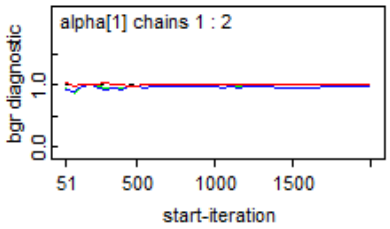
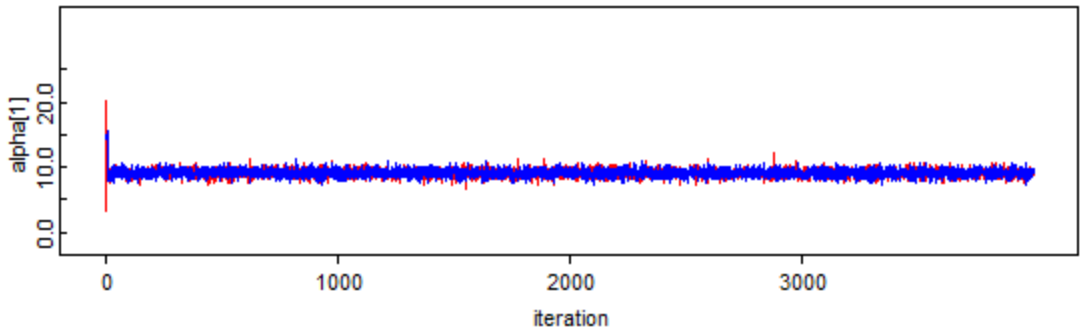
Problem 10.3:

1.

```
model
{
for( i in 1 :N ) {
   for( j in 1 : T) {
      dep[i , j] ~dnorm(mu[i , j],tau.c)
      mu[i , j] <- alpha[i] + beta[i] * (year[j] - yearbar)
}
   alpha[i] ~ dnorm(alpha.c,tau.alpha)
   beta[i] ~ dnorm(beta.c,tau.beta)
}

tau.c ~ dgamma(0.001,0.001)
sigma <- 1 / sqrt(tau.c)
alpha.c ~ dnorm(0.0,1.0E-6)
sigma.alpha~ dunif(0,100)
sigma.beta~ dunif(0,100)
tau.alpha<-1/(sigma.alpha*sigma.alpha)
tau.beta<-1/(sigma.beta*sigma.beta)
beta.c ~ dnorm(0.0,1.0E-6)
alpha0 <- alpha.c - yearbar * beta.c
}
}

#data
list( dep = structure(.Data = c(7.412, 7.061, 10.481, 8.583, 8.638, 7.154, 9.224,
7.757, 9.594, 11.785, 14.747, 6.872, 13.277, 11.459, 14.855,
17.596, 16.148, 10.993, 8.687, 12.493, 13.257, 9.977, 12.419,
10.565, 4.02, 4.204, 6.613, 6.454, 6.328, 7.272, 6.183, 6.493,
5.874, 7.979, 8.188, 6.978, 15.287, 9.885, 9.449, 13.733, 7.998,
8.309, 12.103, 13.621, 10.249, 8.715, 9.796, 10.651, 5.769, 5.714,
6.065, 6.325, 6.467, 7.937, 6.412, 6.848, 6.978, 4.779, 5.652,
10.211, 7.674, 7.036, 4.486, 6.396, 5.914, 6.526, 6.005, 8.241,
4.911, 6.152, 10.028, 12.359), .Dim = c(6, 12)), year =
c(2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008, 2009, 2010, 2011, 2012),yearbar = 2006.5,
N = 6, T = 12)

#Inits
# for model with prior 1
list(alpha = c( 250, 250, 250, 250, 250, 250),beta = c(6, 6, 6, 6, 6, 6),alpha.c = 150, beta.c = 10,tau.c = 1,
sigma.alpha = 1, sigma.beta = 1)
list(alpha = c(25.0, 25.0, 25.0, 25.0, 25.0, 25.0),beta = c( 0.6, 0.6, 0.6, 0.6,0.6, 0.6),alpha.c = 15.0, beta.c = 1.0,
tau.c = 0.1, sigma.alpha = 0.1, sigma.beta = 0.1)
```

2. According to bgr, auto-correlation, and history plots, **all the parameters converge** quickly.





3.

(a) The posterior mean is **-157.7** and 95% CS is **(-843.5, 493.5)**.

	mean	sd	MC_error	val2.5pc	median	val97.5pc	start	sample
alpha0	-157.7	336.8	5.846	-843.5	-152.4	493.5	1	8000

(b) The post. mean of estimated slop is **0.126** and 95% CS is **(-0.152, 0.420)**.

	mean	sd	MC_error	val2.5pc	median	val97.5pc	start	sample
beta[5]	0.1263	0.1448	0.002523	-0.1517	0.1192	0.4202	1	8000

(c) The post. mean of Sd. around regression line is **2** and 95% CS is **(1.665, 2.410)**.

	mean	sd	MC_error	val2.5pc	median	val97.5pc	start	sample
sigma	2.0	0.2742	0.007492	1.665	1.978	2.41	1	8000

(d) The post mean. of Sd. variability captured is **0.146** and 95% CS is **(0.014, 0.398)**.

	mean	sd	MC_error	val2.5pc	median	val97.5pc	start	sample
tau.alpha	0.1455	0.4624	0.01059	0.01391	0.1114	0.3975	1	8000

(e) The individual intercept-slope pair for site 2:

mu[2,1]	13.45	1.133	0.02865	11.27	13.47	15.64	1	8000
mu[2,2]	13.27	0.9887	0.02382	11.36	13.29	15.19	1	8000
mu[2,3]	13.1	0.8556	0.0191	11.41	13.11	14.74	1	8000
mu[2,4]	12.93	0.7403	0.01461	11.46	12.94	14.34	1	8000
mu[2,5]	12.75	0.6524	0.01062	11.49	12.76	13.98	1	8000
mu[2,6]	12.58	0.6039	0.007947	11.42	12.58	13.71	1	8000
mu[2,7]	12.41	0.6043	0.008033	11.27	12.4	13.53	1	8000
mu[2,8]	12.23	0.6536	0.01081	11.01	12.22	13.48	1	8000
mu[2,9]	12.06	0.7421	0.01484	10.65	12.05	13.46	1	8000
mu[2,10]	11.89	0.8577	0.01935	10.28	11.88	13.49	1	8000
mu[2,11]	11.71	0.9911	0.02408	9.828	11.7	13.56	1	8000
mu[2,12]	11.54	1.136	0.02891	9.365	11.52	13.66	1	8000