

## **R script**

**##Install the INLA package from the repository (it takes some minutes)**

```
install.packages("INLA",repos=c(getOption("repos"),INLA="https://inla.r-inla-download.org/R/stable"), dep=TRUE)
```

```
install.packages("INLA",repos=c(getOption("repos"),INLA="https://inla.r-inla-download.org/R/testing"), dep=TRUE)
```

**## load the required libraries**

```
library(readxl)
```

```
library(mapview)
```

```
library(raster)
```

```
library(INLA)
```

**## load the file with the measurements at different locations that are used as references**

```
d <- read_excel("C:/Users/pc/Desktop/memoire/mail promoteur/versions du memoire/Air quality values European database.xlsx",
```

```
  sheet = "ozone")
```

```
d <- data.frame(lat = d$Latitude, long = d$Longitude, AQ = d$AQ)
```

```
mapview(d, xcol = "long", ycol = "lat", crs = 4269) # to visualize the dataset
```

**## inla**

```
library(INLA)
```

```
coo <- cbind(d$long, d$lat)
mesh <- inla.mesh.2d(loc = coo, max.edge = c(0.5, 5), cutoff = 0.01)
plot(mesh)
spde <- inla.spde2.matern(mesh = mesh, alpha = 2, constr = TRUE)
indexs <- inla.spde.make.index("s", spde$n.spde)
lengths(indexs)
A <- inla.spde.make.A(mesh = mesh, loc = coo)
```

### **## load the dataset with the coordinates to predict**

```
r <- read_excel("C:/Users/pc/Desktop/memoire/mail promoteur/ALS database version 1.xlsx")
dp <- data.frame(lat = r$`y coord`, long = r$`x coord`)
mapview(dp, xcol = "long", ycol = "lat", crs = 4269)
```

```
coop <- cbind(dp$long, dp$lat)
Ap <- inla.spde.make.A(mesh = mesh, loc = coop)
# stack for estimation stk.e
stk.e <- inla.stack(
  tag = "est",
  data = list(y = d$AQ),
  A = list(1, A),
  effects = list(data.frame(b0 = rep(1, nrow(d))), s = indexs))
```

### **# stack for prediction stk.p**

```
stk.p <- inla.stack(
```

```
tag = "pred",
data = list(y = NA),
A = list(1, Ap),
effects = list(data.frame(b0 = rep(1, nrow(dp))), s = indexes))
```

```
# stk.full has stk.e and stk.p
```

```
stk.full <- inla.stack(stk.e, stk.p)
```

```
# call INLA with the fitted model
```

```
formula <- y ~ 0 + b0 + f(s, model = spde)
res <- inla(formula, data = inla.stack.data(stk.full),
            control.predictor = list(compute = TRUE, link = 1,
                                     A = inla.stack.A(stk.full) ))
```

```
index <- inla.stack.index(stack = stk.full, tag = "pred")$data
dp$mean <- res$summary.fitted.values[index, "mean"]
dp$l1 <- res$summary.fitted.values[index, "0.025quant"]
dp$l95 <- res$summary.fitted.values[index, "0.975quant"]
mapview(dp, xcol = "long", ycol = "lat", zcol = "mean", crs = 4269)
```

```
##extract data and save into a csv file
```

```
summary(dp)
```

```
print(dp)
```

```
write.table(dp)
```

```
write.csv(dp, "c:/Users/pc/Desktop/memoire/mail promoteur/versions du
memoire/resultsINLAPM10bisCTRL.csv")
```