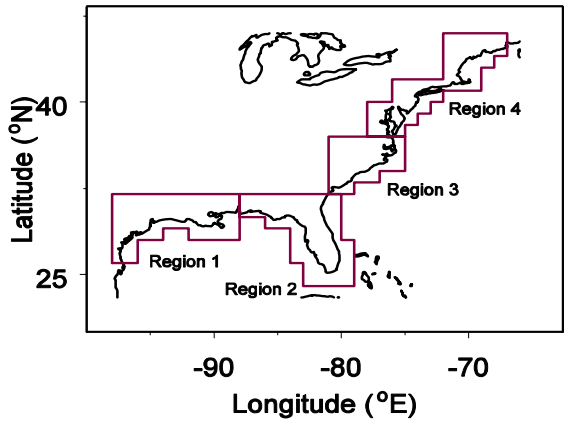
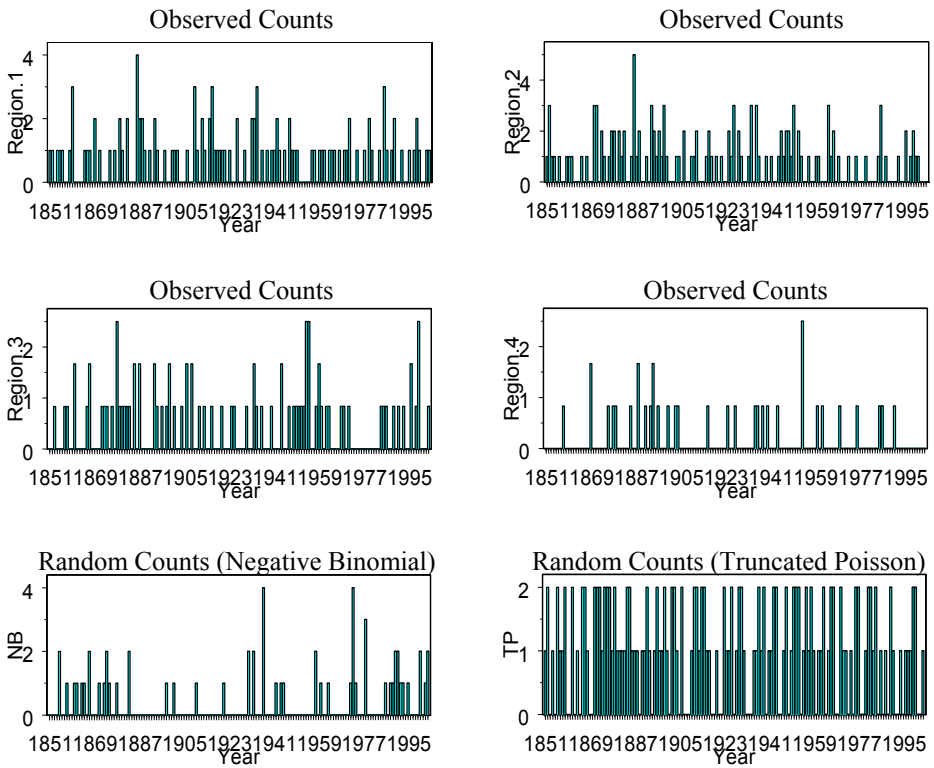
Examination of over dispersion in coastal hurricane counts

