

Assignment-3

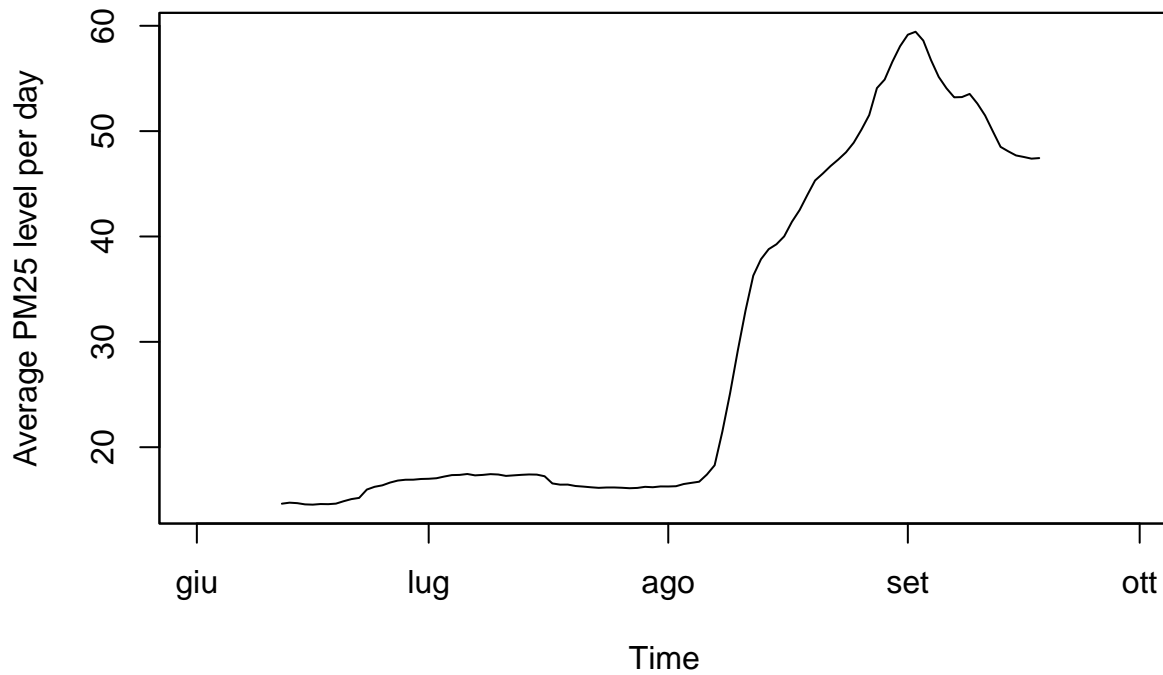
Group 22

Imanbayeva Sofya, Mazzi Lapo, Piras Mattia, Srivastava Dev

2023-03-31

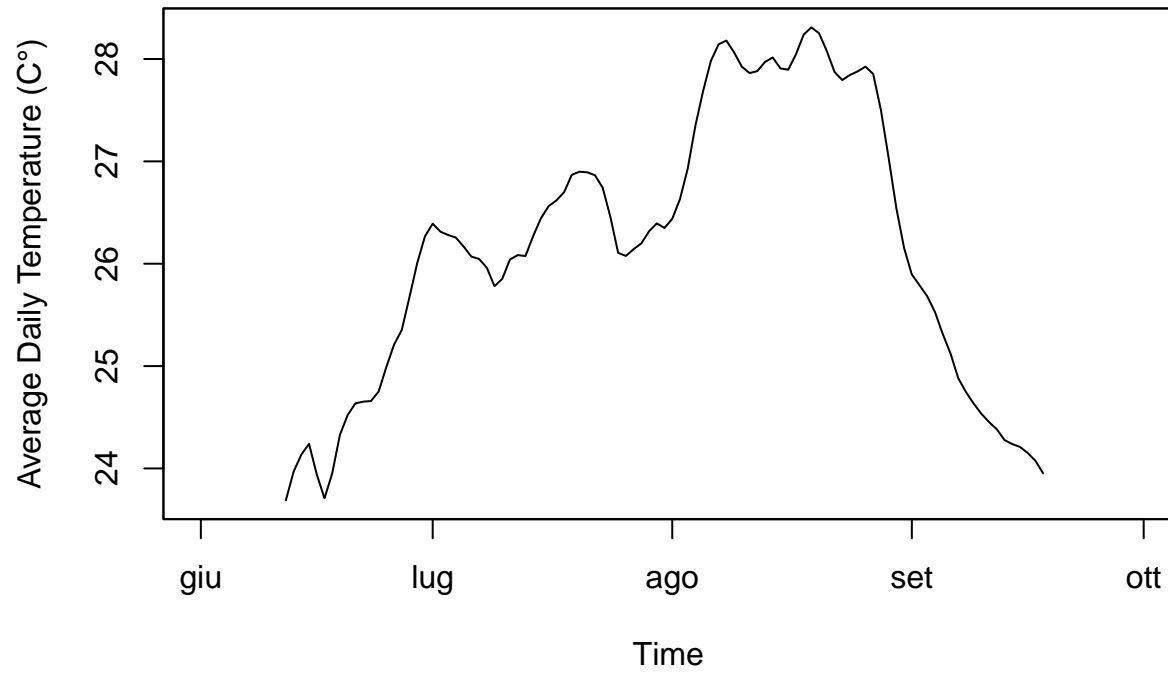
```
## I seguenti oggetti sono mascherati da airdataset:  
##  
##     datetime, Latitude, Longitude, pm25, station_id, temp, time_n, wind
```

