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Precipitation and microphysical studies with a low cost high resolution X-band radar: an innovative project prospective

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Abstract. This paper describes an innovative project which has just been launched at the "Laboratoire de Météorologie Physique" (LaMP) in Clermont-Ferrand in collaboration with the "Meteorologische Institut" in Hamburg, where a low cost X-band high resolution precipitation radar is combined with supporting measurements and a bin microphysical cloud resolving model in order to develop adapted $Z-R$ relationships for accurate rain rate estimates over a local area such as a small catchment basin, an urban complex or even an agriculture domain.

In particular, the use of K-band micro rain radars which can retrieve vertical profiles of drop size distribution and the associated reflectivity will be used to perform direct comparisons with X-band radar volume samples while a network of rain-gauges provides ground truth to which our rain estimates will be compared. Thus, the experimental suite of instrumentation should provide a detailed characterization of the various rain regimes and their associated $Z-R$ relationship. Furthermore, we will make use of the hilly environment of the radar to test the use of novel attenuation methods in order to estimate rainfall rates.

A second important aspect of this work is to use the detailed cloud modeling available at LaMP. Simulations of precipitating clouds in highly resolved 3-D dynamics model allow predicting the spectra of rain drops and precipitating ice particles. Radar reflectivity determined from these model studies will be compared with the observations in order to better understand which raindrop size spectrum shape factor should be applied to the radar algorithms as a function of the type of precipitating cloud. Likewise, these comparisons between the modeled and the observed reflectivity will also give us the opportunity to further improve our model microphysics and the parameterizations for meso-scale models.

Full Article in PDF (PDF, 1208 KB)

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