Small-scale sim study results

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Simulation study settings

All: $\mathbf{s} \in [0, 6] \times [0, 6]$

1. GEV link
    a. $\alpha = 0.3$, 144 knots, 1% rareness, $\rho = 0.542$, $\xi = 0.25$
    b. $\alpha = 0.7$, 144 knots, 1% rareness, $\rho = 0.542$, $\xi = 0.25$
    c. $\alpha = 0.3$, 144 knots, 5% rareness, $\rho = 0.542$, $\xi = 0.25$
    d. $\alpha = 0.7$, 144 knots, 5% rareness, $\rho = 0.542$, $\xi = 0.25$
2. Logit link
    a. $\rho = 3$, 144 knots, 1% rareness
    b. $\rho = 1$, 144 knots, 1% rareness
    c. $\rho = 3$, 144 knots, 5% rareness
    d. $\rho = 1$, 144 knots, 5% rareness

where ρ is the bandwidth parameter.

Models fit

We fit three different models using MCMC

1. Spatial logit
2. Spatial probit
3. Spatial GEV

The chains ran for 40000 iterations with a burnin period of 30000 iterations.

Prior distributions

For all models, we fit an intercept-only model.

For the logit model, we use the following priors:

$$\begin{aligned} \beta &\sim \text{N}(0, 100) \quad (1) \\ \rho &\sim \text{Unif}(0, 10) \\ \sigma^2 &\sim \text{IG}(1, 1) \\ \tau^2 &\sim \text{IG}(1, 1) \quad (2) \end{aligned}$$

For the probit model, we use the following priors:

$$\begin{aligned} \beta &\sim \text{N}(0, 100) \\ \rho &\sim \text{log-Normal}(-1, 2) \end{aligned} \tag{3}$$

For the GEV model, we use the following priors:

$$\begin{aligned} \xi &\sim \text{N}(0, 0.5) \\ \beta &\sim \text{N}(0, 100) \\ \alpha &\sim \text{Unif}(0, 1) \\ \rho &\sim \text{Unif}(0, 9) \end{aligned} \tag{4}$$

Brier skill scores

We average the Brier skill scores across all 10 datasets and multiply them by 1000 in the following tables.

Table 1: Results from settings with GEV link

	1a	1b	1c	1d
Spatial Logit	8.9705	10.363	26.494	44.056
Spatial Probit	7.3856	10.047	15.127	36.776
Spatial GEV	8.8898	10.053	22.033	43.069
Spatial GEV: fixed params	7.2892	9.96	14.44	36.349

Table 2: Results from settings with logit link

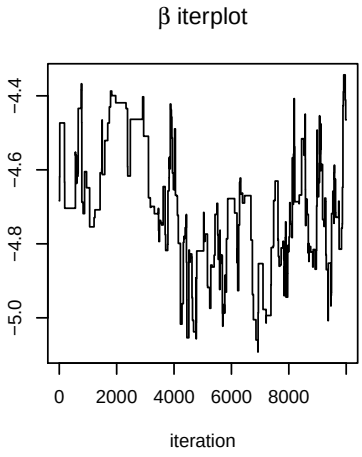
	2a	2b	2c	2d
Spatial Logit	16.445	16.506	84.697	69.547
Spatial Probit	16.3	16.367	81.815	66.387
Spatial GEV	16.272	16.667	83.082	68.74

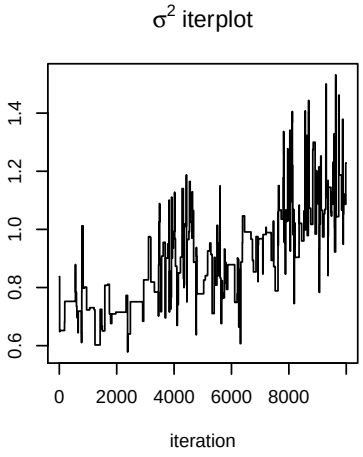
So, when we can fix the spatial settings at their true values for the GEV link, we get some very minor improvements over the spatial probit model. However, when we fit them in the MCMC, our method doesn't perform as well.

