

Synoptic analysis of heat waves in the Barcelona city (Catalonia, Spain) during 21st century

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The impact of extremely warm episodes on health has been analysed by a large number of studies conducted in different countries and cities, showing that heat waves events (HWE) can cause an abrupt increase in mortality. A HWE was defined as a 7-day sequence following a key-day labelled by the 95th percentile of Barcelona daily mortality (see Peña et al., 2015).

The aim of this study is to identify synoptic patterns associated to HWE in Barcelona over the 21st century and evaluate the impact and possible mitigations. To achieve it, a multivariate analysis (MVA) integrating different atmospheric levels (sea level pressure, temperature at 850 hPa and geopotential at 500 hPa) was undertaken. The observed data used for this study was the 20th Century Reanalysis. The Max Planck Institute Earth system model was used to study two scenarios (RCP 4.5 and RCP 8.5) during the 21st century. The model was calibrated given the variability in the climate scenario, using the Quantile-Quantile mapping transformation (Q-Q).

The MVA applied to the observed period (1990-2015) distinguish three main synoptic patterns: two dynamic configurations produced by southern fluxes related to an Atlantic low, associated with HWE recorded in southern Europe, and a third pattern identified by a stagnation situation related to persistent anticyclone periods. These patterns were also detected in the control simulated period (1961-2005) after the Q-Q calibration, preserving, therefore, the climatic variability: the number of HWE during the warm period (1990-2005) is twice more than during the cold period (1976-1989) due to an intensification of the warm masses. In the RCP 4.5 scenario (2006-2100 period) a positive and significant trend is shown in synoptic patterns which provoke HWE in Barcelona, especially during August; in the RCP 8.5 scenario there is no significant trend, but the intensification of the warm masses is higher.