LGCP with PC priors

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The data

```
library("geostatsp")
data('murder')
data('torontoPop')
murder = unwrap(murder)
torontoBorder = unwrap(torontoBorder)
torontoPdens = unwrap(torontoPdens)
torontoIncome = unwrap(torontoIncome)
```

covariates

```
theCrs = paste0("+proj=omerc +lat_0=43.7117469868935 +lonc=-79.3789787759006",
 " +alpha=-20 +gamma=0 +k=1 +x_0=0 +y_0=0 +datum=WGS84 +units=m +no_defs")
murderT = project(murder, theCrs)
borderT = project(torontoBorder, crs(murderT))
borderC = crop(borderT, ext(-12700, 7000, -7500, 3100))

covList = list(
  pop=torontoPdens,
  inc = log(torontoIncome) )

formulaHere = ~ inc + offset(pop, log=TRUE)
```

LGCP with priors given by quantiles

gamma priors.

```
resG=lgcp(
 formula = formulaHere,
 data=murderT,
 grid=squareRaster(borderC, 30),
 covariates=covList,
```

```
  border=borderC,
 buffer=2000,
 prior = list(
    sd = c(lower = 0.2, upper = 2),
    range = c(lower = 2, upper=20)*1000),
 control.inla=list(strategy='gaussian'))

if(!is.null(resG$parameters)) {
 knitr::kable(resG$parameters$summary, digits=3)
}
```

	mean	sd	0.025quant	0.5quant	0.975quant	mode	kld	meanExp
(Intercept)	-4.308	3.543	-11.262	-4.310	2.656	-4.310	7.667	7.777
inc	-1.265	0.327	-1.908	-1.264	-0.623	-1.264	5.991	0.293
range/1000	1.690	0.298	1.193	1.660	2.364	1.593	NA	NA
sd	0.834	-0.016	0.688	0.802	0.943	0.809	NA	NA

LGCP with penalised complexity prior

$pr(sd > 1) = 0.05$ and $pr(phi < 0.2) = 0.95$

```
resP=lgcp(formulaHere, data=murderT,
    grid=squareRaster(borderC, 30),
    covariates=covList,
    border=borderC, buffer=2000,
    prior = list(
     sd = c(u=0.5, alpha=0.05),
     range = c(u=10*1000, alpha = 0.4)),
    control.inla = list(strategy='gaussian')
 )

if(!is.null(resP$parameters)) {
 knitr::kable(resP$parameters$summary, digits=3)
}
```

	mean	sd	0.025quant	0.5quant	0.975quant	mode	kld	meanExp
(Intercept)	-4.426	3.528	-11.349	-4.428	2.508	-4.428	7.922	6.582
inc	-1.254	0.326	-1.894	-1.253	-0.614	-1.253	5.972	0.297
range/1000	1.723	0.306	1.215	1.692	2.415	1.623	NA	NA
sd	0.826	-0.015	0.679	0.794	0.937	0.801	NA	NA

LGCP with table priors

```
sdSeq = seq(0,4,len=501)
rangeSeq = seq(0,15*1000, len=501)
```