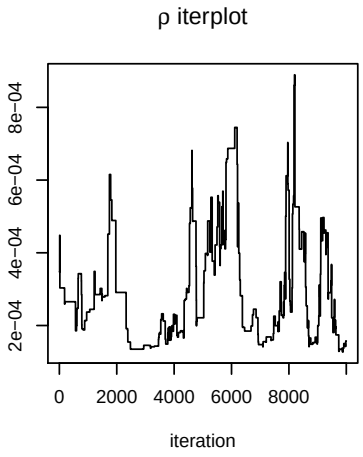
Iteration plots

Data setting 1a

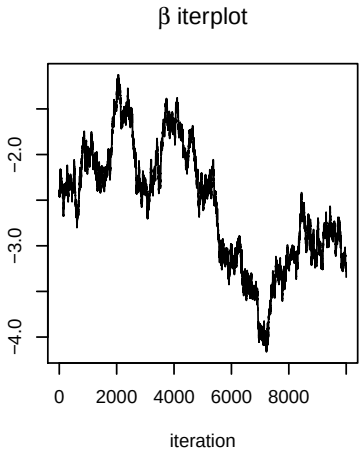
Fit using spatial logit

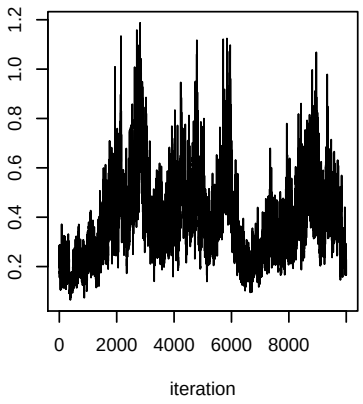


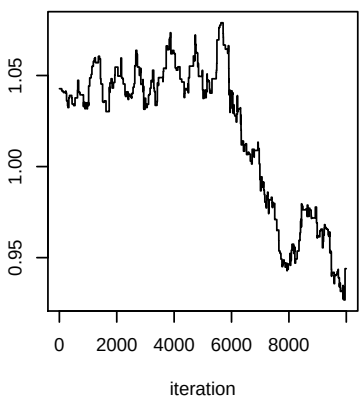




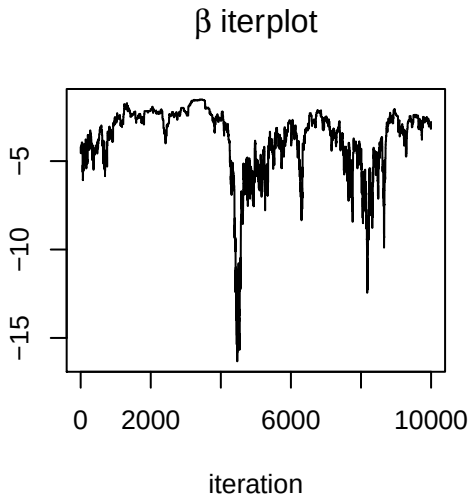
Fit using spatial probit

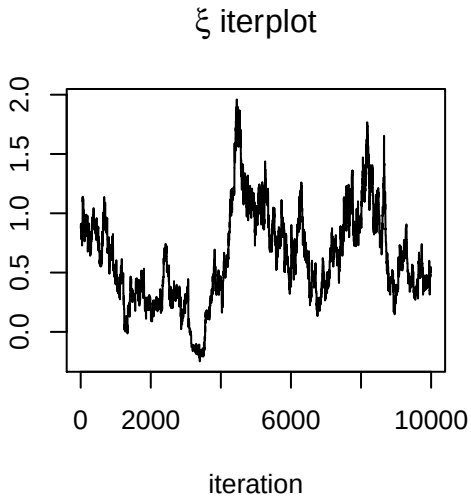


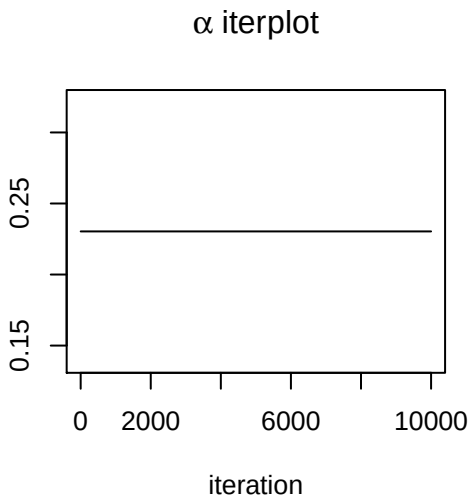


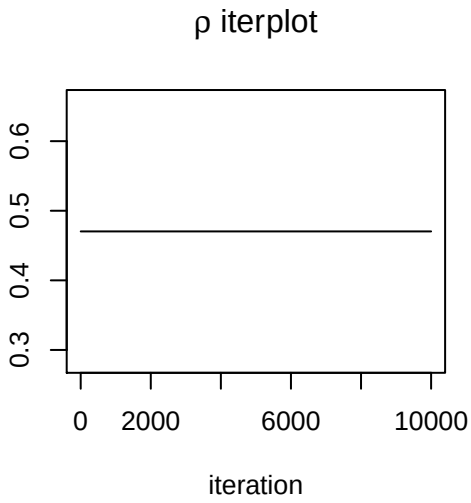


Fit using spatial GEV



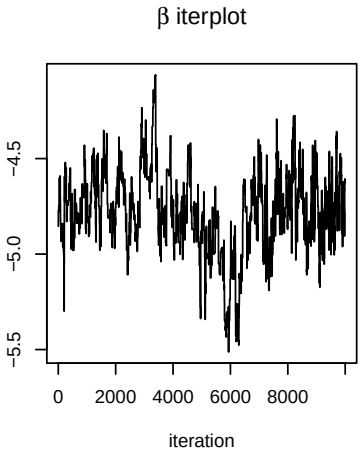


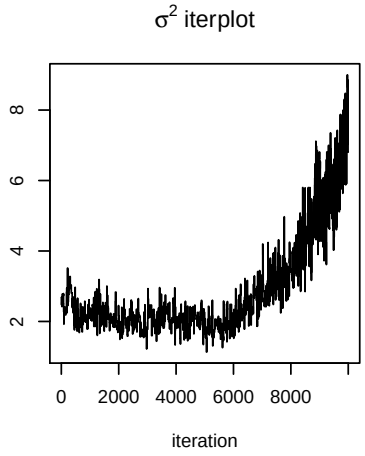


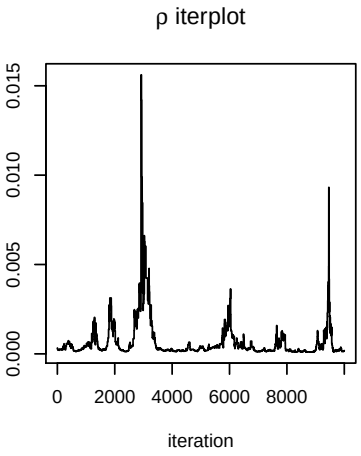


