

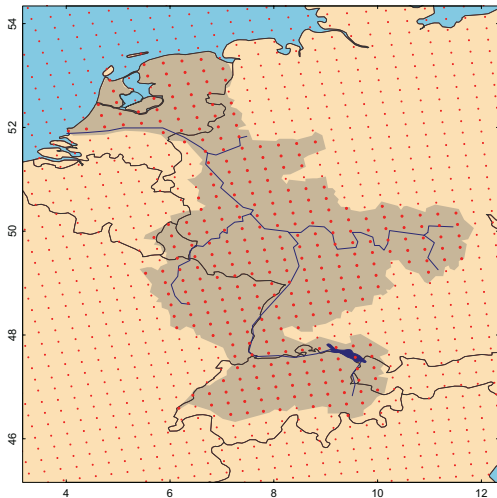
Modelling of precipitation extremes in a transient Regional Climate Model run for the Rhine basin

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ENSEMBLES WP5.4

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The Rhine basin



- area \doteq 185.000 km²
- RACMO_ECHAM5 RCM, gridsize = 25 x 25 km
- transient run (1950-2100) under SRES A1B scenario
- modelling of
1 day summer (JJA) and
5 day winter (DJF)
precipitation extremes

$$F(x) = \exp \left\{ - \left[1 + \xi \left(\frac{x - \mu}{\sigma} \right) \right]^{-\frac{1}{\xi}} \right\}, \quad \xi \neq 0$$

$$F(x) = \exp \left\{ - \exp \left[- \left(\frac{x - \mu}{\sigma} \right) \right] \right\}, \quad \xi = 0$$

- μ ... location parameter
- σ ... scale parameter
- ξ ... shape parameter

GEV parameters μ , σ , and ξ

- may vary over the region (spatial heterogeneity)
- may vary over time (climate change)

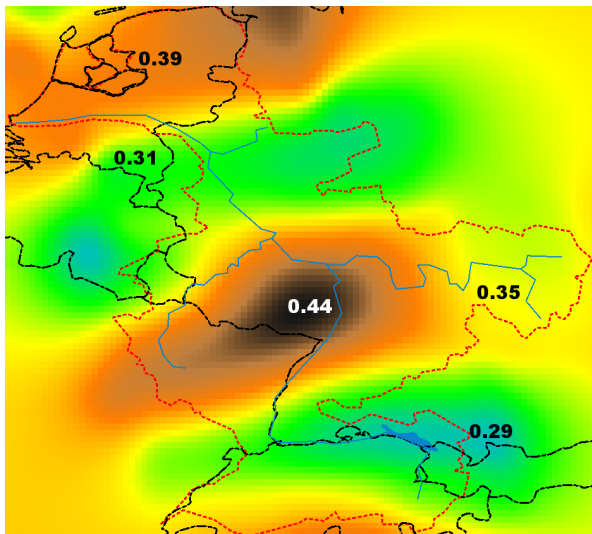
A popular assumption about spatial heterogeneity is that

- μ varies over the region
- ξ and $\gamma = \frac{\sigma}{\mu}$ are constant over the region
(γ is a dispersion coefficient comparable with the coefficient of variation)

Further we assume that

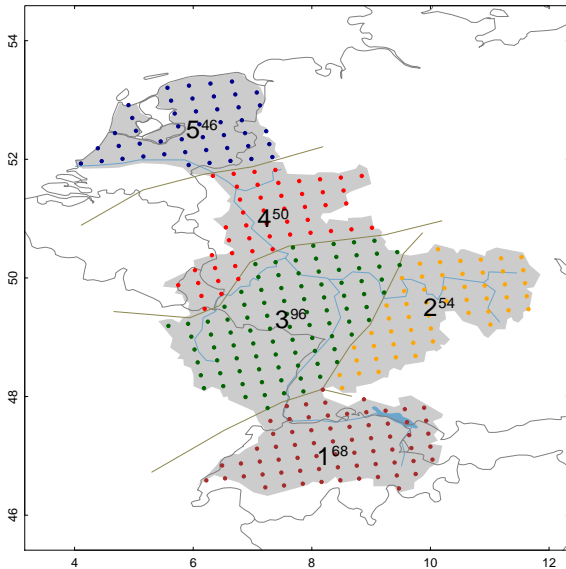
- the changes of μ , γ and ξ in time are constant over the region

