



Regional scenarios of mean and extreme precipitation regimes in the Basque Country

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According to different regional projections of climate change for the 21st century, changes in the mean and extreme precipitation regimes are expected in most of Europe (Christensen et al., 2007). Precipitation extreme events, in particular, can generate important natural hazards and associated social impacts, such as increasing the probability of flooding events. The objective of this paper is to calibrate the regional models for mean and extreme precipitation regimes through a reference time series (1961-2000) in the Basque Country. The reference time series have been obtained previously from a spatially reconstruction with a Digital Terrain Model and a multiple regression model. In this study, we have used four regional climate models of ENSEMBLE project: METNO-HIRHAM, UCLM-PROMES, KNMI-RAKMO2 and CNRM-RM4.5, under A1B scenario and the ERA40 climate reanalysis. The analysis of extreme precipitation has been based on a relationship between the intensity-duration-frequency (IDF) curves and the Main-Average-Intensity (MAI) curves (Moncho et al., 2009).

The regional climate models showed no significant change in mean annual precipitation in the Basque Country for the period 1961-2000 ($0 \pm 3\%$ decade⁻¹). This result is consistent with the trend of the reference series, which was not significant ($-1 \pm 3\%$ decade⁻¹, p-value = 0.51). For the period of 2001 to 2050, the calibration of the model ensemble showed no significant change in trend ($-1 \pm 3\%$ decade⁻¹, p-value = 0.35). However, some models showed a significant change in mean precipitation from 1961-2000 to 2001-2050 (METNO-HIRHAM, $-10 \pm 5\%$, p-value = 0.019) and from 2051-2100 (KNMI-RAKMO2, $-8 \pm 3\%$, p-value = 0.007). The model that best fits the reference period 1961-2000 for extreme precipitation was the METNO-HIRHAM model, followed by the UCLM-PROMES and KNMI-RAKMO2 models, therefore, these models would best describe the possible changes in future regimes. After calibrating the projections of the heavy rainfall of the climate models, 2 out of 4 models (METNO-HIRHAM and UCLM-PROM) project an increase of $12 \pm 1\%$ of the maximum daily rainfall, with a return period of 50 years for a meteorological station on average, for the period 2001-2050 with respect to the period 1961-2000. However, the KNMI-RAKMO2 model delayed this increase for the period 2051-2100 (increase of $7.7 \pm 0.7\%$), and the CNRM-RM4.5 model showed no significant change for the period 2001-2050. Since the CNRM-RM4.5 model was less reliable, the results of analysis of the other three models suggest that the extreme precipitation in the Basque Country will increase around 10% throughout the 21st century.

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