Data setting 1b

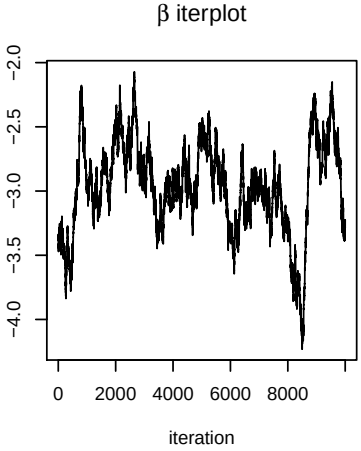
Fit using spatial logit

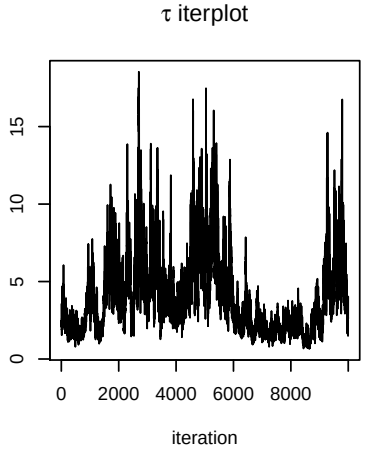


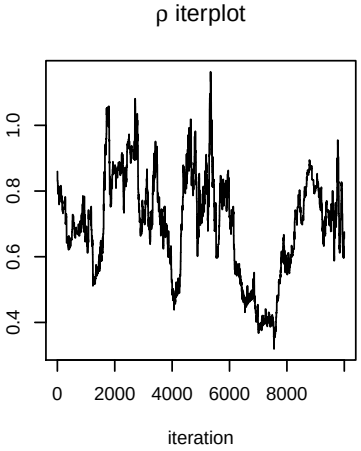




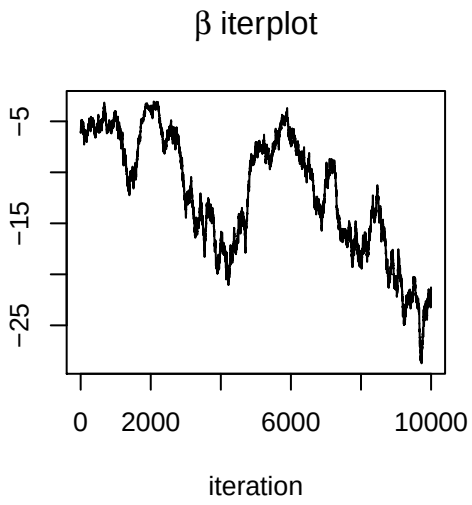
Fit using spatial probit

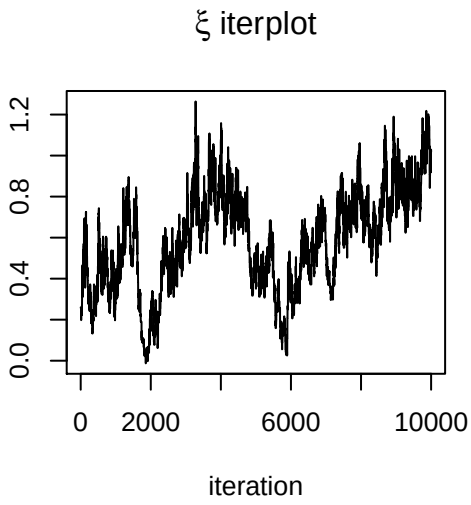


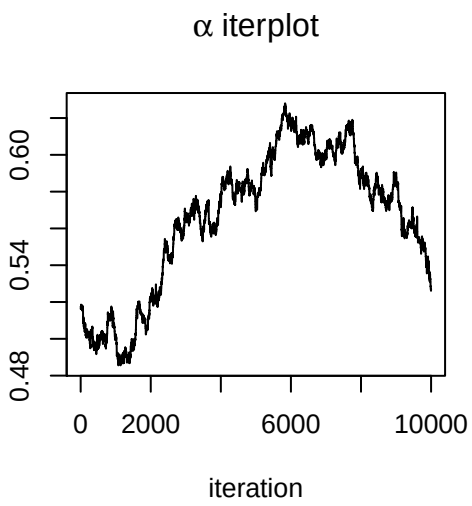


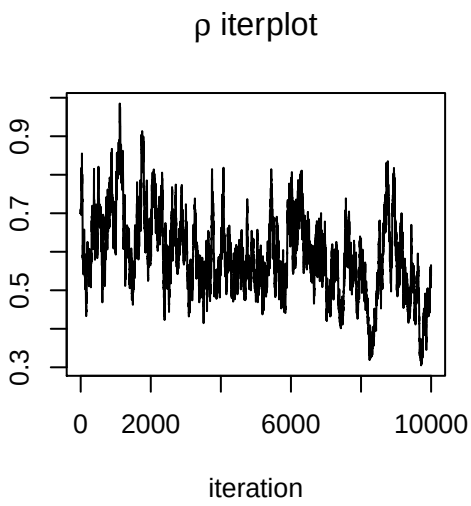


Fit using spatial GEV



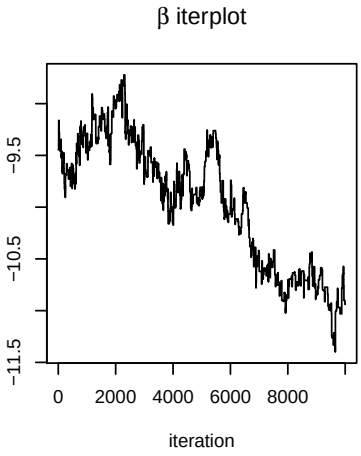


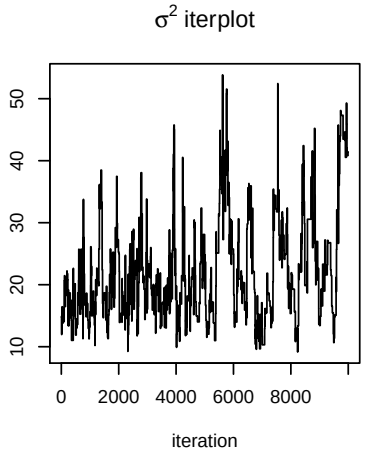


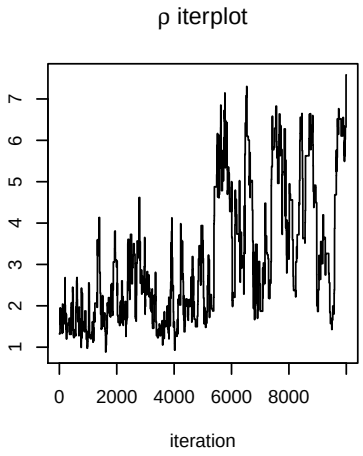


Data setting 1c

