Geophysical Research Abstracts
Vol. 20, EGU2018-12300, 2018
EGU General Assembly 2018

X-band radar attenuation statistics: how often do we lose the signal

Hidde Leijnse

Royal Netherlands Meteorological Institute (KNMI), R&D Observations and Data Technology, De Bilt, Netherlands (hidde.leijnse@knmi.nl)

X-band radars are becoming increasingly popular for urban hydrology. Their relatively small size and low cost makes them ideal for such applications. Furthermore, because they are generally only used for quantitative precipitation estimation at short ranges, the spatial resolution of derived precipitation products is generally high, and measurements are close to the ground. The well-known challenge with X-band radars is signal attenuation. This can partly be compensated by using polarimetric radars, but these will only be able to provide rainfall estimates if there's any signal left. It is therefore highly relevant to know how often conditions occur in which there is no detectable signal left.

The rate of exceedance of different levels of X-band radar attenuation at different ranges is investigated here. From this it is possible to derive how often an X-band radar is no longer able to provide any precipitation estimate due to attenuation, given its characteristics (transmit power, antenna gain, noise floor, etc.) and the rate of the rain that should still be detectable.

A 10-year radar-rain gauge product (1-km, 5-min resolution) over the Netherlands is used to simulate X-band attenuation, assuming a known relation between specific X-band attenuation and rainfall intensity. For a given virtual X-band radar location, attenuation is computed for every 5-minute interval and for all ranges and azimuths of the X-band radar by integrating the specific X-band attenuation fields over range. Rates of exceedance of attenuation levels are then computed as a function of radar range.

The rate of signal loss (i.e., signal-to-noise ratio less than 1) is investigated for several common types of radars for given minimum detectable rain rates. This rate is typically on the order of several minutes to hours per for a minimum detectable rain rate of 1 mm h^{-1}, depending on the radar type.