Modelling sub-hourly rainfall extremes with short records - a comparison of MEV, Simplified MEV and point process methods

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Metastatistical Extreme Value (MEV) framework relaxes the asymptotic assumption of traditional AM methods. MEV considers, year by year, the full distribution of the underlying ordinary events and their number of occurrences.

$$MEV(x) = \frac{1}{M} \cdot \sum_{j=1}^{M} \left[\prod_{i=1}^{S} \left[F_i\left(x; \theta_{i,j}\right) \right]^{n_{i,j}} \right]$$

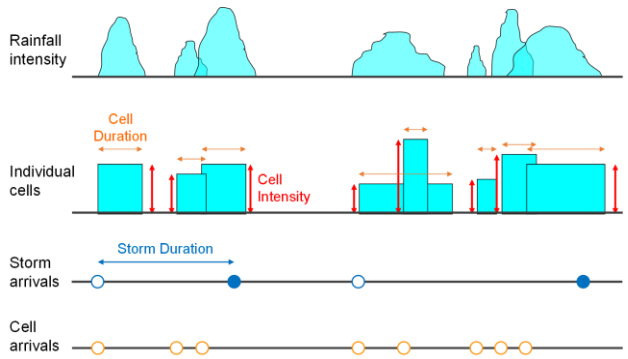
(Marani, M. & Ignaccolo, M., 2015)

Simplified MEV (SMEV, a variant of MEV) further neglects the inter-annual variability, in favour of simpler parametrisation and more robust parameter estimation.

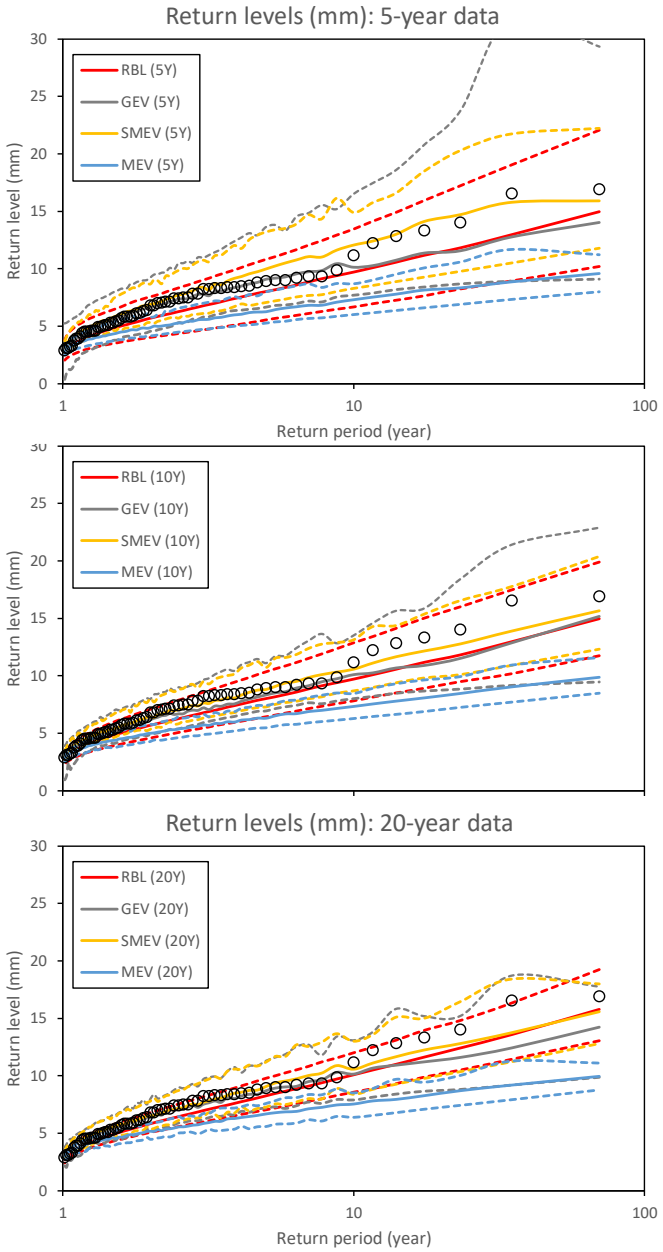
$$SMEV(x) = \prod_{i=1}^{S} \left[F_i\left(x; \theta_i\right) \right]^{n_i}$$

(Marra, F. et al., 2019)

Randomised Bartlett-Lewis rectangular Model (RBL), based upon point process theory, represents the temporal rainfall process in a realistic yet simple way, such that the hierarchical structure of rainfall is explicitly incorporated, and several parameters have a physical interpretation.



(Onof, C. & Wang, L.-P., 2020)



Experiment

- The scenarios where sub-hourly rainfall time series data are available with various short lengths (i.e. 5/10/15/20 years) were resembled.
- MEV, SMEV and RBL and the traditional GEV were compared against observed rainfall extremes at 5-min timescale.

Main Findings

- **GEV** appears to be very sensitive to data length. It requires more than 20 years of data to reach similar performance to other models.
- **MEV** totally fails in reproducing sub-hourly rainfall extremes, in spite of being insensitive to data length.
- **SMEV** generally has the best fit to sub-hourly rainfall extremes and is much less sensitive to data length.
- **RBL** slightly underestimates sub-hourly rainfall extremes, as compared to SMEV, but it is even less sensitive to data length. In addition, RBL has the advantage of preserving rainfall extremes across multiple timescales (i.e. from sub-hourly, hourly to 1-day) at the same time