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Spatial and temporal autocorrelation structure of convective rainfall in semiarid-arid climate: implications for rain gauge and remote sensing estimation

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Small scale rainfall variability is a key factor driving runoff response, particularly in fast responding systems, such as mountainous, urban and arid catchments and needs to be taken into account when interpreting and using rainfall estimates from rain gauges or remote sensing instruments. We derive the spatial and temporal autocorrelation structure of convective rainfall for 11 storms occurred between 2014-2016 in a semiarid-arid region in the eastern Mediterranean, exploiting the extremely high resolution (60 m, 1 min) of an X-Band weather radar. We present results on the 2-dimensional spatial autocorrelation as well as on the temporal autocorrelation of point-wise and distributed rainfall fields. The autocorrelation structures highlight extremely large rainfall variability, with spatial anisotropies, correlation distances rarely exceeding 5 km (mostly $\sim$1.5–2.8 km), and time-correlation distances rarely exceeding 10 min (mostly $\sim$1.8–6.4 min). We discuss the impact of such observations on rainfall estimation by means of rain gauges (point sampling, temporal aggregation) and remote sensing instruments such as coarser-resolution weather radars, satellites (2-dimensional spatial aggregation, temporal sampling), and commercial microwave links (1-dimensional spatial aggregation, statistical information on the temporal development).