Air Quality Analysis with Openair

- R STUDIO
- OPENAIR PACKAGE
- AIR POLLUTANTS
- METEOROLOGY
- VISUALIZATIONS

Required Activities Prior Use of Openair Package in R

#Datasets gathering/extraction (excel/csv file)

#Data preparation & cleaning (excel)

#Handling missing data (R studio)

#Data manipulation

#Normality test

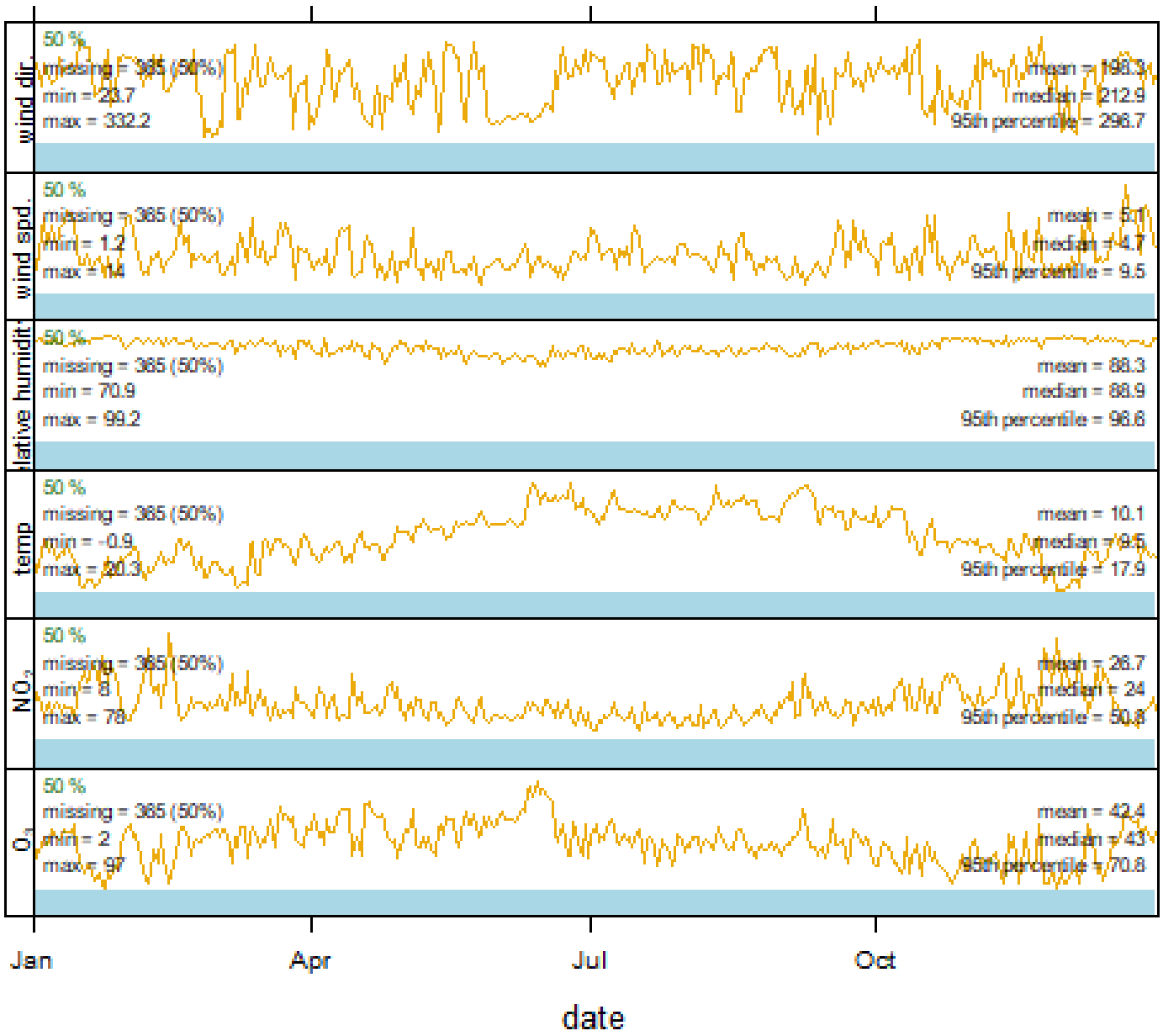
#Convert date components to factor

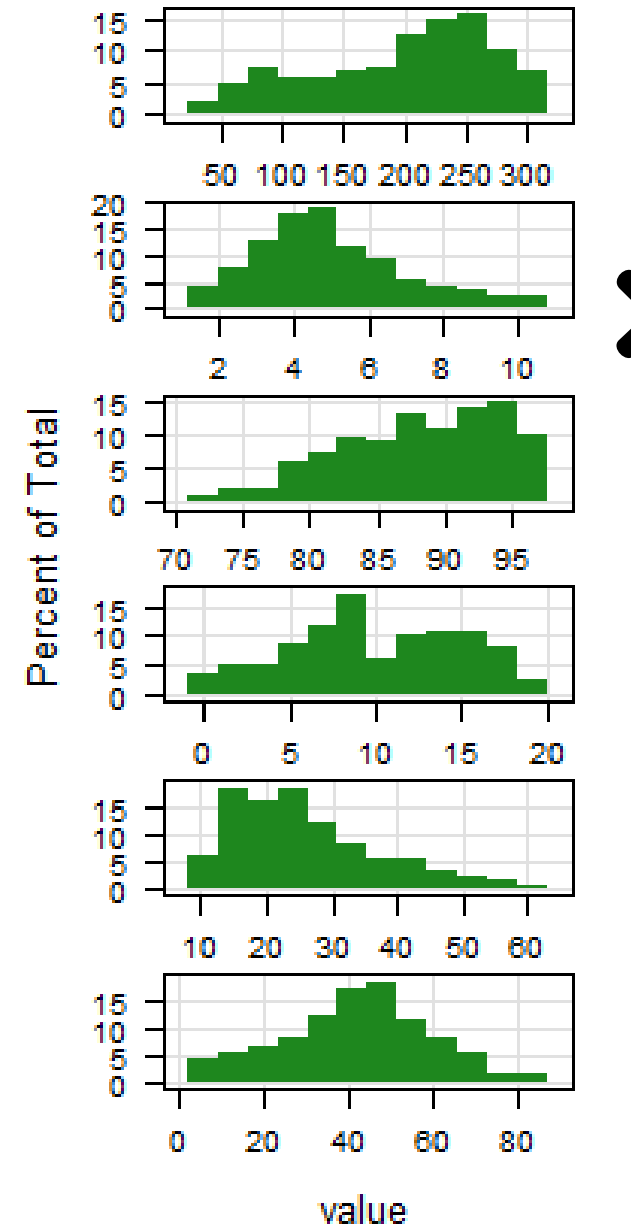
R codes for some analysis using the Openair package functions are presented for air quality datasets from Manchester, UK for the year 2023.

@DonAniche

#summary plot for time series and distribution histogram

summaryPlot(air_manchester3)



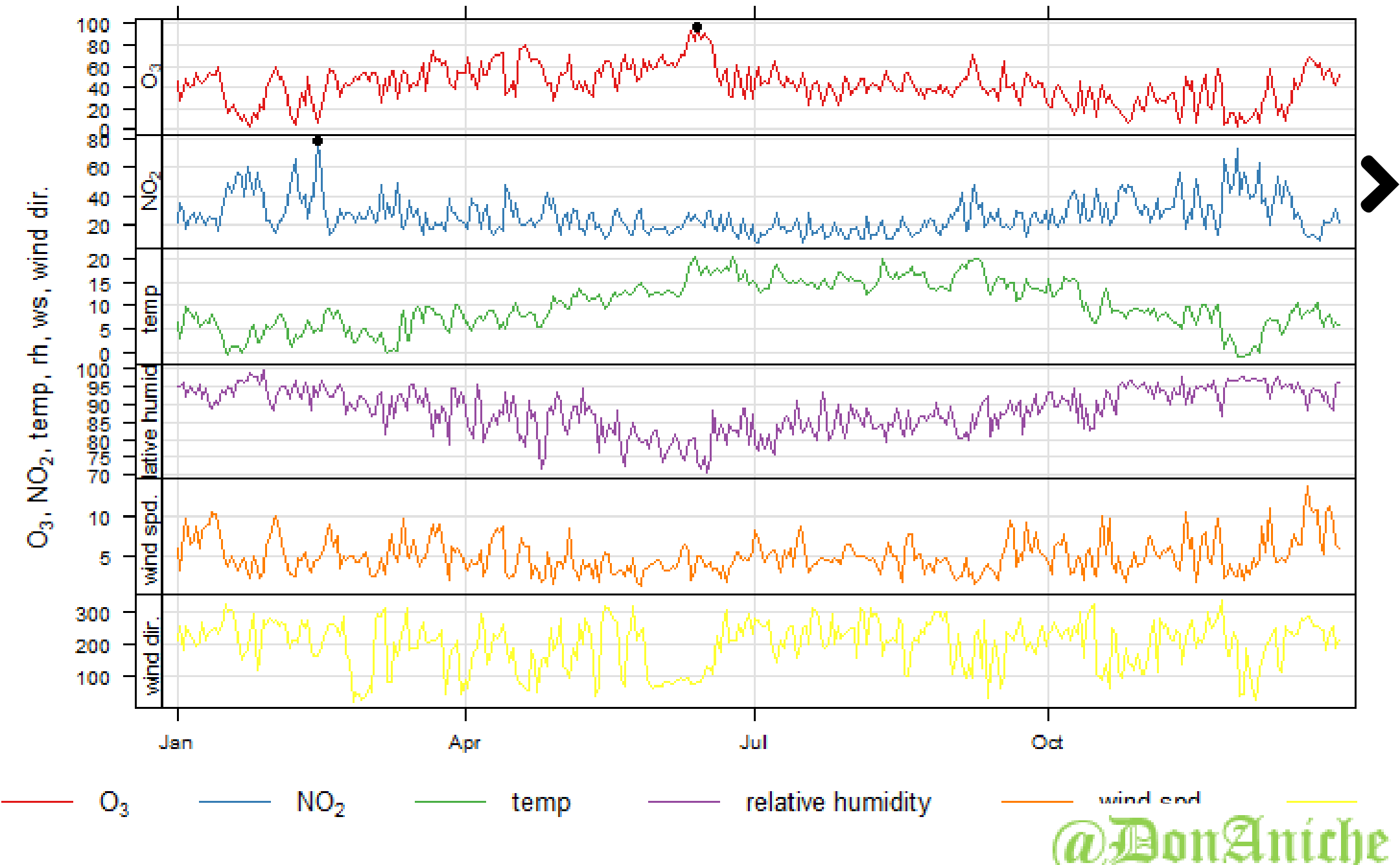


#timeplot for all variables in one frame

timePlot(selectByDate(air_manchester3, month = 1:12), pollutant = c("ozone", "no2", "temp", "rh", "ws", "wd"), y.relation = "free")