Dispersion coefficient

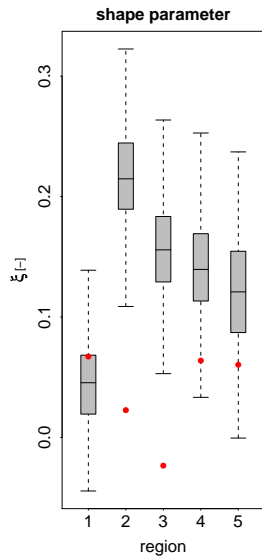
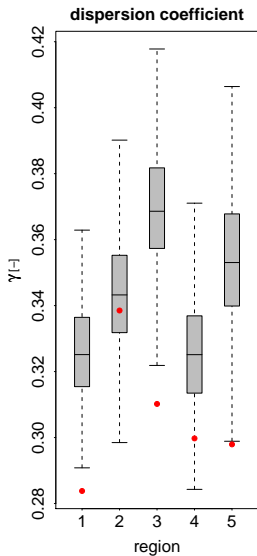
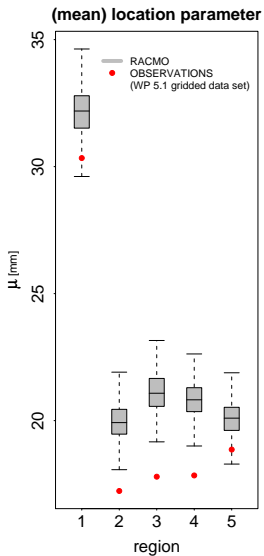


Maximum 1 day precipitation in JJA (1950-1990)

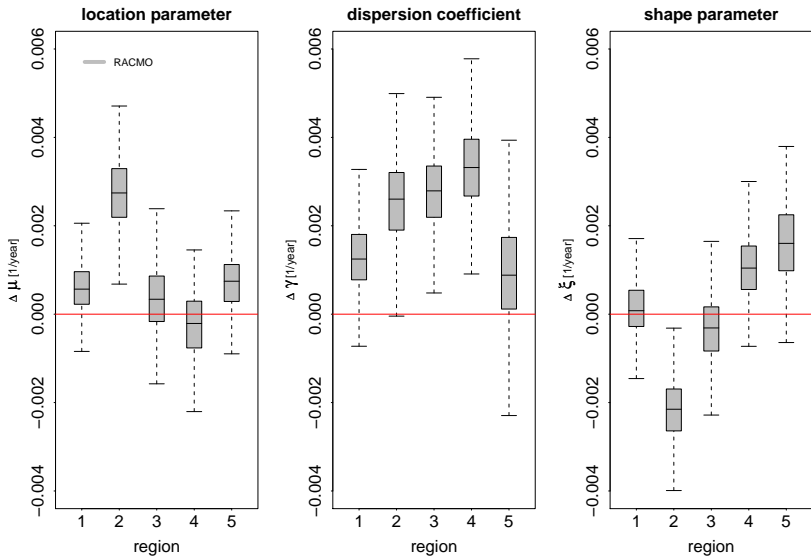
Division of the area



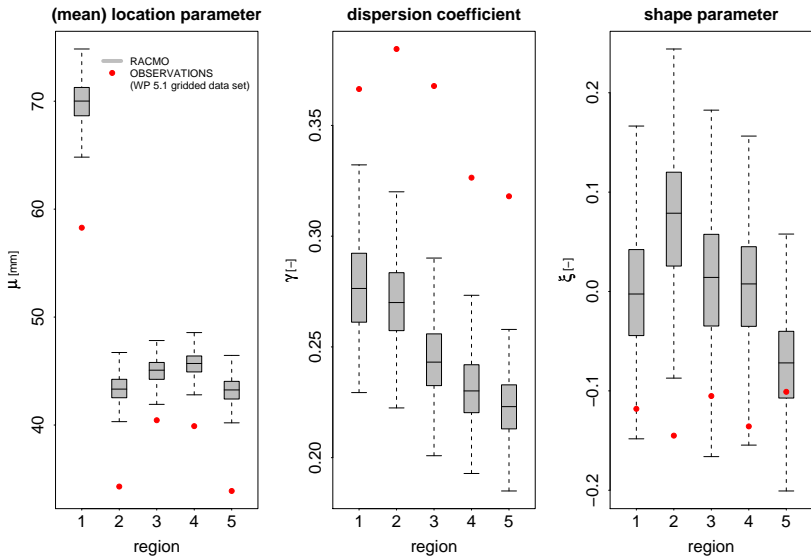
Resulting parameters (JJA)



