

Combined Effects of Temperature and Precipitation Extremes Based on Climate Extremes Index over Europe

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The Climate Extremes Index (CEI) is an implementation of five indicators those measure extremes in monthly maximum/minimum temperatures, drought or moisture surplus (Palmer Drought Severity Index), extremes in 1-day precipitation, and days with/without precipitation based on the thresholds. In this study, we have defined the extremes as the percentage of each indicator that existed above/below 90th/10th percentile of reference value which was calculated on the period of 1981-2010, and studied the CEI over the European countries for the years between 1979 and 2015 using gridded observational data sets. We applied calculations with E-OBS data set for daily maximum and minimum temperature, Climate Prediction Center (CPC) data set for daily precipitation and Climate Research Unit (CRU) data set for monthly self-calibrating Palmer Drought Severity Index (scPDSI). Results indicate that Northern Europe, Western Europe and Central Europe have experienced extreme events in the range of 30%-33% for the long term average. The climatological mean of CEI reaches up to 35% for Italy, Eastern Europe and Balkan countries and the maximum values calculated over southern parts of the Europe, and the Mediterranean costs exceeding 38%. Additionally, anomalies have been calculated to define the decadal variability. The decadal anomaly of 1979-1989 has negative biases over most of the countries of Europe. The recent decades (2000-2015) indicate that increased the CEI signal is detected and the extremes became more evident over the Mediterranean countries. During this period, the CEI exceeds 40% for these countries. Trend analyses reveal that the decadal increase reaches up to 4% over Turkey, Italy, the Balkan countries, some part of North Africa. The results of this study strengthen previous researches related to the recent shifts of the temperature and precipitation extremes caused by the human-induced climate change over the EURO-MED domain which is already determined as a major climate hot-spot region.