Análisis del ruido en Madrid

```
library("dplyr")
```

```
##
## Attaching package: 'dplyr'
```

```
## The following objects are masked from 'package:stats':
##
##     filter, lag
```

```
## The following objects are masked from 'package:base':
##
##     intersect, setdiff, setequal, union
```

```
library("ggplot2")
library('gridExtra')
```

```
##
## Attaching package: 'gridExtra'
```

```
## The following object is masked from 'package:dplyr':
##
##     combine
```

```
df <- read.csv(file = './data/datos_ruido_madrid.csv', header = FALSE, sep = ';', strip.white = TRUE)
dfs <- read.csv(file = './data/EstacionesMedidaControlAcustico.csv', header = FALSE, sep = ';', strip.wh

colnames(df) <- c("Station","Year","Month","Day","Period","LAeq","LAS01","LAS10","LAS50","LAS90","LAS99

df$Date <- as.Date(with(df, paste(Year, Month, Day,sep="-")), "%Y-%m-%d")

head(df)
```

```
##   Station Year Month Day Period LAeq LAS01 LAS10 LAS50 LAS90 LAS99
## 1       1 2015    12  31      D 69.1  74.9  72.6  66.7  60.1  56.2
## 2       1 2015    12  31      E 70.7  74.4  71.5  64.0  56.4  52.2
## 3       1 2015    12  31      N 66.7  73.8  70.9  63.4  56.4  51.4
## 4       1 2015    12  31      T 68.9  74.6  72.0  65.1  57.7  52.6
## 5       2 2015    12  31      D 74.1  85.2  77.2  69.6  64.4  59.7
## 6       2 2015    12  31      E 74.0  84.4  77.4  67.8  61.5  58.4
##         Date
## 1 2015-12-31
## 2 2015-12-31
## 3 2015-12-31
## 4 2015-12-31
## 5 2015-12-31
## 6 2015-12-31
```

```
dfs <- read.csv(file = './data/EstacionesMedidaControlAcustico.csv', header = TRUE, sep = ',', strip.whi

dfs$COD_VIA <- NULL
dfs$VIA_CLASE <- NULL
dfs$VIA_PAR <- NULL
dfs$VIA_NOMBRE <- NULL
dfs$Dirección <- NULL
```

```r
dfs <- dfs %>%
  rename(
    Station=Nº,
    NameStation = Nombre
    )


head(dfs)
```

```
##   Station      NameStation Longitud_gms  Latitud_gms     LATITUD_ED50
## 1       1     Pº Recoletos 3º41'27'' O º 40º25'24'' N 40.4233333333333
## 2       2         Carlos V   3º41'25 O º  40º24'36" N            40.41
## 3       3 Plaza del Carmen  3º42'17" O º  40º25'16" N 40.4211111111111
## 4       4  Plaza de España  3º42'40" O º  40º25'40" N 40.4277777777778
## 5       5     Bº del Pilar  3º42'55" O º  40º28'37" N 40.4769444444444
## 6       6 Gregorio Marañón  3º41'22" O º  40º26'33" N          40.4425
##       LONGITUD_ED50 Alt..m. Fecha.alta Coordenada_X_ETRS89
## 1 -3.69083333333333     648      40609              441302
## 2 -3.69027777777778     629      36130              441328
## 3 -3.70472222222222     657      36465              440346
## 4 -3.71111111111111     637      36130              439579
## 5 -3.71527777777778     673      36318              439689
## 6 -3.68944444444444     669      36312              441412
##   Coordenada_Y_ETRS89 LONGITUD_WGS84 LATITUD_WGS84         X      X.1 X.2
## 1                8676        4474895           436 -3.691926 40.42262  NA
## 2                 186        4473395           505 -3.691490 40.40911  NA
## 3                3619        4474524           357 -3.703166 40.41921  NA
## 4                3291        4475049           263 -3.712257 40.42388  NA
## 5                 496        4481081           619 -3.711536 40.47823  NA
## 6                6622        4476553           971 -3.690785 40.43757  NA
##   X.3
## 1  NA
## 2  NA
## 3  NA
## 4  NA
## 5  NA
## 6  NA
```