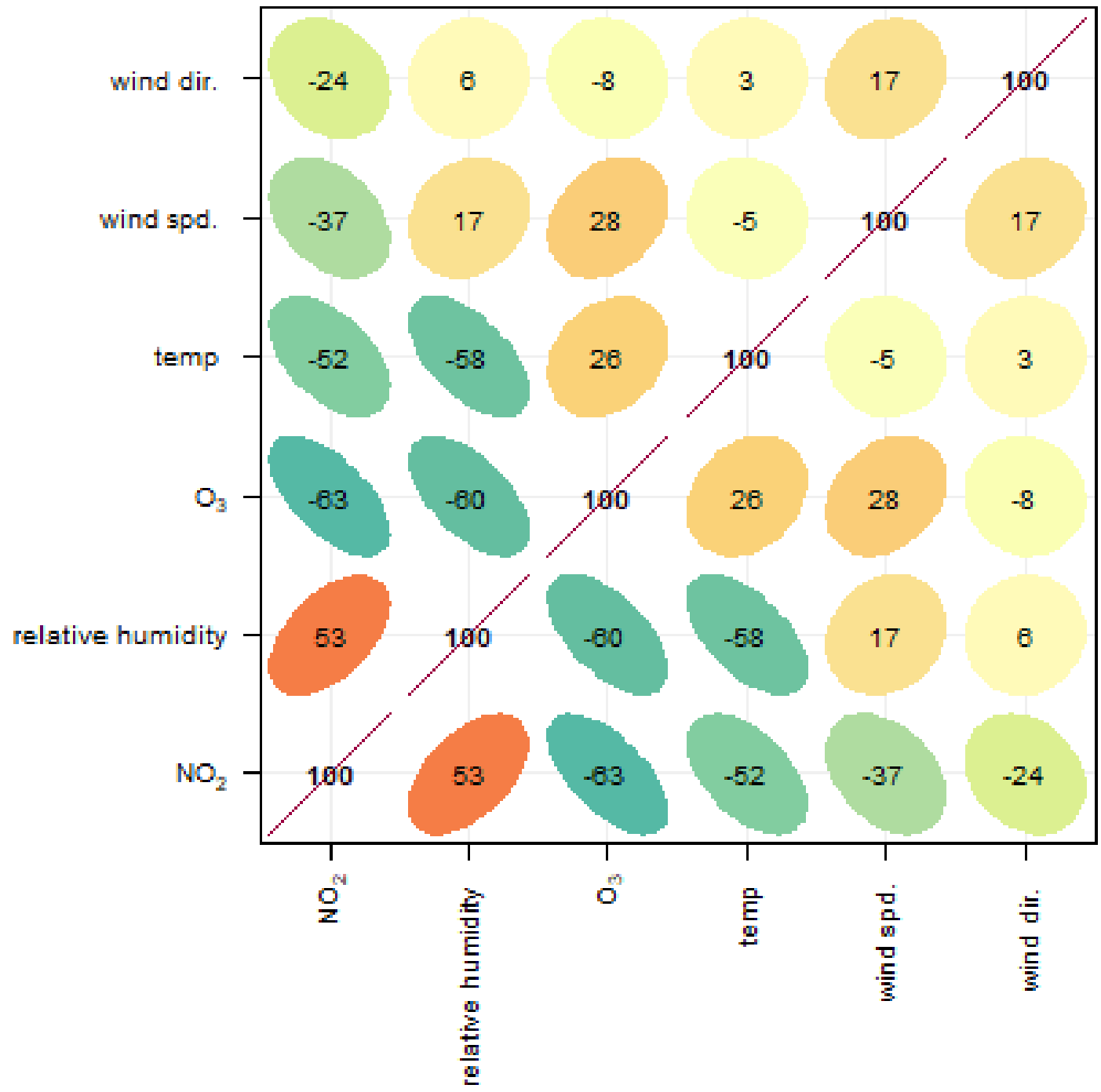
#load "latticeExtra" for last plot update ##latticeExtra is used indicate highest point of select variables (only air pollutants which are row 1 & 2 selected here).

trellis.last.object() +
layer({maxy <- which.max(y);
lpoints(x[maxy], y[maxy], col = "black", pch = 16)},
rows = c(1,2))



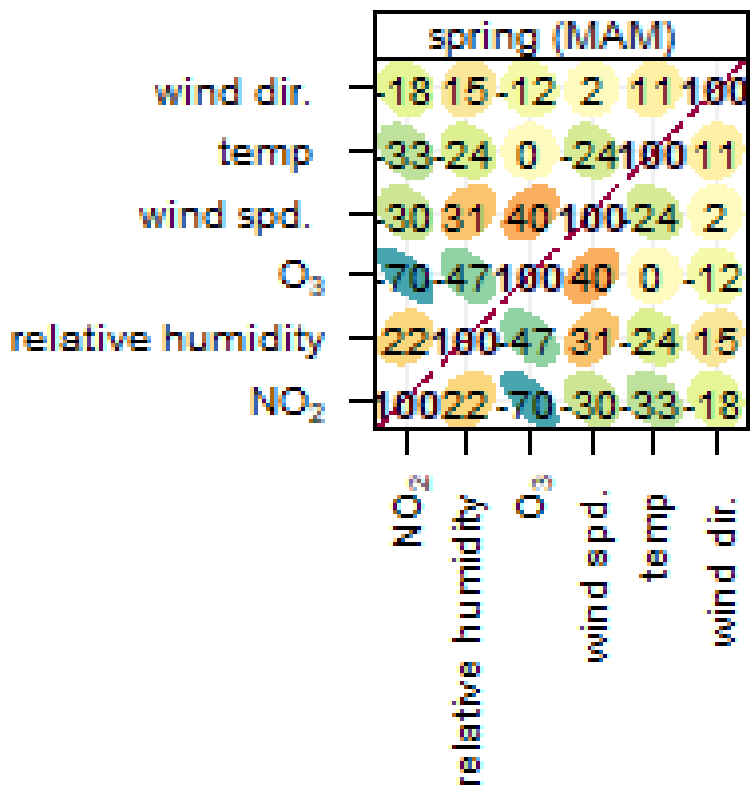
#corplot function for correlation matrices between variables
##spearman method for correlation coefficients (datasets failed normality test)
###Repressented in % & 100 = 1 = r

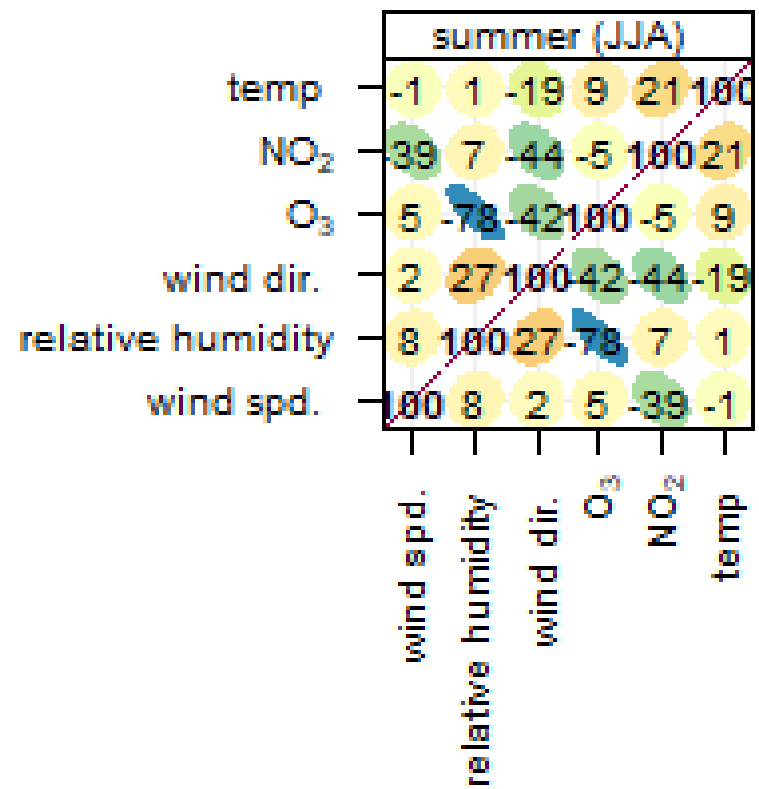
corPlot(air_manchester3, method = "spearman")

