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An Assessment of Long-Term Temperature Variability in the Sierra de Guadarrama (Spain)

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The Sierra de Guadarrama National Park is a protected area of the Central System in the Iberian Peninsula, located 50 km north–northwest of Madrid, that generates a scientific, educational and recreational interest in a unique high mountain environment. This work provides a first assessment of temperature variability at interannual and decadal timescales in the Sierra de Guadarrama. Observational data from meteorological stations located in the area and simulated data from a high-resolution configuration (1 km) of the Weather Research and Forecasting (WRF) model are used in order to analyse the temperature variability in the period 2000 - 2015. By comparing both datasets, the model capability in reproducing the observations is evaluated. This comparison proves the model simulations to be representative of the observations. Results show observations and simulations are very consistent, although there is a tendency in the model to underestimate
observational temperatures, mostly at low altitudes. A linear vertical temperature gradient is observed, about-6.52 degC for the simulations and -3.95 degC for the observations in the annual season. Temperature
anomaly ranges for the observations are wider with increasing height for the annual, winter and summer seasons.

A Principal Component Analysis (PCA) is performed for the assessment of temperature variability. This PCA provides a very dominant first variability mode in terms of explained variance, which is an indication of a very homogeneous field where all observational series and model grid points show large covariances. Temperature variability in the Sierra de Guadarrama shows a high relationship with temperature in the
interior of the Iberian Peninsula and broadly over south-western Europe.