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IDRA, a new advanced high-resolution instrument for drizzle observation

J. Figueras i Ventura and H.W.J. Russchenberg

International Research Centre for Telecommunication and Radar-Delft University of Technology, Delft, The Netherlands (j.figueras@irctr.tudelft.nl / Fax: +31 152784046 / Phone: +31 152787603)

Motivation

Human activities have an impact on global climate not yet fully understood. A little known phenomenon is the effect of the increase in the anthropogenic aerosols on the radiation budget through clouds and drizzle formation. Better measurements and parameterization of the relation between aerosol concentration and cloud formation are required to quantify it. A radar designed to observe the horizontal spatial and temporal distribution of drizzle, in combination with other instruments, will certainly help to quantify this impact. IRCTR is currently developing such radar in the framework of the CESAR project (Cabauw Experimental Site for Atmospheric Research). The location of the system, on top of a 214 m high meteorological tower situated in Cabauw (The Netherlands) offers several advantages. In the first place the high altitude of the tower and the flatness of the surroundings ensure a low impact of the ground clutter in the measurements, secondly a full set of instruments, including several radars and lidars, is available in the vicinity, therefore allowing an enhancement of the measurements by taking advantage of the synergies between instruments.

Particularities of the radar

The radar offers reflectivity as well as Doppler information (mean velocity and Doppler spectrum width). The fact that is fully polarimetric enhances enormously the capabilities of the system. By using polarimetry, clutter suppression is greatly improved, obtaining a much clean atmospheric signal, which facilitates quantitative measurements. Also drop size distributions and size-shape relations can be estimated from polarimetric data. Classification of meteorological phenomena can also be performed.

The high linearity of the modulation obtained by direct digital synthesis offers an increased sensitivity, necessary to detect such low reflectivity phenomena as drizzle. Its high resolution (from 3 to 30 m) allows much more spatial detail than most of the existing meteorological radars. Full raw data sets can be recorded allowing complex post-processing and increasing flexibility. The combination of the system with other instruments further enhances its capabilities. For example, its combination with a vertically pointing radar would allow obtaining the 3-dimensional structure of clouds.