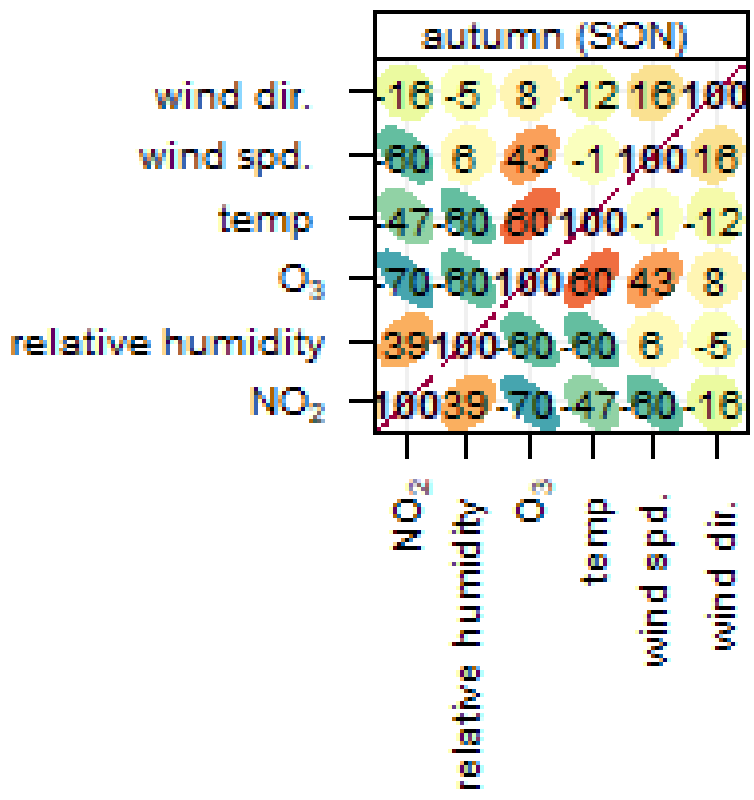


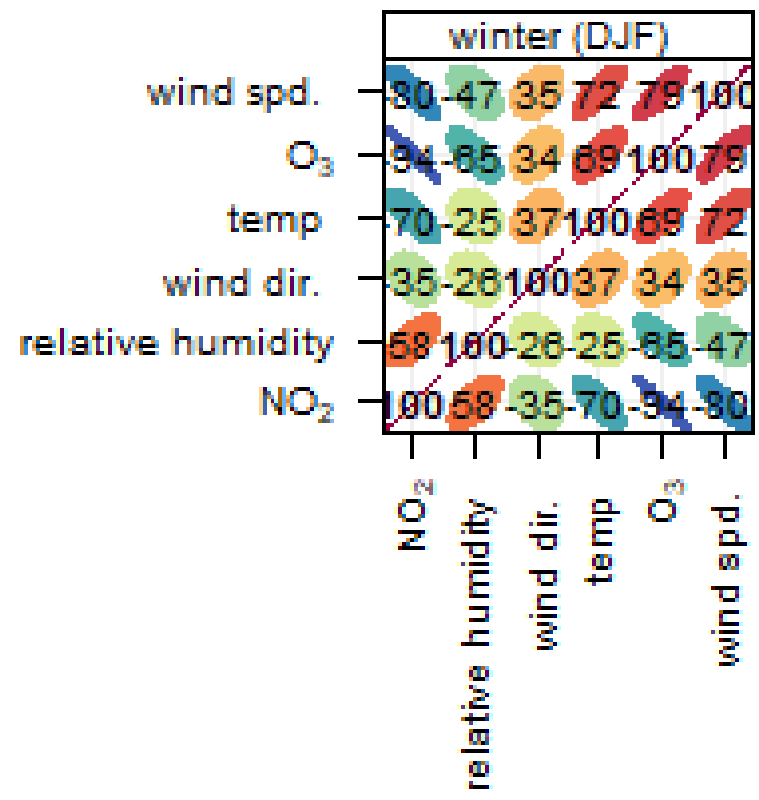
#correlation by seasons

corPlot(air_manchester3, type = "season", method = "spearman")



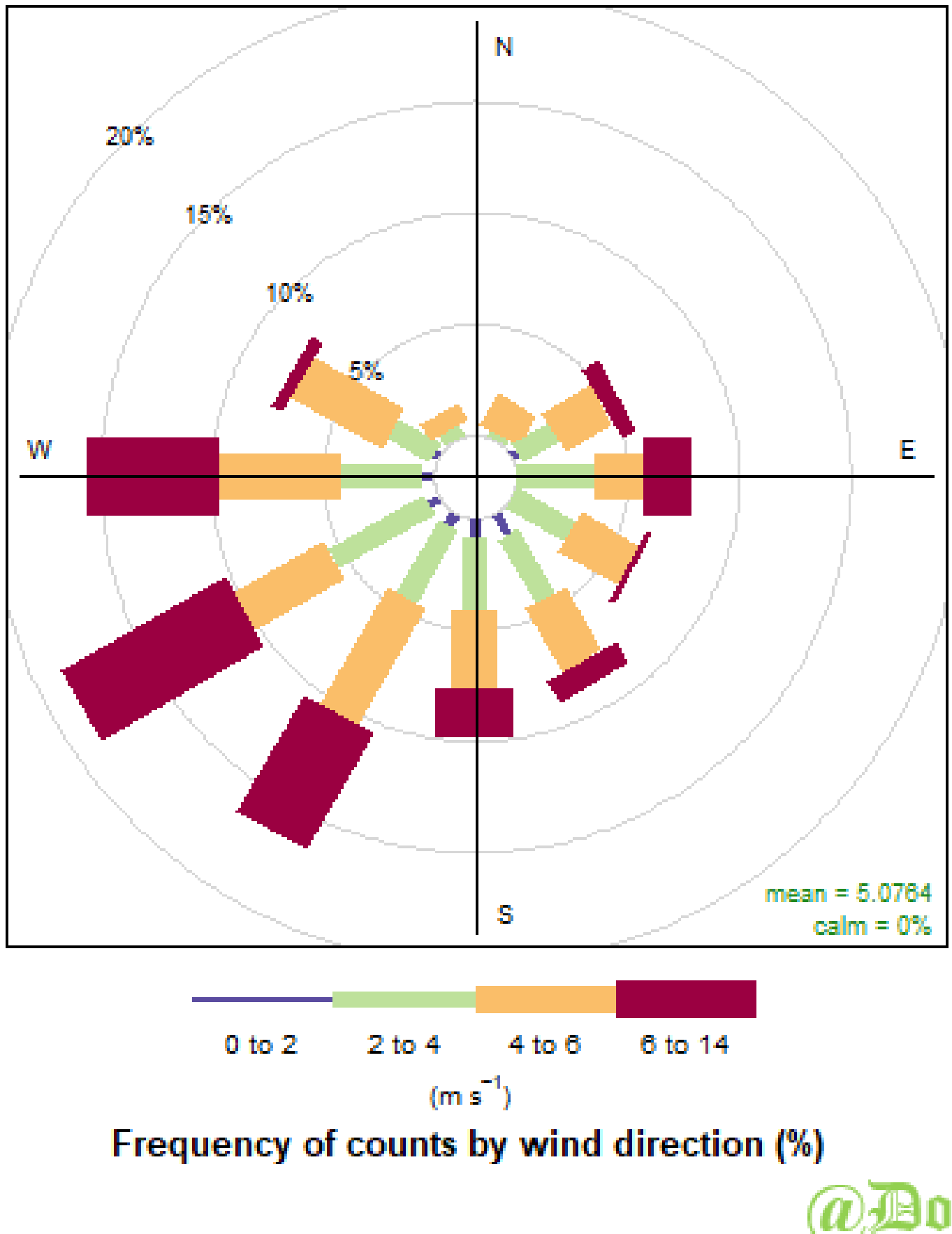






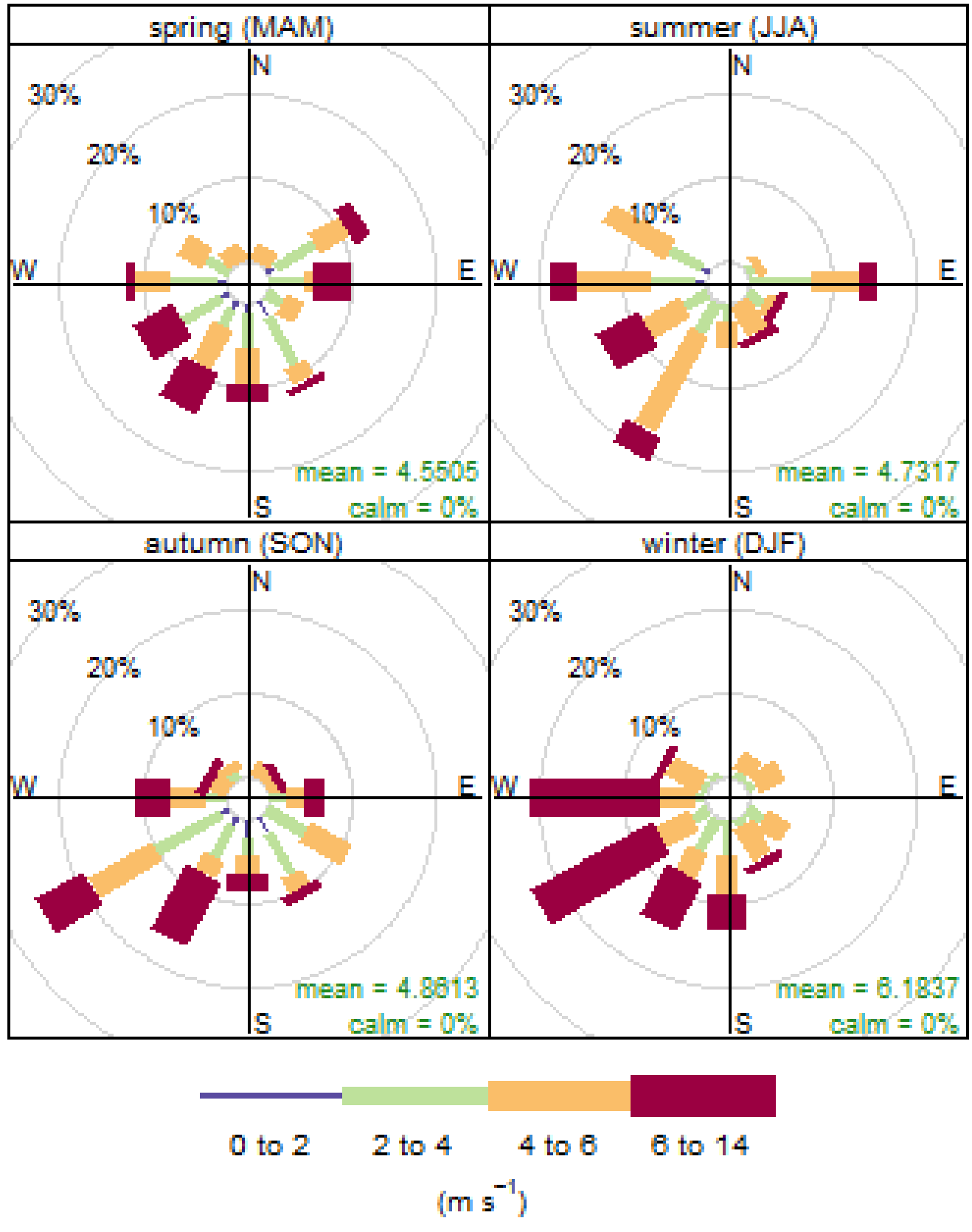
#wind speed and wind direction intervals

windRose(air_manchester3)



