

Data: Mortality of Fetuses. Study conducted in São Paulo, Brazil, 1991 - 1992

In a period of two years, the daily mortality of fetuses in the city of São Paulo was observed. As explanatory variables, the humidity, the temperature, and a variety of pollutant concentrations were daily recorded. In detail, we have the variables given below:

DAY	Enumeration of days	
WEEK	Week day	1 : Sunday 2 : Monday 3 : Tuesday 4 : Wednesday 5 : Thursday 6 : Friday 7 : Saturday
MONTH	Month	1 : January 1991 : 24: December 1992
YEAR	Year	
NO2	Concentration of NO_2 in $\mu g/m^3$.	
SO2	Concentration of SO_2 in $\mu g/m^3$.	
CO	Concentration of CO in ppm .	
PM10	Concentration of particular matter $\leq 10\mu m(PM_{10})$ in $\mu g/m^3$.	
O3	Concentration of O_3 in $\mu g/m^3$.	
UMID	Relative humidity in % .	
TEMP	Temperature in C.	
NATMOR	Number of daily intrauterine mortalities.	

Sample Size: 730.

Model: Generalized Linear Model or Generalized Additive Model.

Dependent Variable: NATMOR (Type: Count Data.)

Predictor:

- “Core-Model” according to Pereira et al. (1998):

$$\eta = \beta_0 + \sum_{j=1}^6 \beta_j \text{WEEK}_j + \sum_{j=1}^{23} \beta_j \text{MONTH}_j + \text{TEMP} + \text{UMID}$$

Thereby $\text{WEEK}_j, j = 1, \dots, 6$, and $\text{MONTH}_j, j = 1, \dots, 23$, are indicator variables for weekday and month, respectively.

- To evaluate the influence of the pollutants, they are subsequently added to the core-model, e.g.

$$\tilde{\eta} = \eta + \text{SO}_2.$$

In practice, the explanatory variables may be replaced by their 2-5 days moving averages (Pereira et al., 1998) or by smooth estimates (see Fig. 1)

Link: $g(\mu) = \ln(\mu)$, i.e. $h(\eta) = \exp(\eta)$.

Literature working with this data:

Pereira, L.A.A., Loomis, D., Conceição, G.M.S., Braga, A.L.F., Arcas, R.M., Kishi, H.S., Singer, J.M., Böhm, G.M. and Saldiva, P.H.N. (1998). Association between air pollution and intrauterine mortality in São Paulo, Brazil. *Environ Health Perspect*, **106**, 325-329, <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1532988/>

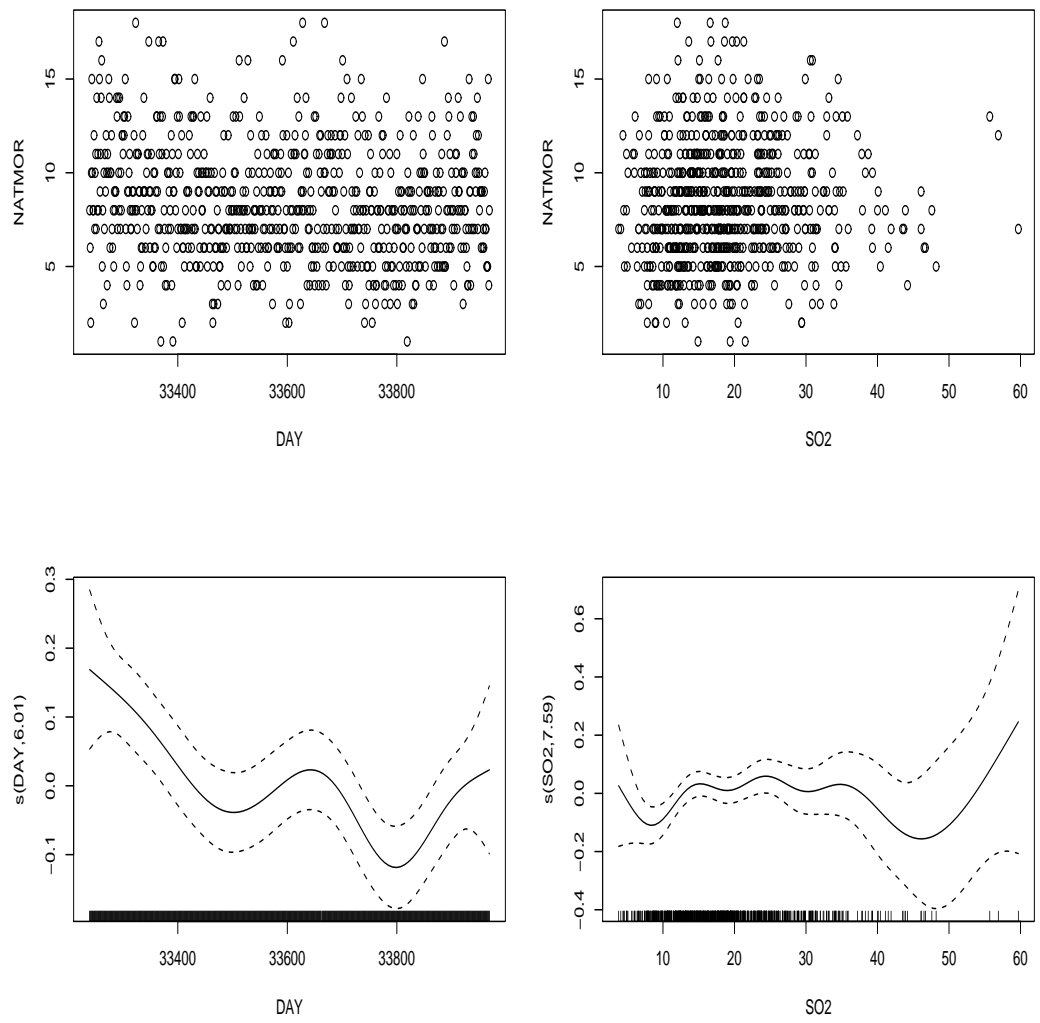


Figure 1: Plots of NATMOR against DAY and SO2 and the corresponding smooth estimates $s(\text{DAY})$ and $s(\text{SO}_2)$ calculated using `gam` (ignoring other predictors).