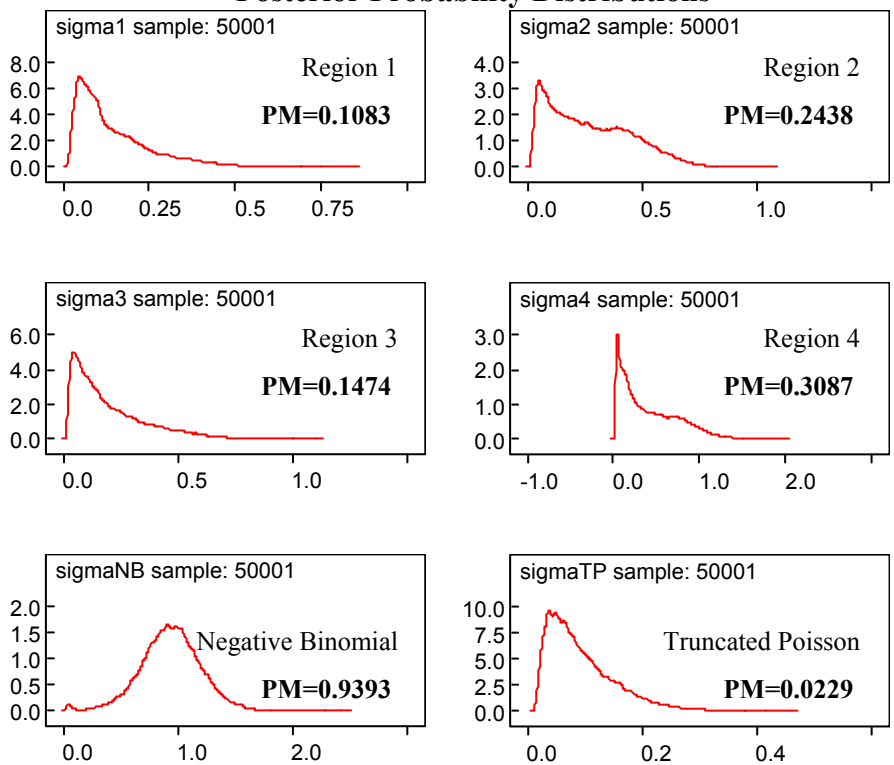


Region/ Distribution	Mean (hur/yr)	Variance (hur/yr)^2	Var/Mean	p-value*
1	0.752	0.6879	0.9148	0.7650
2	0.837	0.9665	1.1547	0.0922
3	0.556	0.5643	1.0149	0.4305
4	0.229	0.2565	1.1201	0.1454
NB	0.392	0.5820	1.4847	0.0001
TP	1.046	0.6229	0.5955	1.0000

*Probability in support of the null hypothesis that the true dispersion is zero or less.



Posterior Probability Distributions



Sigma is the magnitude of the dispersion using a Bayesian model that only allows for over dispersion. PM = posterior median value.

Magnitude of overdispersion in coastal hurricane count data

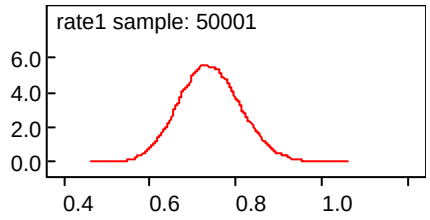
H_i are the hurricane counts for regions 1-4. NB is a set of random counts from a negative binomial [using R, rbinom(153,1,0.75)], TP is a set of counts from a truncated poisson, and eta_i is the random effect which has zero mean (thus not contributing to the count) but adds to the variance of H_I, tau_i is a scalar that captures the precision (inverse variance) of the random effect, thus indicating how much (or little) overdispersion there is.

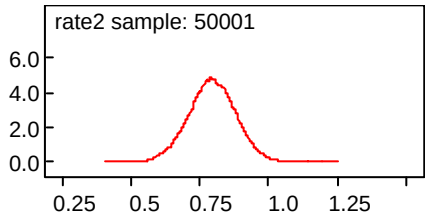
Results indicate that overdispersion is not a problem with coastal hurricane counts aggregated in this way. Note that the posterior mean of the overdispersion magnitude for each region falls between that of the negative binomial and truncated poisson.