#wind direction and wind speed by seasons

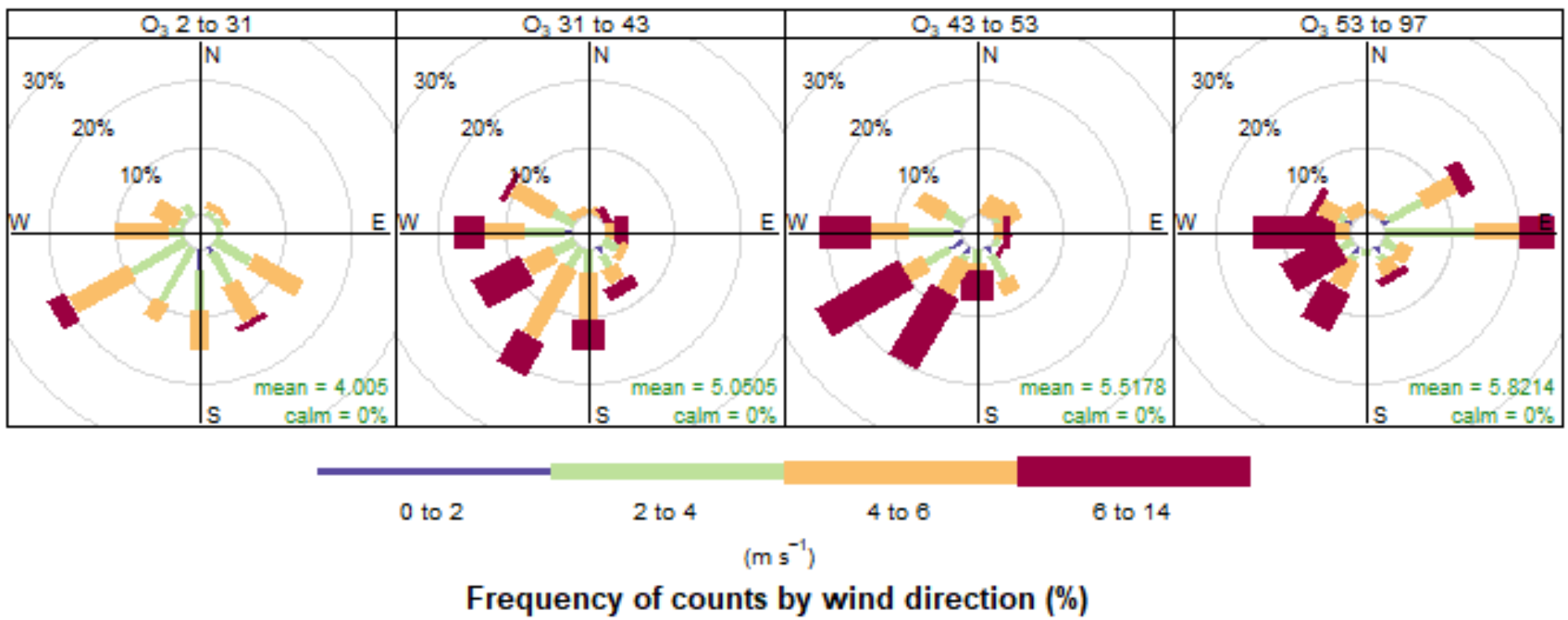
windRose(air_manchester3, type = "season")



#wind direction/speed frequencies influence on pollutants in quartiles.

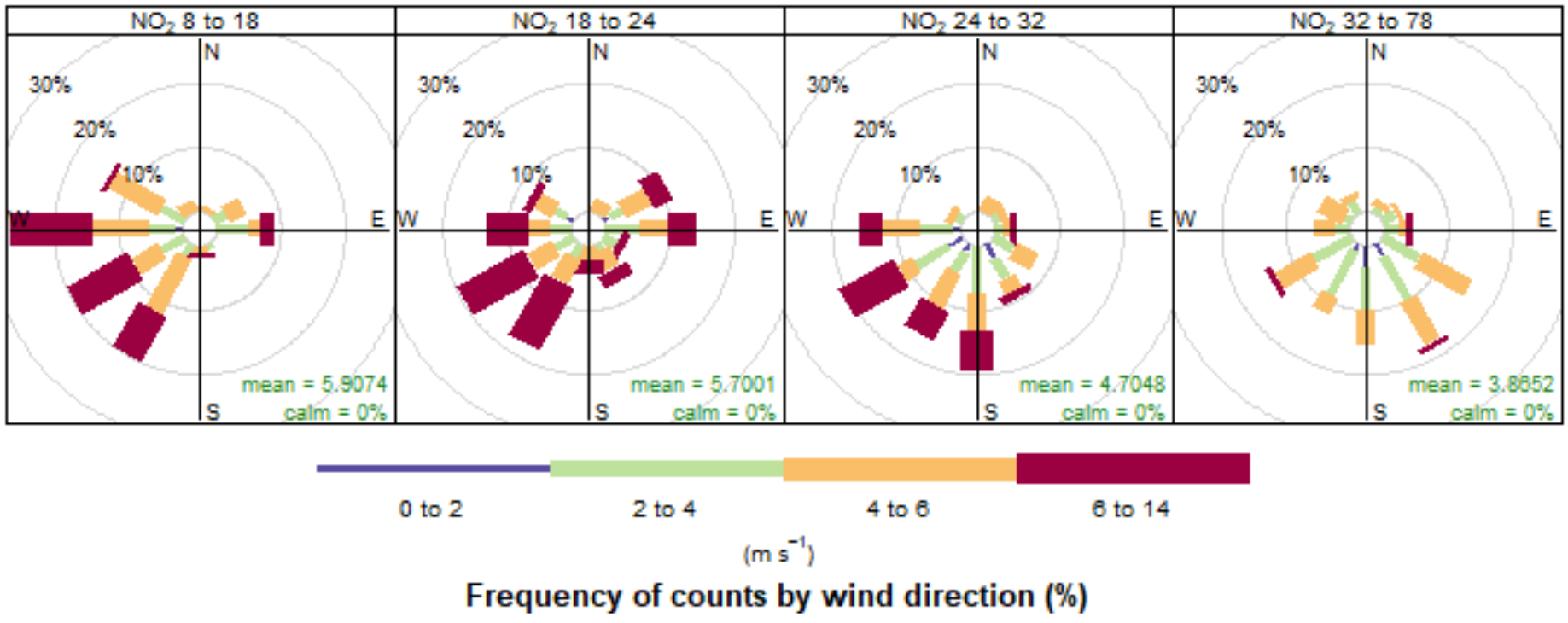
#Ozone

windRose(air_manchester3, type = "ozone", layout = c(4,1))



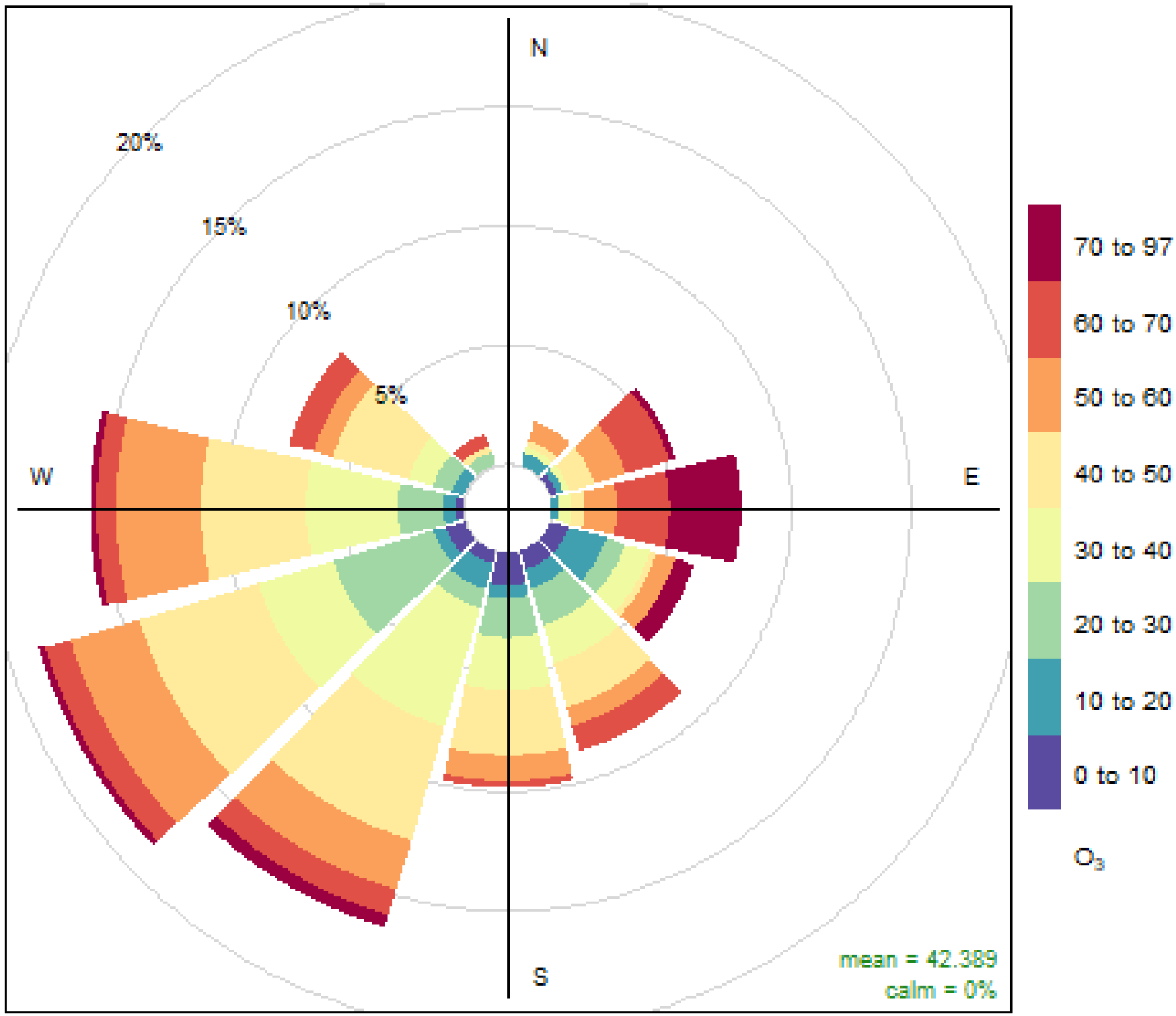
#NO2

windRose(air_manchester3, type = "no2", layout = c(4,1))



#pollutant concentration influence by wind direction
#Ozone

pollutionRose (air_manchester3, pollutant = "ozone")

