```
##### R-code used to fit ENVIR model with heterogeneous errors

library(MASS)
library(utils)
library(Matrix)
library(ape)
library(coda)
library(MCMCglmm)
library(LaplacesDemon)

trial<-
read.table("D:/starykomp/programy/stability/potato3y.txt",h=TRUE)

trial$site<-factor(trial$site)
trial$variety<-factor(trial$variety)
trial$rep<-factor(trial$rep)
trial$year<-factor(trial$year)
trial$env<-factor(trial$env)
trial$exper<-factor(trial$exper)
trial$block<-factor(trial$block)
trial$system<-factor(trial$system)


var<-aggregate(yield/10~variety,data=trial,na.rm=TRUE,FUN="var")

###### apriori distributions for fixed, random effects and residuals
prior.m3a.4 = list(
B=list(mu=rep(0,8),V=diag(1e+8,8)),
R = list(V=diag(67)*(0.002/2.002),nu=2.002),
G = list(G1 = list(V=diag(c(var[,2]),8)/8,nu=9),
G2 = list(V=diag(1)*(0.002/2.002),nu=2.002)))

start1 <- list(R = list(R1 = rIW(diag(67),nu=67)),
               G = list(G1 = rIW(diag(8),nu=8),
                        G2 = 10000))
start2 <- list(R = list(R1 = diag(10000,67)),
               G = list(G1 = diag(10000,8),
                    G2 = 10000))

x<-rinvgamma(67, shape=0.5, scale=0.5)
y<-rinvgamma(8, shape=4, scale=0.001)
start3 <- list(R = list(R1 = diag(c(x),67)),
               G = list(G1 = diag(c(y),8),
                    G2 = rinvgamma(1,shape=1,scale=2)))#,

pro<-c(0.1,0.45,0.45)
pro2<-c(0.01,0.65,0.34)
z<-c(100,10000,0.001)
xx<-sample(z, size=8,replace = TRUE,prob=pro)

w<-c(100,0.001,10000)
yy<-sample(w,size=67,replace=TRUE,prob=pro2)
```

```
start5 <- list(R = list(R1 = diag(c(yy),67)),
               G = list(G1 = diag(c(xx),8),
              G2 = rinvgamma(1,shape=0.01,scale=0.01)))



##### model
modenv<-MCMCglmm(yield/10~variety-1,
random=~us(variety):env+env:rep,
rcov=~idh(env):units,family="gaussian",prior=prior.m3a.4,DIC=TRUE,
nitt=2000000,burnin=1000000,thin=50,data=trial,
verbose=TRUE)

modenv2<-MCMCglmm(yield/10~variety-1,
random=~us(variety):env+env:rep,
rcov=~idh(env):units,family="gaussian",DIC=TRUE,
nitt=2000000,burnin=1000000,thin=50,prior=prior.m3a.4,start=start2,data
=trial,
verbose=TRUE)

modenv3<-MCMCglmm(yield/10~variety-1,
random=~us(variety):env+env:rep,
rcov=~idh(env):units,family="gaussian",DIC=TRUE,
nitt=2000000,burnin=1000000,thin=50,prior=prior.m3a.4,start=start2,data
=trial,
verbose=TRUE)

modenv4<-MCMCglmm(yield/10~variety-1,
random=~us(variety):env+env:rep,
rcov=~idh(env):units,family="gaussian",DIC=TRUE,
nitt=2000000,burnin=1000000,thin=50,prior=prior.m3a.4,start=start3,data
=trial,
verbose=TRUE)

modenv5<-MCMCglmm(yield/10~variety-1,
random=~us(variety):env+env:rep,
rcov=~idh(env):units,family="gaussian",DIC=TRUE,
nitt=2000000,burnin=1000000,thin=50,prior=prior.m3a.4,start=start5,data
