

spatial_model

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load doubts dataset from ade4

```
library(ade4)
data(doubs, package = "ade4")
str(doubs)
```

```
## List of 4
## $ env      : 'data.frame': 30 obs. of  11 variables:
##   ..$ dfs: num [1:30] 3 22 102 185 215 324 268 491 705 990 ...
##   ..$ alt: num [1:30] 934 932 914 854 849 846 841 792 752 617 ...
##   ..$ slo: num [1:30] 6.18 3.43 3.64 3.5 3.18 ...
##   ..$ flo: num [1:30] 84 100 180 253 264 286 400 130 480 1000 ...
##   ..$ pH : num [1:30] 79 80 83 80 81 79 81 81 80 77 ...
##   ..$ har: num [1:30] 45 40 52 72 84 60 88 94 90 82 ...
##   ..$ pho: num [1:30] 1 2 5 10 38 20 7 20 30 6 ...
##   ..$ nit: num [1:30] 20 20 22 21 52 15 15 41 82 75 ...
##   ..$ amm: num [1:30] 0 10 5 0 20 0 0 12 12 1 ...
##   ..$ oxy: num [1:30] 122 103 105 110 80 102 111 70 72 100 ...
##   ..$ bdo: num [1:30] 27 19 35 13 62 53 22 81 52 43 ...
## $ fish      : 'data.frame': 30 obs. of  27 variables:
##   ..$ Cogo: num [1:30] 0 0 0 0 0 0 0 0 0 0 ...
##   ..$ Satr: num [1:30] 3 5 5 4 2 3 5 0 0 1 ...
##   ..$ Phph: num [1:30] 0 4 5 5 3 4 4 0 1 4 ...
##   ..$ Neba: num [1:30] 0 3 5 5 2 5 5 0 3 4 ...
##   ..$ Thth: num [1:30] 0 0 0 0 0 0 0 0 0 0 ...
##   ..$ Teso: num [1:30] 0 0 0 0 0 0 0 0 0 0 ...
##   ..$ Chna: num [1:30] 0 0 0 0 0 0 0 0 0 0 ...
##   ..$ Chto: num [1:30] 0 0 0 0 0 0 0 0 0 0 ...
##   ..$ Lele: num [1:30] 0 0 0 0 5 1 1 0 0 2 ...
##   ..$ Lece: num [1:30] 0 0 0 1 2 2 1 0 5 2 ...
##   ..$ Baba: num [1:30] 0 0 0 0 0 0 0 0 0 0 ...
##   ..$ Spbi: num [1:30] 0 0 0 0 0 0 0 0 0 0 ...
##   ..$ Gogo: num [1:30] 0 0 0 1 2 1 0 0 0 1 ...
##   ..$ Eslu: num [1:30] 0 0 1 2 4 1 0 0 0 0 ...
##   ..$ Pefl: num [1:30] 0 0 0 2 4 1 0 0 0 0 ...
##   ..$ Rham: num [1:30] 0 0 0 0 0 0 0 0 0 0 ...
##   ..$ Legi: num [1:30] 0 0 0 0 0 0 0 0 0 0 ...
##   ..$ Scer: num [1:30] 0 0 0 0 2 0 0 0 0 0 ...
##   ..$ Cyca: num [1:30] 0 0 0 0 0 0 0 0 0 0 ...
##   ..$ Titi: num [1:30] 0 0 0 1 3 2 0 0 1 0 ...
##   ..$ Abbr: num [1:30] 0 0 0 0 0 0 0 0 0 0 ...
##   ..$ Icme: num [1:30] 0 0 0 0 0 0 0 0 0 0 ...
##   ..$ Acce: num [1:30] 0 0 0 0 0 0 0 0 0 0 ...
```

```
## ..$ Ruru: num [1:30] 0 0 0 0 5 1 0 0 4 0 ...
## ..$ Blbj: num [1:30] 0 0 0 0 0 0 0 0 0 0 ...
## ..$ Alal: num [1:30] 0 0 0 0 0 0 0 0 0 0 ...
## ..$ Anan: num [1:30] 0 0 0 0 0 0 0 0 0 0 ...
## $ xy      : 'data.frame': 30 obs. of 2 variables:
## ..$ x: num [1:30] 88 94 102 100 106 112 114 110 136 168 ...
## ..$ y: num [1:30] 7 14 18 28 39 51 61 76 100 112 ...
## $ species: 'data.frame': 27 obs. of 4 variables:
## ..$ Scientific: chr [1:27] "Cottus gobio" "Salmo trutta fario" "Phoxinus phoxinus" "Nemacheilus ba
## ..$ French      : chr [1:27] "chabot" "truite fario" "vairon" "loche franche" ...
## ..$ English     : chr [1:27] "european bullhead" "brown trout" "minnow" "stone loach" ...
## ..$ code        : Factor w/ 27 levels "Abbr","Acce",...: 9 22 19 17 26 25 7 8 16 14 ...
```

view the doubs dataset

```
spe <- doubs$fish
head(spe)
```

```
##   Cogo Satr Phph Neba Thth Teso Chna Chto Lele Lece Baba Spbi Gogo Eslu Pefl
## 1    0    3    0    0    0    0    0    0    0    0    0    0    0    0    0
## 2    0    5    4    3    0    0    0    0    0    0    0    0    0    0    0
## 3    0    5    5    5    0    0    0    0    0    0    0    0    0    1    0
## 4    0    4    5    5    0    0    0    0    0    1    0    0    1    2    2
## 5    0    2    3    2    0    0    0    0    5    2    0    0    2    4    4
## 6    0    3    4    5    0    0    0    0    1    2    0    0    1    1    1
##   Rham Legi Scer Cyca Titi Abbr Icme Acce Ruru Blbj Alal Anan
## 1    0    0    0    0    0    0    0    0    0    0    0    0
## 2    0    0    0    0    0    0    0    0    0    0    0    0
## 3    0    0    0    0    0    0    0    0    0    0    0    0
## 4    0    0    0    0    1    0    0    0    0    0    0    0
## 5    0    0    2    0    3    0    0    0    5    0    0    0
## 6    0    0    0    0    2    0    0    0    1    0    0    0
```