Long term oscillations in rainfall extremes

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Long term oscillations in rainfall extremes

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Motivation and Aim

- Urban design rainfall has increases in Denmark over the last 35 years
- We seek to understand if this is climate change or natural variations
- Willems (2013) found a consistent oscillation pattern in the 15 highest daily rainfall events in the winter season for the entire European region
- We deepen the analysis of Willems (2013) focusing on Denmark, with a threshold corresponding to the three highest rainfall event in the entire season
- We furthermore model the variations separately for the two for Peak Over Threshold (POT) parameters (Coles, 2001)
- Five Danish (Cappelen, 2013) and one Swedish diurnal rainfall series with 137 years of measurements are analysed

Multidecedal variations

Extremes are defined by a POT model with z_0 = 19.2 mm/day

A method developed by Ntegeka and Willems (2008) defines perturbation factors for extreme rainfall characteristics:

$$pf = \frac{C_{extreme}(t_{sub})}{C_{extreme}(t_{full})}$$

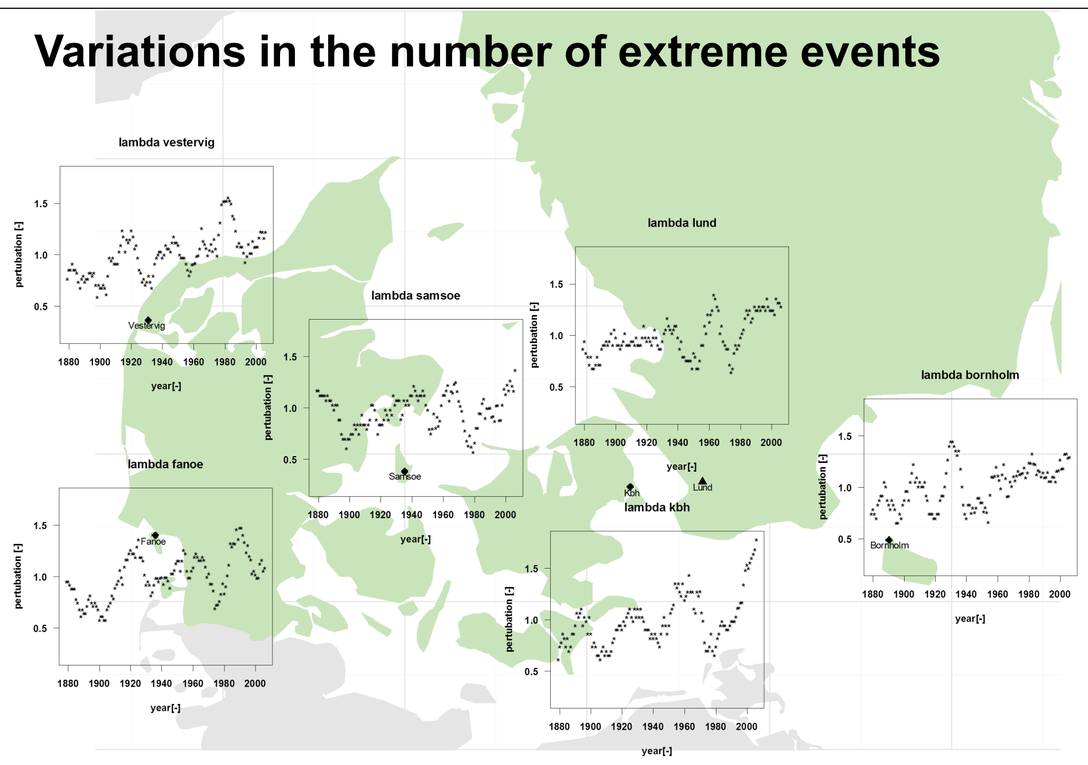
In the present study *pf* is calculated for

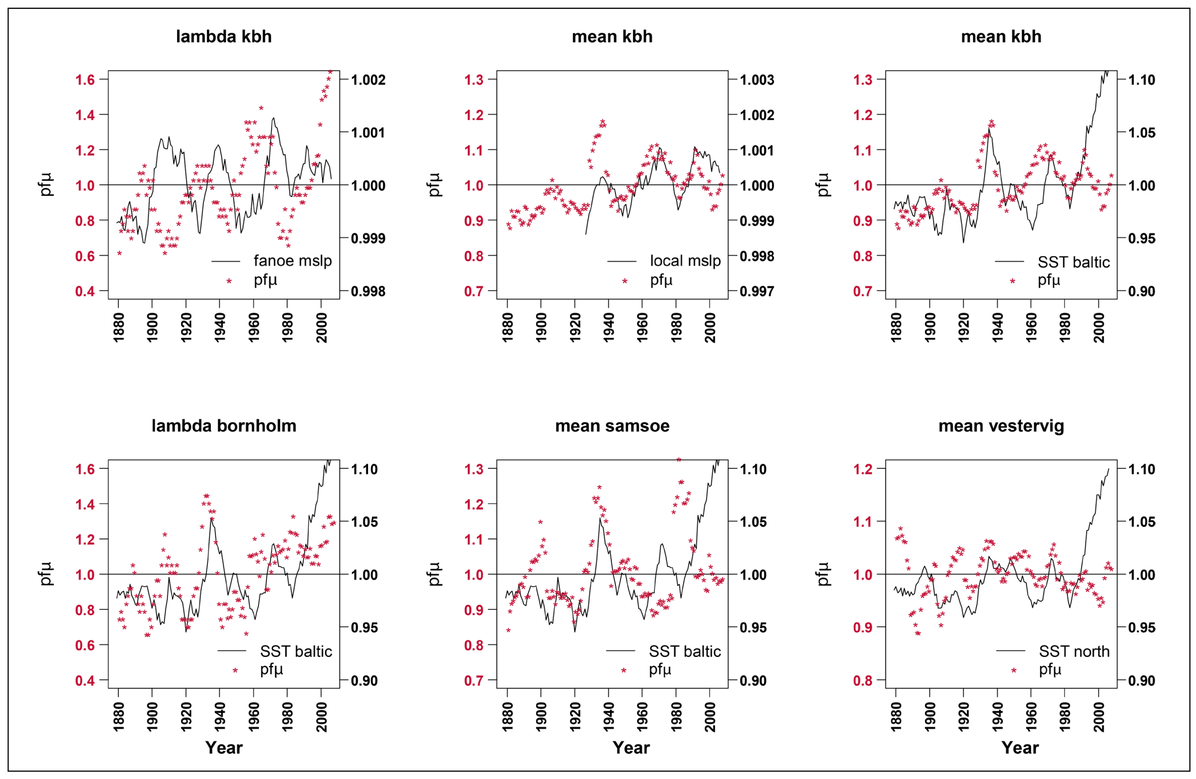
- The annual number of extreme rainfall events (λ)
- The mean annual magnitude of extreme rainfall (μ)

With a moving window length (t_{sub}) of 10 years and a timestep of 1 year

Patterns are evaluated by spectral analysis (Shumway and Stoffer 2010)

Variations in the number of extreme events





Conclusion

- A general increase is found for λ, together with an oscillation pattern with a period of 25-40 years
  - Regional differences exists
- Oscillations are identified for μ with a period of 15-30 years
  - The amplitude is smaller in comparison to the oscillations found for λ
- There is a possible link to Sea Surface Temperature, Sea Level Pressure, wind direction and topography. The details are still explored
- Regional increases of the urban design rainfall from 1979-2012 are partly caused by this natural oscillation.

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