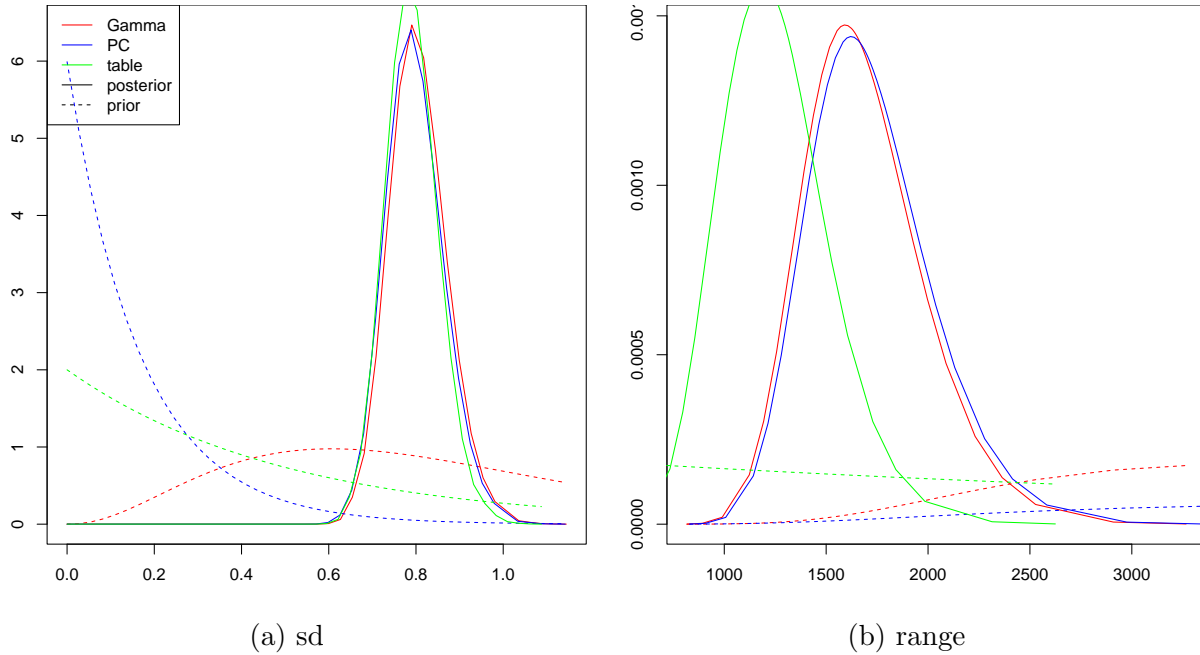(a) sd   (b) range

Figure 1: Priors and posteriors

```
resT=lgcp(formulaHere,
    data=murderT,
    grid=squareRaster(borderC, 30),
    covariates=covList,
    border=borderC, buffer=2000,
    prior = list(
        sd = cbind(sdSeq, dexp(sdSeq, 2)),
        range = cbind(rangeSeq, dexp(rangeSeq, 1/5000))),
    control.inla = list(strategy='gaussian')
)

if(!is.null(resT$parameters)) {
 knitr::kable(resT$parameters$summary, digits=3)
}
```
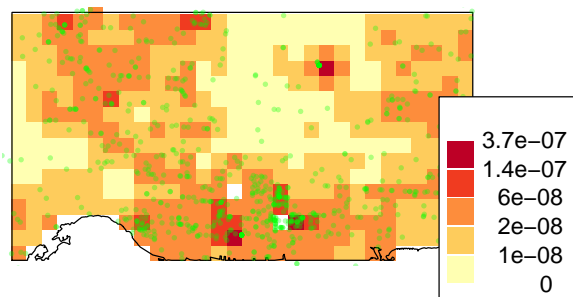
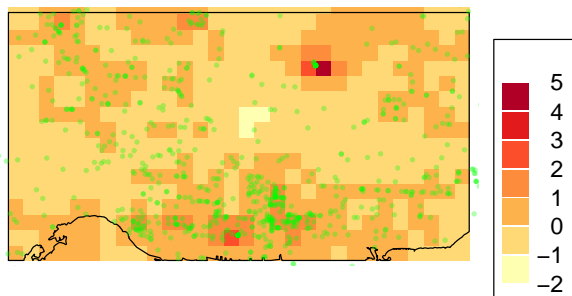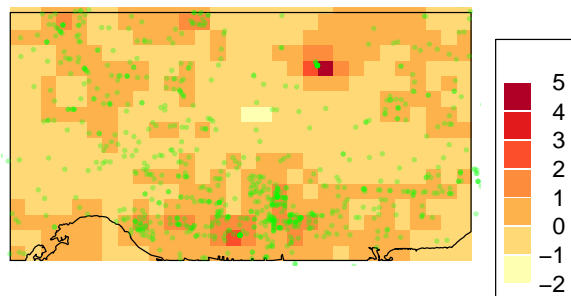|	mean	sd	0.025quant	0.5quant	0.975quant	mode	kld	meanExp
(Intercept)	-3.621	3.331	-10.183	-3.614	2.904	-3.614	5.869	7.075
inc	-1.328	0.308	-1.932	-1.328	-0.721	-1.328	7.240	0.274
range/1000	1.253	0.267	0.796	1.230	1.842	1.191	NA	NA
sd	0.819	-0.016	0.681	0.788	0.914	0.796	NA	NA

Maps
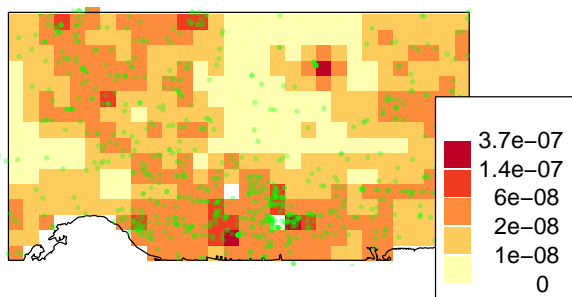
(a) gamma, fitted

(b) pc fitted

(c) gamma random

(d) pc random

Figure 2: Random effects and fitted values