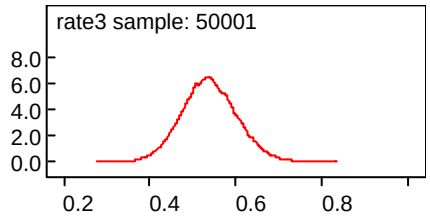
```
model{

for (i in 1: N)
{
H1[i]~dpois(lambda1[i])
H2[i]~dpois(lambda2[i])
H3[i]~dpois(lambda3[i])
H4[i]~dpois(lambda4[i])
NB[i]~dpois(lambdaNB[i])
TP[i]~dpois(lambdaTP[i])
log(lambda1[i])<-alpha1+eta1[i]
log(lambda2[i])<-alpha2+eta2[i]
log(lambda3[i])<-alpha3+eta3[i]
log(lambda4[i])<-alpha4+eta4[i]
log(lambdaNB[i])<-alphaNB+etaNB[i]
log(lambdaTP[i])<-alphaTP+etaTP[i]

eta1[i]~dnorm(0,tau1)
eta2[i]~dnorm(0,tau2)
eta3[i]~dnorm(0,tau3)
eta4[i]~dnorm(0,tau4)
etaNB[i]~dnorm(0,tauNB)
etaTP[i]~dnorm(0,tauTP)
}

alpha1~dnorm(0,0.000001)
alpha2~dnorm(0,0.000001)
alpha3~dnorm(0,0.000001)
alpha4~dnorm(0,0.000001)
alphaNB~dnorm(0,0.000001)
alphaTP~dnorm(0,0.000001)

rate1<-exp(alpha1)
rate2<-exp(alpha2)
rate3<-exp(alpha3)
rate4<-exp(alpha4)
rateNB<-exp(alphaNB)
rateTP<-exp(alphaTP)

tau1~dgamma(0.001,0.001)
tau2~dgamma(0.001,0.001)
tau3~dgamma(0.001,0.001)
tau4~dgamma(0.001,0.001)
```

