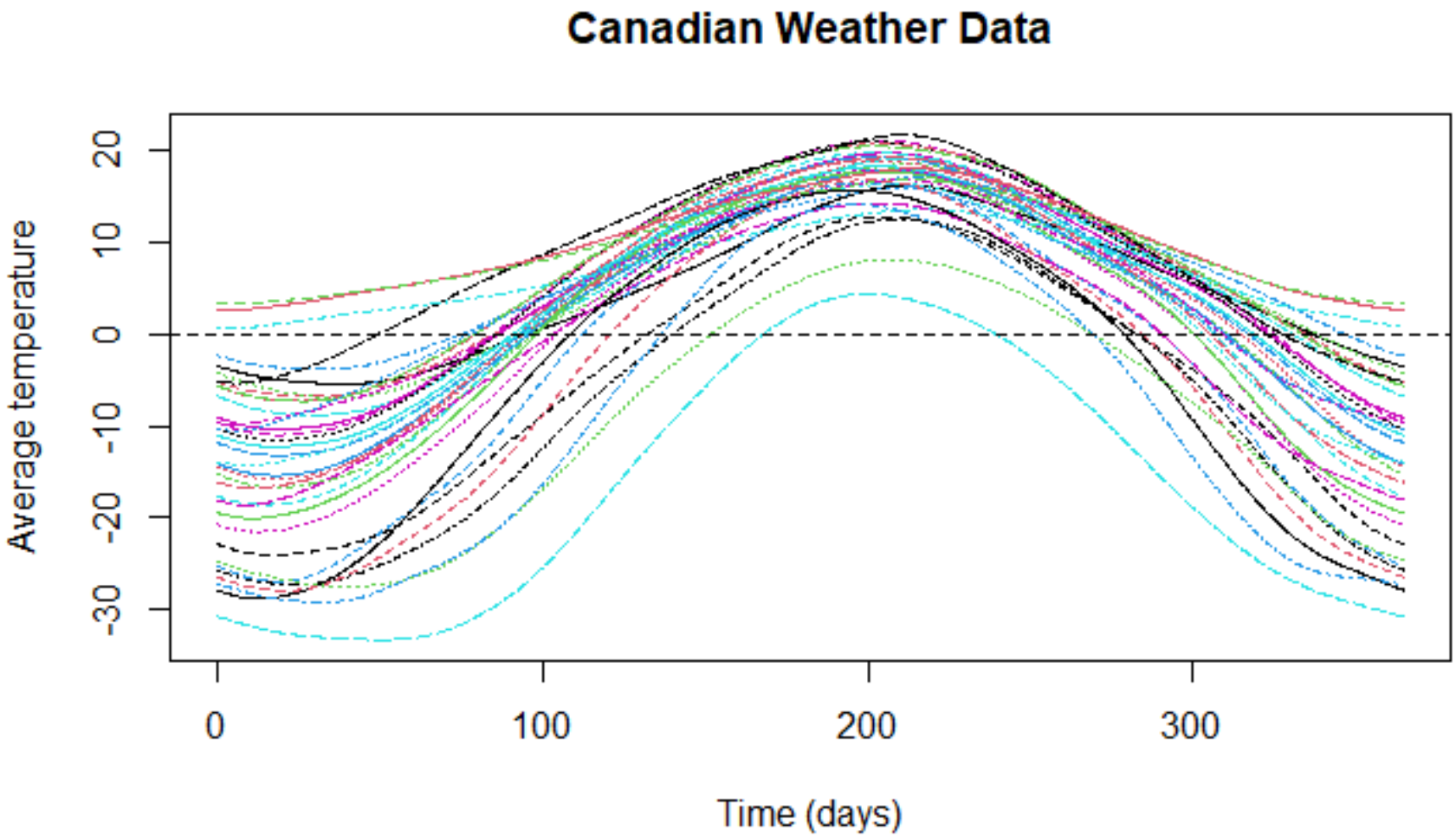
Table: The path of Descriptive Analysis

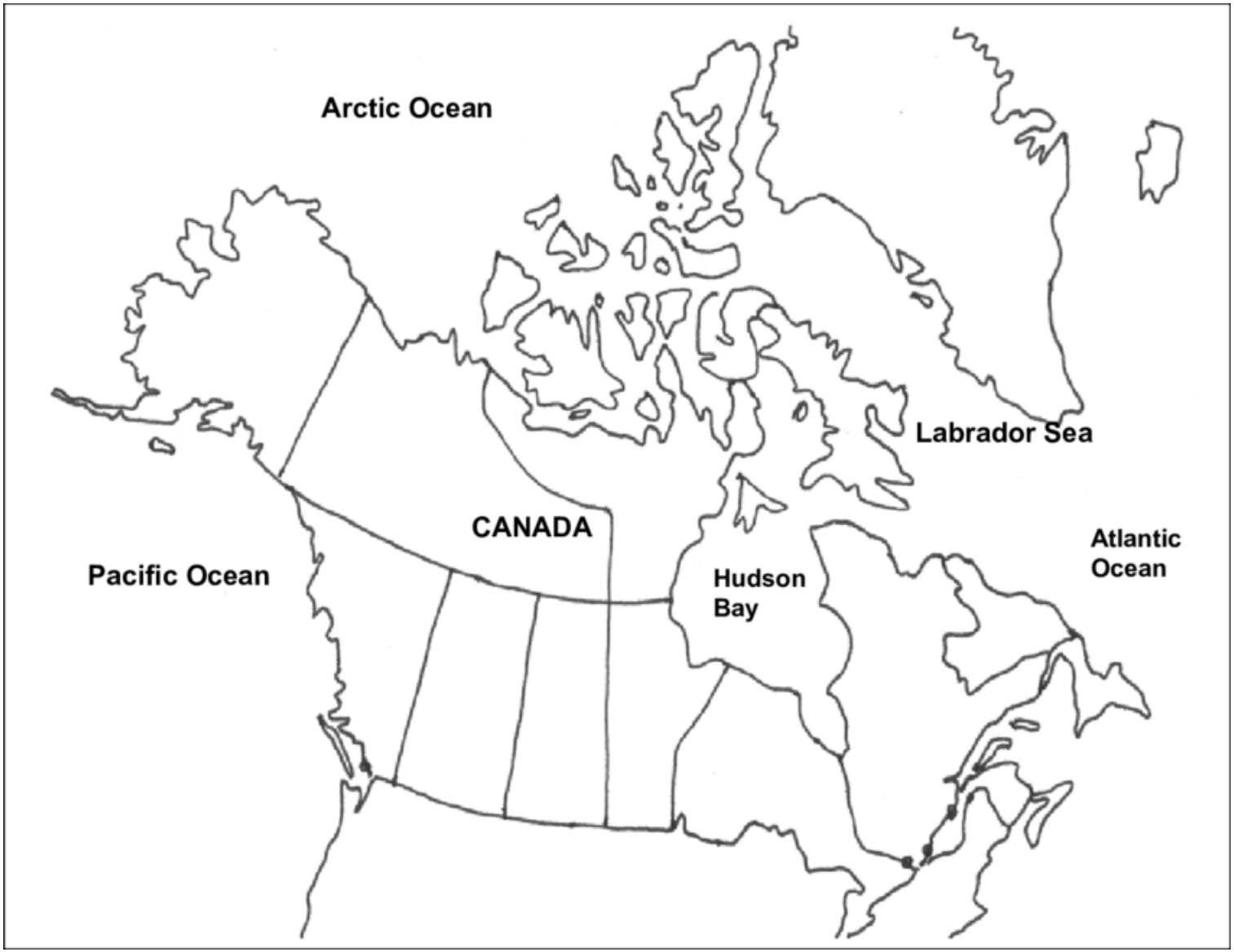
	Euclidean Space	**Object data**
Depth Functions	Tukey's depth	Metric halfspace depth
Mean	Mean sample	Fréchet mean
Dimension Reduction	PCA	MDS
...	...	...
...	...	...
...	...	...