Graph 1: Average PM25 levels at station 55, 2020



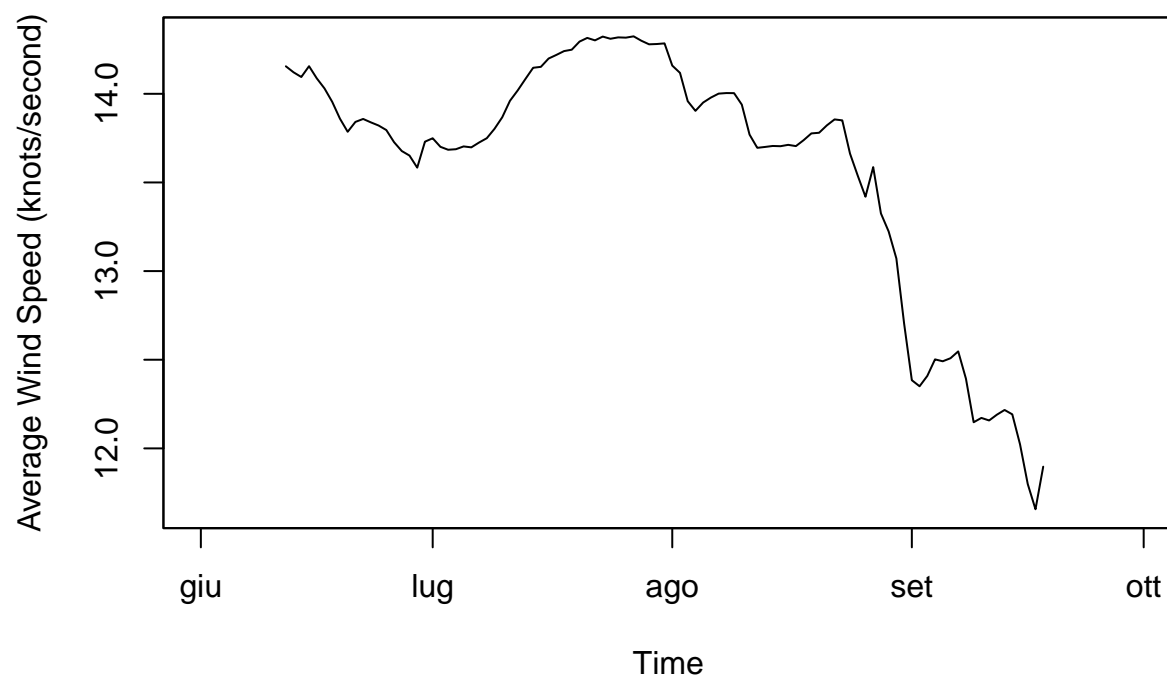
Moving average dramatically increases in the beginning of August from around 17 to its peak in the beginning of September at around 60 in its PM25 levels. The values slightly decrease in September.