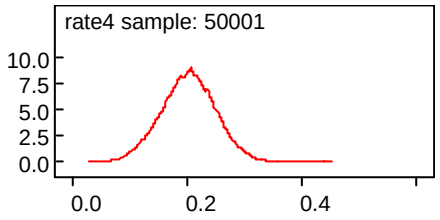
```
tauNB~dgamma(0.001,0.001)
tauTP~dgamma(0.001,0.001)

sigma1<-1/sqrt(tau1)
sigma2<-1/sqrt(tau2)
sigma3<-1/sqrt(tau3)
sigma4<-1/sqrt(tau4)
sigmaNB<-1/sqrt(tauNB)
sigmaTP<-1/sqrt(tauTP)
}

list(tau1=0.1,tau2=0.1,tau3=0.1,tau4=0.1,tauNB=0.1,tauTP=0.1,alpha1=0,
alpha2=0,alpha3=0,alpha4=0,alphaNB=0,alphaTP=0)

list(N=153,H1=c(1, 1,
   0, 1, 1, 1, 0, 0, 1, 3, 0, 0, 0, 0, 1, 1, 1, 0, 2, 0, 1, 0, 0, 0, 1, 0, 1, 0, 2, 1,
   0, 2, 0, 0, 0, 4, 2, 2, 1, 0, 1, 0, 2, 1, 0, 0, 1, 0, 0, 1, 1, 1, 0, 0, 0, 1, 0, 0,
   3, 1, 0, 2, 1, 0, 2, 3, 1, 1, 1, 1, 1, 0, 1, 0, 0, 2, 0, 0, 1, 0, 0, 2, 2, 3, 0, 1,
   0, 1, 0, 1, 1, 2, 1, 0, 1, 0, 2, 1, 1, 1, 0, 0, 0, 0, 0, 1, 1, 0, 1, 1, 1, 0, 1, 1,
   1, 0, 1, 0, 1, 1, 2, 0, 0, 1, 0, 0, 1, 0, 2, 1, 0, 0, 1, 0, 3, 1, 0, 1, 2, 0, 0, 1,
   0, 0, 1, 0, 1, 2, 1, 0, 0, 1, 1),H2=c(1, 3, 1, 1, 0, 1, 0, 0, 1, 1, 1, 0, 0,
   0, 1, 0, 1, 0, 0, 3, 3, 0, 2, 1, 0, 1, 2, 2, 0, 2, 1, 2, 0, 0, 1, 5, 1, 2, 0, 0, 1,
   0, 3, 2, 1, 2, 1, 3, 1, 0, 0, 0, 1, 1, 0, 2, 0, 0, 1, 1, 2, 0, 0, 0, 1, 2, 1, 0, 1,
   0, 1, 0, 0, 2, 1, 3, 0, 2, 1, 0, 0, 1, 3, 0, 3, 1, 0, 0, 1, 0, 1, 0, 0, 1, 2, 1, 2,
   2, 1, 3, 0, 2, 1, 0, 0, 1, 0, 0, 1, 1, 0, 0, 0, 3, 1, 2, 0, 1, 0, 0, 0, 1, 0, 0, 1,
   0, 0, 0, 1, 0, 0, 0, 0, 1, 3, 0, 1, 0, 0, 0, 0, 1, 0, 0, 2, 0, 1, 2, 1, 1, 0, 0,
   0),H3=c(0, 0, 1, 0, 0, 0, 1, 1, 0, 0, 2, 0, 0, 0, 0, 1, 2, 0, 0, 0, 0, 1, 1,
   1, 0, 1, 0, 3, 1, 1, 1, 1, 1, 0, 2, 0, 2, 0, 0, 0, 0, 0, 2, 1, 0, 1, 0, 1, 2, 0, 1,
   0, 0, 1, 0, 2, 0, 2, 0, 0, 1, 0, 1, 0, 0, 1, 0, 0, 0, 1, 0, 0, 0, 1, 1, 0, 0, 0, 0,
   1, 0, 0, 2, 1, 0, 1, 0, 0, 0, 1, 0, 0, 0, 2, 0, 0, 1, 0, 1, 1, 1, 1, 1, 3, 3, 0, 0,
   1, 2, 1, 0, 1, 1, 0, 0, 0, 0, 1, 1, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 1,
   1, 0, 0, 1, 0, 1, 0, 1, 0, 0, 2, 0, 1, 3, 0, 0, 0, 1),H4=c(0, 0, 0, 0, 0, 0,
   0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 1, 0, 1, 1, 0, 0, 0, 0, 0,
   1, 0, 0, 2, 0, 0, 1, 0, 1, 2, 0, 1, 0, 0, 0, 1, 0, 0, 1, 1, 0, 0, 0, 0, 0, 0, 0, 0,
   0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 1, 1, 0, 1, 0, 1,
   0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 3, 0, 0, 0, 0, 0, 1, 0, 1, 0, 0, 0, 0, 0, 0,
   1, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 1, 1, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0,
   0, 0, 0, 0, 0, 0, 0, 0),
   NB=c(0, 0, 0, 0, 2, 0, 0, 1, 0, 0, 1, 1, 0, 1, 1, 0, 2, 0, 0, 0, 1, 0, 1, 2, 1, 0, 0,
   1, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 1, 0, 0, 0, 0,
   0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 2,
   0, 0, 0, 4, 0, 0, 0, 0, 1, 0, 1, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 1, 0,
   0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 4, 1, 0, 0, 0, 3, 0, 0, 0, 0, 0, 0, 0, 1, 0, 1, 1,
   2, 2, 1, 1, 0, 1, 0, 0, 0, 0, 2, 0, 1, 2),
   TP=c(1, 2, 0, 1, 0, 2, 1, 1, 2, 0, 0, 2, 0, 1, 0, 2, 2, 1, 0, 0, 2, 2, 2, 1, 2, 2, 2,
   1, 2, 1, 1, 1, 1, 2, 2, 1, 1, 1, 0, 1, 1, 2, 1, 0, 1, 2, 1, 1, 2, 1, 0, 2, 2, 1, 0,
   2, 0, 0, 0, 1, 2, 2, 1, 2, 2, 1, 1, 0, 0, 1, 0, 0, 2, 1, 1, 2, 0, 1, 2, 2, 1, 0, 0,
   0, 1, 1, 2, 1, 2, 0, 1, 1, 2, 2, 0, 0, 1, 2, 0, 1, 2, 2, 2, 0, 1, 2, 1, 2, 1, 0, 1,
   1, 2, 0, 1, 2, 2, 0, 0, 2, 1, 1, 0, 1, 0, 2, 2, 0, 0, 1, 2, 2, 1, 2, 0, 1, 0, 1, 0,
   2, 1, 0, 0, 1, 0, 1, 1, 1, 2, 2, 0, 0, 1))
```