=trial,
verbose=TRUE)


model<-
mcmc.list(modenv$VCV,modenv2$VCV,modenv3$VCV,modenv4$VCV,modenv5$VCV)
model2<-
mcmc.list(modenv$Sol,modenv2$Sol,modenv3$Sol,modenv4$Sol,modenv5$Sol)
gelman.diag(model,multivariate=FALSE)#FALSE
gelman.plot(model,autoburnin=TRUE, auto.layout = TRUE,ask=TRUE)

summary(model)
autocorr.diag(model)
plot(model,ask=TRUE)
```

```
gelman.diag(model2)
gelman.plot(model2,autoburnin=TRUE, auto.layout = TRUE,ask=TRUE)
summary(model2)
plot(model2,ask=TRUE)


data.frame(model=c("modenv","modenv2","modenv3","modenv4","modenv5"),
DIC=c(modenv$DIC,modenv2$DIC,modenv3$DIC,modenv4$DIC,modenv5$DIC))

####### Calculation of posterior coefficient of variation

cv11<-
100*sqrt(modenv$VCV[,"varietyArielle:varietyArielle.env"])/modenv$Sol[,
"varietyArielle"]
cv12<-
100*sqrt(modenv2$VCV[,"varietyArielle:varietyArielle.env"])/modenv2$Sol
[,"varietyArielle"]
cv13<-
100*sqrt(modenv3$VCV[,"varietyArielle:varietyArielle.env"])/modenv3$Sol
[,"varietyArielle"]
cv14<-
100*sqrt(modenv4$VCV[,"varietyArielle:varietyArielle.env"])/modenv4$Sol
[,"varietyArielle"]
cv15<-
100*sqrt(modenv5$VCV[,"varietyArielle:varietyArielle.env"])/modenv5$Sol
[,"varietyArielle"]

cv21<-
100*sqrt(modenv$VCV[,"varietyDenar:varietyDenar.env"])/modenv$Sol[,"var
ietyDenar"]
cv22<-
100*sqrt(modenv2$VCV[,"varietyDenar:varietyDenar.env"])/modenv2$Sol[,"v
arietyDenar"]
cv23<-
100*sqrt(modenv3$VCV[,"varietyDenar:varietyDenar.env"])/modenv3$Sol[,"v
arietyDenar"]
cv24<-
100*sqrt(modenv4$VCV[,"varietyDenar:varietyDenar.env"])/modenv4$Sol[,"v
arietyDenar"]
cv25<-
100*sqrt(modenv5$VCV[,"varietyDenar:varietyDenar.env"])/modenv5$Sol[,"v
arietyDenar"]

cv31<-
100*sqrt(modenv$VCV[,"varietyEverest:varietyEverest.env"])/modenv$Sol[,
"varietyEverest"]
cv32<-
100*sqrt(modenv2$VCV[,"varietyEverest:varietyEverest.env"])/modenv2$Sol
[,"varietyEverest"]
```

```
cv33<-
100*sqrt(modenv3$VCV[,"varietyEverest:varietyEverest.env"])/modenv3$Sol
[,"varietyEverest"]
cv34<-
100*sqrt(modenv4$VCV[,"varietyEverest:varietyEverest.env"])/modenv4$Sol
[,"varietyEverest"]
cv35<-
100*sqrt(modenv5$VCV[,"varietyEverest:varietyEverest.env"])/modenv5$Sol
[,"varietyEverest"]

cv41<-
100*sqrt(modenv$VCV[,"varietyImpala:varietyImpala.env"])/modenv$Sol[,"v
arietyImpala"]
cv42<-
100*sqrt(modenv2$VCV[,"varietyImpala:varietyImpala.env"])/modenv2$Sol[,
"varietyImpala"]
cv43<-
100*sqrt(modenv3$VCV[,"varietyImpala:varietyImpala.env"])/modenv3$Sol[,
"varietyImpala"]
cv44<-
100*sqrt(modenv4$VCV[,"varietyImpala:varietyImpala.env"])/modenv4$Sol[,
"varietyImpala"]
cv45<-
100*sqrt(modenv5$VCV[,"varietyImpala:varietyImpala.env"])/modenv5$Sol[,
"varietyImpala"]

cv51<-
100*sqrt(modenv$VCV[,"varietyLord:varietyLord.env"])/modenv$Sol[,"varie