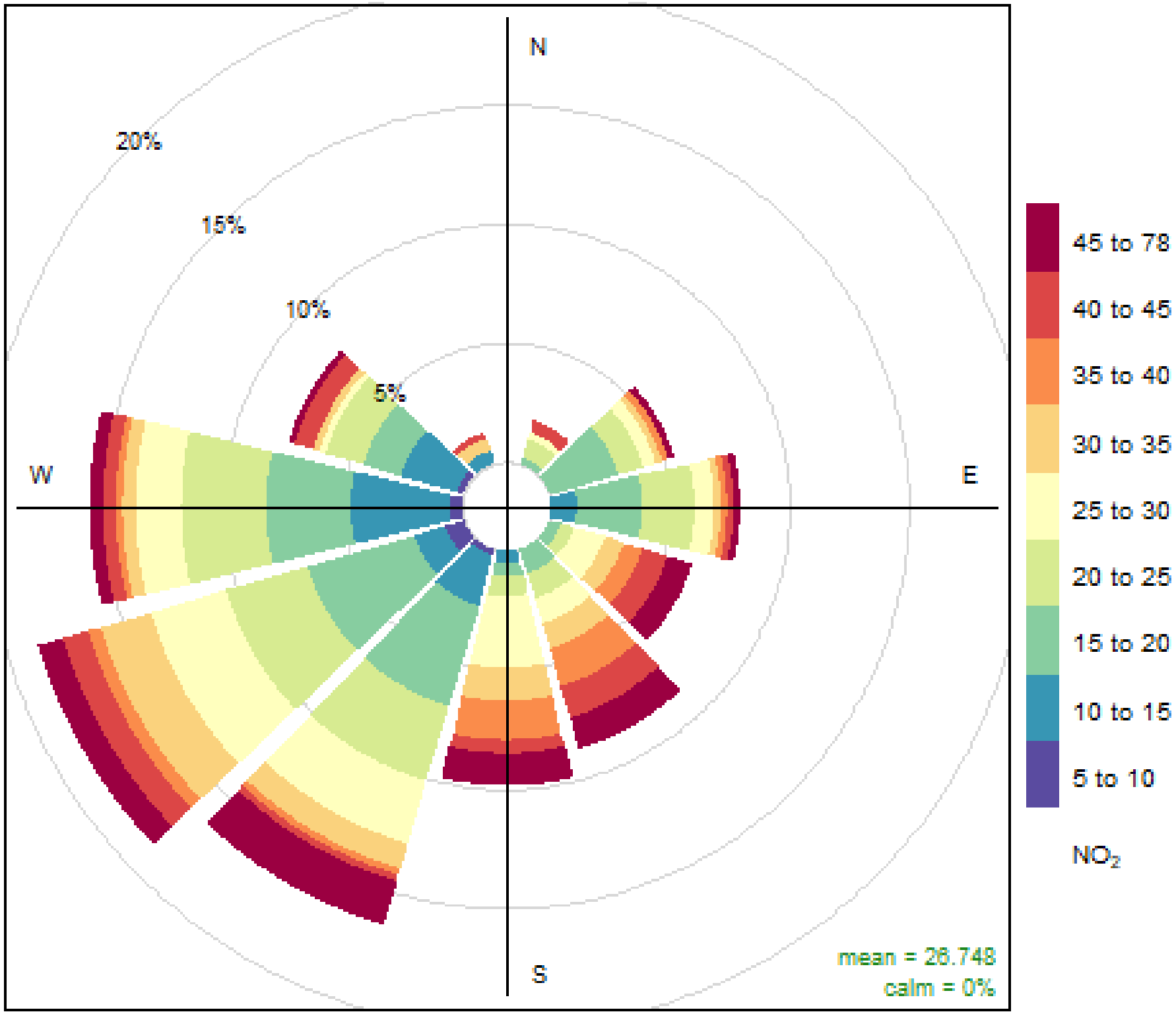


Frequency of counts by wind direction (%)

#pollutant concentration influence by wind direction

#NO2

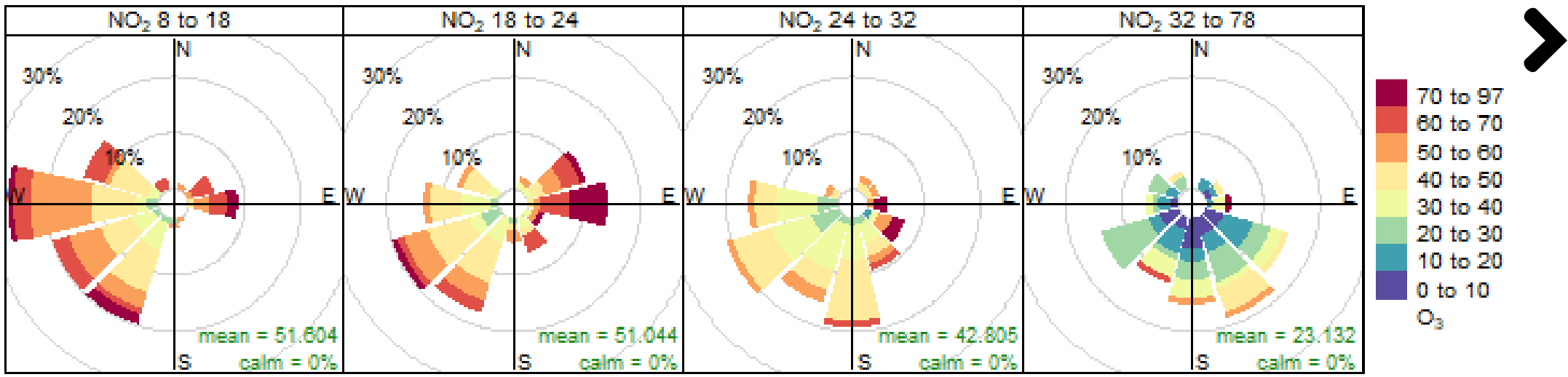
pollutionRose (air_manchester3, pollutant = "no2")



Frequency of counts by wind direction (%)

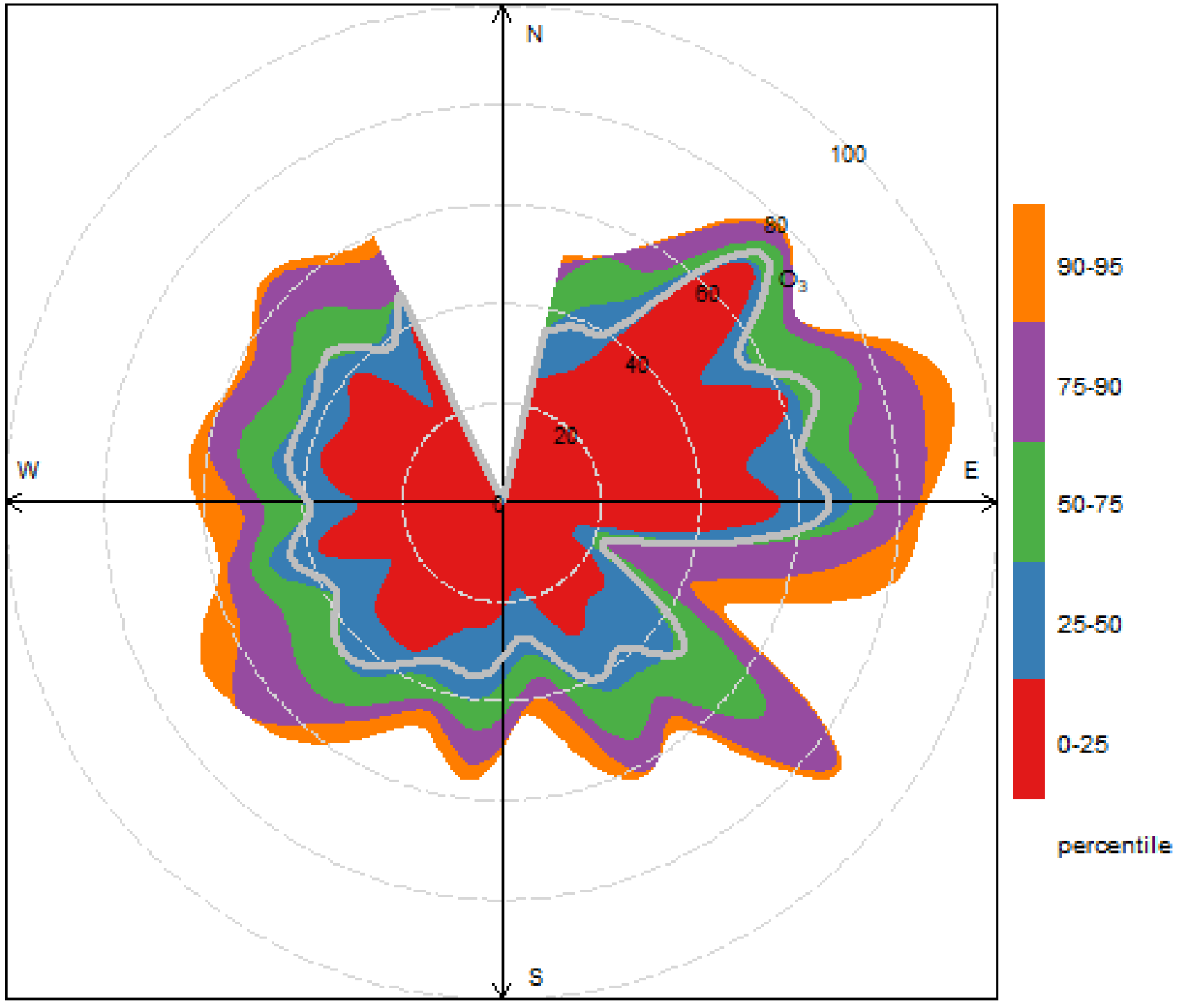
#pollutant conditioned by another pollutant under wind direction #NO2vsOzone

pollutionRose (air_manchester3, pollutant = "ozone", type = "no2", layout = c(4,1))