```r
df <- merge(df, dfs, by = "Station", all.x = TRUE)
head(df)
```

```
##   Station Year Month Day Period LAeq LAS01 LAS10 LAS50 LAS90 LAS99
## 1       1 2015    12  31      D 69.1  74.9  72.6  66.7  60.1  56.2
## 2       1 2015    12  31      E 70.7  74.4  71.5  64.0  56.4  52.2
## 3       1 2015    12  31      N 66.7  73.8  70.9  63.4  56.4  51.4
## 4       1 2015    12  31      T 68.9  74.6  72.0  65.1  57.7  52.6
## 5       1 2015     4  18      T 68.2  74.3  71.3  65.7  58.8  53.8
## 6       1 2018    10  26      E 68.2  75.5  70.8  66.7  60.4  57.8
##         Date  NameStation Longitud_gms  Latitud_gms     LATITUD_ED50
## 1 2015-12-31 Pº Recoletos 3º41'27'' O º 40º25'24'' N 40.4233333333333
## 2 2015-12-31 Pº Recoletos 3º41'27'' O º 40º25'24'' N 40.4233333333333
## 3 2015-12-31 Pº Recoletos 3º41'27'' O º 40º25'24'' N 40.4233333333333
## 4 2015-12-31 Pº Recoletos 3º41'27'' O º 40º25'24'' N 40.4233333333333
## 5 2015-04-18 Pº Recoletos 3º41'27'' O º 40º25'24'' N 40.4233333333333
```

```
## 6 2018-10-26 Pº Recoletos 3º41'27'' Oº 40º25'24'' N 40.4233333333333
##       LONGITUD_ED50 Alt..m. Fecha.alta Coordenada_X_ETRS89
## 1 -3.69083333333333     648      40609              441302
## 2 -3.69083333333333     648      40609              441302
## 3 -3.69083333333333     648      40609              441302
## 4 -3.69083333333333     648      40609              441302
## 5 -3.69083333333333     648      40609              441302
## 6 -3.69083333333333     648      40609              441302
##   Coordenada_Y_ETRS89 LONGITUD_WGS84 LATITUD_WGS84         X      X.1 X.2
## 1                8676        4474895           436 -3.691926 40.42262  NA
## 2                8676        4474895           436 -3.691926 40.42262  NA
## 3                8676        4474895           436 -3.691926 40.42262  NA
## 4                8676        4474895           436 -3.691926 40.42262  NA
## 5                8676        4474895           436 -3.691926 40.42262  NA
## 6                8676        4474895           436 -3.691926 40.42262  NA
##   X.3
## 1  NA
## 2  NA
## 3  NA
## 4  NA
## 5  NA
## 6  NA
```

Calculamos la media de los índices por año, mes, estación y periodo, y añadimos las variables al dataframe.

```
meanLAeqByMonthStationAndPeriod <- df %>%
    group_by(Year,Month, NameStation, Period) %>%
    summarise(meanLAeqByMonth = mean(LAeq),
              meanLAS01ByMonth = mean(LAS01),
              meanLAS10ByMonth = mean(LAS10),
              meanLAS50ByMonth = mean(LAS50),
              meanLAS90ByMonth = mean(LAS90),
              meanLAS99ByMonth = mean(LAS99))

df <- merge(df, meanLAeqByMonthStationAndPeriod, by = c("Year","Month", "NameStation", "Period"), all.x

colnames(df)
```