tyLord"]
cv52<-
100*sqrt(modenv2$VCV[,"varietyLord:varietyLord.env"])/modenv2$Sol[,"var
ietyLord"]
cv53<-
100*sqrt(modenv3$VCV[,"varietyLord:varietyLord.env"])/modenv3$Sol[,"var
ietyLord"]
cv54<-
100*sqrt(modenv4$VCV[,"varietyLord:varietyLord.env"])/modenv4$Sol[,"var
ietyLord"]
cv55<-
100*sqrt(modenv5$VCV[,"varietyLord:varietyLord.env"])/modenv5$Sol[,"var
ietyLord"]

cv61<-
100*sqrt(modenv$VCV[,"varietyMilek:varietyMilek.env"])/modenv$Sol[,"var
ietyMilek"]
cv62<-
100*sqrt(modenv2$VCV[,"varietyMilek:varietyMilek.env"])/modenv2$Sol[,"v
arietyMilek"]
cv63<-
100*sqrt(modenv3$VCV[,"varietyMilek:varietyMilek.env"])/modenv3$Sol[,"v
arietyMilek"]
```

```
cv64<-
100*sqrt(modenv4$VCV[,"varietyMilek:varietyMilek.env"])/modenv4$Sol[,"v
arietyMilek"]
cv65<-
100*sqrt(modenv5$VCV[,"varietyMilek:varietyMilek.env"])/modenv5$Sol[,"v
arietyMilek"]

cv71<-
100*sqrt(modenv$VCV[,"varietyRiviera:varietyRiviera.env"])/modenv$Sol[,
"varietyRiviera"]
cv72<-
100*sqrt(modenv2$VCV[,"varietyRiviera:varietyRiviera.env"])/modenv2$Sol
[,"varietyRiviera"]
cv73<-
100*sqrt(modenv3$VCV[,"varietyRiviera:varietyRiviera.env"])/modenv3$Sol
[,"varietyRiviera"]
cv74<-
100*sqrt(modenv4$VCV[,"varietyRiviera:varietyRiviera.env"])/modenv4$Sol
[,"varietyRiviera"]
cv75<-
100*sqrt(modenv5$VCV[,"varietyRiviera:varietyRiviera.env"])/modenv5$Sol
[,"varietyRiviera"]

cv81<-
100*sqrt(modenv$VCV[,"varietyViviana:varietyViviana.env"])/modenv$Sol[,
"varietyViviana"]
cv82<-
100*sqrt(modenv2$VCV[,"varietyViviana:varietyViviana.env"])/modenv2$Sol
[,"varietyViviana"]
cv83<-
100*sqrt(modenv3$VCV[,"varietyViviana:varietyViviana.env"])/modenv3$Sol
[,"varietyViviana"]
cv84<-
100*sqrt(modenv4$VCV[,"varietyViviana:varietyViviana.env"])/modenv4$Sol
[,"varietyViviana"]
cv85<-
100*sqrt(modenv5$VCV[,"varietyViviana:varietyViviana.env"])/modenv5$Sol
[,"varietyViviana"]

cv1<-mcmc.list(cv11,cv12,cv13,cv14,cv15)
cv2<-mcmc.list(cv21,cv22,cv23,cv24,cv25)
cv3<-mcmc.list(cv31,cv32,cv33,cv34,cv35)
cv4<-mcmc.list(cv41,cv42,cv43,cv44,cv45)
cv5<-mcmc.list(cv51,cv52,cv53,cv54,cv55)
cv6<-mcmc.list(cv61,cv62,cv63,cv64,cv65)
cv7<-mcmc.list(cv71,cv72,cv73,cv74,cv75)
cv8<-mcmc.list(cv81,cv82,cv83,cv84,cv85)

summary(cv1)#Arielle
summary(cv2)#Denar
summary(cv3)#Everest
summary(cv4)#Impala
```

```
summary(cv5)#Lord
summary(cv6)#Milek
summary(cv7)#Riviera
summary(cv8)#Viviana

##### Posterior density functions for coefficient of variation

par(mfrow=c(4,2))
densplot(cv1,main="variety Arielle")
densplot(cv2,main="variety Denar")
densplot(cv3,main="variety Everest")
densplot(cv4,main="variety Impala")
densplot(cv5,main="variety Lord")
densplot(cv6,main="variety Milek")
densplot(cv7,main="variety Riviera")
densplot(cv8,main="variety Viviana")
```