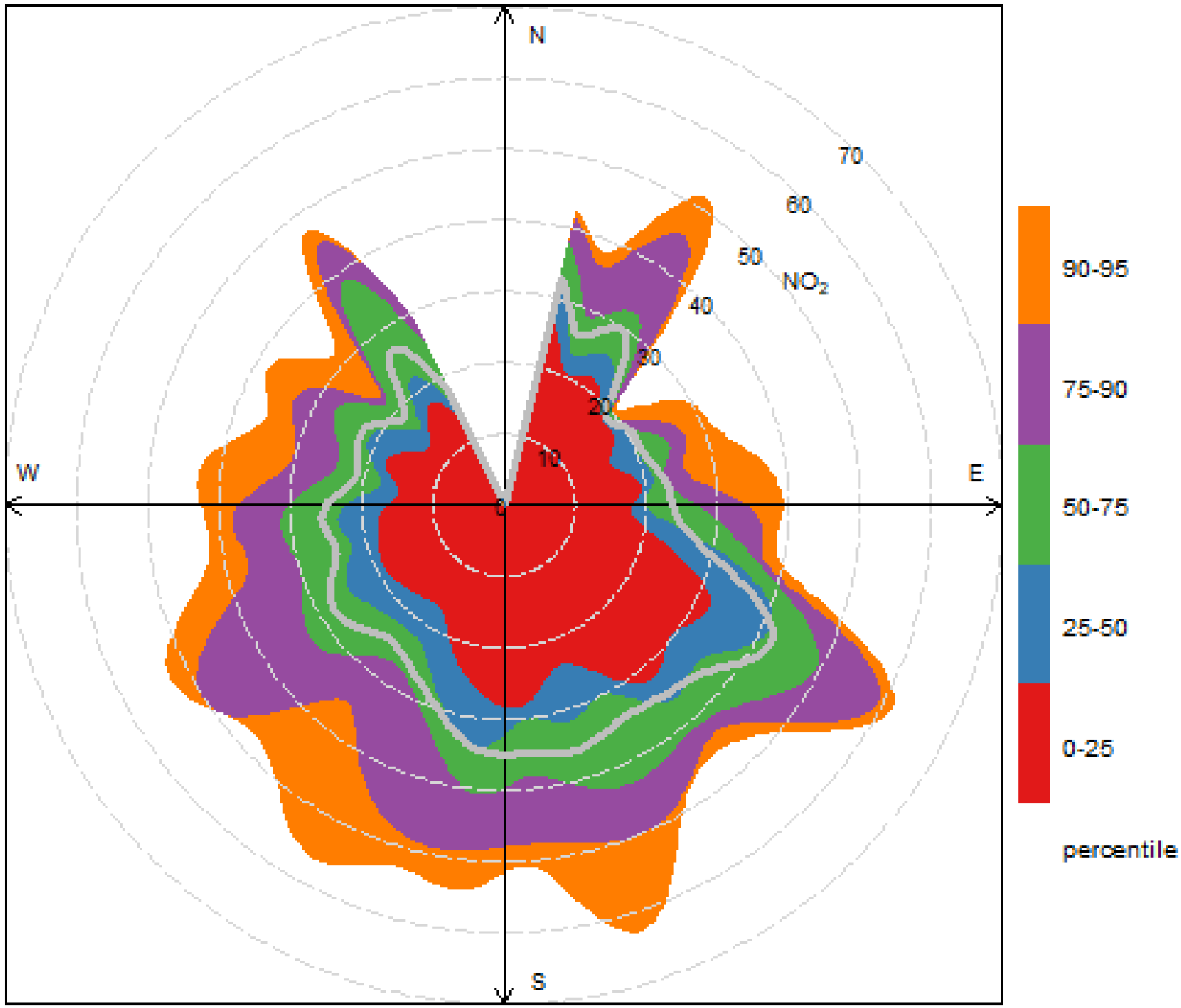
#pollutant concentration influence by wind direction in percentile #Ozone

```
percentileRose (air_manchester3, pollutant = "ozone", col =
"brewer1", key.position = "right",
                    smooth = TRUE)
```



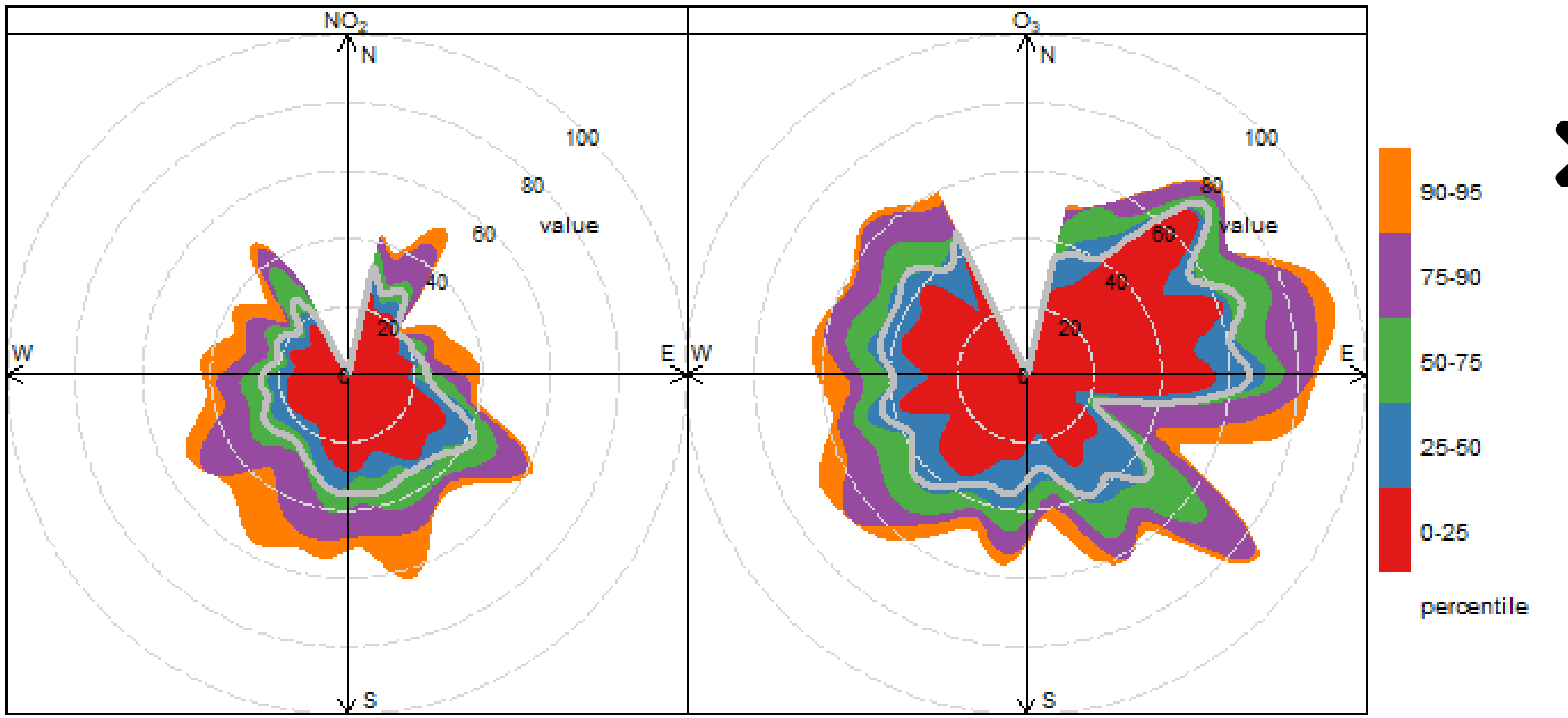
#pollutant concentration influence by wind direction in percentile #NO2

```
percentileRose (air_manchester3, pollutant = "no2", col =
"brewer1", key.position = "right",
                smooth = TRUE)
```



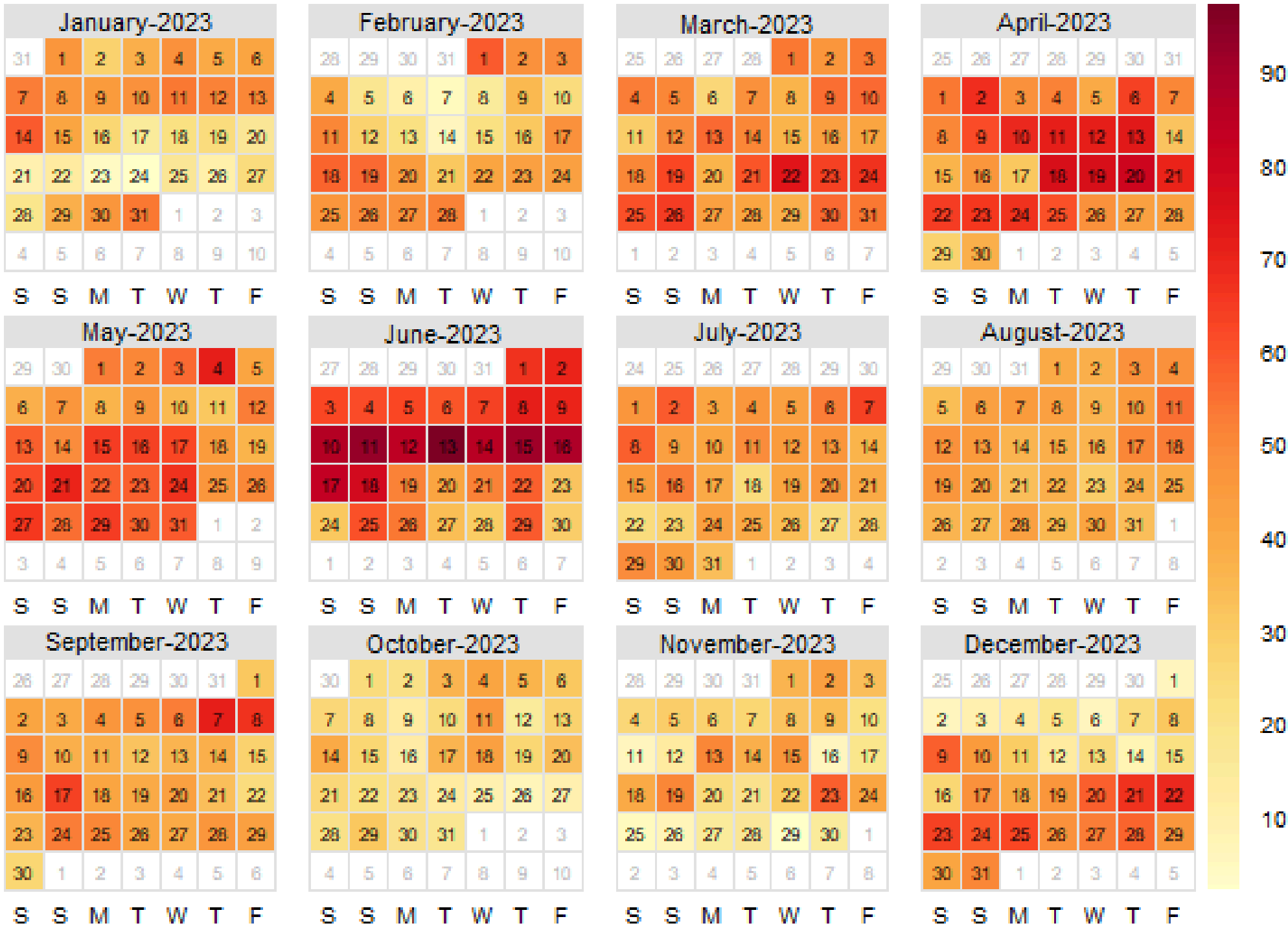
#pollutant concentration influence by wind direction in percentile #Ozone & NO2 in one frame

```
percentileRose (air_manchester3, poll = c("ozone", "no2"),
col = "brewer1", key.position = "right",
                smooth = TRUE)
```