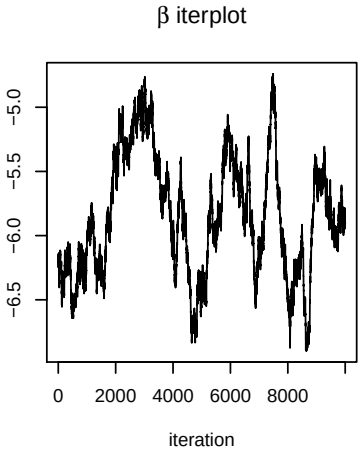
Fit using spatial logit

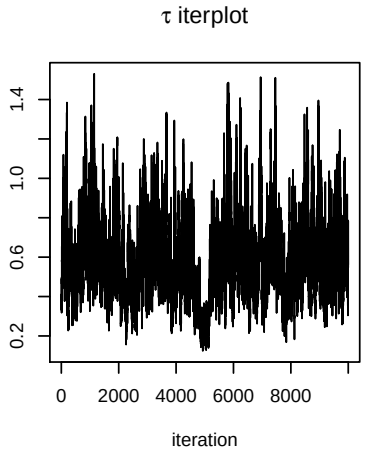


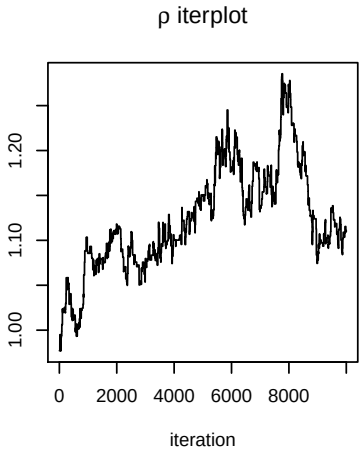




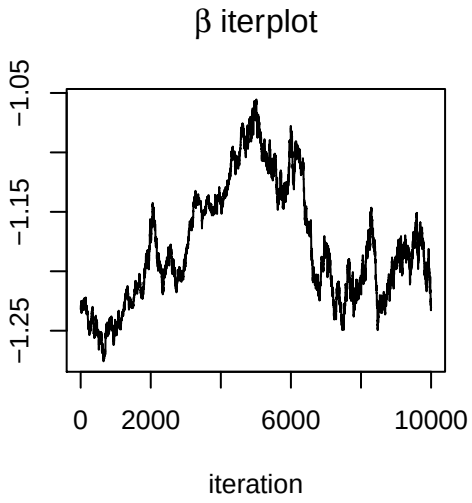
Fit using spatial probit

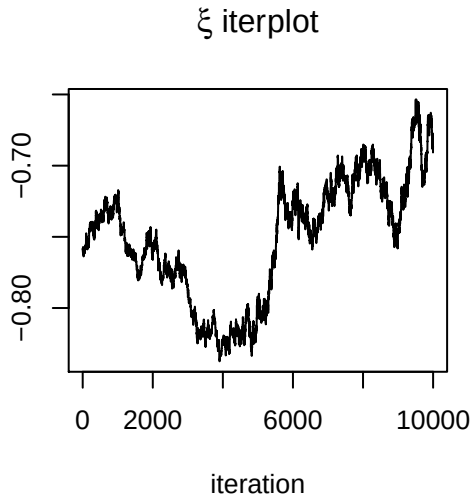


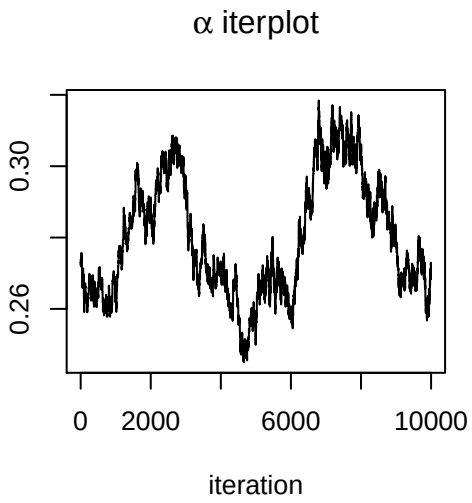


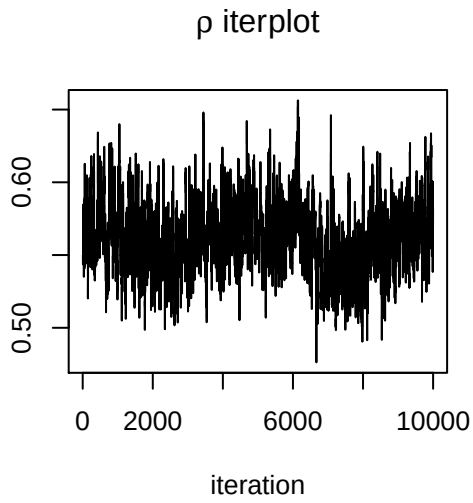


Fit using spatial GEV



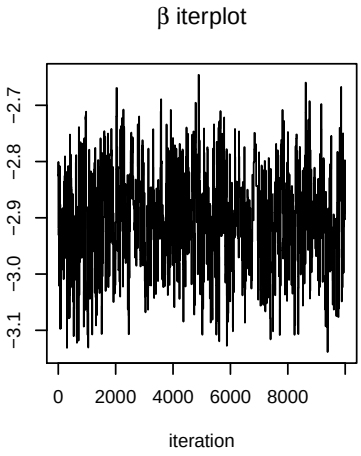


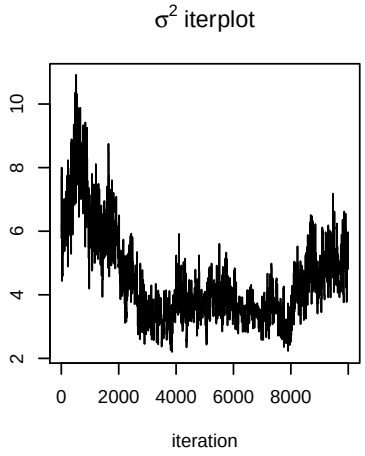


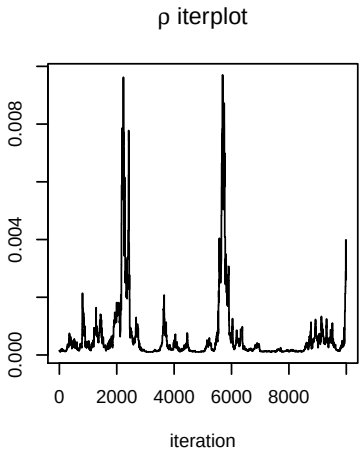


Data setting 1d

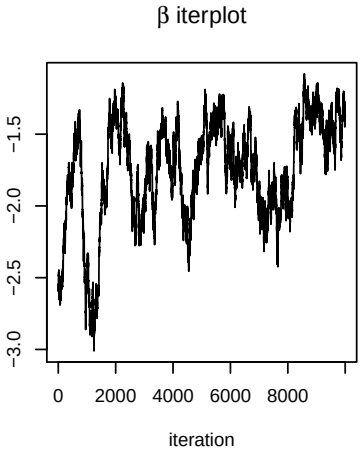
