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Using the three points approach to see beyond extremes for urban hydrology

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Abstract

In a changed climate precipitation has to be assessed not only with regard to extremes but for all aspects relevant in urban hydrology. The everyday domain, the design domain and the extreme domain delineated by the Three Points Approach provides a relevant framework for doing so (see Figure 1) (Sørup et al. (submitted). Thus, precipitation has to be assessed at event level for different return periods representing the different domains to give a full picture of how precipitation patters affect urban hydrology.

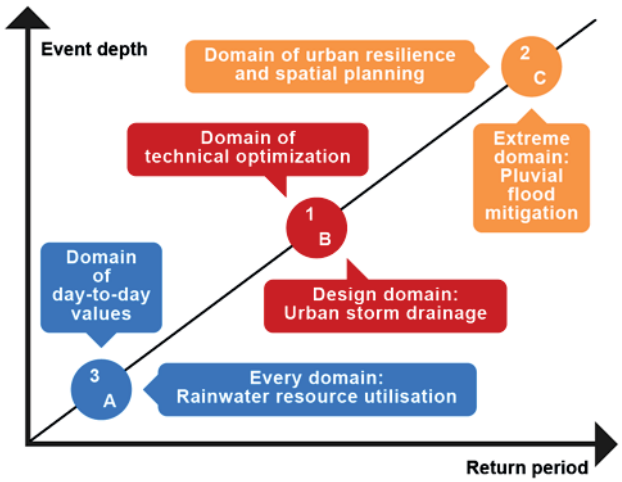

Fig 1: The three points approach as delineated in Sørup et al. (submitted).

Precipitation from Regional Climate Models (RCMs) tend to produce smaller extreme intensities than what is observed from point observations (Figure 2) and produce extreme event that has too large spatial extent (Gregersen et al., 2013, Mayer et al., 2015). High resolution RCMs, as presented by Mayer et al. (2015), do a much better job than coarser resolution models like the ENSEMBLES models presented in Gregersen et al. (2013). Kendon et al. (2014) run an RCM at radar resolution (1.5 km spatial resolution) and show that the performance with regard to short term local extremes is increased markedly. However, this approach is extremely computationally costly compared to statistical downscaling which can provide some of the same benefits (Maraun et al., 2010). Sørup et al. (2015), for instance, uses a Neyman-Scott weather generator for spatial downscaling and show how this downscaling product with respect to extremes behave much more realistic for both intensities and for spatial extent.

Figure 2 sums up the intensities from extremes from the precipitation product from the ENSEMBLES models used in Gregersen et al. (2013), the high resolution RCMs presented by Mayer et al. (2015) and from the weather generator presented by Sørup et al. (2015). The ENSEMBLES RCMs perform ok for domain A events and less and less well for domain B and C events when more and more extreme extremes are considered. The high resolution RCMs and the weather generator is able to produce realistic precipitation across all domains.

In contrary to most other downscaling techniques the weather generator provides us with useful time series that can be used for modelling of urban hydrological systems in all situations not just extreme ones.

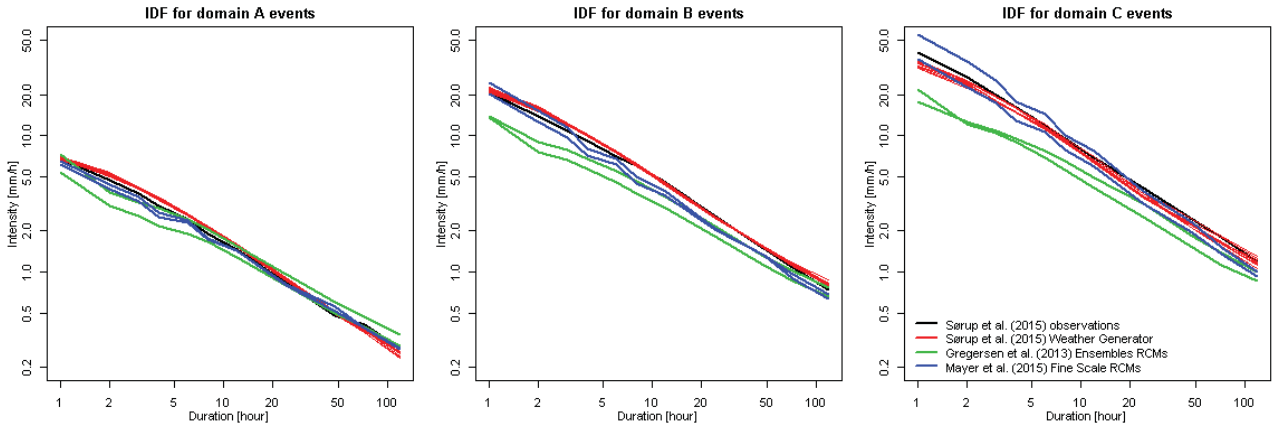

Fig 2: Intensity-duration-frequency plots for representative events from the three domains of the three points approach for all considered data sets.

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