reto etapa 3 intervalos de medias

gian media2020rco innocenti

2023-10-09

R media2020rkdown

Prueba de diferencia intervalos de media

```
M=read.csv('DatasetAnovaComparacionMedias_Concentracion.csv')
#M
```

```
M1=M
```

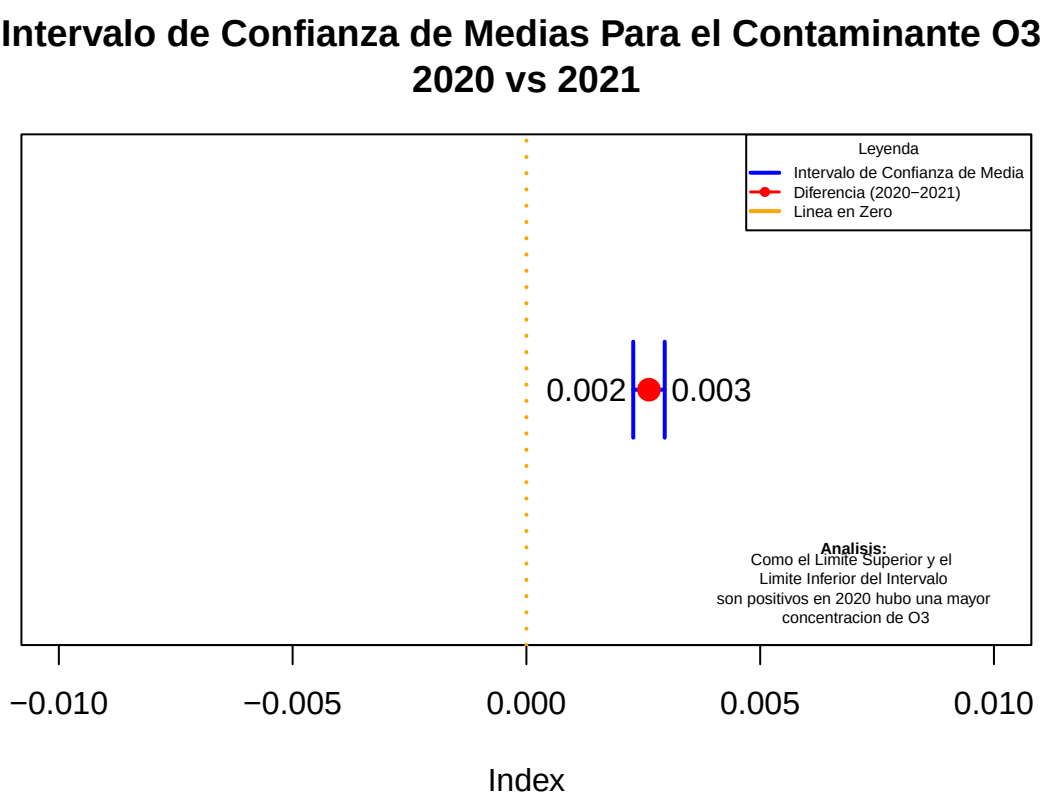
2020 contra 2021

```
listacolumn2020s=c('O3Concentracion','CO','NO2','PM10')

for (i in 1:length(listacolumn2020s)){
  df_2020 <- M[M$Year == 2020, listacolumn2020s[i]]
  df_2021 <- M[M$Year == 2021, listacolumn2020s[i]]
  #calcular desviacion estandar
  desv2020=sd(df_2020, na.rm = TRUE)
  desv2021=sd(df_2021, na.rm = TRUE)
  #calcular medias
  media2020=mean(df_2020, na.rm = TRUE)
  media2021=mean(df_2021, na.rm = TRUE)
  #calcular numero de observaciones
  n2020=sum(!is.na(df_2020))
  n2021=sum(!is.na(df_2020))
  alfa=0.05
  #calcular z
  Z=abs(qnorm(alfa/2))
  EE= sqrt((desv2020^2/n2020)+(desv2021^2/n2021))                    #Error estandar
  #calcular limites
  Linf=(media2020-media2021)-(Z*EE)
  Lsup=(media2020-media2021)+(Z*EE)
  cat("[",Linf,",",Lsup,"]\n")
  if(i== 1){
      plot(NA,xlim=c(-0.01,0.01),ylim=c(0,2),yaxt="n",ylab="",main="Intervalo de Confianza de Medias Pa
  arrows(Linf,1,Lsup,1,code=3,angle=90,col="blue",lwd=2)
#arroes(x1,y1,x2,y2)
```

```
  points(media2020-media2021,1,pch=19,col="red",cex=1.5)
  text(Linf-0.001,1,round(Linf,3))
  text(Lsup+0.001,1,round(Lsup,3))
  abline(v=0,col="orange",lty=3,lwd=2)


  legend("topright", legend = c("Intervalo de Confianza de Media", "Diferencia (2020-2021)", "Linea en 
       col = c("blue", "red", "orange"), lwd = c(2, 1.5, 2), pch = c(-1, 19, -1),
       title = "Leyenda",cex = 0.5)
  text(0.007, 0.33, "Analisis:", font = 2, cex = 0.5)  # Title in bold
text(0.007, 0.16, "Como el Limite Superior y el \n Limite Inferior del Intervalo \n son positivos en 20
  }
  else if(i==2){
          plot(NA,xlim=c(-0.159,0.1),ylim=c(0,2),yaxt="n",ylab="",main="Intervalo de Confianza de Medias
  arrows(Linf,1,Lsup,1,code=3,angle=90,col="blue",lwd=2)
#arroes(x1,y1,x2,y2)
  points(media2020-media2021,1,pch=19,col="red",cex=1.5)
  text(Linf-0.015,1+0.04,round(Linf,3))
  text(Lsup+0.015,1+0.04,round(Lsup,3))
  abline(v=0,col="orange",lty=3,lwd=2)
  legend("topright", legend = c("Intervalo de Confianza de Media", "Diferencia (2020-2021)", "Linea en 
       col = c("blue", "red", "orange"), lwd = c(2, 1.5, 2), pch = c(-1, 19, -1),
       title = "Leyenda",cex = 0.5)

    text(0.07, 0.33, "Analisis:", font = 2, cex = 0.5)  # Title in bold
text(0.07, 0.16, "Como el Limite Superior y el Limite \n Inferior del Intervalo  son \n negativos en 20
  }

    else if(i==3){
          plot(NA,xlim=c(-0.007,0.002),ylim=c(0,2),yaxt="n",ylab="",main="Intervalo de Confianza de Medi
  arrows(Linf,1,Lsup,1,code=3,angle=90,col="blue",lwd=2)
#arroes(x1,y1,x2,y2)
  points(media2020-media2021,1,pch=19,col="red",cex=1.5)
  text(Linf-0.00065,1+0.04,round(Linf,5))
  text(Lsup+0.00065,1+0.04,round(Lsup,5))
  abline(v=0,col="orange",lty=3,lwd=2)
  legend("topright", legend = c("Intervalo de Confianza de Media", "Diferencia (2020-2021)", "Linea en 
       col = c("blue", "red", "orange"), lwd = c(2, 1.5, 2), pch = c(-1, 19, -1),
       title = "Leyenda",cex = 0.5)
      text(0.0012, 0.33, "Analisis:", font = 2, cex = 0.5)  # Title in bold
text(0.0012, 0.16, "Como el Limite Superior y el Limite \n Inferior del Intervalo  son \n negativos en 
  }
  else{
          plot(NA,xlim=c(-10,10),ylim=c(0,2),yaxt="n",ylab="",main="Intervalo de Confianza de Medias Pa
  arrows(Linf,1,Lsup,1,code=3,angle=90,col="blue",lwd=2)
#arroes(x1,y1,x2,y2)
  points(media2020-media2021,1,pch=19,col="red",cex=1.5)
  text(Linf-1.3,1,round(Linf,3))
  text(Lsup+1.3,1,round(Lsup,3))
  abline(v=0,col="orange",lty=3,lwd=2)
        text(7, 0.4, "Analisis:", font = 2, cex = 0.75)  # Title in bold
text(7, 0.16, "Como el Limite Superior y el Limite \n Inferior del Intervalo  son \n negativos en 2021 
  }
```

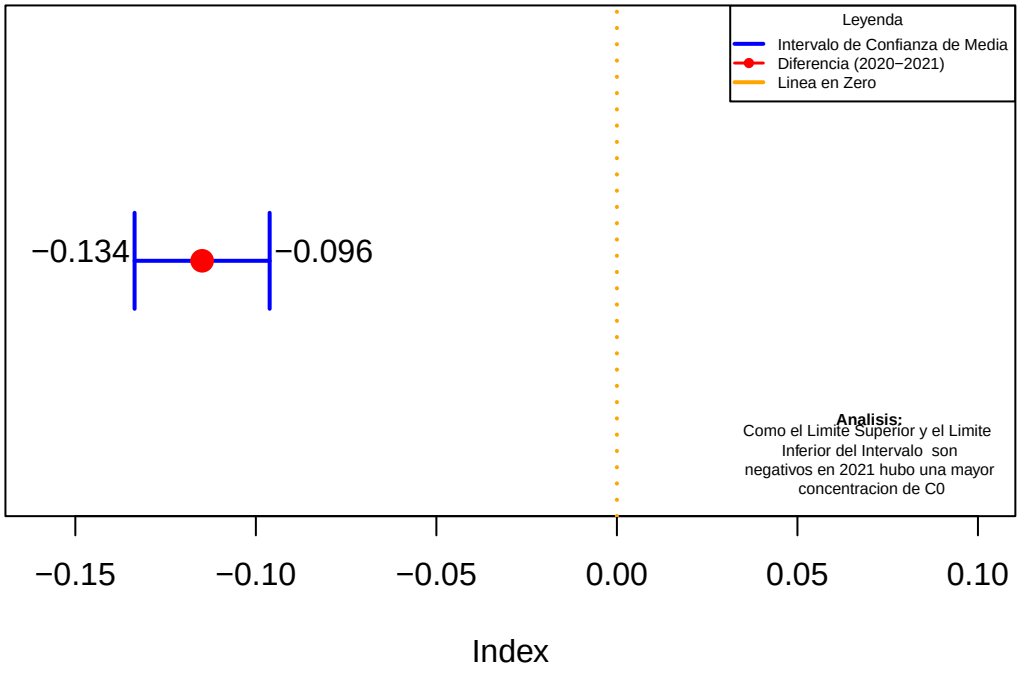
```
}
```

```
## [ 0.002285218 , 0.002958642 ]
```

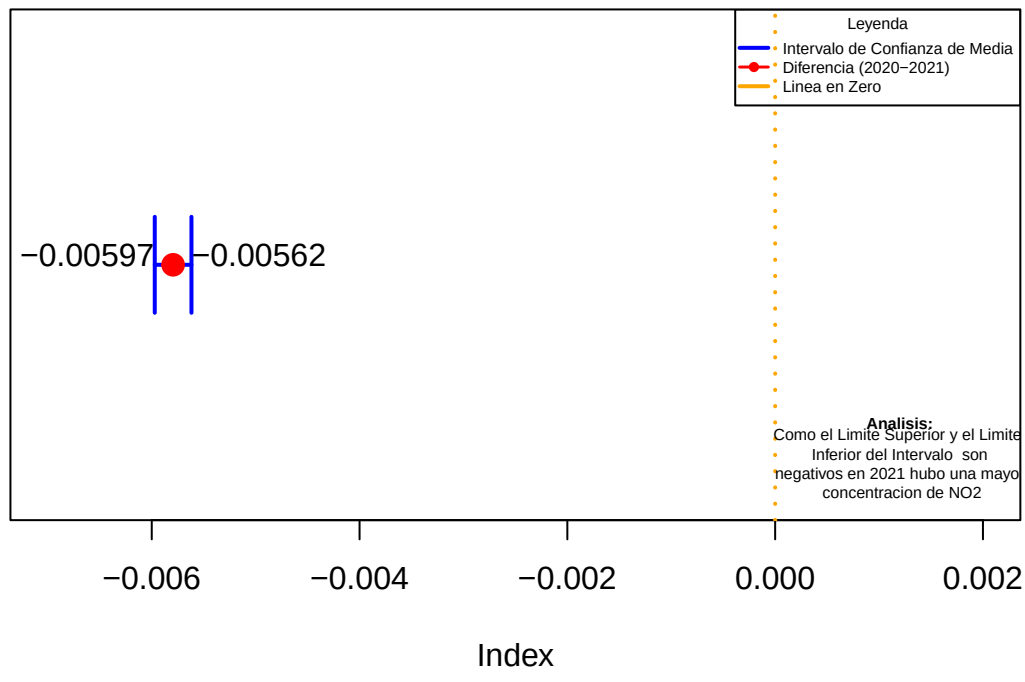



```
## [ -0.1335895 , -0.09617842 ]
```