Graph 2: Average Daily Temperature (C°) at station 55, 2020



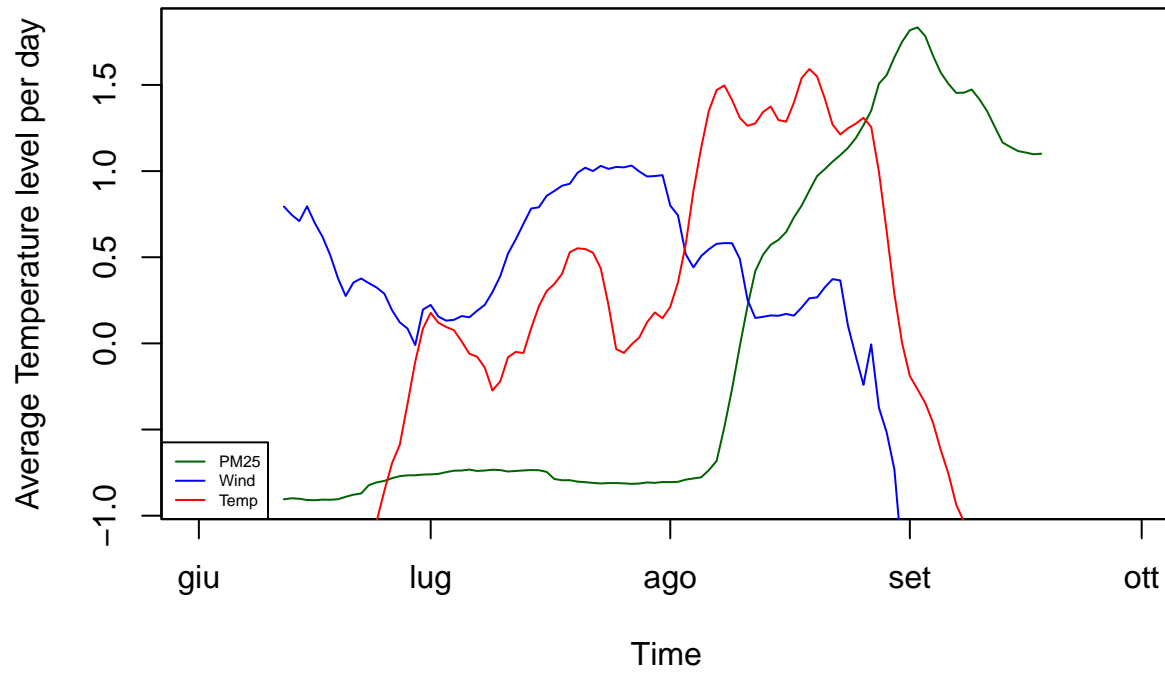
The temperature has been increasing from June's values of 24 degrees Celsius to its peak in August at around 28.

