Breakout E: Max' example

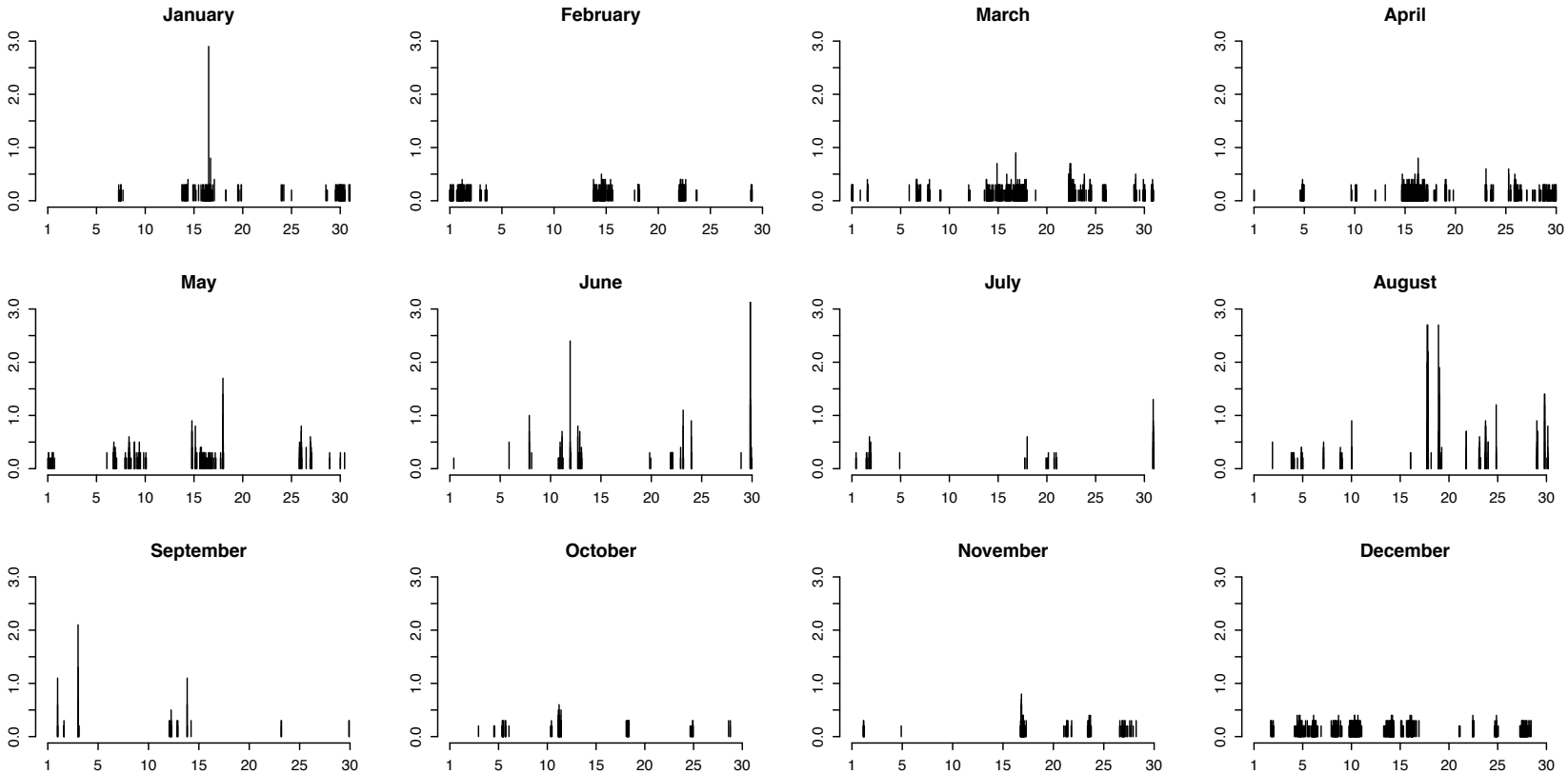
- Hawkes process for modelling earthquakes
- How to include measuring errors (location, magnitude) in the analysis/modelling?
- "shifting around", papers by Lund&Rudemo and Lund&Penttinen (from the 90's)

- Hawkes processes for nerve fibers (entry, branching and end points)