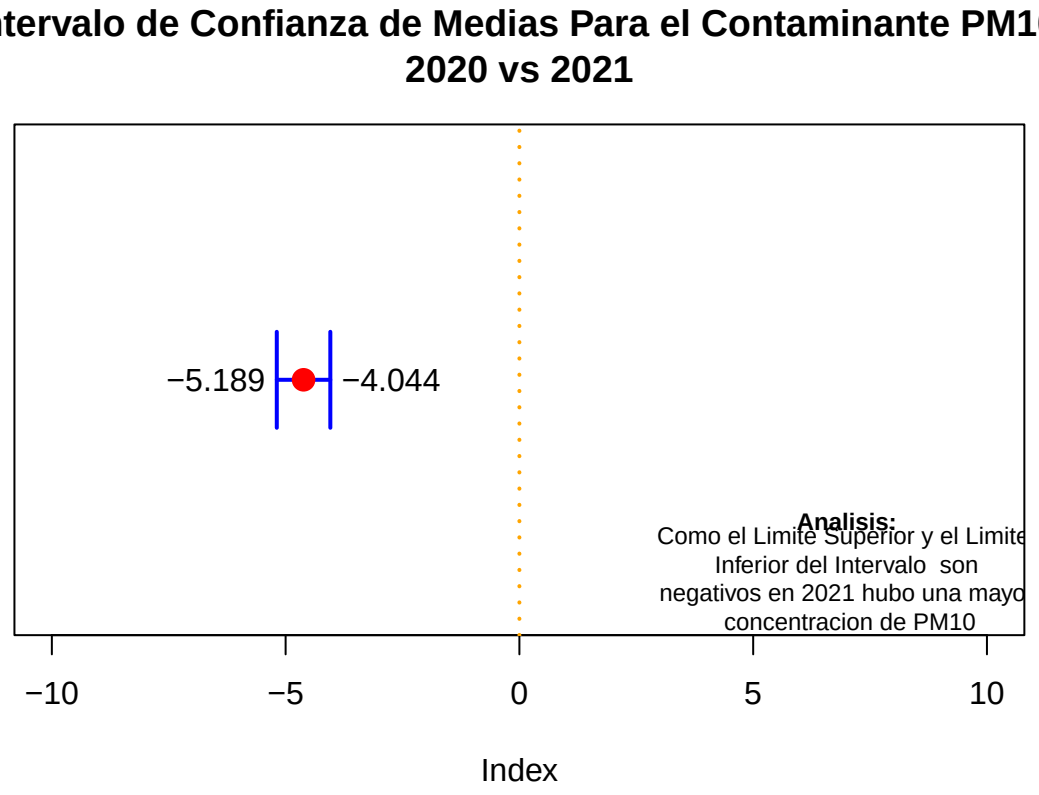
Intervalo de Confianza de Medias Para el Contaminante CO 2020 vs 2021




```
## [ -0.005970981 , -0.005617868 ]
```




```
## [ -5.189046 , -4.043723 ]
```



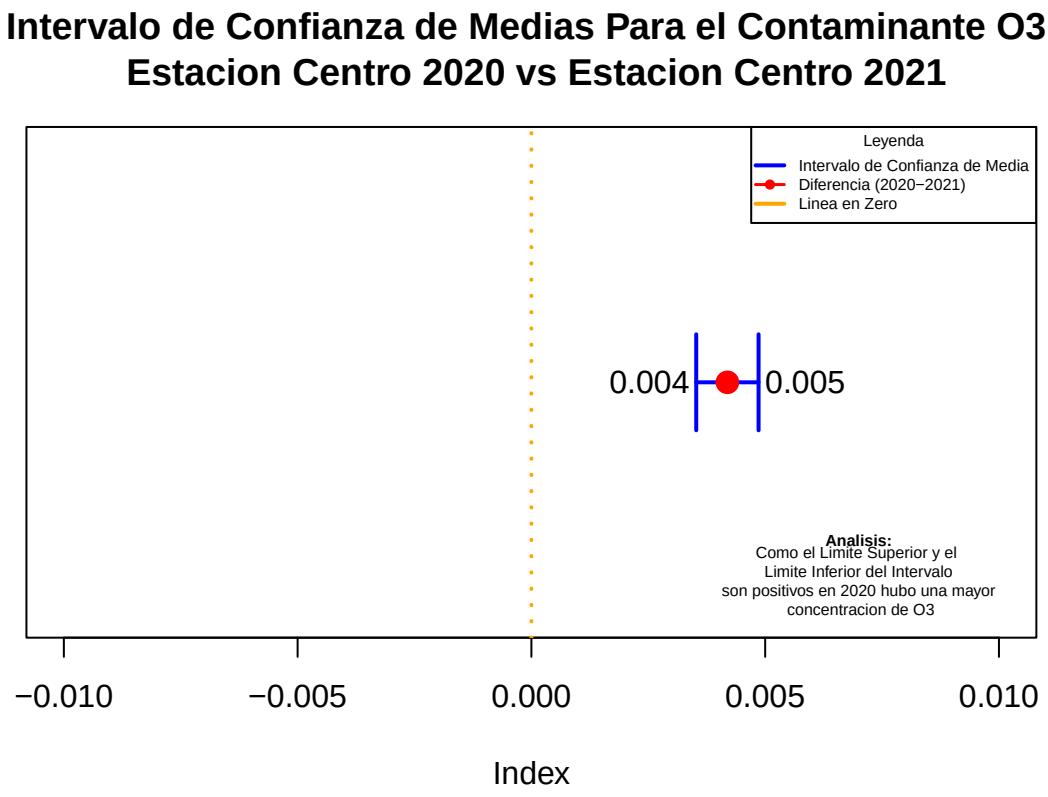
Centro 2020 contra Centro 2021

```
M <- subset(M1, Estacion %in% c("Centro_2020", "Centro_2021"))

listacolumn2020s=c('O3Concentracion','CO','NO2','PM10')

for (i in 1:length(listacolumn2020s)){
  df_2020 <- M[M$Year == 2020, listacolumn2020s[i]]
  df_2021 <- M[M$Year == 2021, listacolumn2020s[i]]
  #calcular desviacion estandar
  desv2020=sd(df_2020, na.rm = TRUE)
  desv2021=sd(df_2021, na.rm = TRUE)
  #calcular medias
  media2020=mean(df_2020, na.rm = TRUE)
  media2021=mean(df_2021, na.rm = TRUE)
  #calcular numero de observaciones
  n2020=sum(!is.na(df_2020))
  n2021=sum(!is.na(df_2020))
  alfa=0.05
  #calcular z
  Z=abs(qnorm(alfa/2))
  EE= sqrt((desv2020^2/n2020)+(desv2021^2/n2021))                    #Error estandar
  #calcular limites
```

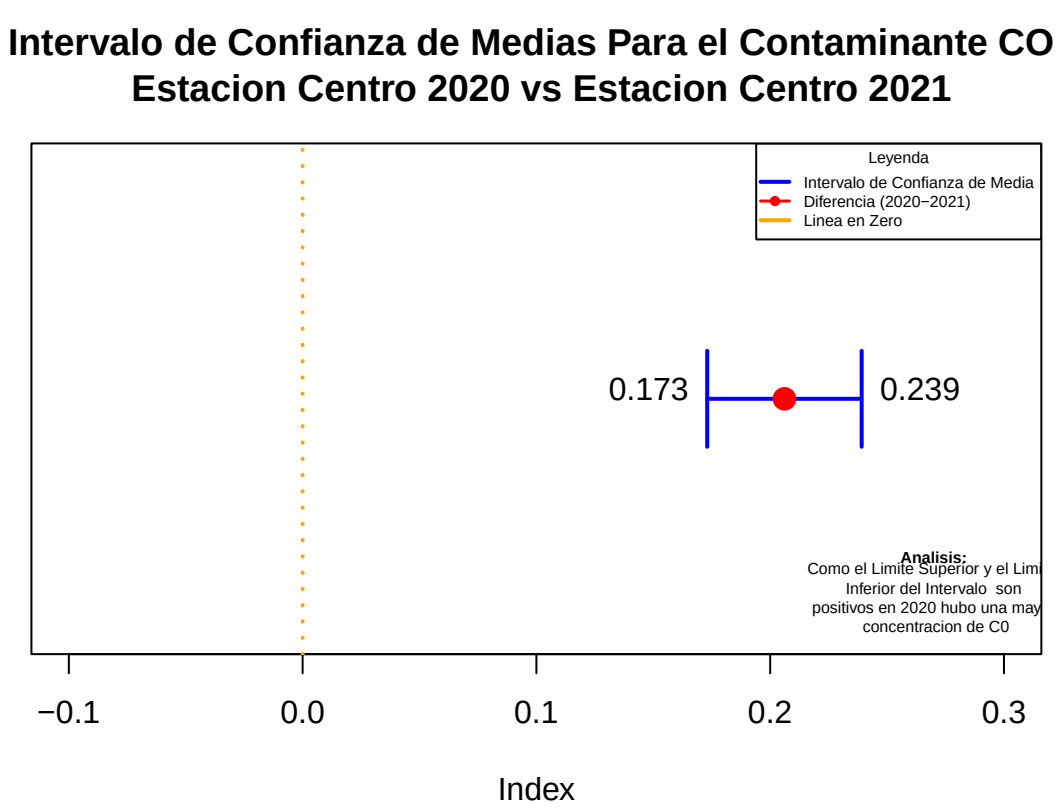
```
  Linf=(media2020-media2021)-(Z*EE)
  Lsup=(media2020-media2021)+(Z*EE)
  cat("[",Linf,",",Lsup,"]\n")
  if(i== 1){
      plot(NA,xlim=c(-0.01,0.01),ylim=c(0,2),yaxt="n",ylab="",main="Intervalo de Confianza de Medias Pa
  arrows(Linf,1,Lsup,1,code=3,angle=90,col="blue",lwd=2)
#arroes(x1,y1,x2,y2)
  points(media2020-media2021,1,pch=19,col="red",cex=1.5)
  text(Linf-0.001,1,round(Linf,3))
  text(Lsup+0.001,1,round(Lsup,3))
  abline(v=0,col="orange",lty=3,lwd=2)


  legend("topright", legend = c("Intervalo de Confianza de Media", "Diferencia (2020-2021)", "Linea en
       col = c("blue", "red", "orange"), lwd = c(2, 1.5, 2), pch = c(-1, 19, -1),
       title = "Leyenda",cex = 0.5)
  text(0.007, 0.33, "Analisis:", font = 2, cex = 0.5)  # Title in bold
text(0.007, 0.16, "Como el Limite Superior y el \n Limite Inferior del Intervalo \n son positivos en 20
  }
  else if(i==2){
          plot(NA,xlim=c(-0.1,0.3),ylim=c(0,2),yaxt="n",ylab="",main="Intervalo de Confianza de Medias
  arrows(Linf,1,Lsup,1,code=3,angle=90,col="blue",lwd=2)
#arroes(x1,y1,x2,y2)
  points(media2020-media2021,1,pch=19,col="red",cex=1.5)
  text(Linf-0.025,1+0.04,round(Linf,3))
  text(Lsup+0.025,1+0.04,round(Lsup,3))
  abline(v=0,col="orange",lty=3,lwd=2)
  legend("topright", legend = c("Intervalo de Confianza de Media", "Diferencia (2020-2021)", "Linea en
       col = c("blue", "red", "orange"), lwd = c(2, 1.5, 2), pch = c(-1, 19, -1),
       title = "Leyenda",cex = 0.5)

    text(0.27, 0.33, "Analisis:", font = 2, cex = 0.5)  # Title in bold
text(0.27, 0.16, "Como el Limite Superior y el Limite \n Inferior del Intervalo  son \n positivos en 20
  }

    else if(i==3){
          plot(NA,xlim=c(-0.01,0.003),ylim=c(0,2),yaxt="n",ylab="",main="Intervalo de Confianza de Media
  arrows(Linf,1,Lsup,1,code=3,angle=90,col="blue",lwd=2)
#arroes(x1,y1,x2,y2)
  points(media2020-media2021,1,pch=19,col="red",cex=1.5)
  text(Linf-0.00085,1+0.04,round(Linf,5))
  text(Lsup+0.00085,1+0.04,round(Lsup,5))
  abline(v=0,col="orange",lty=3,lwd=2)
  legend("topright", legend = c("Intervalo de Confianza de Media", "Diferencia (2020-2021)", "Linea en
       col = c("blue", "red", "orange"), lwd = c(2, 1.5, 2), pch = c(-1, 19, -1),
       title = "Leyenda",cex = 0.5)
      text(0.0018, 0.33, "Analisis:", font = 2, cex = 0.5)  # Title in bold
text(0.0018, 0.16, "Como el Limite Superior y el Limite \n Inferior del Intervalo  son \n negativos en
  }
  else{
          plot(NA,xlim=c(-14.3,9),ylim=c(0,2),yaxt="n",ylab="",main="Intervalo de Confianza de Medias Pa
  arrows(Linf,1,Lsup,1,code=3,angle=90,col="blue",lwd=2)
#arroes(x1,y1,x2,y2)
```

```
  points(media2020-media2021,1,pch=19,col="red",cex=1.5)
  text(Linf-1.3,1,round(Linf,3))
  text(Lsup+1.3,1,round(Lsup,3))
  abline(v=0,col="orange",lty=3,lwd=2)
        text(5, 0.4, "Analisis:", font = 2, cex = 0.75)  # Title in bold
text(5, 0.16, "Como el Limite Superior y el Limite \n Inferior del Intervalo  son \n negativos en 2021 l
  }

}
```

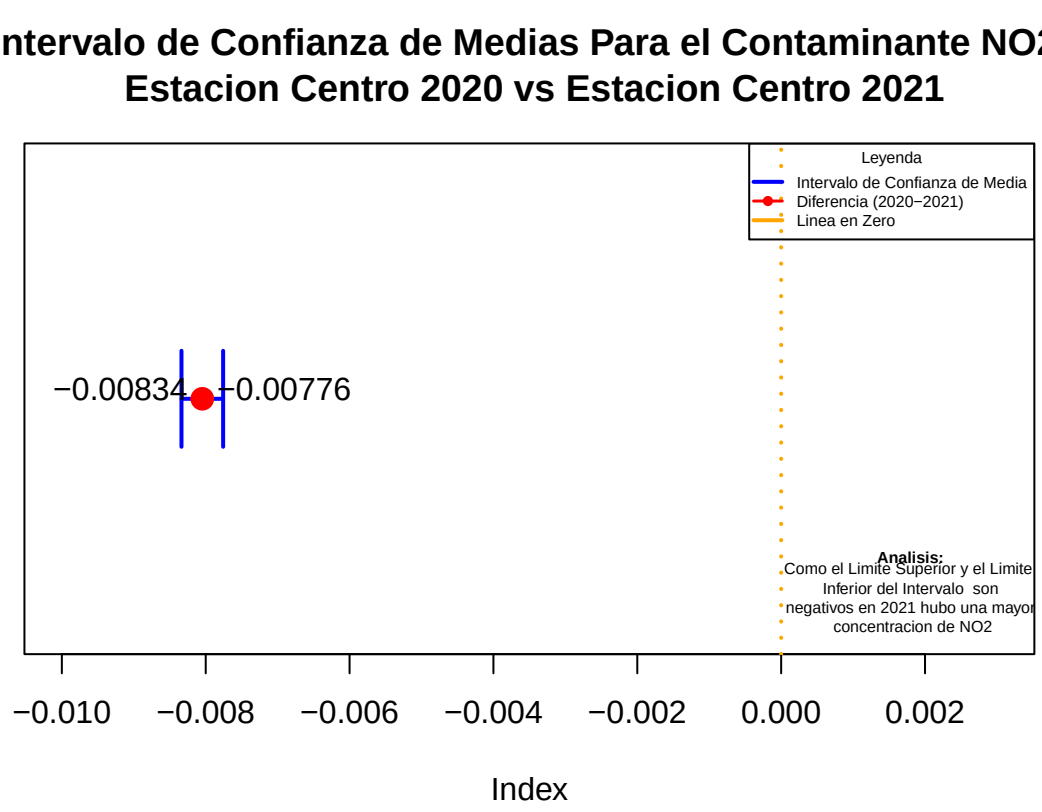
```
## [ 0.003525326 , 0.004858766 ]
```