Graph 3: Average Wind Speed (knots/second) at station 55, 2020



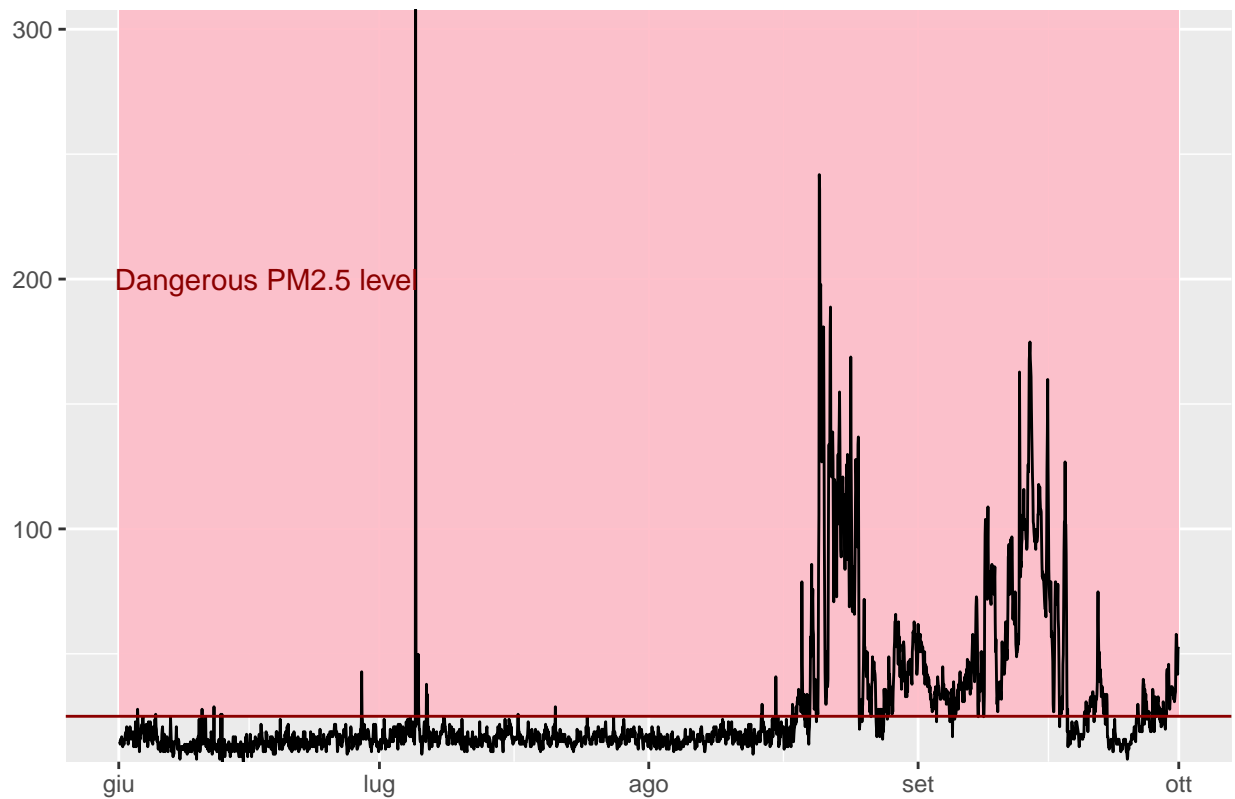
Average wind level has been stable at around 14m/s in the summer and started to decrease in the second part of August to around 12 in mid-September.

