

Temperature curves: a functional-circular view

Rosa M. Crujeiras¹, Andrea Meilán-Vila², Mario Francisco-Fernández³

¹rosa.crujeiras@citmaga.gal, Centro de Investigación e Tecnoloxía Matemática de Galicia (CITMAga),
Universidade de Santiago de Compostela

²ameilan@est-econ.uc3m.es, Department of Statistics, Carlos III University of Madrid

³mario.francisco@udc.es, Department of Mathematics, Universidade da Coruña

Climate change, although a global problem, is usually perceived by individuals on a local scale, being changes in temperature patterns the most direct indicator of global warming. Specifically, for an Atlantic climate location (as it happens in Galicia, NW-Spain), spring and fall are expected to present mild transitions between summer/winter, but people in this region usually perceive that this transition has disappeared in the last decade. We have considered daily temperature curves along time, being each curve attached to a certain calendar day, and therefore enabling the formulation of a regression model with functional covariate (the temperature curve) and circular response (the calendar day). Such a model is fitted with observations from the early 21st century. For observations from recent years (for which the corresponding calendar day is known), the fitted model is used to predict the calendar day, observing a remarkable misalignment between observed and predicted days for a certain curve. Apart from the interesting practical results, the methodological proposal is studied, and the asymptotic bias and variance of a Nadaraya-Watson type estimator, jointly with its asymptotic distribution, is derived. Simulation results support the finite sample performance of the proposal.

Keywords: Circular data, Flexible regression, Temperature curves.