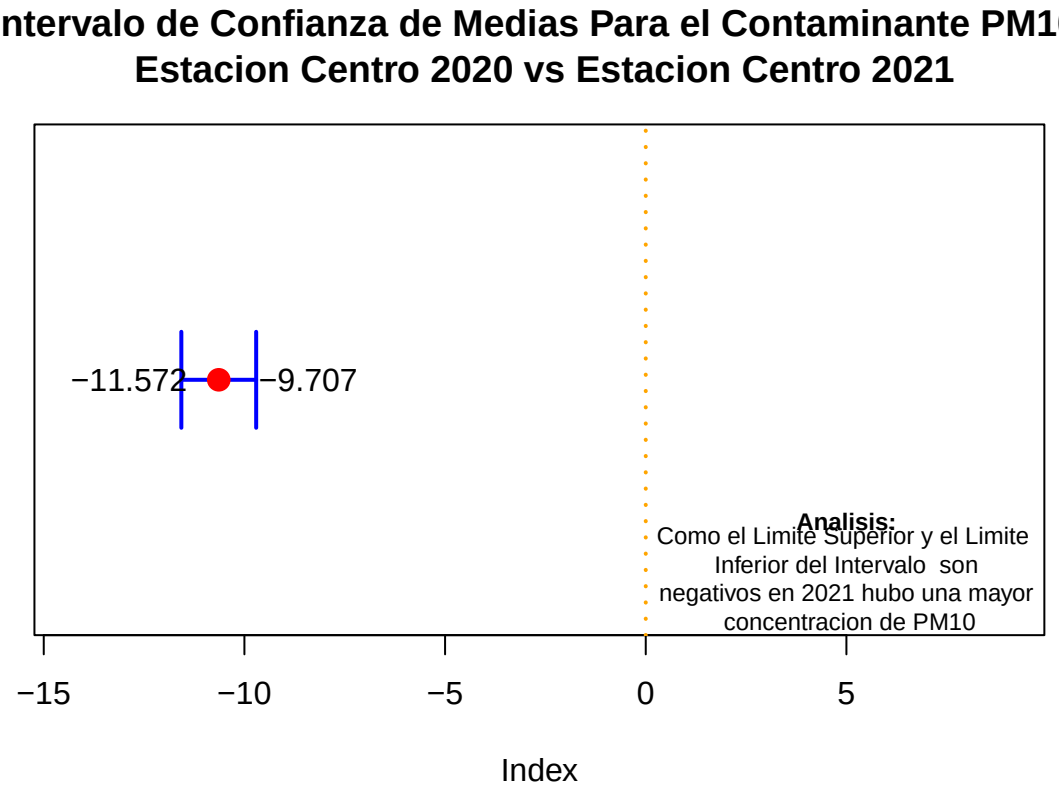

```
## [ 0.1730599 , 0.239132 ]
```




```
## [ -0.00833677 , -0.007757838 ]
```




```
## [ -11.57165 , -9.706989 ]
```



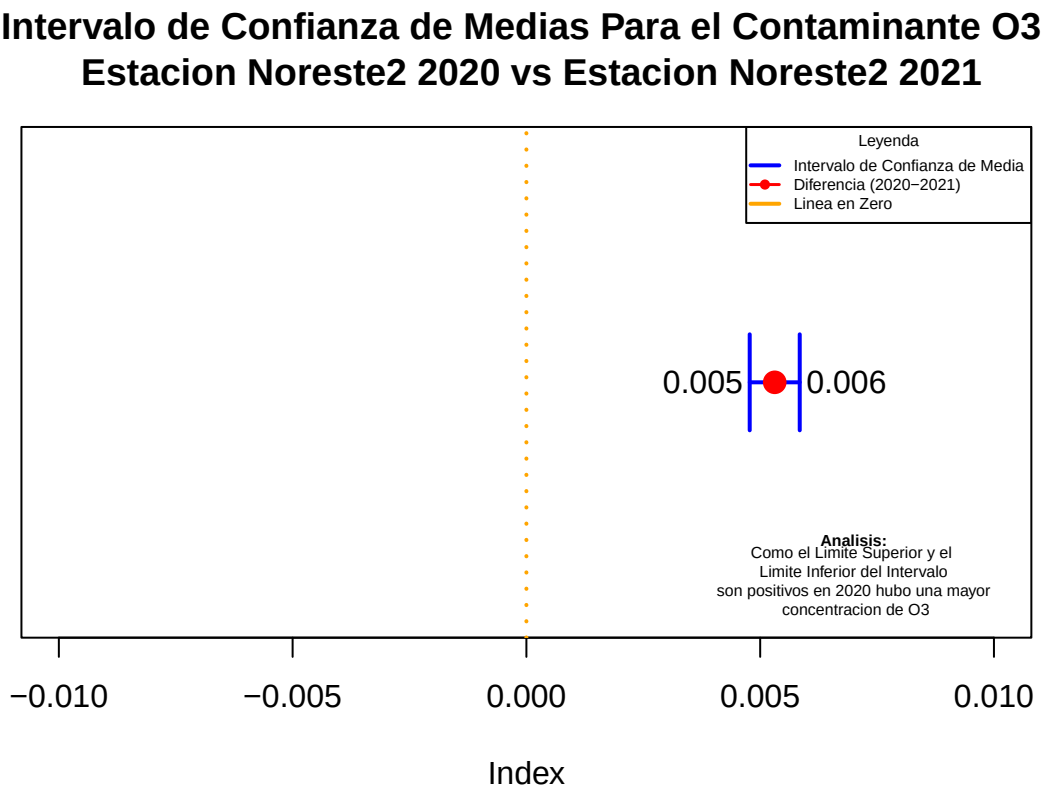
Noreste2 2020 contra Noreste2 2021

```
M <- subset(M1, Estacion %in% c("Noreste2_2020", "Noreste2_2021"))

listacolumn2020s=c('O3Concentracion','CO','NO2','PM10')

for (i in 1:length(listacolumn2020s)){
  df_2020 <- M[M$Year == 2020, listacolumn2020s[i]]
  df_2021 <- M[M$Year == 2021, listacolumn2020s[i]]
  #calcular desviacion estandar
  desv2020=sd(df_2020, na.rm = TRUE)
  desv2021=sd(df_2021, na.rm = TRUE)
  #calcular medias
  media2020=mean(df_2020, na.rm = TRUE)
  media2021=mean(df_2021, na.rm = TRUE)
  #calcular numero de observaciones
  n2020=sum(!is.na(df_2020))
  n2021=sum(!is.na(df_2020))
  alfa=0.05
  #calcular z
  Z=abs(qnorm(alfa/2))
  EE= sqrt((desv2020^2/n2020)+(desv2021^2/n2021))                    #Error estandar
  #calcular limites
```

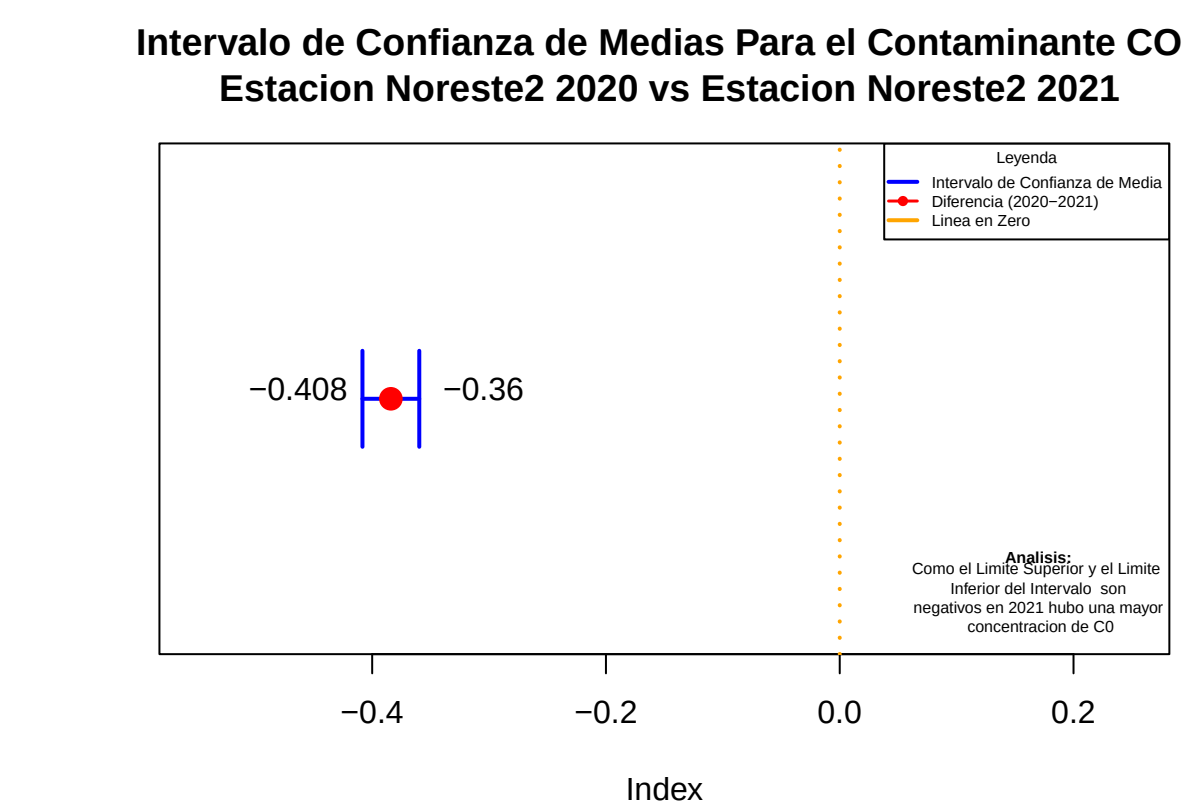
```
  Linf=(media2020-media2021)-(Z*EE)
  Lsup=(media2020-media2021)+(Z*EE)
  cat("[",Linf,",",Lsup,"]\n")
  if(i== 1){
      plot(NA,xlim=c(-0.01,0.01),ylim=c(0,2),yaxt="n",ylab="",main="Intervalo de Confianza de Medias Pa
  arrows(Linf,1,Lsup,1,code=3,angle=90,col="blue",lwd=2)
#arroes(x1,y1,x2,y2)
  points(media2020-media2021,1,pch=19,col="red",cex=1.5)
  text(Linf-0.001,1,round(Linf,3))
  text(Lsup+0.001,1,round(Lsup,3))
  abline(v=0,col="orange",lty=3,lwd=2)


  legend("topright", legend = c("Intervalo de Confianza de Media", "Diferencia (2020-2021)", "Linea en
       col = c("blue", "red", "orange"), lwd = c(2, 1.5, 2), pch = c(-1, 19, -1),
       title = "Leyenda",cex = 0.5)
  text(0.007, 0.33, "Analisis:", font = 2, cex = 0.5)  # Title in bold
text(0.007, 0.16, "Como el Limite Superior y el \n Limite Inferior del Intervalo \n son positivos en 20
  }
  else if(i==2){
          plot(NA,xlim=c(-0.55,0.25),ylim=c(0,2),yaxt="n",ylab="",main="Intervalo de Confianza de Media
  arrows(Linf,1,Lsup,1,code=3,angle=90,col="blue",lwd=2)
#arroes(x1,y1,x2,y2)
  points(media2020-media2021,1,pch=19,col="red",cex=1.5)
  text(Linf-0.055,1+0.04,round(Linf,3))
  text(Lsup+0.055,1+0.04,round(Lsup,3))
  abline(v=0,col="orange",lty=3,lwd=2)
  legend("topright", legend = c("Intervalo de Confianza de Media", "Diferencia (2020-2021)", "Linea en
       col = c("blue", "red", "orange"), lwd = c(2, 1.5, 2), pch = c(-1, 19, -1),
       title = "Leyenda",cex = 0.5)

    text(0.17, 0.33, "Analisis:", font = 2, cex = 0.5)  # Title in bold
text(0.17, 0.16, "Como el Limite Superior y el Limite \n Inferior del Intervalo  son \n negativos en 20
  }

    else if(i==3){
          plot(NA,xlim=c(-0.02,0.01),ylim=c(0,2),yaxt="n",ylab="",main="Intervalo de Confianza de Media
  arrows(Linf,1,Lsup,1,code=3,angle=90,col="blue",lwd=2)
#arroes(x1,y1,x2,y2)
  points(media2020-media2021,1,pch=19,col="red",cex=1.5)
  text(Linf-0.00185,1+0.04,round(Linf,5))
  text(Lsup+0.00185,1+0.04,round(Lsup,5))
  abline(v=0,col="orange",lty=3,lwd=2)
  legend("topright", legend = c("Intervalo de Confianza de Media", "Diferencia (2020-2021)", "Linea en
       col = c("blue", "red", "orange"), lwd = c(2, 1.5, 2), pch = c(-1, 19, -1),
       title = "Leyenda",cex = 0.5)
      text(0.006, 0.33, "Analisis:", font = 2, cex = 0.5)  # Title in bold
text(0.006, 0.16, "Como el Limite Superior y el Limite \n Inferior del Intervalo  son \n negativos en 2
  }
  else{
          plot(NA,xlim=c(-10,10),ylim=c(0,2),yaxt="n",ylab="",main="Intervalo de Confianza de Medias Pa
  arrows(Linf,1,Lsup,1,code=3,angle=90,col="blue",lwd=2)
#arroes(x1,y1,x2,y2)
```

```
  points(media2020-media2021,1,pch=19,col="red",cex=1.5)
  text(Linf-1.3,1,round(Linf,3))
  text(Lsup+1.3,1,round(Lsup,3))
  abline(v=0,col="orange",lty=3,lwd=2)
        text(5, 0.4, "Analisis:", font = 2, cex = 0.75)  # Title in bold
text(5, 0.16, "Como el Limite Superior y el Limite \n Inferior del Intervalo  son \n negativos en 2021 l
  }

}
```

