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PATTERN: Combining different radars for improved precipitation estimates

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Precipitation observations with radars operating in the X-band frequency range are essential to meet present and future requirements for flood forecasting, water management and other hydro-meteorological applications. Besides higher resolution, these systems are cost-effective compared to C-band radars because of smaller antenna size. Disadvantages of stand-alone X-band radars are high attenuation by liquid water and a relatively short maximum range.

Within the project PATTERN (Precipitation and Attenuation Estimates from a High Resolution Weather Radar Network) the University of Hamburg and the Max-Planck-Institute for Meteorology set up a network consisting of four low-cost X-band radars. Additionally, this network is situated within the range of the C-band radar Boostedt from the German Weather Service (DWD). The set-up is completed by seven vertically pointing micro rain K-band radars (MRR), providing drop size spectra as well as reflectivity and rain rate for 31 height levels.

The X-band radars demonstrate that a network of high-resolution weather radars can overcome the apparent drawback of attenuation when using stand-alone radars. Additionally, the high spatial and temporal resolution leads to more accurate algorithms for clutter identification as necessary for simple backscatter radars.

The MRRs are used for calibration as well as for estimation of instantaneous local Z-R relationships in the common intersecting volume of X-band radar and MRR. These relations are applied to the X-band radar network leading to more accurate quantitative radar rainfall rates in comparison to rainfall estimates based on common climatological relations.

A merged product combining X-band and C-band measurements shows potential for improving radar rainfall estimates as it combines the advantages of both systems, high resolution (X-band) and low attenuation (C-band).

The presentation will give an overview of the radar network set-up and introduce the techniques used to derive rainfall fields using the advantages of the different radar types.