Graph 4: Scaled development of PM25, temperature and wind, 2020



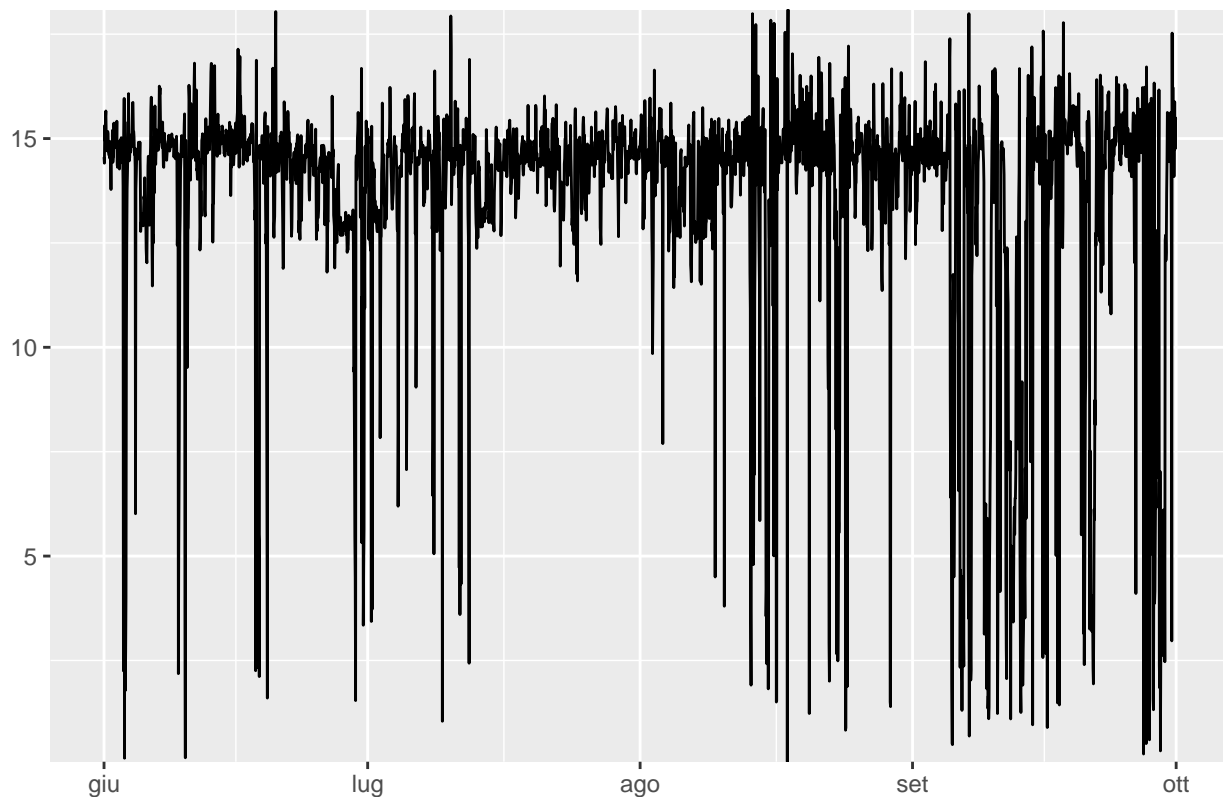
High average temperature in August and comparatively strong winds seem to have a correlation with fires, which have increased the values of PM25 particles in the air. There is around 10 day lag between the temperature increases and PM25 value increase in August.

PM2.5 levels at Station #55



Majority of measurements from June to mid-August are smaller than the prescribed limit with the exception of a peak of an outlying 307.81 in July. However, since then until October, the dynamic has changed with only a few days where the values staying within the limit constraints below 25. The peaks are high, probably resulted from fires, high temperatures and strong wind.

Wind strength



First, we set up our model. The initial probabilities and the transition matrix are just made by default values. Since, there are 3 states, they will have 1/3 probability each.

```
Initial state probabilities model pr1 pr2 pr3 0.333 0.333 0.333
```

```
Transition matrix toS1 toS2 toS3 fromS1 0.333 0.333 0.333 fromS2 0.333 0.333 0.333 fromS3 0.333 0.333 0.333
```

```
Response parameters Resp 1 : gaussian Re1.(Intercept) Re1.sd St1 0 1 St2 0 1 St3 0 1
```

converged at iteration 25 with logLik: -9089.537 The results of the estimation of both the initial probabilities and the transition matrix are indicated below.

```
summary(fmodel)
```

```
Initial state probabilities model pr1 pr2 pr3 1 0 0
```

```
Transition matrix toS1 toS2 toS3 fromS1 0.993 0.007 0.000 fromS2 0.023 0.951 0.026 fromS3 0.000 0.043 0.957
```

```
Response parameters Resp 1 : gaussian Re1.(Intercept) Re1.sd St1 15.890 3.005 St2 33.295 8.079 St3 91.293 36.059
```

First thing looking at the mean for the parameters of the emissions distribution we can identify the three states that we wanted to study. State 2 is the one relative to low pollution, state 3 is relative to high pollution levels and state 1 is the one that we can associate to a medium pollution levels. Looking at the transition matrix we note that there are steps that are never possible, such as the one from state 2 to 3.

```
## Warning in .local(object, ...): Argument 'type' not specified and will default
## to 'viterbi'. This default may change in future releases of depmixS4. Please
## see ?posterior for alternative options.
```