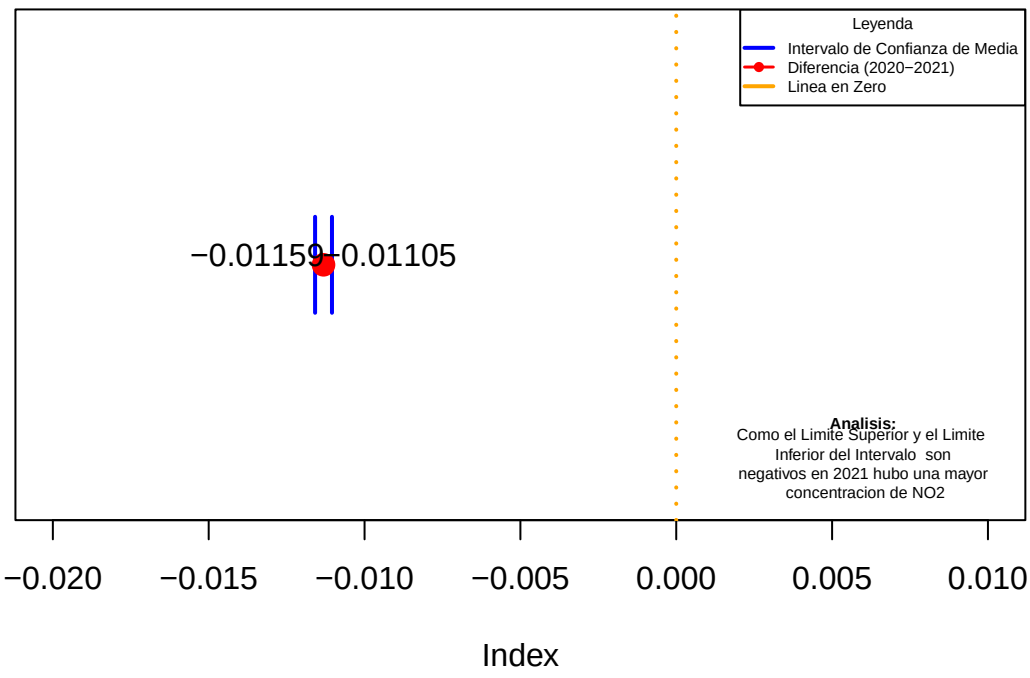
```
## [ 0.004775976 , 0.00584612 ]
```



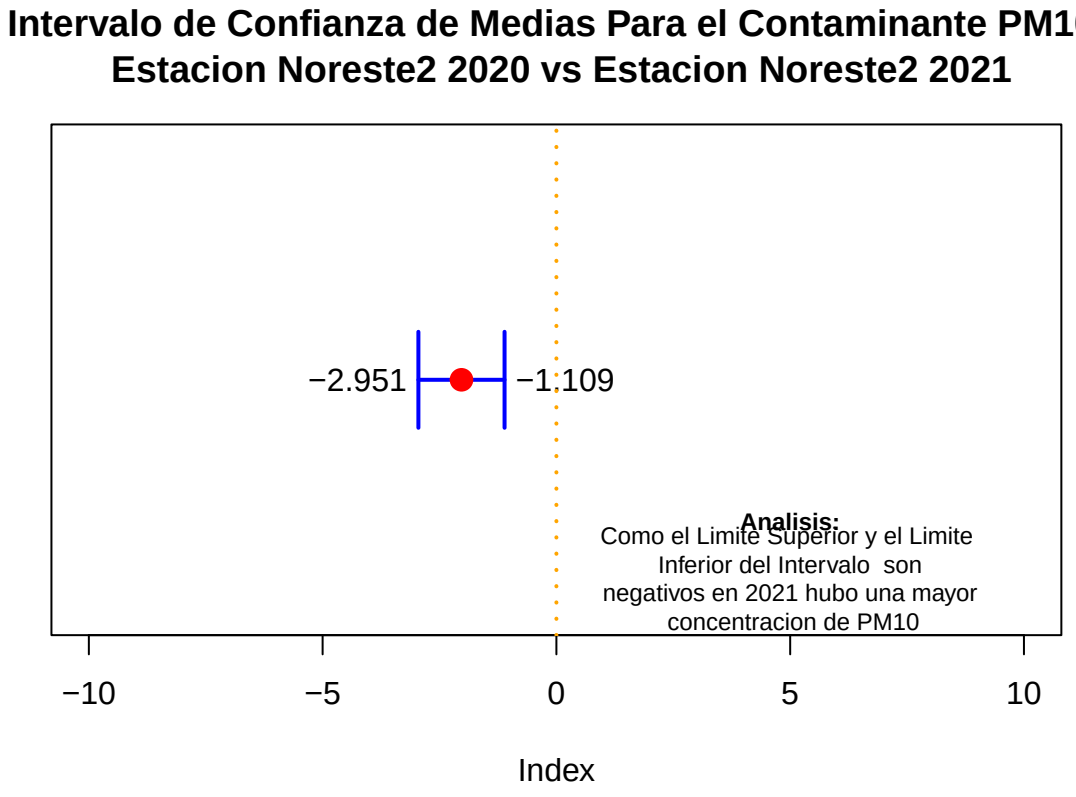

```
## [ -0.40832 , -0.3597015 ]
```




```
## [ -0.01158686 , -0.01104537 ]
```




```
## [ -2.951327 , -1.108905 ]
```



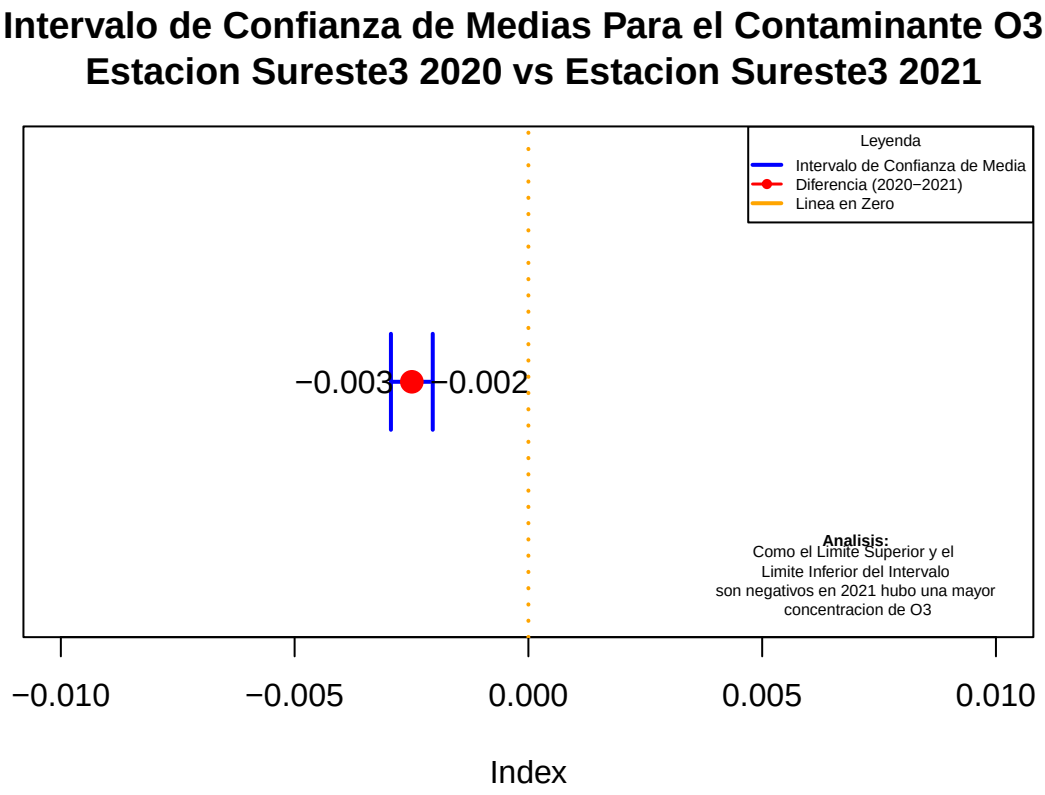
Sureste 3 2020 contra Sureste 3 2021

```
M <- subset(M1, Estacion %in% c("Sureste3_2020", "Sureste3_2021"))

listacolumn2020s=c('O3Concentracion','CO','NO2','PM10')

for (i in 1:length(listacolumn2020s)){
  df_2020 <- M[M$Year == 2020, listacolumn2020s[i]]
  df_2021 <- M[M$Year == 2021, listacolumn2020s[i]]
  #calcular desviacion estandar
  desv2020=sd(df_2020, na.rm = TRUE)
  desv2021=sd(df_2021, na.rm = TRUE)
  #calcular medias
  media2020=mean(df_2020, na.rm = TRUE)
  media2021=mean(df_2021, na.rm = TRUE)
  #calcular numero de observaciones
  n2020=sum(!is.na(df_2020))
  n2021=sum(!is.na(df_2020))
  alfa=0.05
  #calcular z
  Z=abs(qnorm(alfa/2))
  EE= sqrt((desv2020^2/n2020)+(desv2021^2/n2021))                    #Error estandar
  #calcular limites
  Linf=(media2020-media2021)-(Z*EE)
  Lsup=(media2020-media2021)+(Z*EE)
  cat("[",Linf,",",Lsup,"]\n")
  if(i== 1){
```

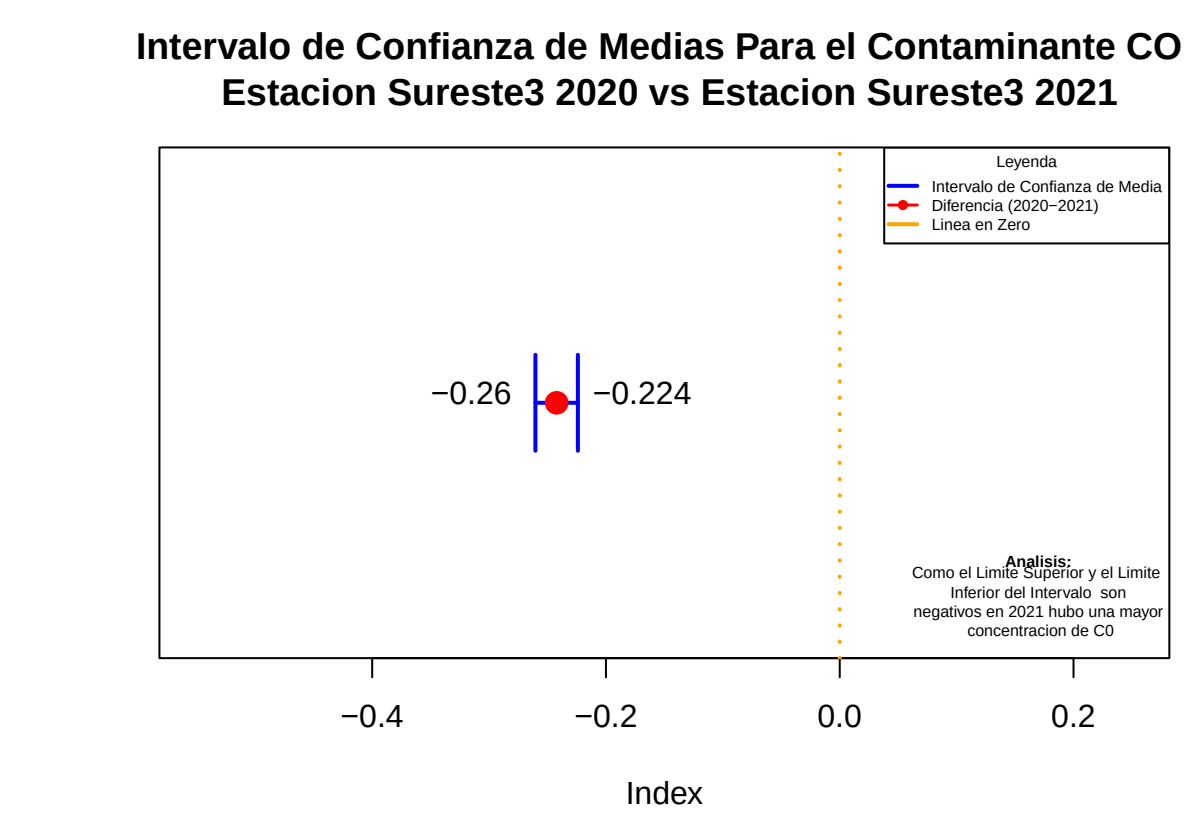
```
      plot(NA,xlim=c(-0.01,0.01),ylim=c(0,2),yaxt="n",ylab="",main="Intervalo de Confianza de Medias Pa
  arrows(Linf,1,Lsup,1,code=3,angle=90,col="blue",lwd=2)
#arroes(x1,y1,x2,y2)
  points(media2020-media2021,1,pch=19,col="red",cex=1.5)
  text(Linf-0.001,1,round(Linf,3))
  text(Lsup+0.001,1,round(Lsup,3))
  abline(v=0,col="orange",lty=3,lwd=2)


  legend("topright", legend = c("Intervalo de Confianza de Media", "Diferencia (2020-2021)", "Linea en
       col = c("blue", "red", "orange"), lwd = c(2, 1.5, 2), pch = c(-1, 19, -1),
       title = "Leyenda",cex = 0.5)
  text(0.007, 0.33, "Analisis:", font = 2, cex = 0.5)  # Title in bold
text(0.007, 0.16, "Como el Limite Superior y el \n Limite Inferior del Intervalo \n son negativos en 20
  }
  else if(i==2){
         plot(NA,xlim=c(-0.55,0.25),ylim=c(0,2),yaxt="n",ylab="",main="Intervalo de Confianza de Media
  arrows(Linf,1,Lsup,1,code=3,angle=90,col="blue",lwd=2)
#arroes(x1,y1,x2,y2)
  points(media2020-media2021,1,pch=19,col="red",cex=1.5)
  text(Linf-0.055,1+0.04,round(Linf,3))
  text(Lsup+0.055,1+0.04,round(Lsup,3))
  abline(v=0,col="orange",lty=3,lwd=2)
  legend("topright", legend = c("Intervalo de Confianza de Media", "Diferencia (2020-2021)", "Linea en
       col = c("blue", "red", "orange"), lwd = c(2, 1.5, 2), pch = c(-1, 19, -1),
       title = "Leyenda",cex = 0.5)

    text(0.17, 0.33, "Analisis:", font = 2, cex = 0.5)  # Title in bold
text(0.17, 0.16, "Como el Limite Superior y el Limite \n Inferior del Intervalo  son \n negativos en 20
  }

    else if(i==3){
         plot(NA,xlim=c(-0.02,0.01),ylim=c(0,2),yaxt="n",ylab="",main="Intervalo de Confianza de Media
  arrows(Linf,1,Lsup,1,code=3,angle=90,col="blue",lwd=2)
#arroes(x1,y1,x2,y2)
  points(media2020-media2021,1,pch=19,col="red",cex=1.5)
  text(Linf-0.00185,1+0.04,round(Linf,5))
  text(Lsup+0.00185,1+0.04,round(Lsup,5))
  abline(v=0,col="orange",lty=3,lwd=2)
  legend("topright", legend = c("Intervalo de Confianza de Media", "Diferencia (2020-2021)", "Linea en
       col = c("blue", "red", "orange"), lwd = c(2, 1.5, 2), pch = c(-1, 19, -1),
       title = "Leyenda",cex = 0.5)
      text(0.006, 0.37, "Analisis:", font = 2, cex = 0.5)  # Title in bold
text(0.0058, 0.16, "Como el Limite Superior es positivo y el \n Limite Inferior Negativo y el 0 se encu
  }
  else{
         plot(NA,xlim=c(-10,10),ylim=c(0,2),yaxt="n",ylab="",main="Intervalo de Confianza de Medias Pa
  arrows(Linf,1,Lsup,1,code=3,angle=90,col="blue",lwd=2)
#arroes(x1,y1,x2,y2)
  points(media2020-media2021,1,pch=19,col="red",cex=1.5)
  text(Linf-1.3,1,round(Linf,3))
  text(Lsup+1.3,1,round(Lsup,3))
  abline(v=0,col="orange",lty=3,lwd=2)
```

```
        text(5, 0.4, "Analisis:", font = 2, cex = 0.75)  # Title in bold
text(5, 0.16, "Como el Limite Superior y el Limite \n Inferior del Intervalo  son \n negativos en 2021 h
  }

}
```