Fit using spatial logit

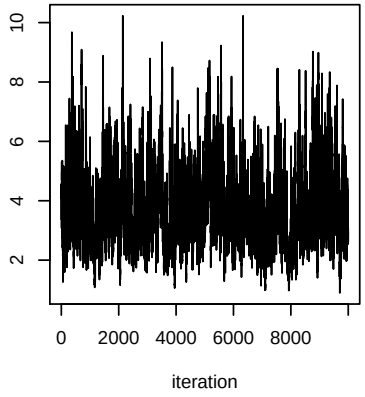


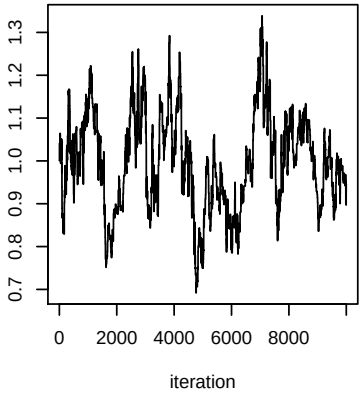




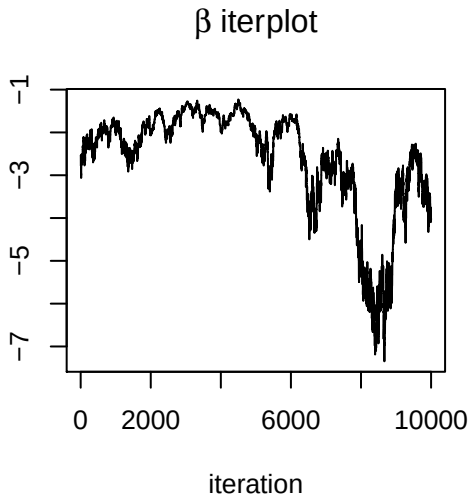
Fit using spatial probit

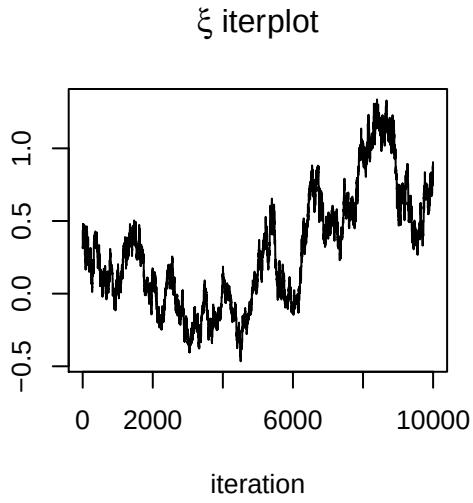


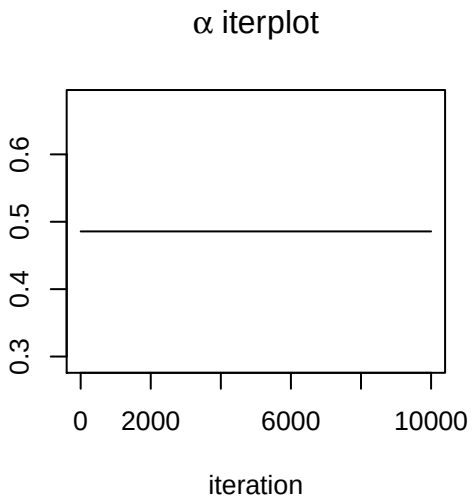


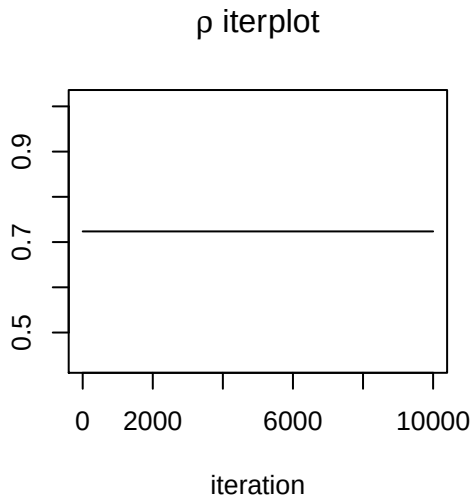


Fit using spatial GEV



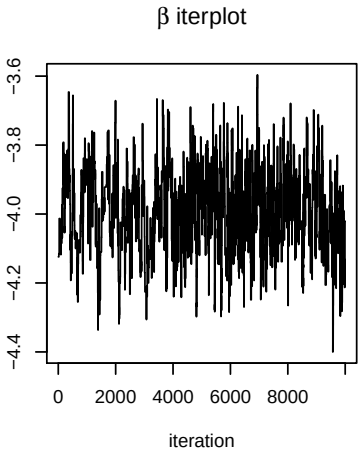


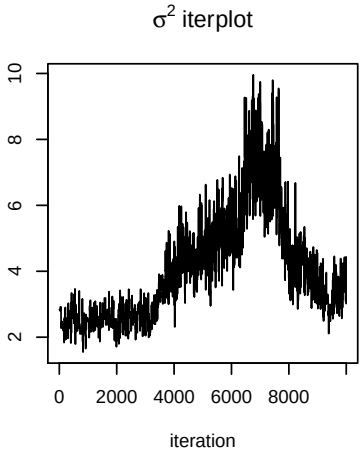


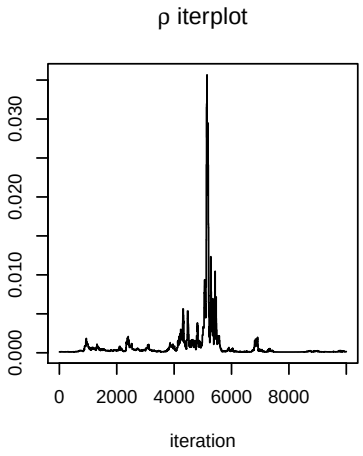


Data setting 2a

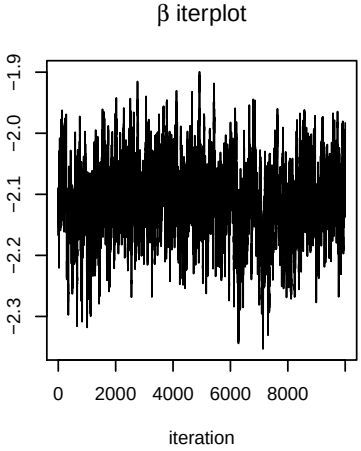
Fit using spatial logit

