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Drought events over the Levant - synoptic-climatic study

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Prolonging dry spells within the rainy season, have severe environmental implications, including water shortage, damage to agriculture and ecosystems and increased potential for forest fires. This holds in particular for vulnerable regions, such as the Levant. This region is already subjected to decrease in rainfall and lengthening of dry spells, in agreement with predictions of climatic models for the coming decades.
Most studies on droughts over the eastern Mediterranean focus on annual or monthly time-scales, though severe environmental and hydrological implications result also from shorter dry periods. This study analyzes drought events, i.e. dry spells of >7 days in Israel, representing the Levant, through the regional synoptic systems. The rainfall daily data for 60 years (1948/49-2007/08) are taken from stations of the Israel Meteorological Service spread over the Mediterranean climate region of Israel, having annual rainfall of >400 mm. A total of 131 drought events were found within the months November-March during the study period. Their average duration is 11.4 ($\pm$3.7) days, with the longest event lasting 26 days.
The study hypothesizes 3 types of drought; 'subtropical' – associated with expansion of the subtropical high over the majority of the Mediterranean Basin (MB), 'baroclinic' – induced by pronounced stagnant ridge, being a part of Rossby wave, and 'polar' – associated with an intrusion of lower-level continental polar air. These types are first explored through anomalies in the distribution of the 500-hPa geopotential height (gph), the 850-hPa temperatures and the lower-level winds.
The subtropical type presents enhanced zonal upper-level flow with positive anomalies (in both the 500-hPa gph and the 850-hPa temperatures) over North Africa and the MB and negative over Europe. The baroclinic type is typified by meridional pronounced flow, with positive anomalies over the eastern MB, combined with negative anomalies over its western part. The polar type is characterized by pronounced negative gph anomaly east of the Levant accompanied by blocking high over Europe and pronounced negative temperature anomaly over the Levant and eastward due to lower-level continental polar advection from northeast.
Some drought events were found 'pure', i.e. belonging to one of the 3 types, whereas others were found 'hybrid', in which transition from one type to another took place. Several case studies, of pure and hybrid events, will be presented through composite and daily maps.
The classification of drought events according to synoptic enables the analysis of future changes in the occurrence and duration of droughts through the output of climate models. Furthermore, characterizing evolution scenarios of drought events will improve the prediction of their occurrence beyond the current range of operative forecast.