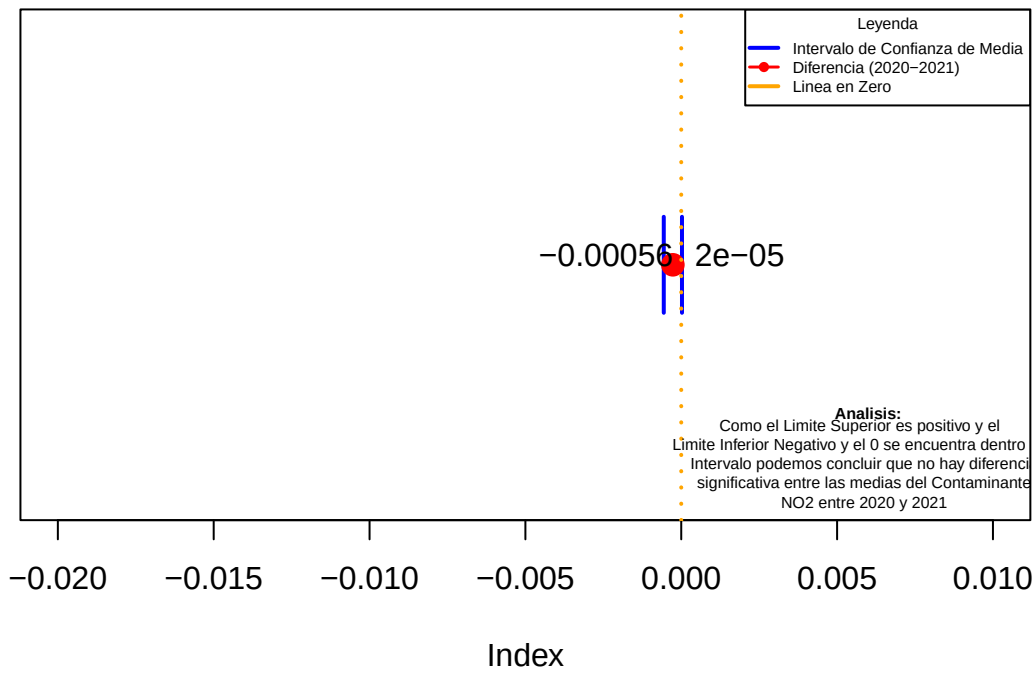
```
## [ -0.002939859 , -0.002045578 ]
```



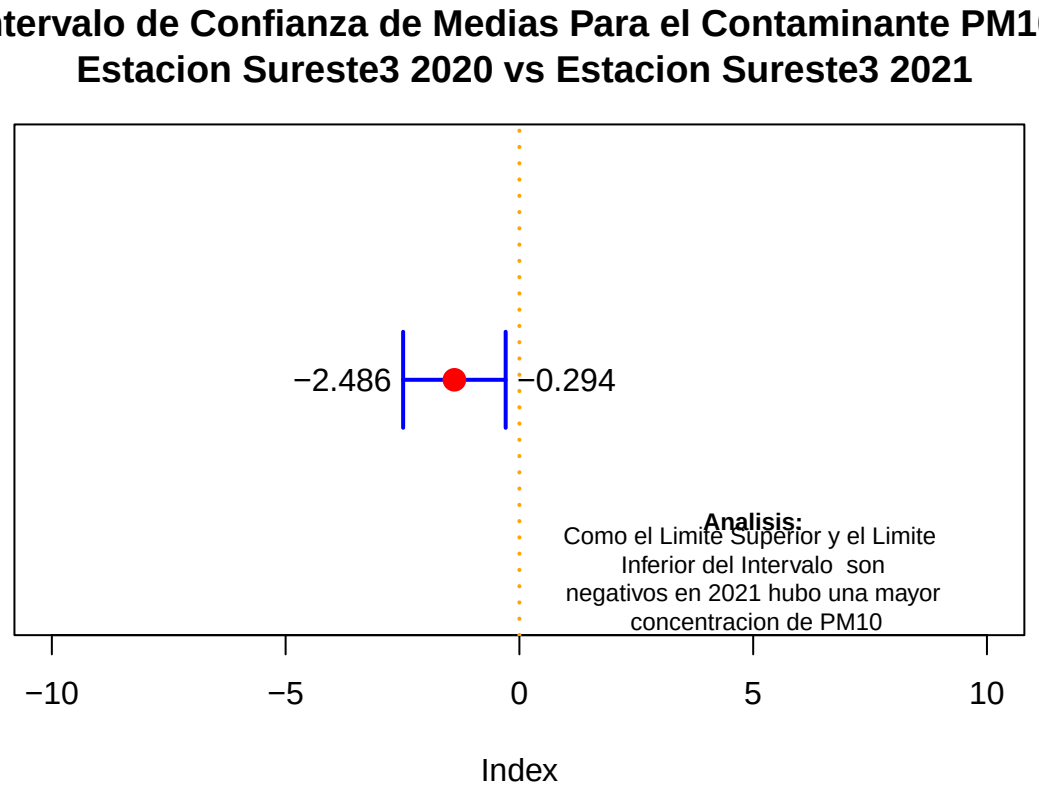

```
## [ -0.2603415 , -0.2240101 ]
```




```
## [ -0.0005611481 , 2.335399e-05 ]
```




```
## [ -2.486423 , -0.293567 ]
```




```
M=read.csv('DatasetAnovaComparacionMedias_Concentracion.csv')
# Assuming your data frame is named "df"
M$Estacion2 <- gsub("Sureste3", "Sur", M$Estacion2)
M$Estacion2 <- gsub("Noreste2", "Norte", M$Estacion2)
M$Year <- gsub("2020", "20", M$Year)
M$Year <- gsub("2021", "21", M$Year)
```

Anova Multifactotial

Pruebas de hiptesis de modelo anova

```
listacolumn2020s=c('O3Concentracion','CO','NO2','PM10')

column_name <- listacolumn2020s[1]
contaminante <- M[[column_name]]

ano=as.factor(M$Year)
estacion=as.factor(M$Estacion2)
modelo=aov(contaminante ~ ano * estacion)
summary(modelo)
```

```
##                Df Sum Sq Mean Sq F value Pr(>F)
```

```
## ano              1  0.077  0.0770   269.3 <2e-16 ***
## estacion         2  0.685  0.3426  1197.6 <2e-16 ***
## ano:estacion     2  0.130  0.0652   227.7 <2e-16 ***
## Residuals    45121 12.909  0.0003
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
## 7479 observations deleted due to missingness
```

```
analisis=TukeyHSD(modelo,conf.level=0.95)


#La unica concentracion con p valor menor a 0.05 el unico factor que se encuentra en el valor de 0.05 a

# normalilibrary(nortest)
#dad de los residuos
library(nortest)
ad.test(modelo$residuals)
```

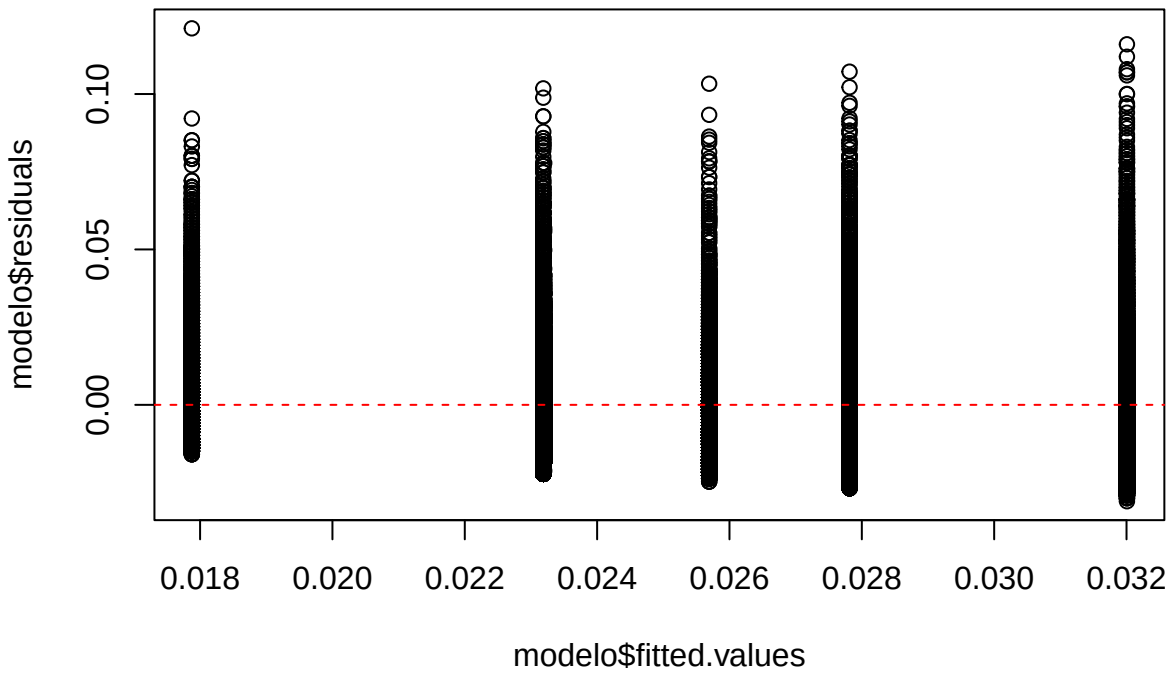
```
##
##  Anderson-Darling normality test
##
## data:  modelo$residuals
## A = 607.93, p-value < 2.2e-16
```

```
#$H_0 : \mu_r=0$
#$H_1 : \mu_r!=0$
#Como p valor =0.5757 no rechazo H0 por lo que podemos conjcluir que los residuos se distribuyen normal
# Homocedasticidad

plot(modelo$fitted.values, modelo$residuals)
abline(h = 0, col = "red", lty = 2)


#En esta grafica se puede ver como el modelo cuenta con homoceasticidad desde el intervalo en #modelofi

# independencia

library(lmtest)
```

```
## Loading required package: zoo
```

```
##
## Attaching package: 'zoo'
```

```
## The following objects are masked from 'package:base':
##
##     as.Date, as.Date.numeric
```




```
dwtest(modelo)
```

```
##
##  Durbin-Watson test
##
## data:  modelo
## DW = 0.15759, p-value < 2.2e-16
## alternative hypothesis: true autocorrelation is greater than 0
```

```
#plot(seq(1,50), modelo$residuals,xlab='observacion',ylab='Residuo',main='normalidad residuos')



#$H_0: Cov(u_i,u_j)=0$
#$H_1: Cov(u_i,u_j)!=0$
#Como  el p valor despues de la prueba = 0.424 no rechazo H0 por lo que puedo concluir que los #residua


# Obtén los intervalos de confianza de resistencia por concentración de madera dura.
#t.test(modelo$residuals)
```

