Geophysical Research Abstracts
Vol. 20, EGU2018-1388, 2018
EGU General Assembly 2018

77 GHz radar for meteorological purposes: preliminary results

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The European Telecommunications Standards Institute defines the frequency band around 77 GHz as dedicated to automatic cruise control long-range radars, but recent works demonstrated that, under specific assumption and with the right theoretical background, it is also possible to use a W-band radar as a short range microwave rain gauge.
Working at 77 GHz, raindrop size are comparable to the used wavelength and therefore it is necessary to use the general Mie scattering theory. In order to avoid underestimation of rain (up to -20 dB), the proper relation between the radar reflectivity factor Z and the rainfall rate R (the so-called Z-R equation) should be used, specifically determined for such frequency with the Mie scattering theory. A possible Z-R equation for 77 GHz radar has been presented by Bertoldo et. al. in 2017, during the EGU General Assembly.
An overview of functional requirements to adapt an automatic cruise control long-range radar (of particular interests for its low cost) to a short-range microwave rain gauge is given qualified for achieving rainfall measurements. Using a commercial prototype of W-band radar some preliminary measurements were made and will be presented. It is shown that it is possible to use W-band radar for monitoring weather events. A good Quantitative Precipitation Estimation (QPE) can be achieved with an acceptable approximation.