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Structure of the rainy season in Israel and its relation with the occurrence and intensity of Cyprus lows

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The rainfall in the Mediterranean-climate region of Israel starts in October and ends in May, 2/3 is obtained in the mid-winter months (DJF). The analysis is based on daily rainfall in 126 stations of the Israel Meteorological Service, representing the Mediterranean-climate region of Israel, for the period 1950/51-2012/13.
First, we studied the long-term course of the rainy season, based on 1-day resolution, with one peak in late December and another in the beginning of February. A prominent finding is a secondary minimum in the middle of the winter. This was found for the average course performed for the entire study period (63 seasons), as well as for the average course of two subsets of 30 seasons, chosen randomly. We suggest two factors that may explain this minimum: (1) the high rain yield in the beginning of the rainy season, presumably due to the contrast between the warm water of the Eastern Mediterranean and the overlying cold air masses, reaching the maximum around December; (2) the maximum in the frequency and intensity of the Cyprus lows, which occurs toward the end of January and the beginning of February. The timing of the maxima of the two factors leaves the center of January with the observed secondary minimum.
In addition, in order to expose the modality of the individual seasons, each season is approximated by a series of Gaussians. A 'daily rainfall' average is calculated over the entire set of the stations and the seasonal time-series is smoothed using weighted moving average of 27 days, which is found optimal for representing the seasonal structure. Each Gaussian corresponds to one mode, characterized by its timing, amplitude and duration. The compatibility of a modeled season with the observed (smoothed) is estimated by the correlation between them, the standard error (SE) and the bias, attempting to keep the number of Gaussians minimal. The thresholds for the three estimates are 0.9 for the correlation (R), 0.5 mm/day for the SE and the bias should not produce an error of >10% of the annual rainfall. Up to five modes are usually found, spread on the entire season and not confined to the mid-winter months. Significant modes were found for example in October (e.g., 2000) and in April (e.g., 1971). The parameters of the Gaussians, that approximate each individual rainy season are a compact tool for environmental and climatological use.