```
##  [1] "Year"                "Month"               "NameStation"
##  [4] "Period"              "Station"             "Day"
##  [7] "LAeq"                "LAS01"               "LAS10"
## [10] "LAS50"               "LAS90"               "LAS99"
## [13] "Date"                "Longitud_gms"        "Latitud_gms"
## [16] "LATITUD_ED50"        "LONGITUD_ED50"       "Alt..m."
## [19] "Fecha.alta"          "Coordenada_X_ETRS89" "Coordenada_Y_ETRS89"
## [22] "LONGITUD_WGS84"      "LATITUD_WGS84"       "X"
## [25] "X.1"                 "X.2"                 "X.3"
## [28] "meanLAeqByMonth"     "meanLAS01ByMonth"    "meanLAS10ByMonth"
## [31] "meanLAS50ByMonth"    "meanLAS90ByMonth"    "meanLAS99ByMonth"
```

```
head(df)
```

```
##   Year Month      NameStation Period Station Day LAeq LAS01 LAS10 LAS50
## 1 2015     1 Alto Extremadura      D      19   8 63.3  70.2  65.4  60.3
## 2 2015     1 Alto Extremadura      D      19  28 63.2  70.2  65.3  60.2
## 3 2015     1 Alto Extremadura      D      19   7 64.4  70.6  65.2  59.9
```

```
## 4 2015     1 Alto Extremadura      D      19   9 62.7  69.7  65.3  60.2
## 5 2015     1 Alto Extremadura      D      19  23 62.4  69.9  65.6  60.6
## 6 2015     1 Alto Extremadura      D      19  13 62.6  70.7  65.8  60.5
##   LAS90 LAS99       Date Longitud_gms Latitud_gms     LATITUD_ED50
## 1  55.9  52.7 2015-01-08  3º44'16" O º 40º24'40" N 40.4111111111111
## 2  55.9  52.6 2015-01-28  3º44'16" O º 40º24'40" N 40.4111111111111
## 3  55.5  52.3 2015-01-07  3º44'16" O º 40º24'40" N 40.4111111111111
## 4  56.0  53.2 2015-01-09  3º44'16" O º 40º24'40" N 40.4111111111111
## 5  56.3  53.3 2015-01-23  3º44'16" O º 40º24'40" N 40.4111111111111
## 6  56.1  53.0 2015-01-13  3º44'16" O º 40º24'40" N 40.4111111111111
##       LONGITUD_ED50 Alt..m. Fecha.alta Coordenada_X_ETRS89
## 1 -3.73777777777778     632      36130              437050
## 2 -3.73777777777778     632      36130              437050
## 3 -3.73777777777778     632      36130              437050
## 4 -3.73777777777778     632      36130              437050
## 5 -3.73777777777778     632      36130              437050
## 6 -3.73777777777778     632      36130              437050
##   Coordenada_Y_ETRS89 LONGITUD_WGS84 LATITUD_WGS84         X      X.1 X.2
## 1                 926        4473291           752 -3.741896 40.40786  NA
## 2                 926        4473291           752 -3.741896 40.40786  NA
## 3                 926        4473291           752 -3.741896 40.40786  NA
## 4                 926        4473291           752 -3.741896 40.40786  NA
## 5                 926        4473291           752 -3.741896 40.40786  NA
## 6                 926        4473291           752 -3.741896 40.40786  NA
##   X.3 meanLAeqByMonth meanLAS01ByMonth meanLAS10ByMonth meanLAS50ByMonth
## 1  NA        62.31034         69.91379         64.82069         59.46207
## 2  NA        62.31034         69.91379         64.82069         59.46207
## 3  NA        62.31034         69.91379         64.82069         59.46207
## 4  NA        62.31034         69.91379         64.82069         59.46207
## 5  NA        62.31034         69.91379         64.82069         59.46207
## 6  NA        62.31034         69.91379         64.82069         59.46207
##   meanLAS90ByMonth meanLAS99ByMonth
## 1          54.4931         50.94828
## 2          54.4931         50.94828
## 3          54.4931         50.94828
## 4          54.4931         50.94828
## 5          54.4931         50.94828
## 6          54.4931         50.94828
```

Nos centramos únicamente en el índice LAeq durante el periodo 'T'. Nos interesa conocer la media mensual por año de ese índice para cada una de las estaciones de Madrid.

```
 dfPeriodT <- df %>% filter(Period == "T")

dfMeanLAeqByMonth <- distinct(dfPeriodT, Year, Month, NameStation, meanLAeqByMonth)

# Year as factor in order to facilitate the choice of colors in the plot
dfMeanLAeqByMonth$Year <- factor(dfMeanLAeqByMonth$Year)
```

```
ggplot(dfMeanLAeqByMonth, aes(x = Month, y = meanLAeqByMonth, group=Year)) +
  geom_point(aes(color=Year), size=2)  +
  geom_line(aes(color=Year))  +
  facet_wrap(~ NameStation, ncol = 3, scales="free") +
  labs(title = "Comparación del índice LAeq medido en las distintas estaciones a lo largo de los años",
       subtitle = "Se ha realizado la media mensual de los datos recopilados en cada una de las estacio
```

```
      y = "Media mensual LAeq") +
theme(legend.position="top")
```