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Information content of differential reflectivity columns for precipitation nowcasting

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Columns of differential reflectivity, the difference between the horizontal and vertical reflectivity, hereafter Zdr columns, are vertical columns of enhanced Zdr that extend above the environmental 0°C
level. These are easily identified when observed by polarimetric radars. Physically, these columns consist
of rain dominated by large drops that are being lofted above the freezing level and have been recognized
as a proxy for the location of updrafts. Their potential for nowcasting severe weather has been shown in
several past studies. We have developed an algorithm that identifies and tracks Zdr columns from volumetric radar data along with 3D wind fields from MultiDoppler analysis to spatially correlate Zdr
columns with updrafts. Since Zdr columns are a manifestation of an updraft, different Zdr columns properties for example Zdr column maximum height, volume, and area are expected to be related to
updraft intensity levels. In turn intensification of updrafts, as indicated by changes in the Zdr columns
properties, should be translated in intensification of observed precipitation at the surface. For the estimation of rain rates, we used a radar-based polarimetric approach, which will allow us to monitor the
temporal evolution for a number of identified convective rain cells. These cells will be identified from
summer events observed by the C-band polarimetric German network. For each cell, the properties of Zdr
columns are correlated with rain rate values. Similarly, correlations are also calculated for updraft volumes, updraft intensity, and other updraft properties. For the nowcasting of observed rain rates, an
extrapolation algorithm based on spatial and temporal properties of rain was used. Preliminary results
have shown that higher precipitation rates are generally associated with Zdr columns, and cells without a
Zdr column produce lower precipitation rates, as expected. Zdr column height and volume show a

positive correlation with precipitation intensity at the surface. The time lag between the intensification of
the Zdr column and associated increase in precipitation at the surface varies significantly between cells,
but it is generally short compared to previous studies, varying mostly between 5 to 15 minutes. An early
identification of cells associated with ZDR columns could benefit the skill of the nowcasting of localized
rain cells, which often are smoothed during extrapolation.