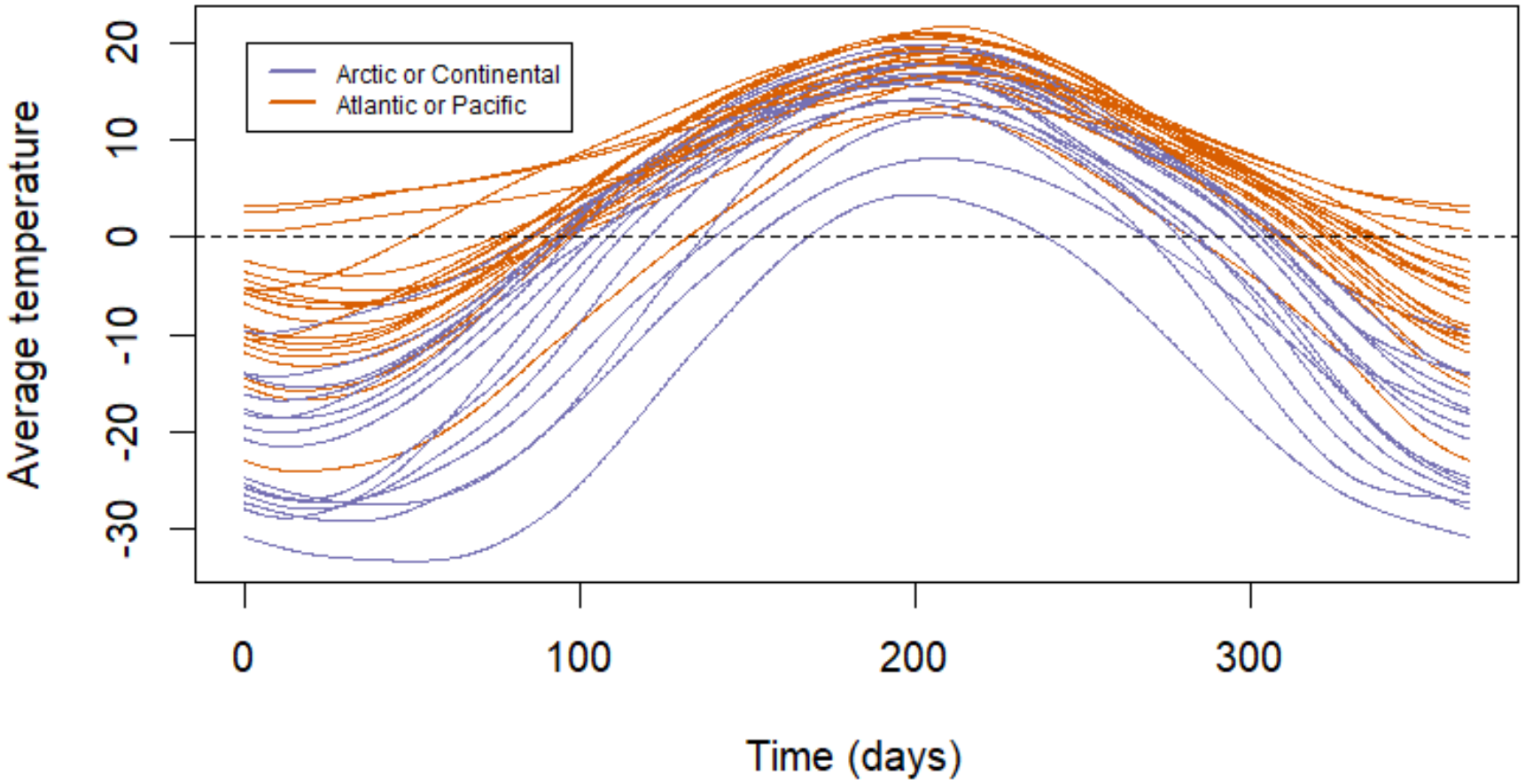


Euclidean Space		Metric Space
Half Space depth (Tukey, 1975)	→	Half Space depth (Dai, 2022)
Oja Depth (1983)	→	------
The Simplicial Depth	→	------
Spatial Depth or L_1- Depth	→	Spatial Depth (Virta, 2023)
Lens Depth (2011)	→	Lens Depth (Geenens, 2023)

