**Stochastic Rainfall Model:**

Once calibrated, the model can be used to generate long (>10,000 years) series of synthetic rainfall.

**Science Question A:** How credible simulated extreme rainfall events are?

**Origin of the Study**

Rogger et al. (GRA 2008): “Reconciling statistical and deterministic flood estimation methods - A case study in Tyrol”

**Statistical Approach:**

- Return period of events
- Data sample not representative for all possible flood events
- Assumptions very strong on time, and rainfall characteristics

**Tools:**

- Single site rainfall simulator fitted to the available observations for the generation of long rainfall series
- Statistical upper bound on observed rainfall maxima (envelope curve)

**Probabilistic Envelope Curves:**

Variation of statistics of rainfall annual maxima with MAP (southern Central Italy)

**Probabilistic Envelope Curves for Extreme Rainfall Events**

Northern Italy - Castellarin et al. (HYDROCL 2005)

**Empirical Envelope Curve (Northern Central Italy)**

Recurrence interval?

**Exceedance probability of an Envelope Curve, \( P_{EC} \)**

The algorithm for estimating \( P_{EC} \) requires:

- The modelling of the cross-correlation structure – model proposed by Tasker and Stedinger (HYDROCL 1986).
- Strong dependence on MAP for long duration (frontal storms)
- Weak dependence on MAP for short duration (convective storms)

**Empirical Envelopes vs. Synthetic Rainfall Series**

- High and realistic is the probabilistic interpretation of envelope curves?

**Empirical Envelope Curve:**

- Logs-linear regression (reasonable option) for representing the regional upper bound of the observed maximum point rainfall

**Mean Annual Maximum Rainfall Depth and Inter-site Correlation (Tyrol)**

Mean:

- Strong dependence on MAP (for short duration)
- Weak dependence on MAP for long duration

**Summary**

- Good agreement (especially for intermediate timescales 1-24 hours)
- Validation of different sources of information (storm and inter-storm statistics, observed characteristics, and cross-correlation among series)
- Suitable for assessment of the probabilistic interpretation of envelope curves (climatic homogeneity, discretization of MAP)

SQB:

- How general and realistic is the probabilistic interpretation of envelope curves?

**Science Questions:**

- SQA: How credible simulated extreme rainfall events are?
- SQB: How general and realistic is the probabilistic interpretation of envelope curves?