x

```r
FactorialPlotList <- list()
BoxPlotList <- list()


listacolumn2020s=c('O3Concentracion','CO','NO2','PM10')
for (i in 1:length(listacolumn2020s) ){
  column_name <- listacolumn2020s[i]
contaminante <- M[[column_name]]

ano=as.factor(M$Year)
estacion=as.factor(M$Estacion2)
modelo=aov(contaminante ~ ano * estacion)
analisis=TukeyHSD(modelo,conf.level=0.95)
anovaxestacion=analisis$estacion
listaetiquetas=as.vector(rownames(anovaxestacion))

anovaxestacion=analisis$estacion
# Sample values for the y-axis
# Debug prints to check the data
linflist=as.vector(anovaxestacion[, 2])
lsuplist=as.vector(anovaxestacion[, 3])

plot(NA, xlim = c(min(linflist)-0.5, max(lsuplist)+0.5), ylim = c(0, length(listaetiquetas) + 1), yaxt =

# Add y-axis labels
par(cex.axis = 0.4)
axis(2, at = 1:length(listaetiquetas), labels = listaetiquetas)
abline(h = 1:length(listaetiquetas), col = "gray", lty = 2)

abline(v=0,col="orange",lty=3,lwd=2)
# Loop to add arrows for each y-value
for (j in 1:length(listaetiquetas)) {
  Linf <- linflist[j]
  Lsup <- lsuplist[j]
  arrows(Linf, j, Lsup, j, code = 3, angle = 90, col = "blue", lwd = 1)
}


anovaxano=analisis$`ano:estacion`

listaetiquetasano=as.vector(rownames(anovaxano))
target_values <- c("21:Centro-20:Centro", "21:Norte-20:Norte", "21:Sur-20:Sur")

# Find the positions using which()
positions <- which(listaetiquetasano %in% target_values)
listaetiquetasano <- listaetiquetasano[listaetiquetasano %in% target_values]
print(listaetiquetasano)
# Sample values for the y-axis
# Debug prints to check the data

linflist=as.vector(anovaxano[, 2])
lsuplist=as.vector(anovaxano[, 3])
linflist <- linflist[positions]
```

```r
lsuplist <- lsuplist[positions]

width <- 10  # Adjust the width as needed
height <- 8  # Adjust the height as needed

nombre=paste(column_name,"_Anova_Grafica.pdf")
# Create a larger plot with increased margins
pdf(nombre, width = width, height = height)  # Save the plot as a PDF file
par(mfrow = c(1, 1), mar = c(4, 5, 2, 5))



plot(NA, xlim = c(min(linflist)-0.5, max(lsuplist)+0.5), ylim = c(0, length(listaetiquetasano) + 1), ya

# Add y-axis labels
par(cex.axis = 0.03)
# Add y-axis labels to the left and right based on position
for (k in 1:length(listaetiquetasano)) {
  label <- listaetiquetasano[k]
  if (k %% 2 == 1) {
    # Odd-numbered labels go on the left
    #par(cex.axis = 0.1)
    mtext(label, side = 2, at = k, line = 0.5, las = 0,cex = 1.2,tck = 0.1)
  } else {
    #par(cex.axis = 0.1)
    # Even-numbered labels go on the right
    mtext(label, side = 4, at = k, line = 0.5, las = 0,cex = 1.2,tck = 0.1)
  }
}
abline(h = 1:length(listaetiquetasano), col = "gray", lty = 2)

abline(v=0,col="orange",lty=3,lwd=2)
# Loop to add arrows for each y-value
arrowhead_length_low <- 0.1  # Length of the lower arrowhead
arrowhead_length_high <- 0.3
for (o in 1:length(listaetiquetasano)) {
  Linf <- linflist[o]
  Lsup <- lsuplist[o]

  # Draw the arrow with custom arrowheads
  y_pos <- o
  # Lower arrowhead
  segments(Linf, y_pos - arrowhead_length_high, Linf, y_pos + arrowhead_length_high, col = "blue", lwd =
  # Main line
  segments(Linf, y_pos, Lsup, y_pos, col = "blue", lwd = 1)
  # Upper arrowhead
  segments(Lsup, y_pos - arrowhead_length_high, Lsup, y_pos + arrowhead_length_high, col = "blue", lwd =
}

dev.off()  # Close the PDF device

library(ggplot2)
library(dplyr)
```

```r
library(effects)

data <- data.frame(Year = ano, Estacion = estacion,Contaminante=contaminante)
# Interaction Plot

# Main Effects Plot (for Factor1)
data %>%
  group_by(Year) %>%
  summarize(mean_response = mean(Contaminante)) %>%
  ggplot(aes(Year, mean_response)) +
  geom_bar(stat = "identity")



# Create a list of ggplot objects

# Factorial Plot
factorialplot<-ggplot(data, aes(x = Year, y = Contaminante, color = Estacion)) +
  geom_point() +
  facet_wrap(~Estacion) +
  labs(
    title = paste("Grafica de Dispersion de Contaminante vs. Año por Estacion",listacolumn2020s[i]),
    x = "Año",
    y = "Contaminante"
  )
FactorialPlotList[[i]] <- factorialplot

# Box Plot with a title
boxplot<-ggplot(data, aes(x = Year, y = Contaminante, fill = Estacion)) +
  geom_boxplot() +
  labs(
    title = paste("Box Plot de Contaminante vs. Año por Estacion para ",listacolumn2020s[i]),
    x = "Año",
    y = "Contaminante"
  )
BoxPlotList[[i]] <- boxplot
}
```

```
## [1] "21:Centro-20:Centro" "21:Norte-20:Norte"   "21:Sur-20:Sur"
```

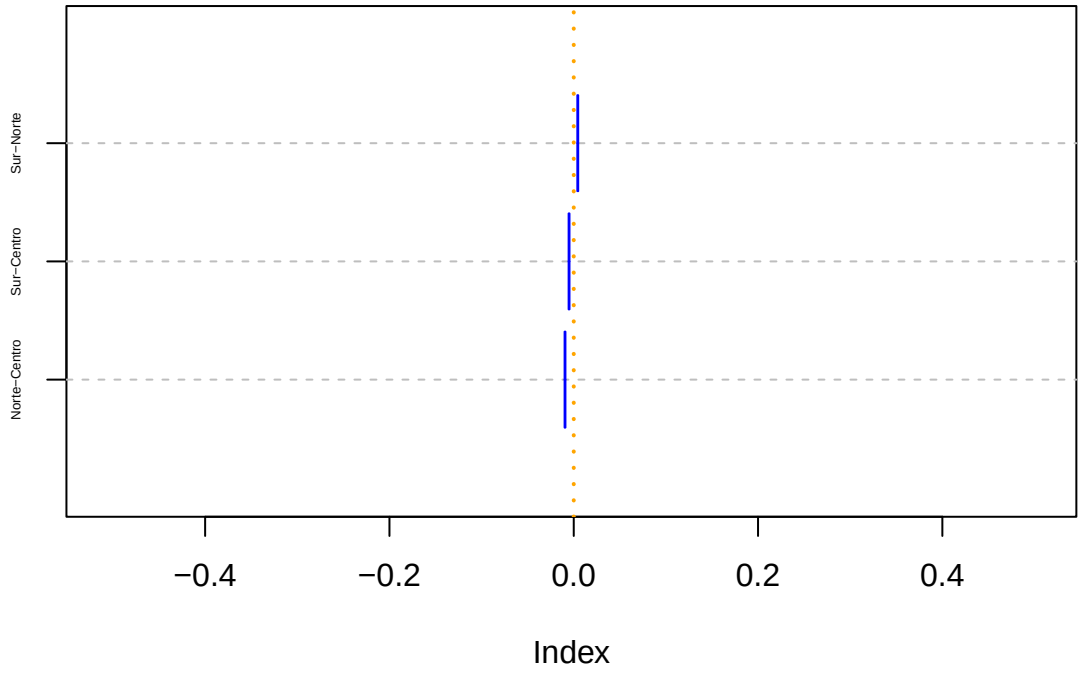
```
##
## Attaching package: 'dplyr'
```

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

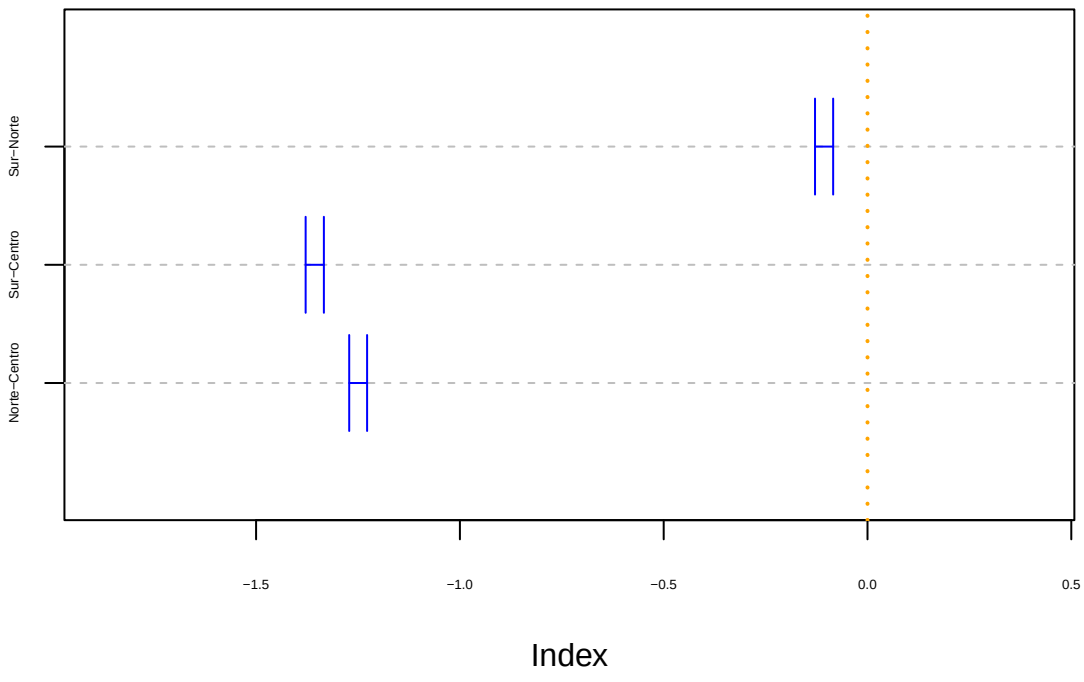
```
## The following objects are masked from 'package:base':
##
##     intersect, setdiff, setequal, union
```

```
## Loading required package: carData
```

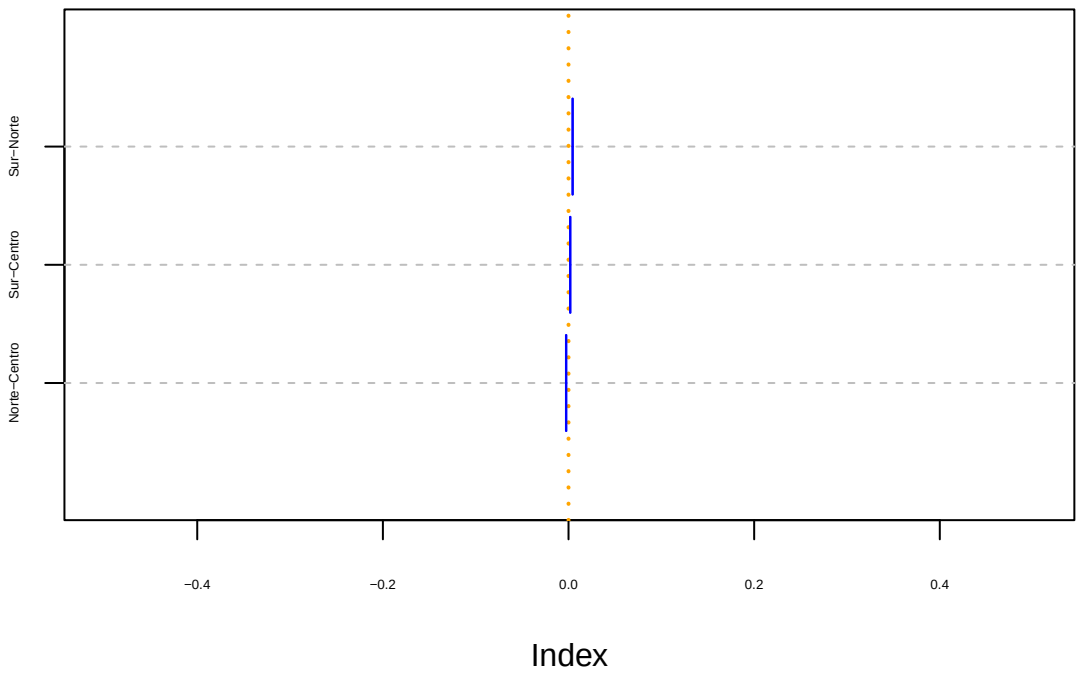
```
## lattice theme set by effectsTheme()
## See ?effectsTheme for details.
```



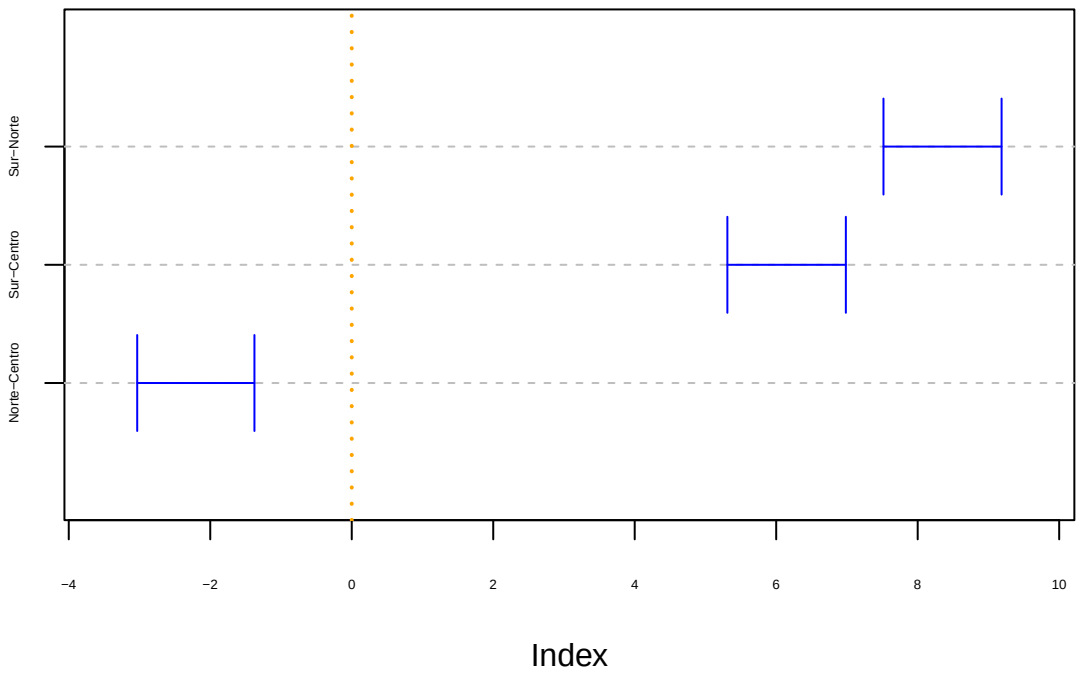

```
## [1] "21:Centro-20:Centro" "21:Norte-20:Norte"   "21:Sur-20:Sur"
```




```
## [1] "21:Centro-20:Centro" "21:Norte-20:Norte"   "21:Sur-20:Sur"
```

