Improved radar QPE with temporal interpolation using an advection scheme on polar radar data

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The temporal resolution of current European weather radar products ranges from 5 min to 15 min. Also with a resolution of 5 min, the time gap from one measurement to the next can lead to significant uncertainties in radar rainfall sums. In ordinary cumulating routines rain intensities are assumed to be constant from one time step to the next. Especially with small precipitation cells and above-average wind velocities this may result in a 'fish-bone-structure' in the cumulated precipitation.

A significant improvement can be achieved by using a temporal interpolation, based on an advection scheme as it is currently used for nowcasting. A cell tracking algorithm is used to recognise rain cell movement and determine velocity vectors which are interpolated to a 2D velocity field. Advection is calculated with a semi-Langrange method.

As a difference to the nowcasting procedure, advection can be determined more reliably as not only previous but also subsequent radar measurements can be used for processing. To estimate the rain intensity between two time steps, intensities from both the previous and the following image are used. The advection of the rain field is calculated forward and backward with a time step of 1 min and interpolated rain sums are calculated using weights depending on the time-lag. While the cell tracking algorithm is executed on a cartesian grid, the velocity field is converted to a polar vector field and applied to the polar precipitation data, thus keeping the original spatial resolution.

Daily precipitation sums calculated this way give an improved visual fit (more homogeneous and without 'fish-bone-structures'). An analysis over a one year time period also shows better results of the QPE in comparison to rain gauge precipitation sums.