Correcting attenuation in operational radars from both heavy rain and the radome using the observed microwave emission

Robert Thompson, Anthony Illingworth, Tim Darlington, James Ovens

Dept of Meteorology, University of Reading, UK, robert.thompson@reading.ac.uk

Presenter : Robert Thompson

We present a new method of correcting errors in radar estimates of rainfall due to attenuation by the rain or a wet radome; the technique is currently being implemented on the UK national radar network. It is based on the physical principle that any attenuating target will itself emit, and that this emission can be detected by an increase noise level in the radar receiver. Radome attenuation can be monitored from the increased noise at the higher beam elevations. This attenuation has a large azimuthal dependence and for an old radome can be up to 4dB for a rain-rate of just 2-4mm/hr, whereas for a newly installed radome it is about 1dB in light rainfall. This effect has been neglected in the past but may be responsible for significant errors in rainfall estimates and in radar calibrations using gauges.

The extra noise at low radar elevations provides an estimate of the total path integrated attenuation of nearby storms; this total attenuation can then be used as a constraint for gate-by-gate or polarimetric correction algorithms. The technique is simple in theory, but care is needed if reliable results are to be obtained. An increase in brightness temperature of 10K is equivalent to a two-way of attenuation of about 0.5dB. The typical noise temperature in the radar receiver is about 1000K, so the return from many distant gates must be averaged to detect the small increase in noise. A calibrated noise source is injected before each transmitted radar pulse. Provided great care is taken to exclude any extraneous returns from the distant gates, we find that we can detect brightness temperature changes of 6-8K for each degree in an azimuthal scan; this is equivalent to detecting a change in attenuation of less than 0.5dB.