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Visualization and Analysis –

Tutorial Presentation for Feedback

University of Hertfordshire UH

Date: 26 November 2025

Part 1: VISUALISATION

We are using the dataset **DS134 - london_weather.csv** to answer our Research Question "Is there a difference in the mean of daily precipitation among the seasons in London from 1979 to 2020?"

	date	cloud_cover	sunshine	global_radiation	max_temp	mean_temp	min_temp	precipitation	pressure	snow_depth
	<dbl>	<dbl>	<dbl>	<dbl>	<dbl>	<dbl>	<dbl>	<dbl>	<dbl>	<dbl>
1	19790101	2	7	52	2.3	-4.1	-7.5	0.4	101900	9
2	19790102	6	1.7	27	1.6	-2.6	-7.5	0	102530	8
3	19790103	5	0	13	1.3	-2.8	-7.2	0	102050	4
4	19790104	8	0	13	-0.3	-2.6	-6.5	0	100840	2
5	19790105	6	2	29	5.6	-0.8	-1.4	0	102250	1

The database has 10 columns and 15,341 Rows. We will use `precipitation`(mm) and `date` columns.

Independent Variable: `date` ==> `Season` (Nominal) | Dependent Variable: `precipitation` (Interval)

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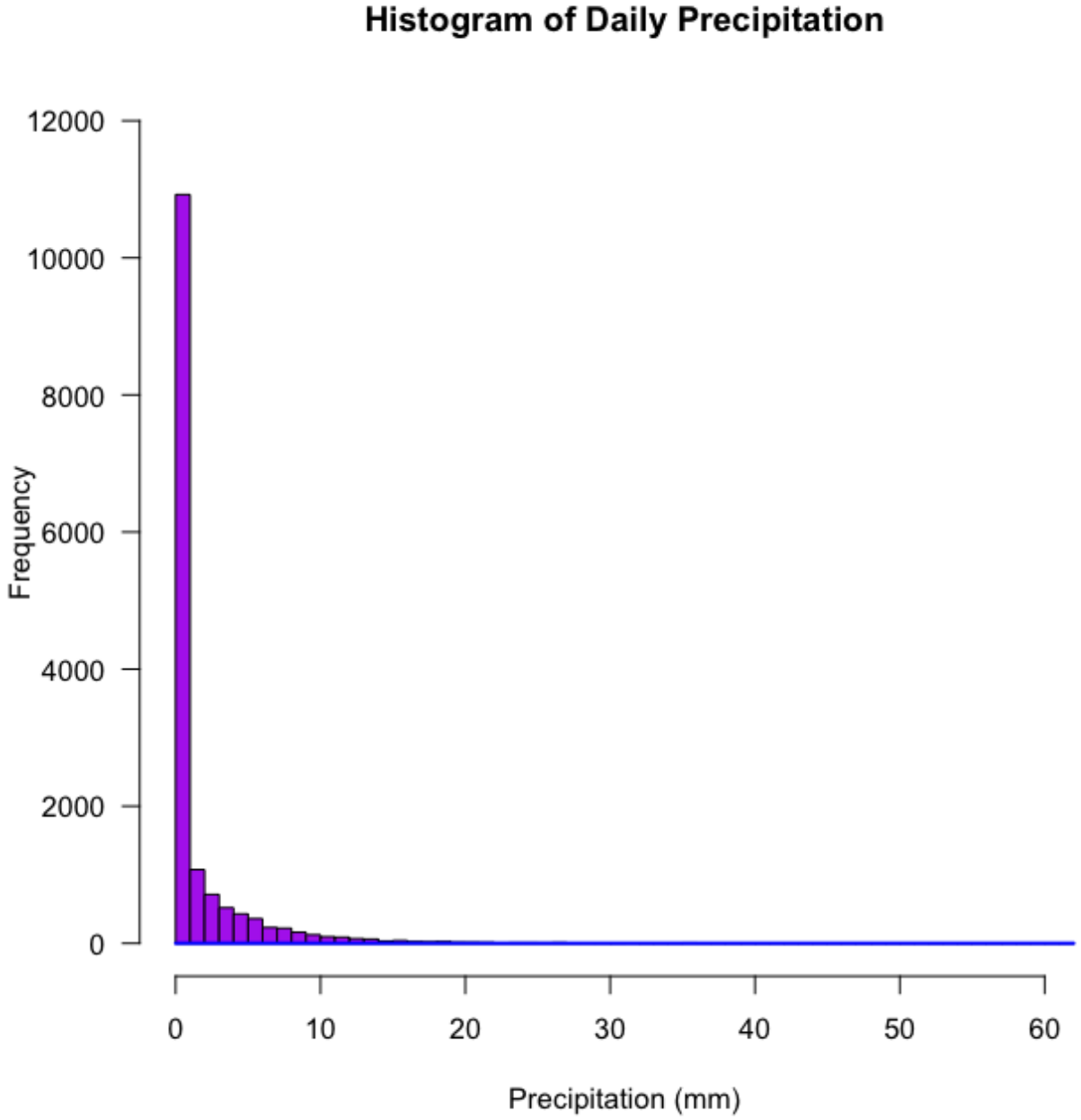
Variable `precipitation`(mm) is **not normally** distributed.



