

Early and late hot extremes, and elongation of the warm period over Greece

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The eastern Mediterranean has been assigned as one of the most responsive areas in climate change, mainly with respect to the occurrence of warmer and drier conditions. In Greece in particular, observations suggest prominent increases in the summer air temperature which in some areas amount to approximately 1 °C/decade since the mid 1970s, while Regional Climate Models simulate further increases in the near and distant future. These changes are coupled with simultaneous increase in the occurrence of hot extremes. In addition to changes in the frequency and intensity of hot extremes, timing of occurrence is also of special interest. Early heat waves in particular, have been found to increase thermal risk in humans.

The study explores variations and trends in timing, namely the date of first and last occurrence of hot extremes within the year, and subsequently the hot extremes period (season), defined as the time interval (number of days) between first and last hot extremes occurrence, over Greece. A case study for the area of Athens covering a longer than 100-years period (1897-2015) was conducted first, which will be extended to other Greek areas. Several heat related climatic indices were used, based either on predefined temperature thresholds such as 'tropical days' (daily maximum air temperature, $T_{max} > 30$ °C), 'tropical nights' (daily minimum air temperature, $T_{min} > 20$ °C), 'hot days' ($T_{max} > 35$ °C), or on local climate statistics such as days with T_{max} (or T_{min}) > 95th percentile.

The analysis revealed significant changes in the period of hot extremes and specifically elongation of the period, attributed to early rather than late hot extremes occurrence. An earlier shift of the first tropical day and the first tropical night occurrence by approximately 2 days/decade was found over the study period. An overall elongation of the 'hot days' season by 2.6 days/decade was also observed, which is more prominent since the early 1980s. Over the last three decades, earlier shift of occurrence of days with $T_{max} > 37$ °C and $T_{min} > 26$ °C (corresponding to the 95th percentiles of summer T_{max} and T_{min} respectively for Athens) was striking, amounting to 8 days/decade.

Our findings for the hot extremes period will be used to validate respective simulations of Regional Climate Models downscaled over the areas of interest.