EMS Annual Meeting Abstracts
Vol. 16, EMS2019-329, 2019


# Linking synoptic systems activity with the occurrence of combined extremes over the Mediterranean region

Iliana D. Polychroni (1), Maria Hatzaki (1), Panagiotis T. Nastos (1), John Kouroutzoglou (2), Helena A. Flocas (3), and Irina Rudeva (4)

(1) Laboratory of Climatology and Atmospheric Environment, National and Kapodistrian University of Athens, University Campus, 15784 Athens, Greece (ipolychroni@geol.uoa.gr), (2) Hellenic National Meteorological Service, (3) National and Kapodistrian University of Athens, Greece, (4) School of Earth Sciences, The University of Melbourne

Extreme events are closely related to circulation features. In this study, the frequencies and the spatial distribution of combined extremes are investigated by relating their occurrence to synoptic scale activity. These combined extremes are referred to the joint modes of air temperature and precipitation extremes, concerning the co-occurrence of Cold/Wet days (CW) and Warm/Dry days (WD). More specifically, they count the number of days over a period (here seasons) having at the same time: i) temperature below the 25th (Cold day) or above the 75th (Warm day) percentile of the mean temperature and ii) precipitation below the 25th (Dry day) or above the 75th (Wet day) percentile of mean daily precipitation amounts over a reference period, here, 1981 – 2005 [1,2].

The climatological data used for the calculations of the combined extremes concern the high-resolution gridded daily mean temperature and precipitation datasets covering the period January 1, 1950 – December 31, 2018, based on E-OBS datasets (0.1°x0.1°; v.19e) [3]. The synoptic activity is determined by the density and the depth of the cyclonic and anticyclonic systems, respectively. The properties of the synoptic systems have resulted from the comprehensive climatology of Mediterranean cyclones and anticyclones assembled using the cyclone finding and tracking algorithm of the University of Melbourne [5], based on the ECMWF ERA-Interim mean sea-level pressure fields for 1979-2017 [4].

The co-examination of the temporal and spatial variations of the combined extremes occurrences along with the variations of the cyclonic and anticyclonic activity shows that in winter the Cold/Wet extremes reinforce with increasing number of cyclones accompanied by a respective decrease of anticyclones, while the Warm/Dry extremes seem to largely result from reduced cyclonic and intensified anticyclonic activity. In summer, these connections are confined in specific regions of the examined area.

We acknowledge the E-OBS dataset from the EU-FP6 project UERRA (http://www.uerra.eu) and the Copernicus Climate Change Service, and the data providers in the ECA&D project (https://www.ecad.eu).

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