



## Weather patterns of joint modes of extreme climate indices over Greece.

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Greece, as the Southeastern part of the Mediterranean region, is a vulnerable area to the upcoming climate change since according to IPCC 2014, the surface temperature is projected to rise over the 21st century and the mean precipitation will likely to decrease in mid-latitude dry regions. From this it is obvious that the two major meteorological variables, that modifies the climate of an area, are the air temperature and the precipitation. Towards this direction, we confronted the challenge to study the weather patterns of joint modes of extreme climate indices over Greece.

The four combined extreme climate indices, based on joint modes of air temperature and precipitation, concern Cold/Dry days (CD), Cold/Wet days (CW), Warm/Dry days (WD), Warm/Wet days (WW) and are defined by the exceedances of the joint modes of temperature and precipitation using the 25th and 75th percentile levels in order to capture a larger number of events. More specifically, the CD index is defined as the number of days as with the daily mean air temperature (T) below the 25th percentile of the daily mean temperature (T<sub>25</sub>) and simultaneously the daily precipitation (P) below the 25th percentile of the daily precipitation (P<sub>25</sub>). Accordingly, the other indices are defined; namely, CW index (T < T<sub>25</sub> and P > P<sub>75</sub>), WD index (T > T<sub>75</sub> and P < P<sub>25</sub>) and WW index (T > T<sub>75</sub> and P > P<sub>75</sub>).

In this work, representative long term time series of precipitation and air temperature from sub regions of Greece with different climatic characteristics have been selected for the assessment/interpretation of the aforementioned joint modes of extreme climate indices during the period 1959-2004.

The seasonal weather patterns of joint modes of extreme climate indices over Greece are analyzed by means of composite means and anomalies (with respect to 1981-2010 climatology) of Geopotential Height at 500mb and 850mb, Omega and Sea Level Pressure from the NCEP reanalysis data. The means and anomalies were estimated for the seasonal values of the aforementioned combined extreme climate indices exceeding the maximum quartile of their distribution.

The findings revealed that WD weather patterns are characterized by NE air flow at the lower troposphere, mainly in summer (this is the case of the Etesians winds, associated with summer drought and uniform weather conditions in Greece). The CD patterns established mostly in the cold period of the year indicate the anticyclonic activity in Europe and Siberia and low pressure in the Mediterranean Sea; thus the dominant wind blow in Greece is from the north, being occasionally interrupted as the wind blows from the south according to the passage of the depressions in the Mediterranean Sea and Europe (WW patterns). The CW patterns are characterized by the advection of polar continental air masses from Scandinavia towards Greece and these conditions persist from the lower to the upper troposphere.