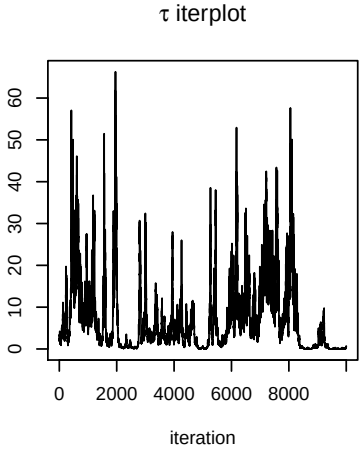


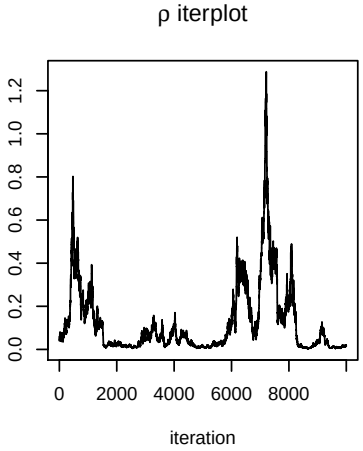




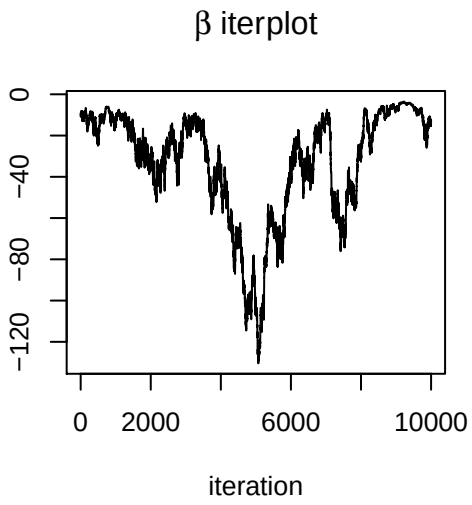
Fit using spatial probit

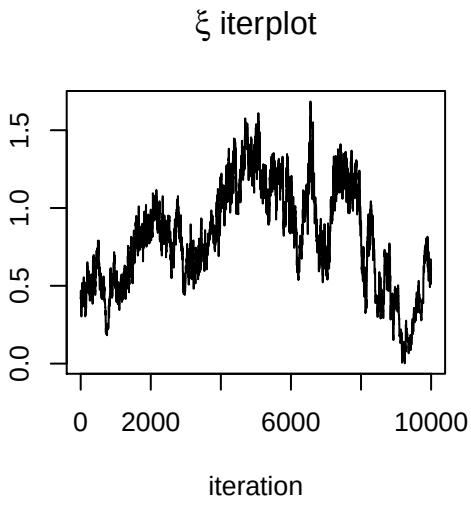


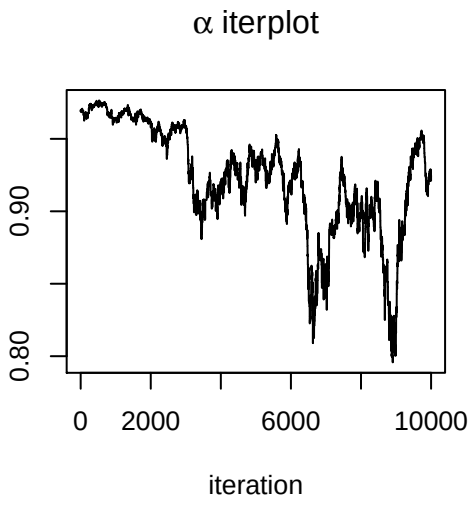


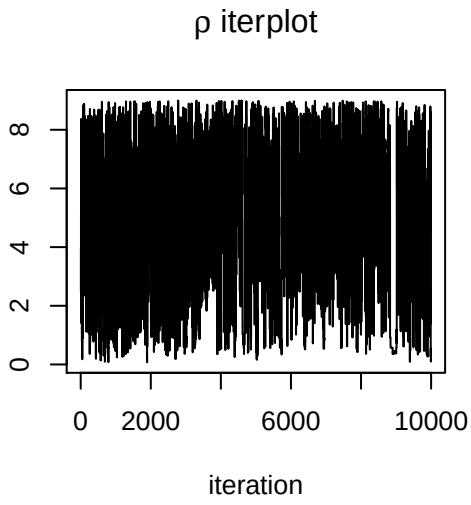


Fit using spatial GEV



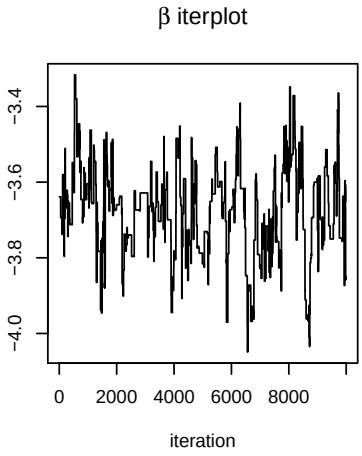


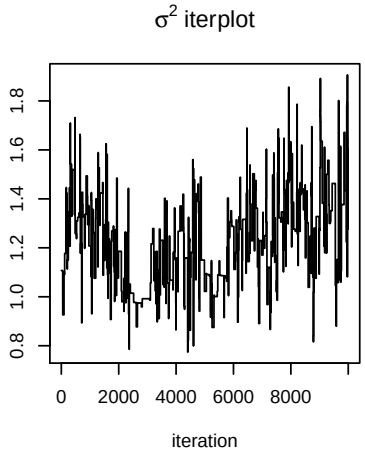


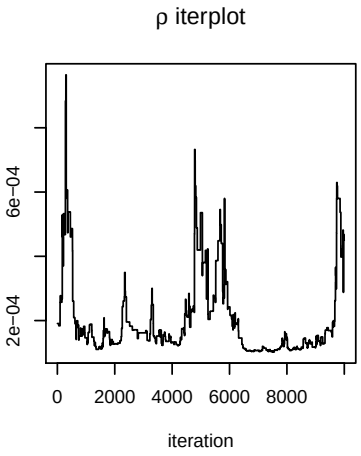


Data setting 2b

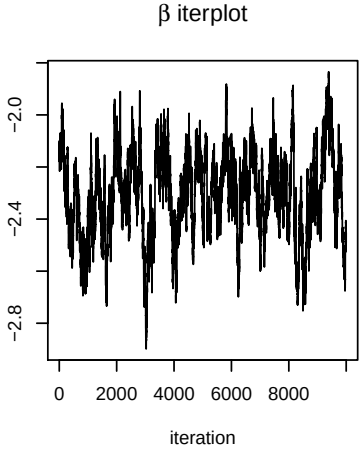
Fit using spatial logit

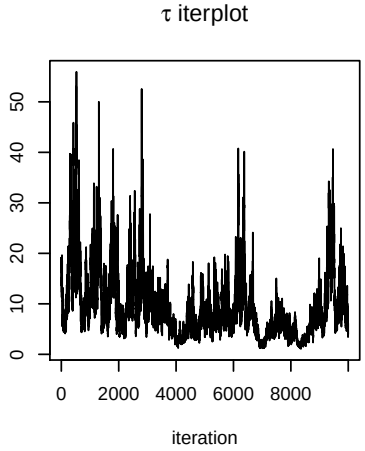


