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# Bridging the scale gap: Radar and small-scale rainfall variability

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An important scientific challenge for the hydrologic research community is improving our understanding of the variability of rainfall at scales below 10 $km^2$ and 1 hour. Statistical scaling modeling provides a useful framework for linking observations with physics-based theories of rainfall behavior. The existing scaling models are based on empirical observations that are often corrupted by significant uncertainty. In-situ observations from rain gauges and disdrometers do not permit meaningful analysis of spatial scaling due to significant smoothing in variability by interpolation methods. Radar based estimates are subject to considerable uncertainties due to numerous, well-documented sources. One of the notorious problems is the scale gap between point observations, useful for quantitative evaluation of the remote sensing products, and those provides by radar. Operational radars typically provide products at scale greater than 2 km by 2 km. Research radar can provide smaller scale observation but those smaller than 250 m by 250 m are often too noisy to be useful. The authors discuss recent results on analysis of small-scale rainfall data and their mathematical models. The presented analyses include results from a dense network of rain gauges regarding point and area-integrated rainfall probability distribution, a scaling analysis of novel lidar-rainfall data, and a comparison of drop size distribution measurements from collocated optical disdrometers.