9.23 RADAR REFLECTIVITY ADVECTION ESTIMATION VIA PROXY CIRCLE IMAGES

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Nowcasting of rainfall rates at high spatial (100 m x 100 m) and temporal resolution (1 minute) is becoming more and more relevant for urban applications. It is not only relevant for the pleasure of citizens or tourists, but also for water management, traffic management, and harbor and airport operations.

A problem with the nowcasting of high-resolution measurements is that the data stream becomes rather large so that is it difficult to process them in realtime applications. Either large computational resources or fast and efficient algorithms are necessary to be able to process them. Nowcasting of rainfall rates can be divided in two parts: (1) the localization of the rain cells, and (2) the growth or dissipation of the rain cells. In this presentation, the focus is on the first, which is the fast estimation of advection from pairs of radar reflectivity measurements. To this end, we would like to apply existing efficient image processing techniques for the estimation of the advection. There is however a problem: efficient image processing techniques, e.g. image translation registration by cross-correlation, can not be applied directly to estimate the image displacement for a pair of two radar images. Next to the displacement of the image (due to advection), the images are mostly not very identical in the details (due to the radar measurement principles and natural variability).

As a solution, proxy circle images are made from the radar reflectivity images to be able to apply existing fast image processing techniques. In the proxy circle image, a filled circle is placed at the weighted location of each rain cell with the same area. From two proxy circle images the image translation can then be estimated via subpixel image translation registration by cross-correlation (this is an efficient image processing technique to estimate image displacement). Finally, the advection of radar reflectivity patterns can be efficiently estimated from radar reflectivity image pairs. The estimation can then be further enhanced by combining estimates from multiple pairs, which also provides an error estimate of the advection estimate.

In the presentation, the advection estimation algorithm is applied to X-band radars in the Netherlands, which are going to be used for realtime nowcasting applications. The algorithm is validated by applying it to radar archive data, and comparing the predictions with measurements.