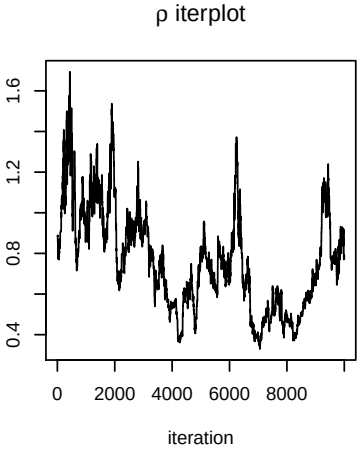




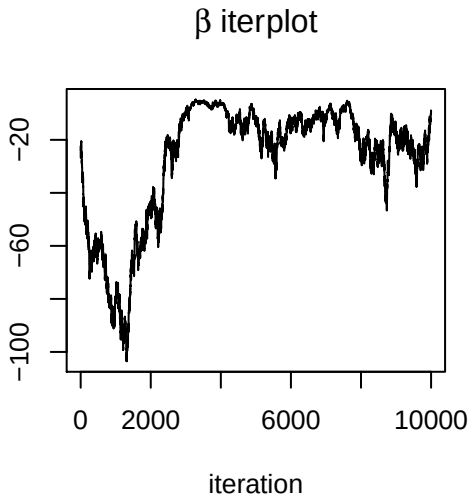
Fit using spatial probit

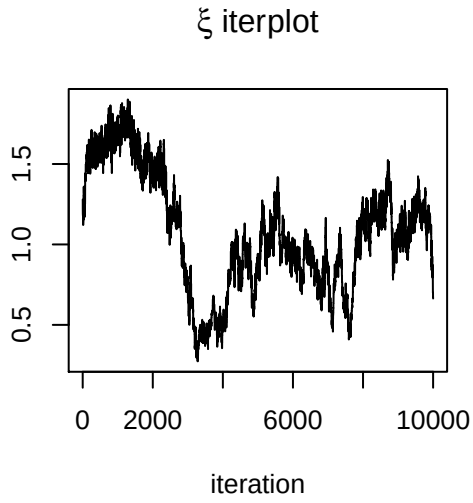


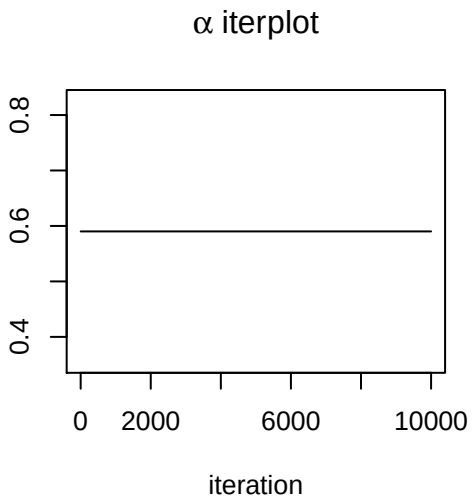


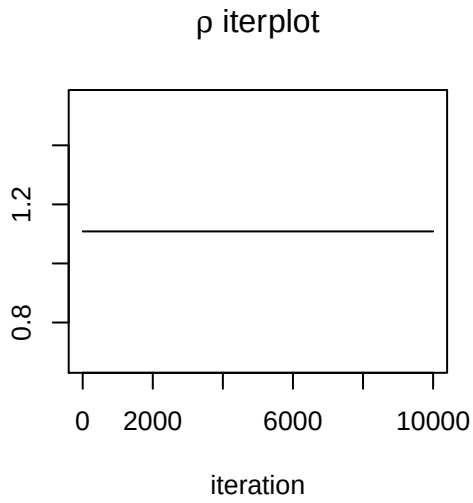


Fit using spatial GEV



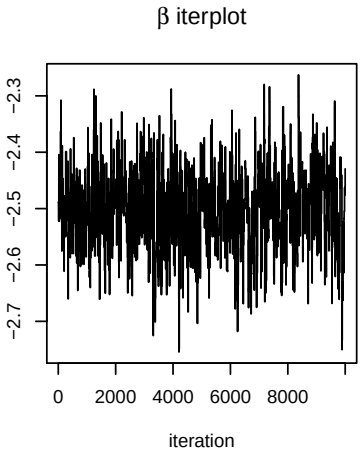


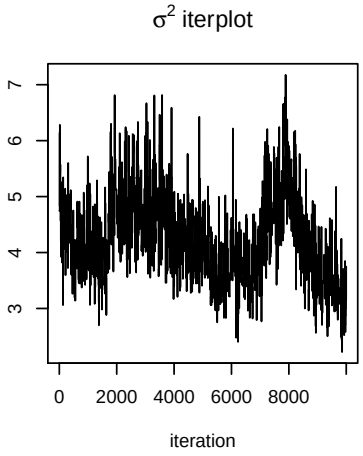


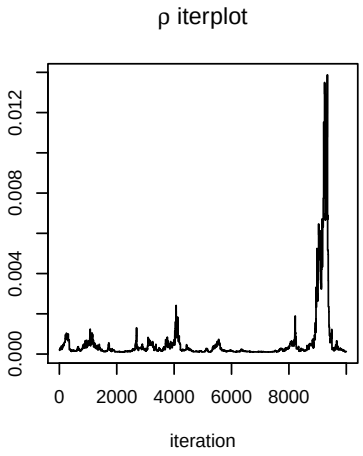


Data setting 2c

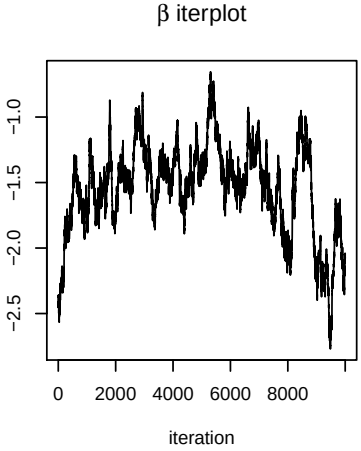
Fit using spatial logit

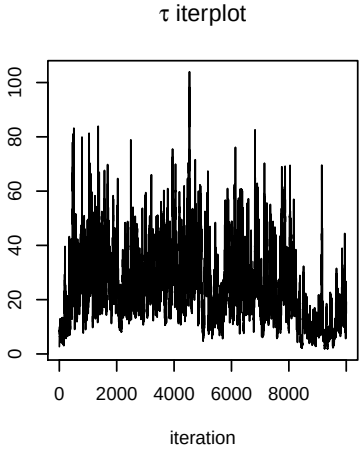


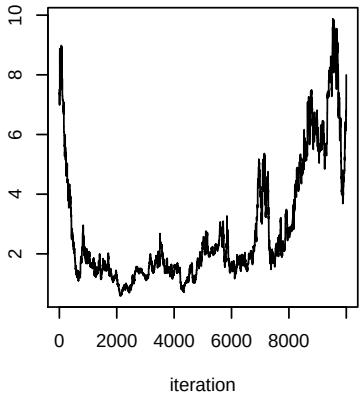