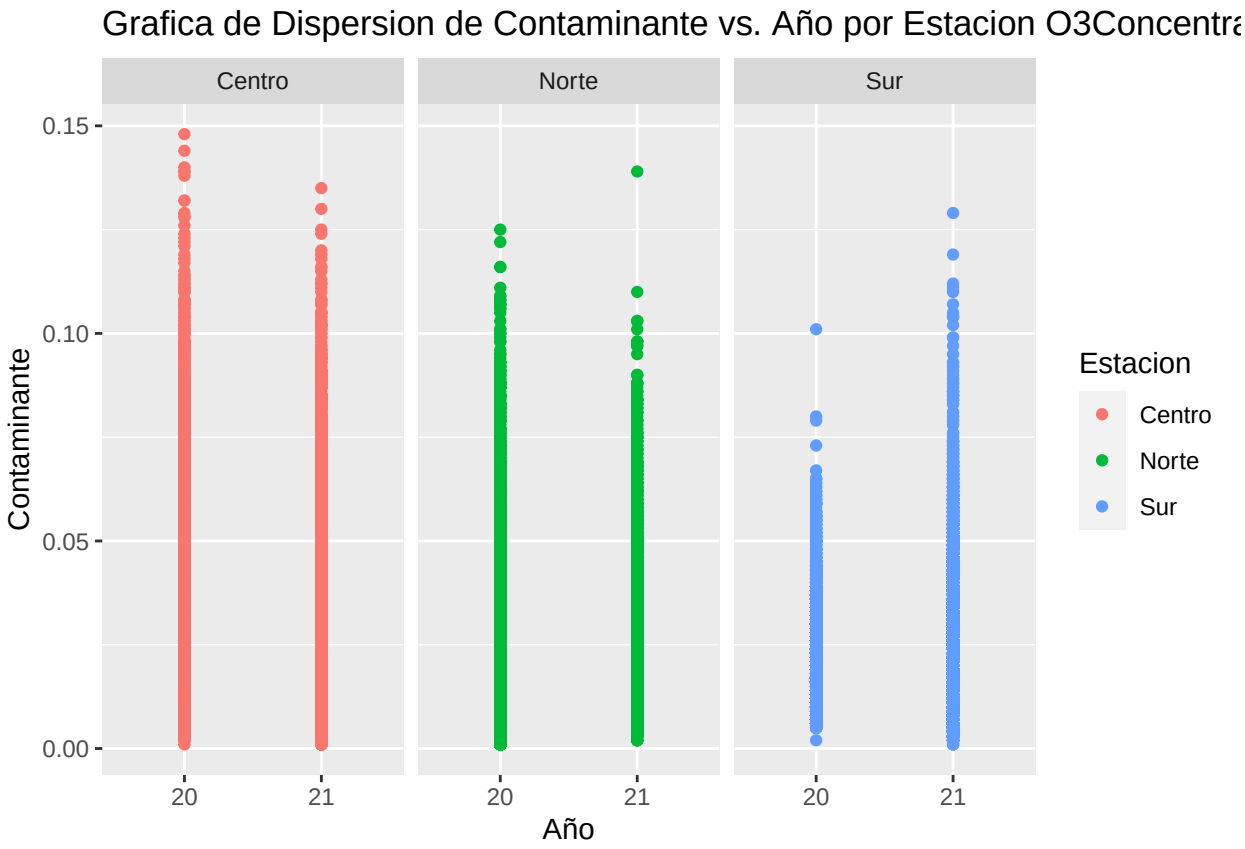



```
## [1] "21:Centro-20:Centro" "21:Norte-20:Norte"   "21:Sur-20:Sur"
```

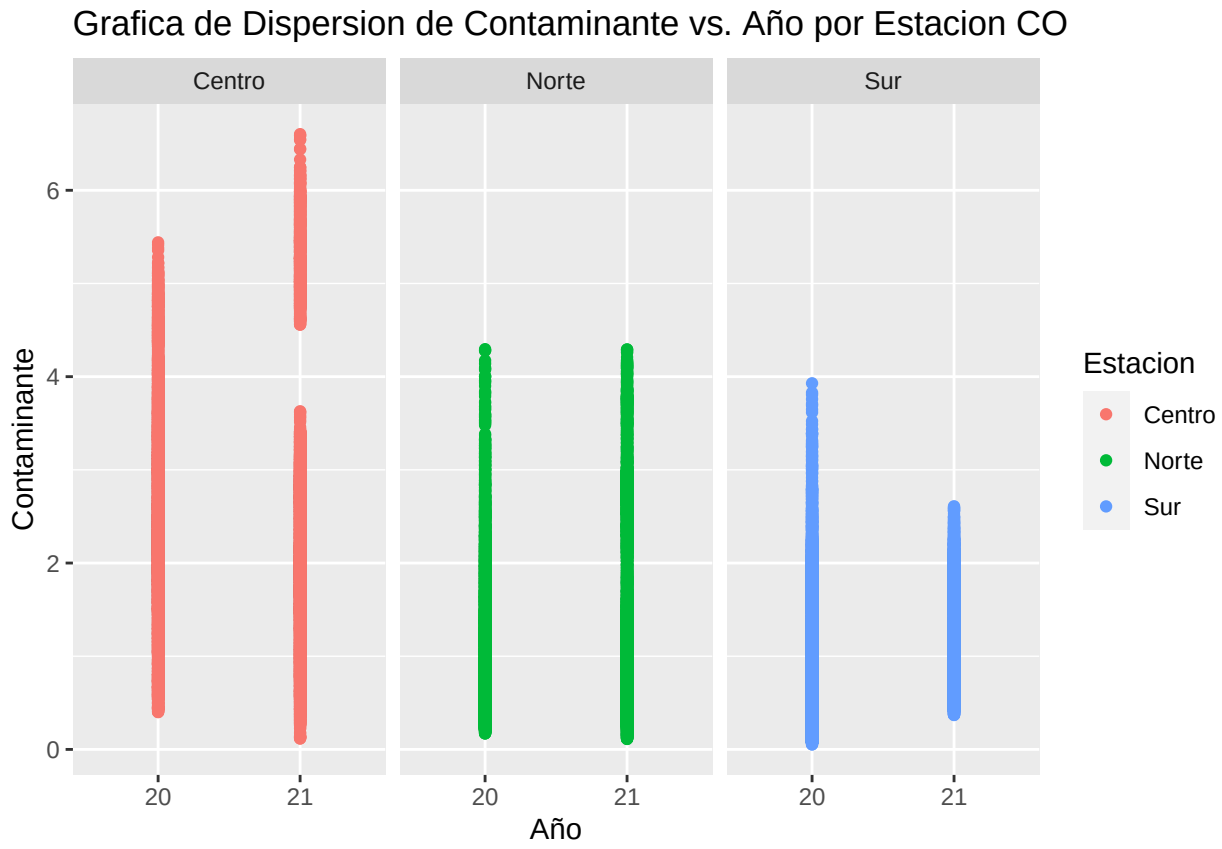



```
for (c in 1:4) {
  print(FactorialPlotList[[c]])
}
```

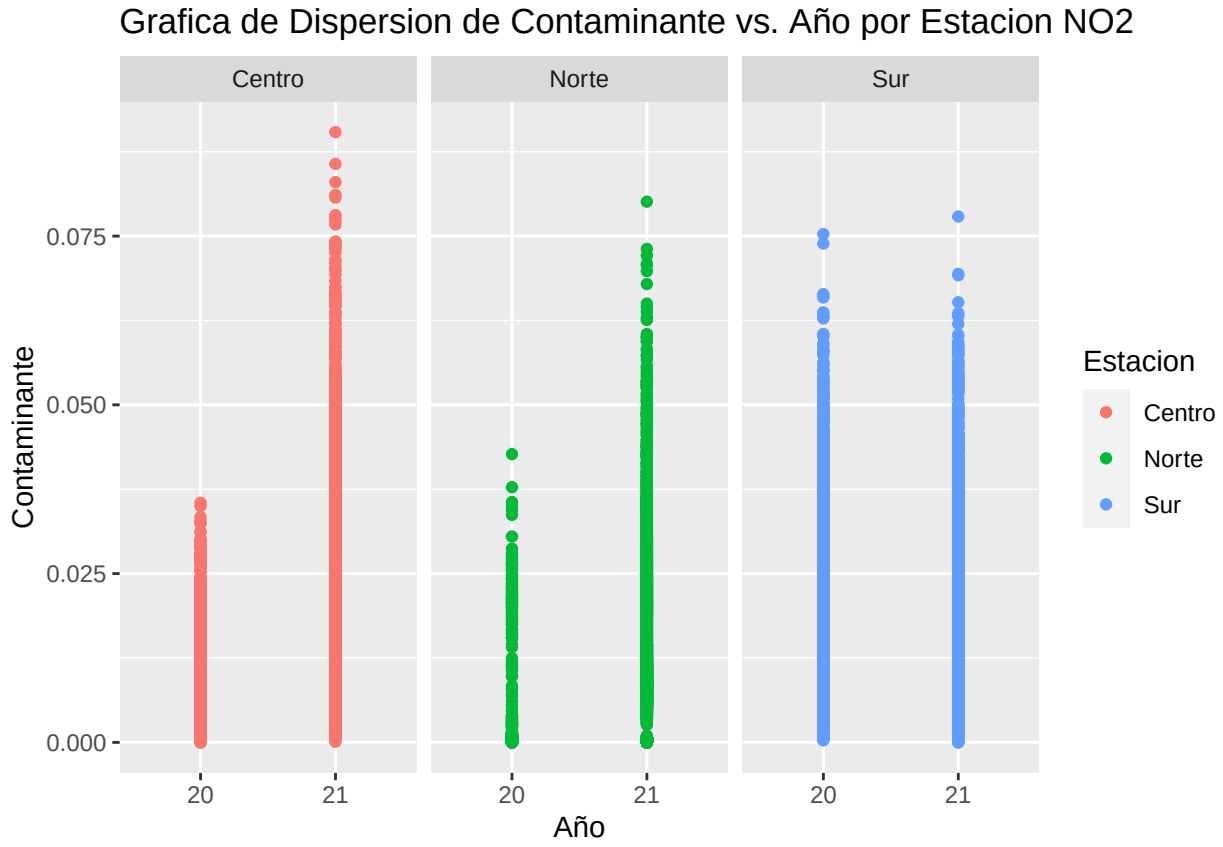
```
## Warning: Removed 7479 rows containing missing values (‘geom_point()‘).
```



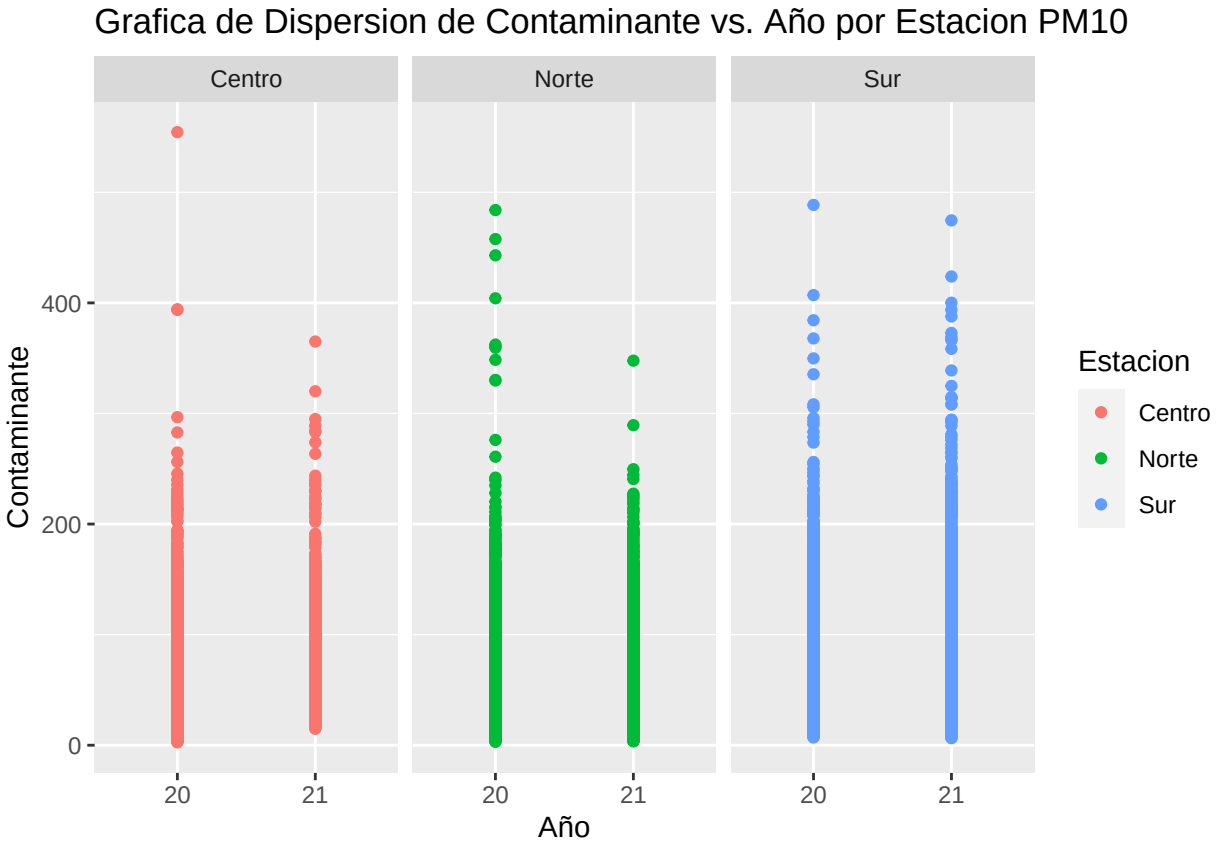

```
## Warning: Removed 3030 rows containing missing values (‘geom_point()‘).
```




```
## Warning: Removed 6574 rows containing missing values (‘geom_point()‘).
```

