

## 2.38 EXTREME RAINFALL ANALYSIS AND ESTIMATION OF INTENSITY-DURATION-FREQUENCY CURVES USING DUAL POLARIZATION WEATHER RADAR DATA OF ESTONIA AND ITALY

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Intensity-duration-frequency (IDF) curves are widely used to quantify the probability of occurrence of extreme rainfall events. These data are commonly taken into account when designing storm water management systems. Rain gauge data have often been used to estimate the rainfall intensity for a given return period. However, the main issue of using rain gauges for this purpose is their low spatial and temporal resolution. Here, weather radar data have obvious advantage with their higher spatial and temporal resolution.

Past studies used horizontal reflectivity (Zh) based rainfall estimates, but they come with a great caveat while proven reliable on low rainfall rates they are subject to major errors in extreme rainfall and convective cases. It is widely known that especially shorter wavelength X-band and C-band weather radars underestimate precipitation intensity due to attenuation and overestimate due to hail contamination.

This study attempts to circumvent these shortcomings by using specific differential phase (KDP) data from dual polarization radars which is immune to attenuation and hail contamination issues. The aim of this study is to derive and analyze IDF curves from polarimetric weather radar data using KDP based quantitative precipitation estimations (QPEs). Furthermore, these parameters were also calculated from legacy Zh based radar rainfall and rain gauge data and they were included in the comparative analysis. Weather observations from Italy and Estonia, hence in two different climate regimes, were used to study the performance of the method in different climate conditions and radar hardware setups.

Data from warm period of the year were used as most of the extreme precipitation events take place at this time. Limiting the dataset to this period also helps to ensure that radar reflectivities are only from liquid precipitation which is required for reliable rainfall intensity estimation by KDP. For Estonia the warm period was defined as months from April to October and for Italy from March to November.

Single radar site data was used both from Estonia and Italy. From Italy radar data from Bric della Croce dual-polarization Doppler C-band radar located in Turin, northern Italy, were used. It was available with 5 minutes temporal resolution and from years 2012-2016. From Estonia radar data from Estonian Weather Service operated Srgavere dual-polarization Doppler C-band radar located in central Estonia in Viljandi county were used. It was available with 15 minute temporal resolution and from years 2010-2016. The lowest Plan Position Indicator (PPI) scan was used to derive radar Zh and KDP based QPEs.

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Rain gauge observations were used for the reference IDF curves calculation. From Italy 1-minute tipping bucket rainfall data were available from 1988 to 2016. From Estonia 10-minute gauge data were available from 2011 to 2016, while for the period 2003-2010 rain gauge data were available with 1 hour resolution.