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```
$Autumn
   Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
  0.000   0.000   0.100   1.901   1.800  59.400

$Spring
   Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
  0.000   0.000   0.000   1.462   1.400  61.800

$Summer
   Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
  0.000   0.000   0.000   1.573   1.000  51.600

$Winter
   Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
  0.000   0.000   0.200   1.742   2.000  35.600
```

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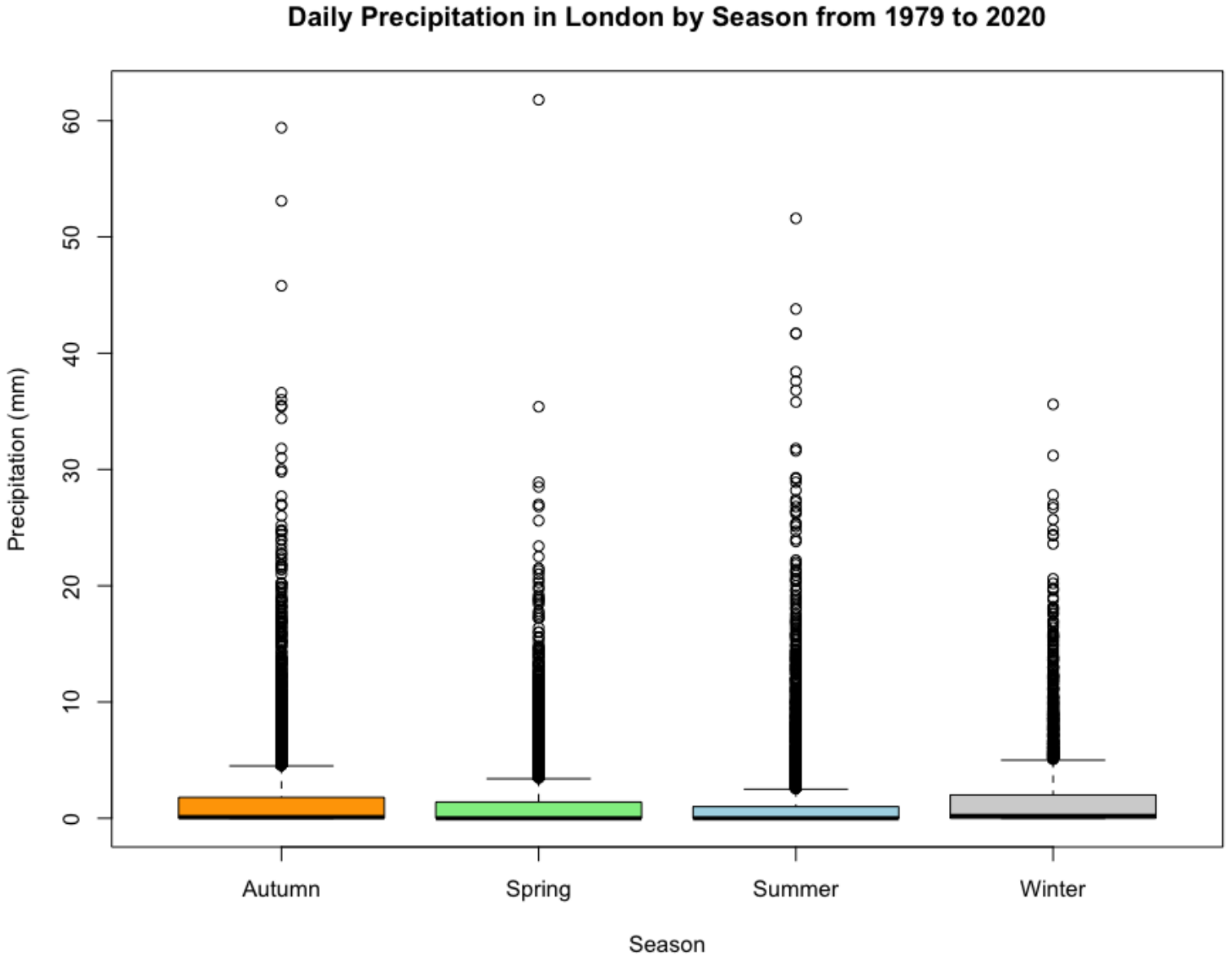

Part 2: Analysis (building on your Visualizations)

~~Null hypothesis (H_0): There is **no difference** in the mean of daily precipitation among the seasons in London.~~
Alternative hypothesis (H_1): There is **a difference** in the mean of daily precipitation among the seasons in London.