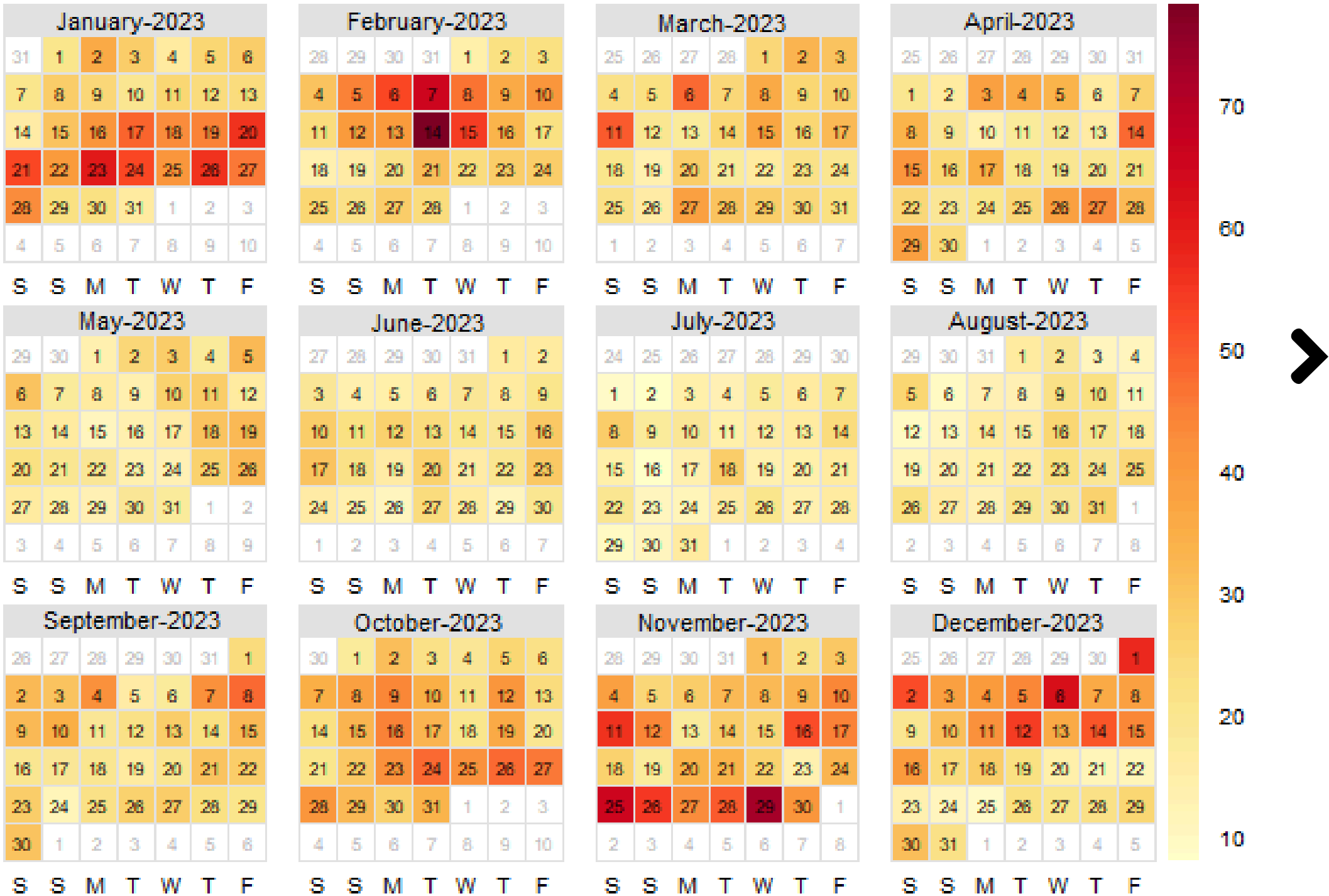
#for daily concentration levels of pollutant #Ozone

calendarPlot(air_manchester3, pollutant = "ozone")



#for daily concentration levels of pollutant #NO2

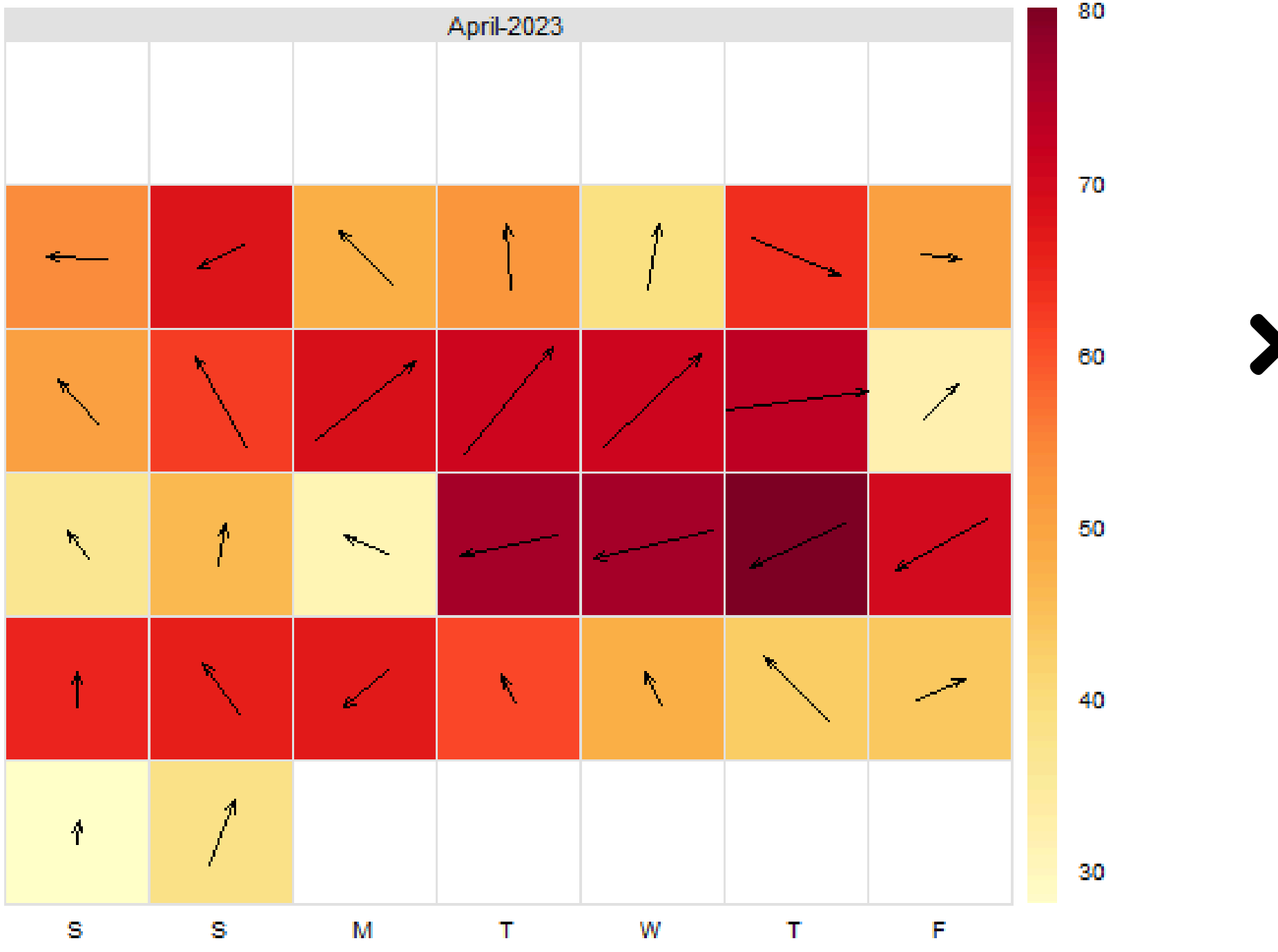
calendarPlot(air_manchester3, pollutant = "no2")



#calendar plot wind direction/speed for ozone in the month of April

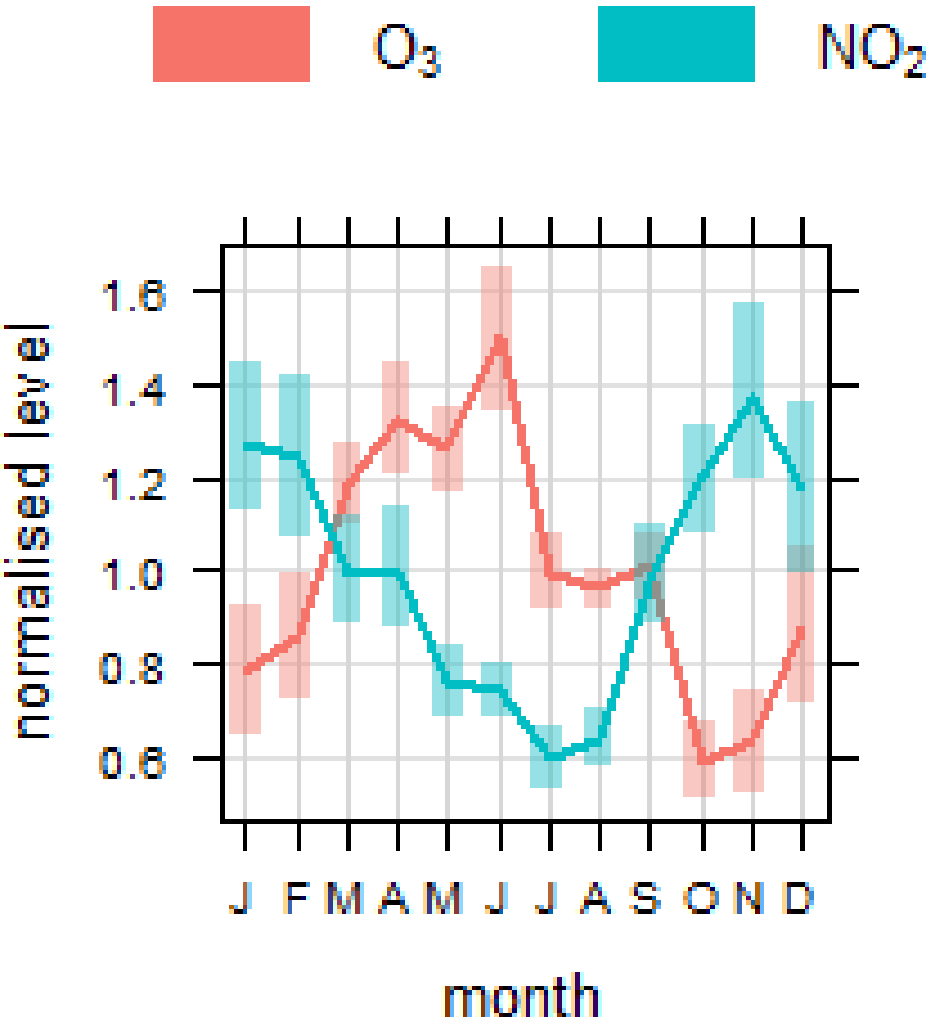
##longer arrow = higher wind speed

calendarPlot(air_manchester3, pollutant = "ozone", month = 4, annotate = "ws")



