The use of GIS to evaluate and map exteme maximum and minimum temperatures in Spain

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The Spanish normative on climatic risks safety for design and construction of infrastructure is in revision due to the necessity of adapting it to the European normative. This normative is based on studies of extreme values for climatic elements such as temperature, precipitation and wind, for several mean recurrence intervals. Revised maps of extreme values for climatic elements for a 50 years recurrence interval will be required. The snow load standards for building design in Spain had already been obtained. Here, extreme maximum and minimum temperature maps for Spain will be evaluated and mapped. The data were extracted from the historical data base of Spanish Meteorological Institute. There are 1181 stations measuring daily extreme temperatures with records longer than 30 years. After a quality control process involving missing, outliers processing and homogenisation, the database consists on 994 time series of maximum and minimum temperatures. The maximum and minimum temperatures that will be mapped are determined as 50 year mean recurrence interval values. To obtain these values a Gumbel distribution is fitted to the annual values extracted from the database. To interpolate directly the Gumbel values is not correct due to the strong dependence of the temperature on the altitude. The observed annual maximum and minimum temperatures are fitted to a linear function of the altitude values obtained form a Digital Terrain Model provided by the Spanish Geographical Institute. The dependence on the altitude is determined in seven zones of similar climatic behaviour and hence seven linear functions are derived, and a new set of maximum and minimum temperatures is obtained. An anomaly is defined as the difference between the values obtained from the Gumbel distribution and from the linear function.

Anomalies are calculated in all observatories and then interpolated in the whole Spain by the Kriging technique in a regular grid of 5 km x 5 km. The maximum and minimum temperature values for a 50 years mean recurrence interval are obtained adding the interpolated anomaly field to the values determined by the linear functions in all grid points. The procedure is realised by means of ESRI® ArcMap 8.3 Software and constitutes a direct climatic application of Geographical Information Systems.