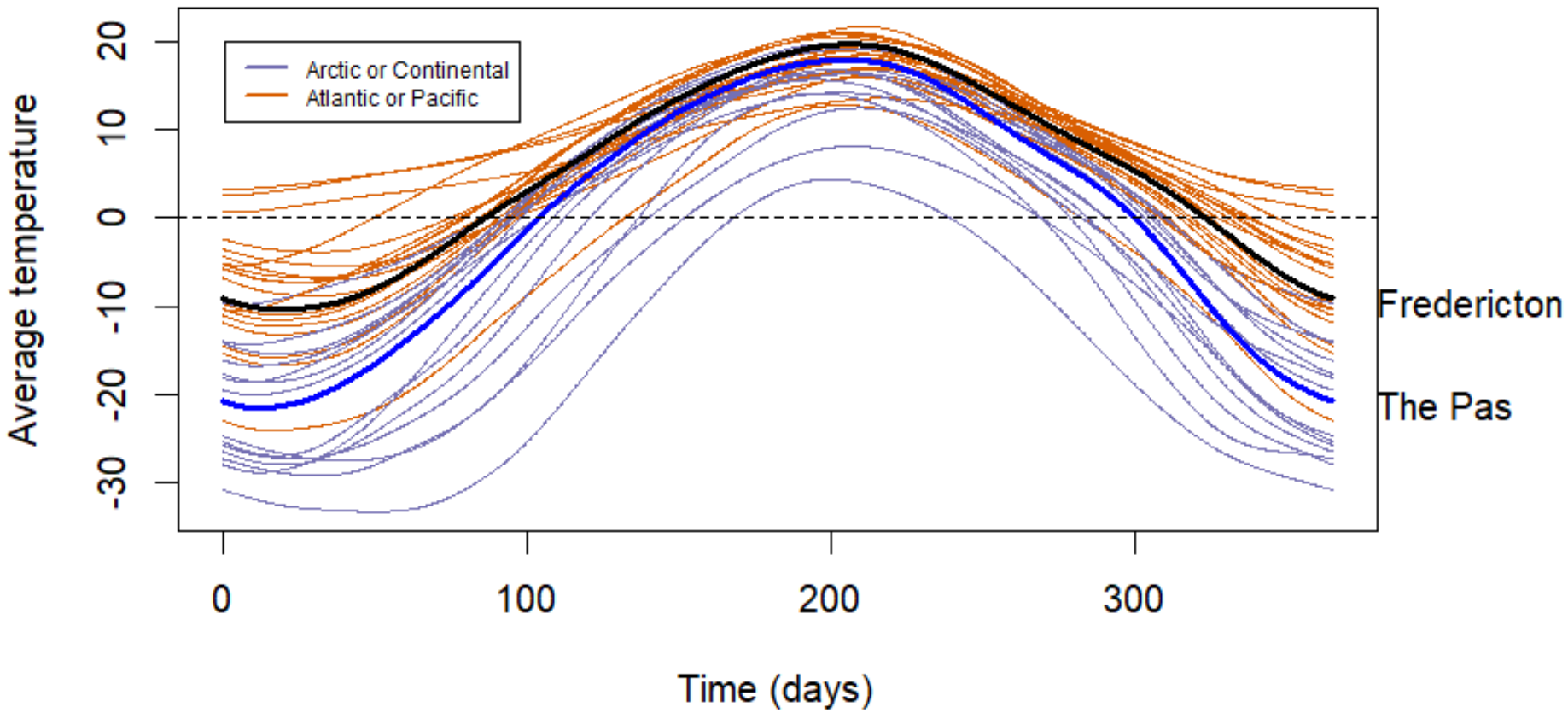
Case Study

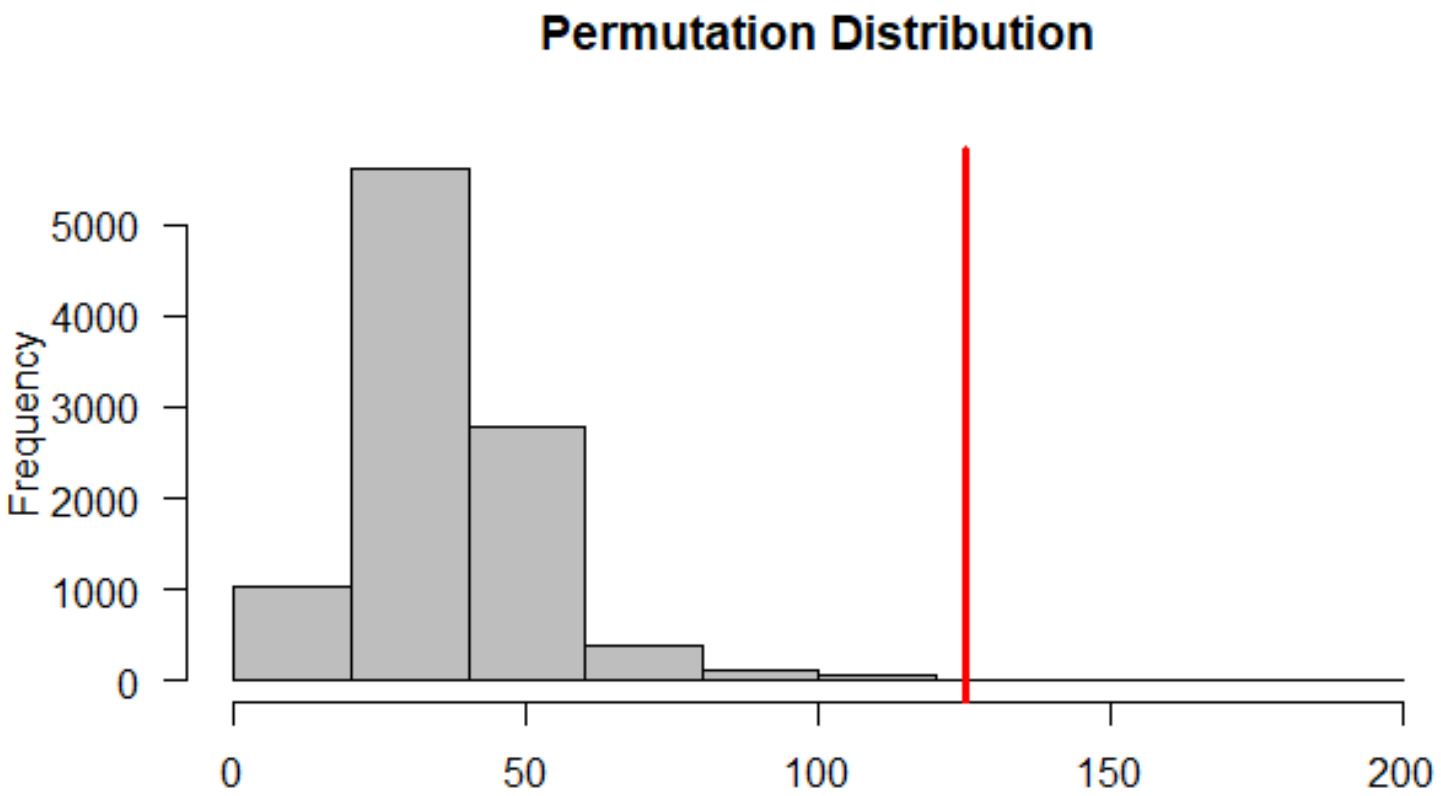

Canadian Weather Data
Average temperature
20
10
0
-10
-20
-30
0
100
200
300
Time (days)


Arctic Ocean
Labrador Sea
CANADA
Pacific Ocean
Hudson Bay
Atlantic Ocean


Arctic or Continental
Atlantic or Pacific
Average temperature
20
10
0
-10
-20
-30
0
100
200
300
Time (days)

Deepest Stations in each groups




Permutation Distribution
Frequency
5000
4000
3000
2000
1000
0
0
50
100
150
200


Thank you!