4.9 INTENSIFICATION OF CONVECTIVE RAIN CELLS AT WARMER TEMPERATURES OBSERVED FROM WEATHER RADAR OVER MEDITERRANEAN TO SEMIARID CLIMATES

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Air temperature influences extreme rainfall intensity due to the increased water vapor-holding capacity of warmer air that follows the well-known Clausius-Clapeyron (CC) relation. The possible intensification of extreme rainfall intensity in a warmer climate has stimulated many studies, most have focused on the scaling of extreme rainfall intensity with temperature, defined as the relative change of rainfall intensity in high quantiles per degree of increase in the air temperature. In this study we explored the relationship between air temperature and convective rainfall by analyzing the characteristics of rainfall at the storm-scale and at the scale of scattered convective features, more specifically, individual convective rain cells. The study is focused on Mediterranean and semiarid climates, where convective rainfall largely contributes to the total annual rainfall and is associated with triggering of high-magnitude flash floods, especially in small- to medium-size catchments. Rainfall estimates from a C-band weather radar (1-km, 5-min, 24-year) were coupled with near-surface air temperature over Mediterranean and semiarid regions in the eastern Mediterranean Sea. The peak intensity of individual convective rain cells was found to increase with temperature (for the examined temperature range of 5 to 25°C), but at lower rate than the 7% $^{\circ}C^{-1}$ scaling expected from the CC relation, while the area of the individual convective rain cells slightly decrease or, at most, remains unchanged. At the storm-scale, the areal convective rainfall was found to increase with warmer temperatures, whereas the areal non-convective rainfall and the storm-wide area decrease. This suggests an enhanced moisture convergence from the storm-wide extent towards the convective rain cells. Results indicate a reduction in the total rainfall amounts and an increased heterogeneity of the spatial structure of the storm rainfall for temperatures increasing up to 25 °C. Thermodynamic conditions, analyzed using convective available potential energy (CAPE), were determined to be similar between Mediterranean and semiarid regions. Limitation in the atmospheric moisture availability when shifting from Mediterranean to semiarid climates was detected and explains the suppression of the intensity of the convective rain cells when moving towards drier regions.