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Investigating wheat yield response to climatic extremes in the Mediterranean region under current and projected future climatic conditions

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Although most past studies tend to agree that projected changes in average climatic conditions could impact negatively wheat production in countries of the Mediterranean basin, there still subsist large uncertainties concerning the magnitude of that projected negative impact. Our inability to infer reliable estimates of the response of crop production to future climatic extremes contributes greatly to these uncertainties. Therefore, the main objective of this study was to investigate the response of wheat production in the Mediterranean region using an innovative statistical approach. Firstly, a frequency analysis using available long time-series of crop yield and daily climatic records between year 1960 and year 2008 in each of the Mediterranean countries was performed. This analysis examined the relationship between the frequency of occurrence of climatic extremes during key phenological stages of wheat crop and its annual yield; which allowed us to infer a statistical model that links the observed reduction in crop production to the frequency of occurrence of climatic extremes. Our analyses of climatic extremes focused on extreme temperatures and dry spell lengths. Secondly, the same frequency analysis was repeated under various climate change scenarios, assuming that the same wheat variety that is currently grown in each country will be grown in the future. Thereafter, the previously inferred statistical model that links wheat production and climatic extremes occurrence frequency using observed yields and climate was used to: i) provide estimates about the response of wheat production to projected climatic extremes in each country of the Mediterranean basin; and ii) to verify whether an increase in the frequency of climatic extremes in the Mediterranean region under projected future climatic conditions will be necessarily detrimental to wheat crop production in this part of the world.