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Climate Change in Mediterranean climate-type regions: A global approach based on the Köppen-Geiger classification

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Mediterranean climate types (MC) are characterized by temperate, wet winters, and hot or warm dry summers and are mostly found at the western edges of all inhabited continents in locations determined by the geography of winter storm tracks and summer subtropical anticyclones. According to the Köppen-Geiger classification, this climate type is classified as Csa and Csb. Although such regions are limited in terms of area, their current population exceeds 700 million inhabitants globally. According to the scientific literature, most MC regions, became hotter and drier during the last century, while future climate projections suggest that these observed trends will continue for the upcoming decades. This combined effect of warming and drying will likely augment the climate change impacts in the MC societies and ecosystems. In this study we investigate how these regions will be impacted by global warming compared to the rest of the world and other regions in the same latitudinal zone. For defining the Csa and Csb regions of the Köppen-Geiger classification, we used the gridded CRU monthly precipitation and temperature observations. Then we analyzed temperature anomalies (area-weighted means) in different MC sub-regions, including North America (NA), South America (SA), Mediterranean Basin (MB), and the southwest of southern Africa (SAF) and southwest Australia (SAU). Our analysis shows that Csa and Csb regions worldwide have not undergone significant spatio-temporal changes during the last 120 years. Nevertheless, we found differences in the observed temperature trends, particularly in the last four decades (1981-2020). In more detail, the Mediterranean Basin with an observed trend of about 0.4 °C/decade has warmed faster than the global mean (0.28 °C/decade) and other MC regions (0.15-0.28 °C/decade). Finally, we will explore the future climate evolution of MC regions and if the observed trends will continue in the 21st century by analyzing a bias-adjusted and statistically downscaled dataset of CMIP6 climate projections. For supporting decision-making and climate mitigations efforts we focus on different global warming levels (e.g., 1.5, 2, and 4°C).

Keywords: Köppen-Geiger, Climate Change; Mean temperature anomalies; World's Mediterranean climates