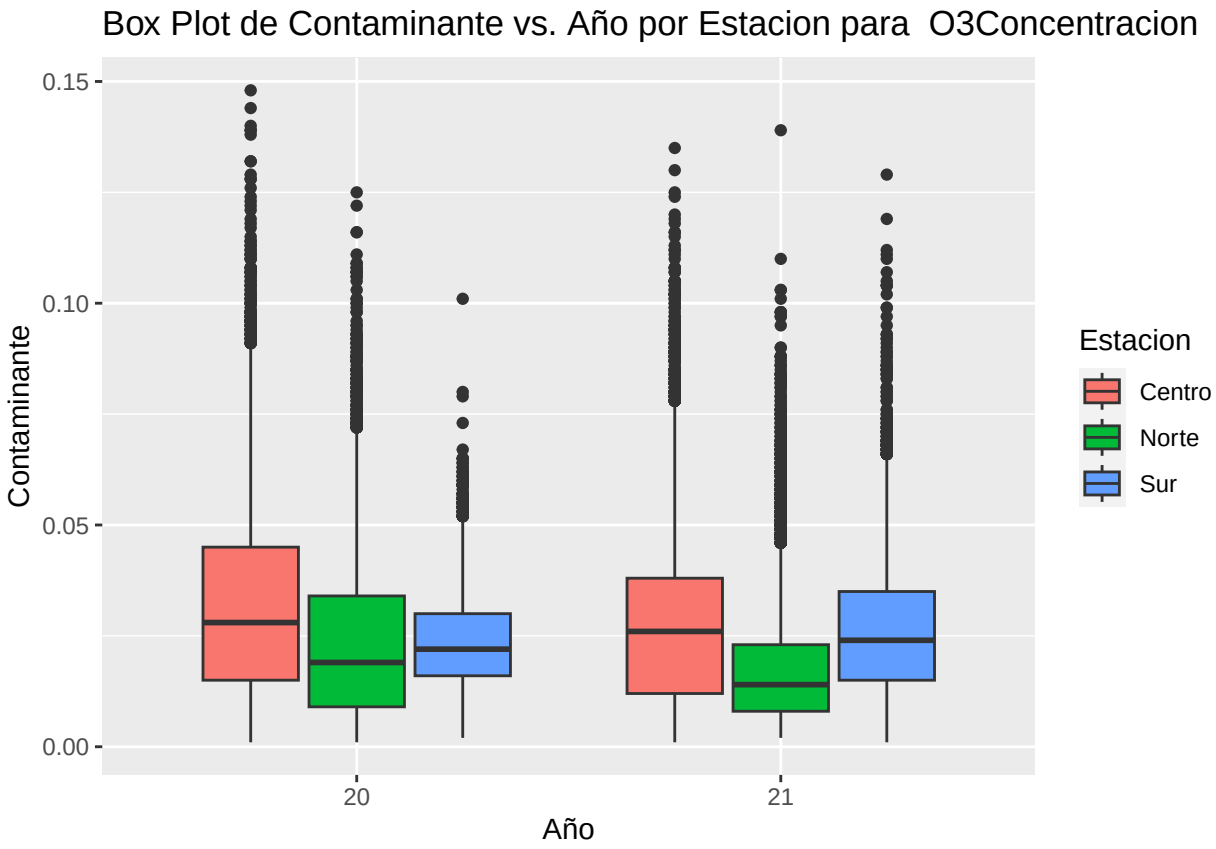



```
## Warning: Removed 3871 rows containing missing values (‘geom_point()‘).
```

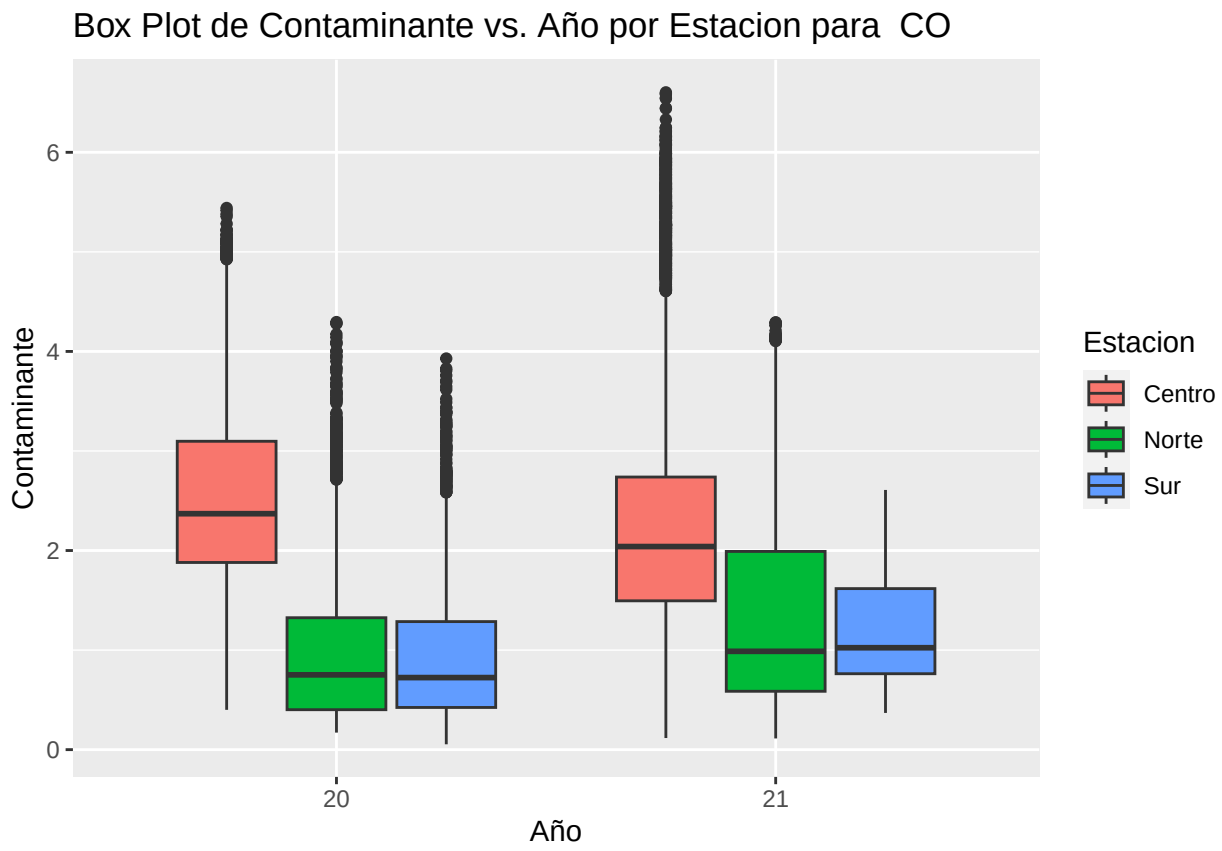



```
for (d in 1:4) {
  print(BoxPlotList[[d]])
}
```

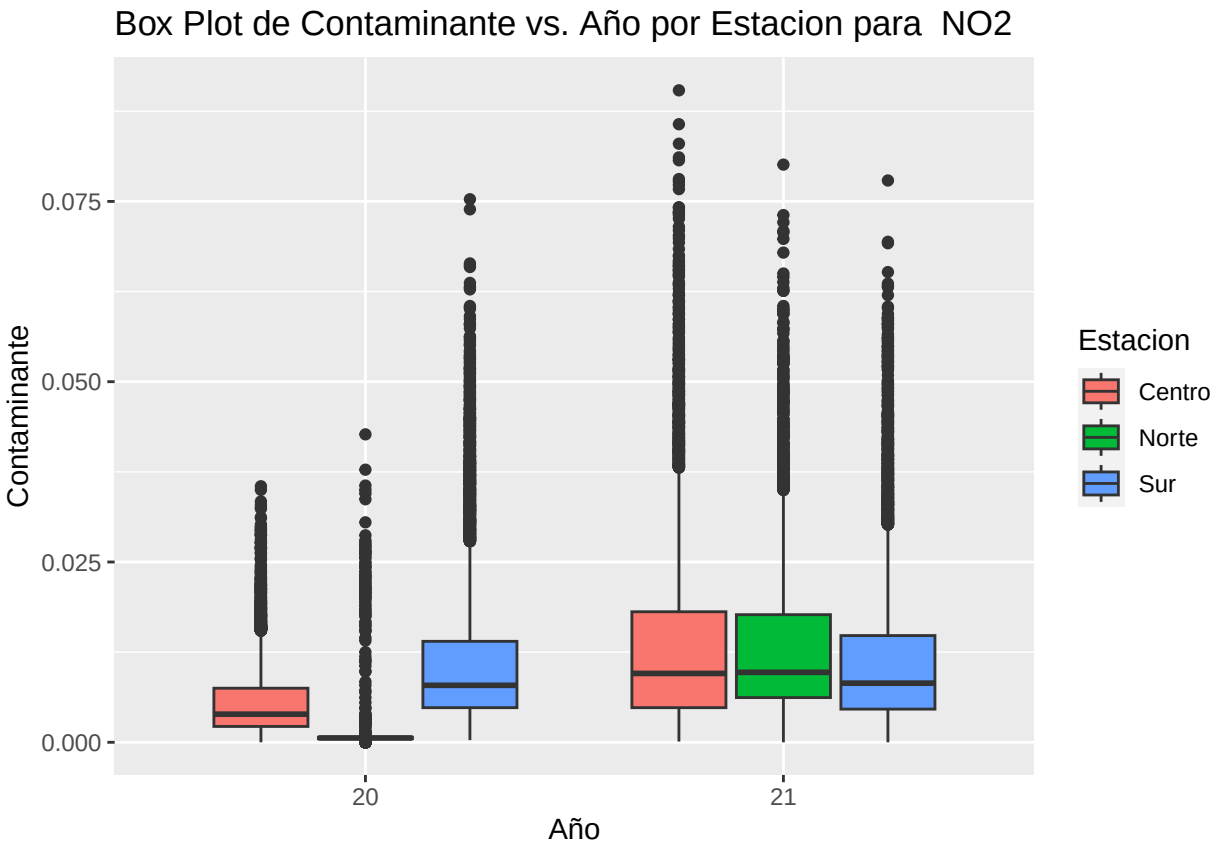
```
## Warning: Removed 7479 rows containing non-finite values (‘stat_boxplot()‘).
```



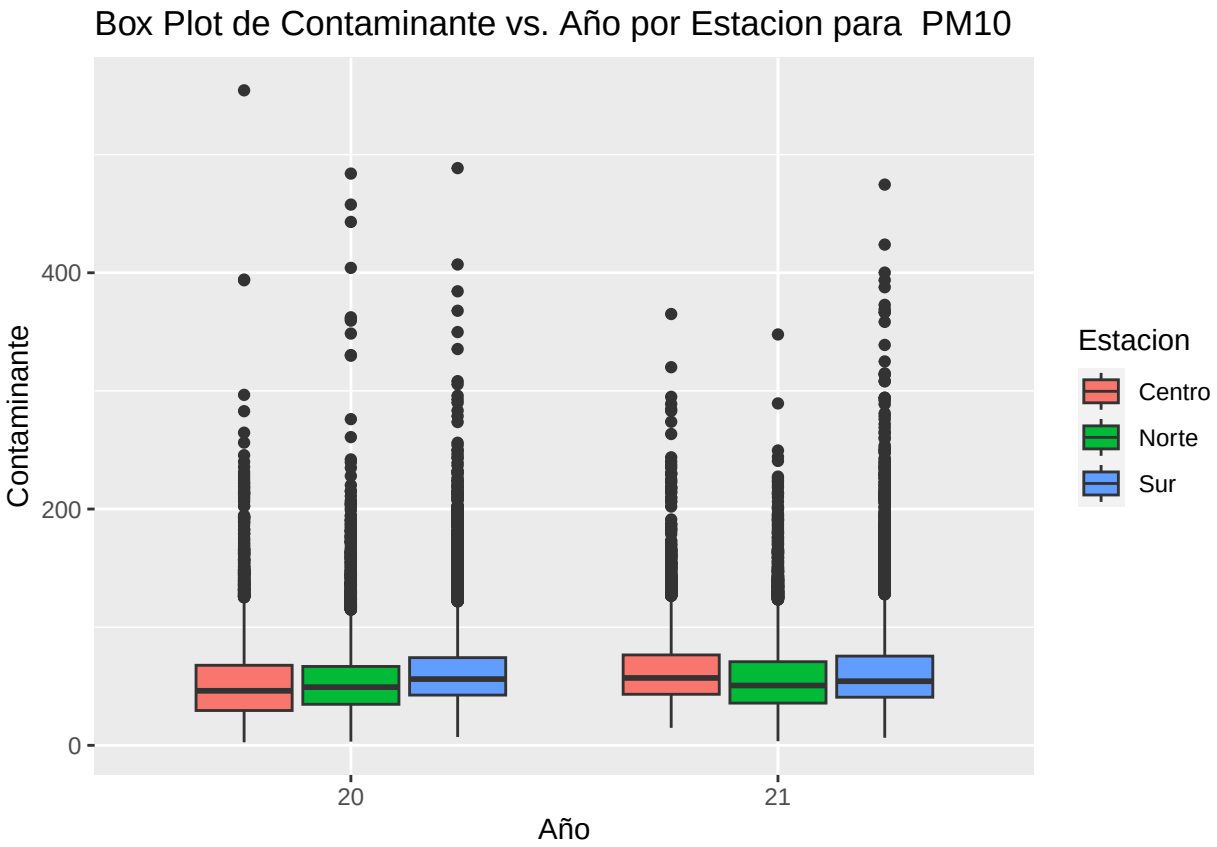

```
## Warning: Removed 3030 rows containing non-finite values (‘stat_boxplot()‘).
```




```
## Warning: Removed 6574 rows containing non-finite values (‘stat_boxplot()‘).
```




```
## Warning: Removed 3871 rows containing non-finite values (‘stat_boxplot()‘).
```



H0: las medias entre todos las poblaciones son iguales H1: las medias entre todos las poblaciones no son iguales