```
> pairwise.wilcox.test(df$precipitation, df$season, p.adjust.method = "holm")

        Pairwise comparisons using Wilcoxon rank sum test with continuity correction

data:  df$precipitation and df$season

       Autumn  Spring  Summer
Spring 8.0e-07 -       -
Summer 2.8e-16 0.0021  -
Winter 0.0021  2.8e-16 < 2e-16

P value adjustment method: holm
```

This means that precipitation patterns in London from 1979 to 2020 are specific to each of the four seasons.

Winter	1			
Spring	8.0e-07 Very significant difference	1		
Summer	2.8e-16 Very significant difference	0.0021 significant difference	1	
Autumn	0.0021 significant difference	2.8e-16 Very significant difference	< 2e-16 Very significant difference	1
	Winter	Spring	Summer	Autumn

```r
# R codes used for analysis and visualization

library(readr)
df <- read_csv("london_weather.csv")

# create year and month column
df$year <- as.numeric(substr(as.character(df$date), 1, 4))
df$month <- as.numeric(substr(as.character(df$date), 5, 6))

df$season <- "Autumn"
df$season[df$month %in% c(12, 1, 2)] <- "Winter"
df$season[df$month %in% c(3, 4, 5)] <- "Spring"
df$season[df$month %in% c(6, 7, 8)] <- "Summer"

df$season_year <- paste(df$season, df$year)

# Clear NA from the data :

sum(is.na(df$date))
sum(is.na(df$precipitation)) #We have 6 NA

df <- df[!is.na(df$date) & !is.na(df$precipitation), ]
sum(is.na(df$precipitation))

View(df)
```

```r
hist(df$precipitation,
     main = "Histogram of Daily Precipitation",
     xlab = "Precipitation (mm)",
     ylab = "Frequency",
     col = "darkorchid2",
     breaks = 50,
     ylim = c(0, 12000),
     las = 1,
)

boxplot(precipitation ~ season, data = df,
        main = "Daily Precipitation in London by Season from 1979 to 2020",
        xlab = "Season",
        ylab = "Precipitation (mm)",
        col = c("orange", "lightgreen", "lightblue", "lightgray"),
        border = "black")

tapply(df$precipitation, df$season, summary)

# Pairwise Wilcoxon Test

pairwise.wilcox.test(df$precipitation, df$season, p.adjust.method = "holm")
```

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