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# Calculation of future Wet and Dry spells duration in Europe, using bias corrected data from the Q-GAM method.

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The climate is continually changing; therefore, making appropriate adaptation and mitigation decisions is essential. Accurate data is paramount for quantifying climate change impacts and performing risk assessments to support decision-making. Nowadays, climate models are the primary tool for understanding and projecting climate variability. However, their outputs systematically differ from observations, especially for climate variables characterized by strong stochasticity (e.g. precipitation). An ongoing problem concerning climate models is the “drizzling” bias. Climate models tend to overestimate the frequency and duration of rainfalls resulting in the underestimation of their intensity and severity. Due to that fact, climate models significantly underestimate consecutive dry days and overestimate wet days. The adjustment of these biases is a critical process that should precede the use of data. This work proposes a novel statistical method, the Q-GAM (quantile generalized additive models), to bias-correct daily precipitation values over Europe. This task is challenging due to the stochasticity that characterizes this variable, especially on high temporal resolution. The Q-GAM method combines Quantile Mapping (QM) and Generalized Additive Models (GAMs). It is an approach that preserves the advantages of the well-established QM and overcomes its limitations using the flexibility of GAMs. Hence, Q-GAM can significantly increase the accuracy of model-simulated rainfall, maintaining its variability and correcting the number of dry days, overcoming the “drizzling” bias. This is critical for robust and reliable impact analysis. The specific aim of this study is to use Q-GAM bias-corrected model projections of precipitation for quantifying future changes in wet and dry spells across Europe. The duration of wet and dry periods is of great importance as dry spells can serve as indicators of drought and affects several aspects of everyday life (e.g. agriculture, health and economy) and builds the intraseasonal structure of water balance. Here, daily rainfall from three EURO-CORDEX climate models is used for the period 1981-2050. The historical period 1981-2005 is for training the bias adjustment method, while the data for 2006-2050 are corrected, and then the projected wet and dry spells are quantified. The future projections are made according to two climate scenarios: the optimistic RCP2.6 and the business-as-usual RCP8.6. The results show that global warming increases rain falling over short periods, likely triggering floods and/or landslides. Additionally, the improvement of dry spell probabilities detection results in an increasing trend of

the duration and severity of drought in future. Furthermore, at a seasonal scale, dry spells are enhanced in future summers and are a temporal extension to transitional and moderate seasons.