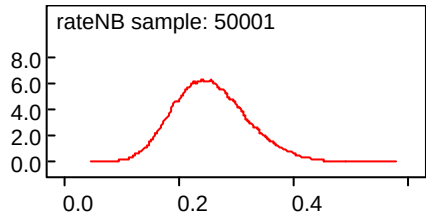
node	mean	sd	MC error	2.5%	median	97.5%	start	sample
rate1	0.7398	0.07202	9.649E-4	0.6031	0.7379	0.8851	10000	50001
rate2	0.7953	0.08546	0.002208	0.6244	0.7957	0.9616	10000	50001
rate3	0.5386	0.06429	0.001232	0.4151	0.5371	0.6688	10000	50001
rate4	0.2033	0.04732	0.001666	0.1097	0.2037	0.2963	10000	50001
rateNB	0.2569	0.06417	0.001941	0.1433	0.2528	0.3941	10000	50001
rateTP	1.04	0.08309	5.004E-4	0.8833	1.038	1.21	10000	50001
sigma1	0.1447	0.1092	0.005776	0.0268	0.1083	0.4301	10000	50001
sigma2	0.2731	0.1813	0.009833	0.03444	0.2438	0.6558	10000	50001
sigma3	0.1983	0.1599	0.00865	0.02739	0.1474	0.6064	10000	50001
sigma4	0.4068	0.3332	0.01888	0.03176	0.3087	1.158	10000	50001
sigmaNB	0.9371	0.2658	0.01014	0.3932	0.9393	1.459	10000	50001
sigmaTP	0.09436	0.05944	0.002864	0.02291	0.07904	0.2439	10000	50001

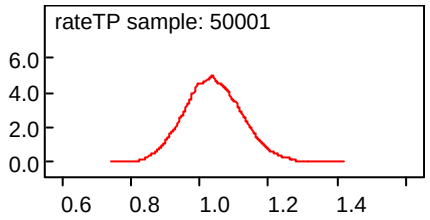


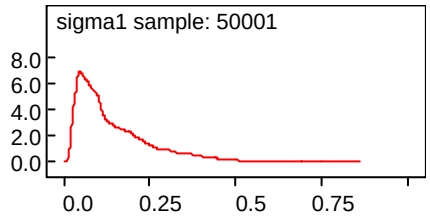


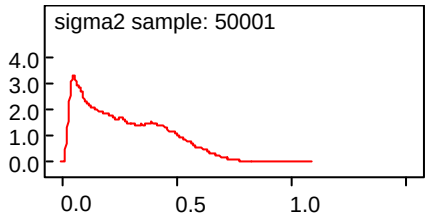


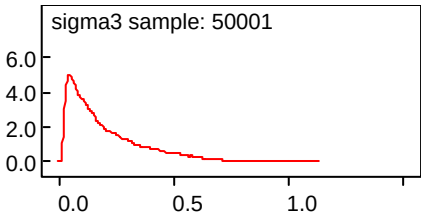








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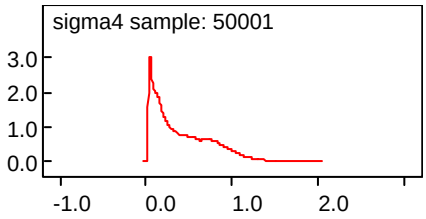
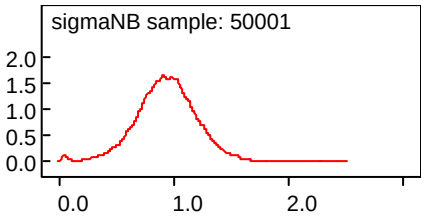
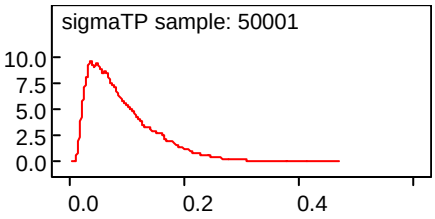
6.0
4.0
2.0
0.0
0.0
0.5
1.0


sigma4 sample: 50001
3.0
2.0
1.0
0.0
-1.0
0.0
1.0
2.0


sigmaNB sample: 50001
2.0
1.5
1.0
0.5
0.0
0.0
1.0
2.0


sigmaTP sample: 50001
10.0
7.5
5.0
2.5
0.0
0.0
0.2
0.4