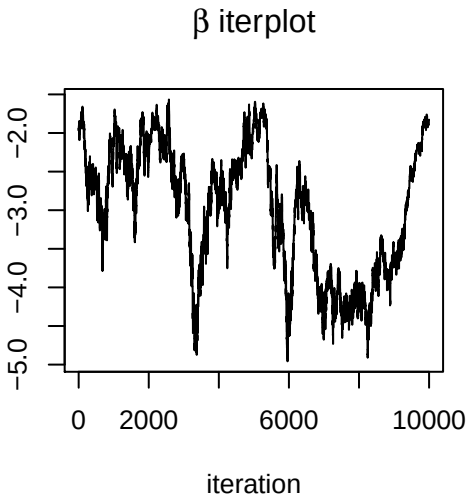
Fit using spatial probit

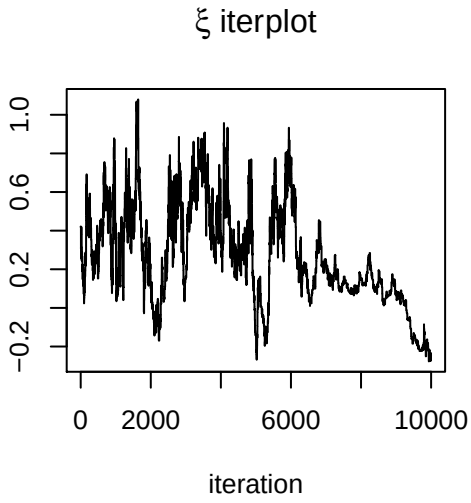


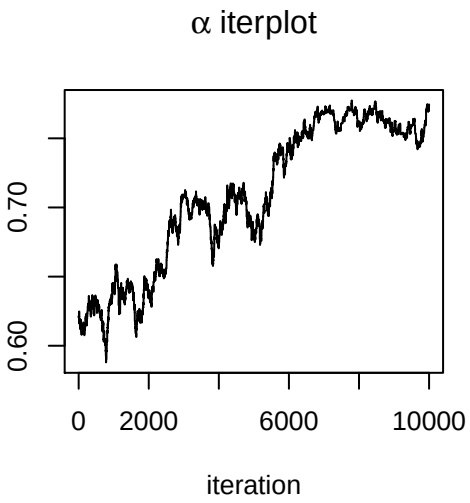


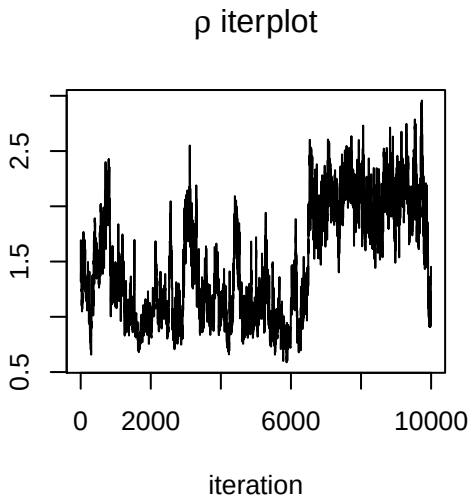


Fit using spatial GEV



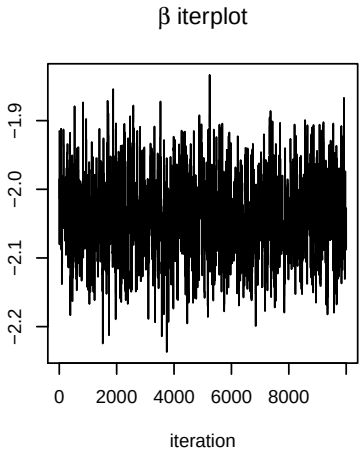


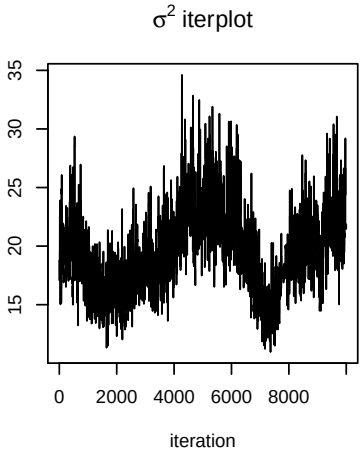


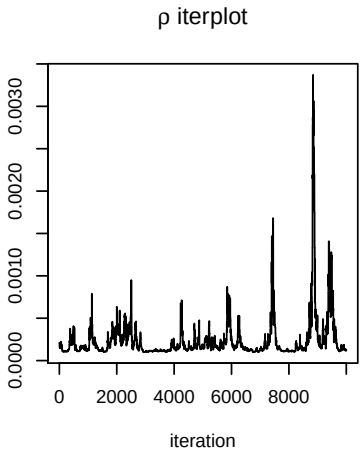


Data setting 2d

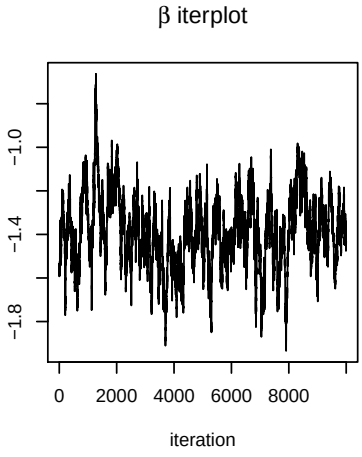
Fit using spatial logit

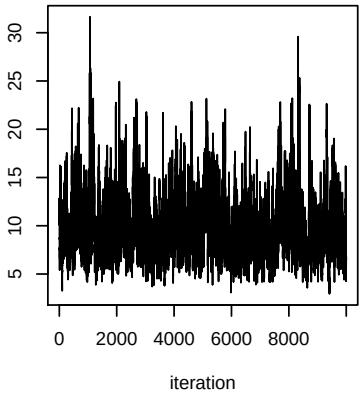


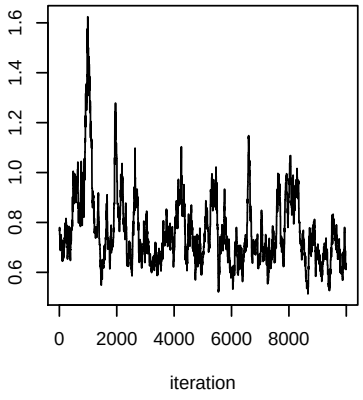




Fit using spatial probit







Fit using spatial GEV