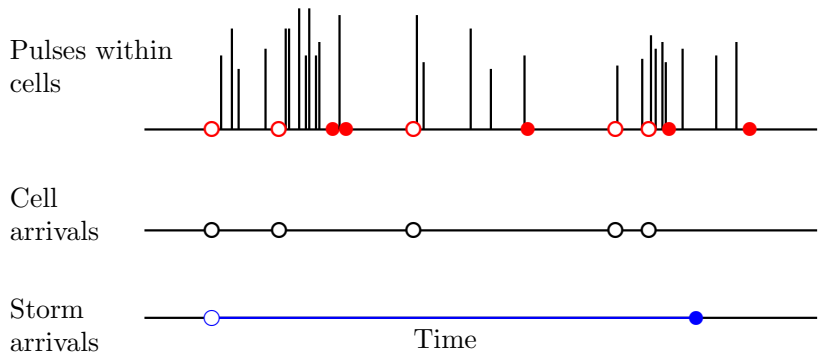
Breakout E: Thordis example

- Rain cells
- Fitting models, estimating parameters
- Compare models
- Poisson or Strauss?
- Model selection

Observed 5 min precip in Boulder, CO in 2016

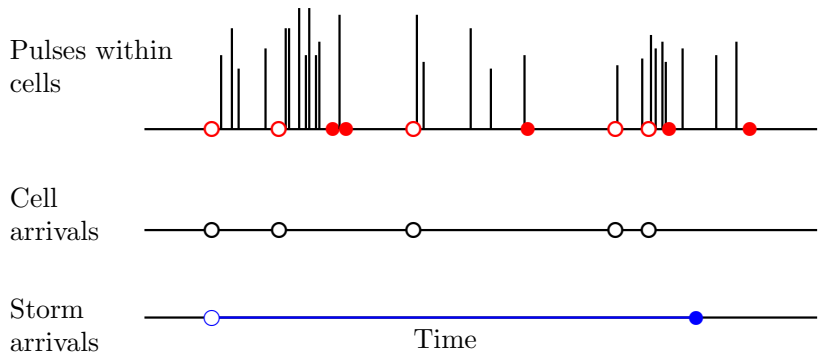


Bartlett-Lewis instantaneous pulse rainfall model



- Storms $\mathbf{s}$ arrive according to Poisson(λ) on $[0, T]$ and have durations $\mathbf{p} \sim \text{Exp}(\gamma)$
- Cells $\mathbf{c}_i$ arrive according to Poisson(β) on $[s_i, s_i + p_i]$ and have durations $\mathbf{d}_i \sim \text{Exp}(\eta)$
- Pulses $\mathbf{x}$ happen inside cells according to Poisson(ξ) and have intensity $\mathbf{m} \sim \text{Exp}(\mu^{-1})$ (or another distribution)

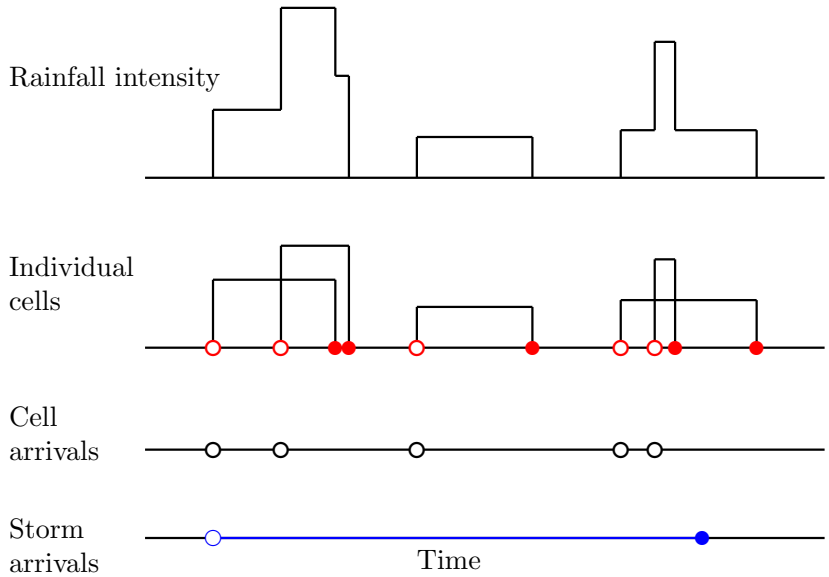
Bartlett-Lewis instantaneous pulse rainfall model



If we think of the storms and the cells as unknown parameters, the observed data is a inhomogeneous marked Poisson process on $[0, T]$ with intensity

$$\xi \sum_i \sum_j \mathbb{1}\{x \in [c_{ij}, c_{ij} + d_{ij}]\}.$$

Bartlett-Lewis rectangular pulse model



- Arrival and duration of storms as before
- Constant rain inside each cell of intensity Exp(μ^{-1}) (or another distribution)
- Observed precip sum of all active cell at the time