Sixteenth International Conference Zaragoza-Pau on Mathematics and its Applications
Jaca, September 7–9th 2022

Analyzing with Bayesian models the climate change in series of maximum daily temperature in Aragón

Alejandro Camón[1], **Jorge Castillo-Mateo**[1], **Jesús Asín**[1], **Ana Carmen Cebrián**[1]

SUMMARY

A Bayesian autoregressive model for local daily maximum temperature series, denoted with Y_t for day t, is proposed in the line of Castillo-Mateo et al. [1]. A joint regression model for mean value and variance is proposed for local series, in contrast with the model of these authors, which is spatio-temporal but considers the variance constant over time.

The model must be able to represent the characteristics of the conditional distribution Y_t due the previous temperature, with linear predictors including Y_{t-1}, to express the serial correlation, including harmonic terms cycling in the year, to capture the seasonality, and some trend that could express the evolution in the long term. A Gaussian distribution is considered for residual error.

The full Bayesian statistical inference is solved with Hamiltonian Monte Carlo, a Markov Chain Monte Carlo (MCMC) method that uses the derivatives of the density function being sampled to generate efficient transitions spanning the posterior distribution. This method uses an approximate Hamiltonian dynamics simulation based on numerical integration which is then corrected by performing a Metropolis acceptance step. Libraries of statistical environment R that link with the **'stan'** framework are used for inference.

The model is fitted to a database with 18 daily maximum temperature series located around Aragón and inference results are compared with those of Castillo-Mateo et al. [1].

Keywords: Bayesian model, autoregressive model, variance model, Rstan

AMS Classification: 62F15, 62M10, 62J05

References

[1] J. Castillo-Mateo, M. Lafuente, J. Asín, A. C. Cebrián, A. E. Gelfand, J. Abaurrea. Spatial modeling of day-within-year temperature time series: an examination of daily maximum temperatures in Aragón, Spain. *Journal of Agricultural, Biological and Environmental Statistics*, 1–19, 2022

[2] Stan Development Team. *RStan: the R interface to Stan*. R package version 2.21.5, 2022. https://mc-stan.org/.

[1]Department of Statistical Methods
University of Zaragoza
email: jorgecm@unizar.es, jasin@unizar.es, acebrian@unizar.es