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Convective rain cells: radar-derived spatio-temporal characteristics and synoptic patterns

N. Peleg (1) and E. Morin (2)

(1) Institute of Earth Sciences, The Hebrew University, Jerusalem, Israel (nadav.peleg@mail.huji.ac.il), (2) Department of Geography, The Hebrew University, Jerusalem, Israel (msmorin@mscc.huji.ac.il)

In this study we present the spatiotemporal characteristics of convective rain cells over the Eastern Mediterranean (northern Israel) and their relationship to synoptic patterns. Information on rain cell features was extracted from high-resolution weather radar data for a total of 191,586 radar volume scans from 12 hydrological years. The convective rain cell features (i.e. cell area, rainfall intensity and cell orientation) were obtained using cell segmentation technique. Cell tracking algorithm was used to analyze the changes of those features over time. Convective rain cells were clustered into three synoptic types (two extratropical winter lows: deep Cyprus low and shallow low, and a tropical intrusion: Active Red Sea Trough) using several NCEP/NCAR parameters, and empirical distributions were computed for their spatial and temporal features. In the study region, it was found that the Active Red Sea Trough rain cells are larger, live for less time and possess lower rain intensities than the rain cells generated by the winter lows. The Cyprus low rain cells were found to be less intense and slightly larger on average than the shallow low rain cells. It was further discovered that the preferential orientation of the rain cells is associated with the direction and velocity of the wind. The effect of distance from the coastline was also examined. An increase in the number and area of the rain cells near the coastline was observed, presumably due to the sea breeze convection. The mean rainfall intensity was found to peak near the shore and decrease with distance inland. This information is of great importance for understanding rain patterns and can be further applied in exploring the hydrological responses of the basins in this region. The presented study is the first step in achieving the long-term goal: to develop a high space-time resolution weather generator for creating rainfall ensembles under different climatology scenarios. Those rainfall ensembles will be incorporated into hydrological models for simulating hydrological response under predicted climate changes.