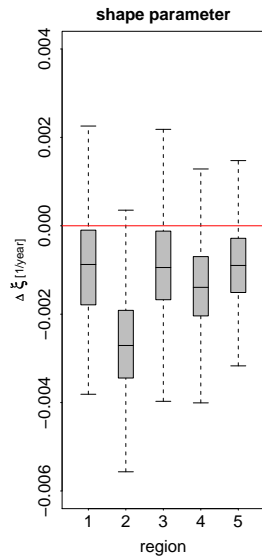
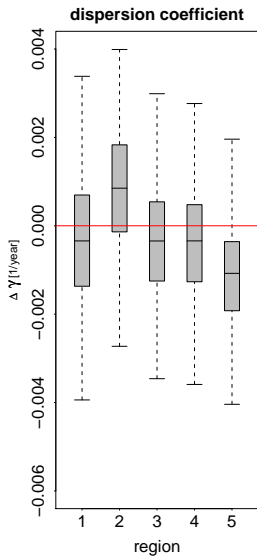
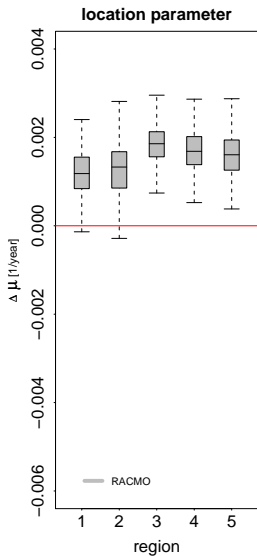
Resulting parameters (JJA)



Resulting parameters (DJF)



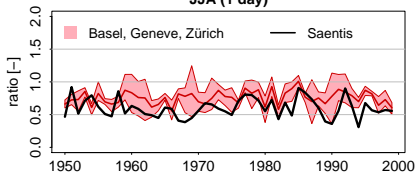
Resulting parameters (DJF)



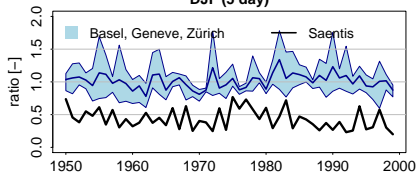
Switzerland

ENSEMBLES GRIDDED DATA SET / ECA&D OBSERVATIONS

JJA (1 day)



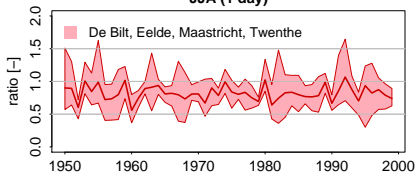
DJF (5 day)



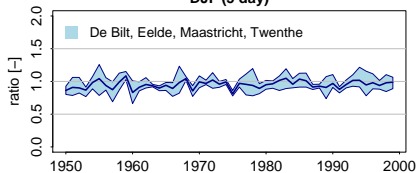
Netherlands

ENSEMBLES GRIDDED DATA SET / ECA&D OBSERVATIONS

JJA (1 day)



DJF (5 day)



Gridded data versus station data:

- 1 day JJA maxima reduced by 10-15 %
- 5 day DJF maxima are similar

Compared to areal reduction factors (ARF) in UK Flood Studies Report:

- $ARF=0.905$ for 24 hour annual maxima
- $ARF=0.950$ for 5 day annual maxima

(Applies to average annual maxima.)

- GEV parameters are generally reasonably reproduced.
- However, there is a strong underestimation in the dispersion coefficient in DJF.
- There is a significant positive trend in the dispersion coefficient in JJA.
- There is a significant positive trend in the location parameter in DJF, plus indication of a negative trend in the shape parameter.