#different time variations for pollutant(s)

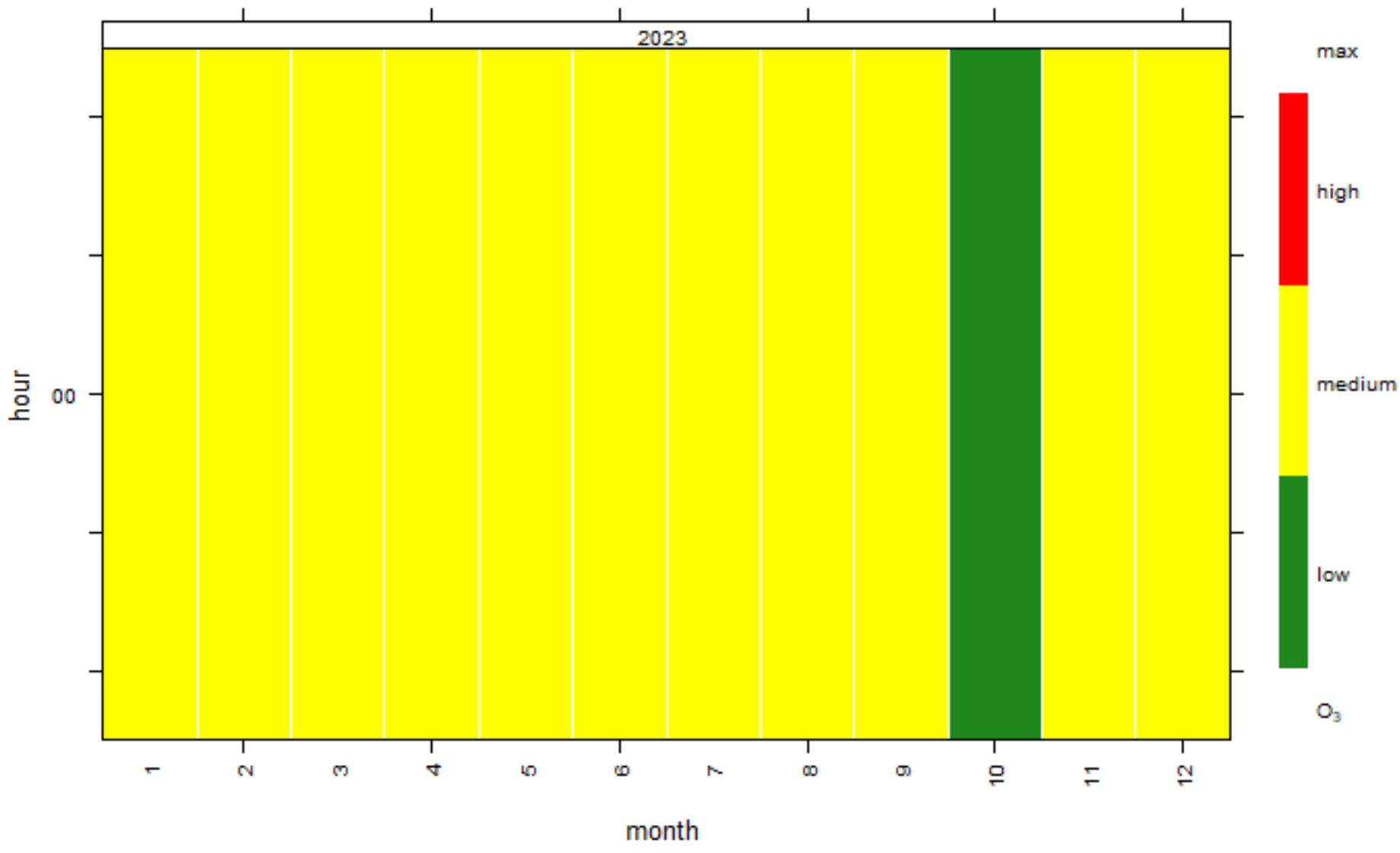
timeVariation(air_manchester3,pollutant = c("ozone", "no2"), normalise = TRUE)



mean and 95% confidence interval in mean

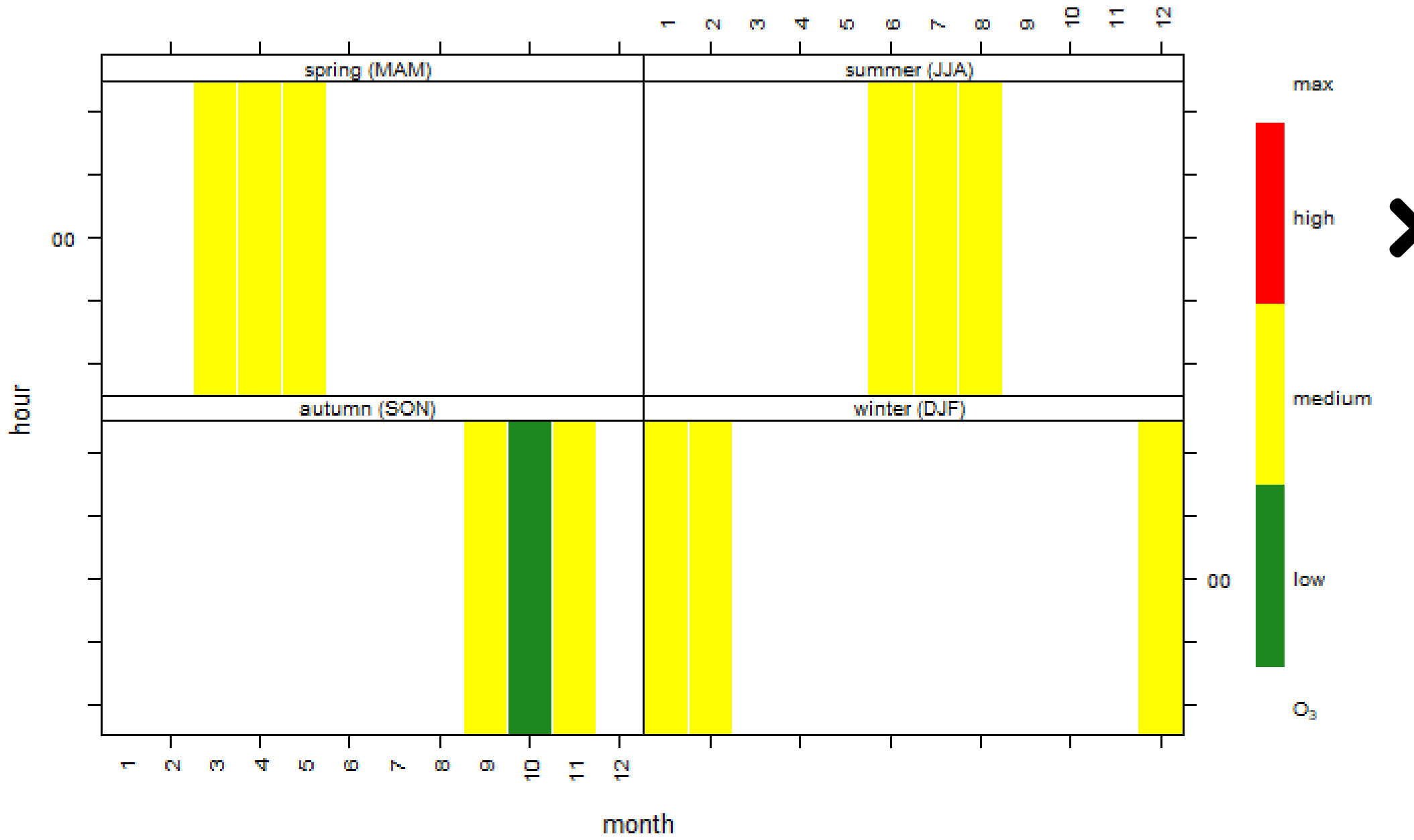
#trend levels of ozone conc across the months #Ozone

```
trendLevel(air_manchester3, pollutant = "ozone",
           border = "white", statistic = "max",
           breaks = c(0, 50, 100, 500),
           labels = c("low", "medium", "high"),
           cols = c("forestgreen", "yellow", "red"))
```



#trend levels of ozone conc by seasons #Ozone

```
trendLevel(air_manchester3, pollutant = "ozone", type = "season",
           border = "white", statistic = "max",
           breaks = c(0, 50, 100, 500),
           labels = c("low", "medium", "high"),
           cols = c("forestgreen", "yellow", "red"))
```



References

Carslaw, D.C. and K. Ropkins, (2012). Openair — an R package for air quality data analysis. *Environmental Modelling & Software*. Volume27-28,pp.52–61.

Carslaw, D.C. (2019). The openair manual — open-source tools for analysing air pollution data. Manual for version 2.6-6, University of York.

Datasets source

https://power.larc.nasa.gov/data-access-viewer/

Datasets link

https://power.larc.nasa.gov/api/temporal/daily/point?parameters=T2M,RH2M,PRECTOTCORR,WS10M,WD10M&community=RE&longitude=-2.2379&latitude=53.4815&start=20230101&end=20231231&format=CSV

Image copyright (Page 1)

What Does 'Unhealthy Air Quality for Sensitive Groups' Mean? (treehugger.com)

Link to Complete Data Manipulation Codes

https://github.com/Donaniche/Air_Quality_Analysis_with_Openair_Package/edit/main/README.md