Quantitative Precipitation Estimates Measured by C- and X-Band Radars

The Potential for Integration

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The perfect weather radar for short drainage applications is a radar with both long-range and high resolution. Unfortunately, in real life a typical trade-off for longer range is a lower spatial resolution of the radar. This is the motivation for this study which is focused on the combination of both radar types. The C-band radar is performing in urban areas, whereas the X-band radar is performing in rural areas. The two radars are working with different temporal and spatial resolution, see table 1 and 2. To be able to quantify the differences in spatial and temporal resolution, see figure 3 and 4. The area for comparison is shown in figure 3 and the data shown is the full resolution of the LAWR (see figure 1) and the data shown is the full resolution of the C-band radar. The area for comparison is set to the right is showing a convective event. The compared area is illustrated in figure 1. The two radars are working with different temporal and spatial resolution, see table 1 and 2. To be able to quantify the differences in spatial and temporal resolution, see figure 3 and 4. The area for comparison is shown in figure 3 and the data shown is the full resolution of the LAWR (see figure 1) and the data shown is the full resolution of the C-band radar. The area for comparison is set to the right is showing a convective event. The compared area is illustrated in figure 1.

Strength and Weaknesses

Different meteorological conditions are found to yield different results for the two radar systems. As an example of this, a stratiform and a convective precipitation event are displayed in figure 4. The area for comparison is the full range of the LAWR (see figure 1) and the data shown is the full spatial resolution of both systems. It is evident that the C-band radar detects a much wider spatial extent of the stratiform precipitation than the LAWR. Due to the large vertical opening angle and the low-laying precipitation, the upper part of the LAWR beam will break out of the precipitation quite close to the radar. This results in partly filled sampling volumes and thereby poor observations at longer distances. In the case of convective precipitation, the vertical extent of the precipitation is much higher and partly filled sampling volumes are no issue for the LAWR radar. In this case, the disadvantage of low spatial resolution for the C-band radar becomes clearer. Even though there is a good visual agreement between the radar images, the result also shows that LAWR detects the spatial variations within the convective precipitation in more details.