### Principal component analysis

# cleaning the data

## occations where plants die as an indicator (goes NA, if model crashes)

# for(j in 1:nrow(Store)){  
# if(is.na(Store$Pzero[j])){  
# Store\_failure <- rbind(Store\_failure, Store[j,])  
# Store<-Store[-j,]  
# }  
# }

# for(j in 1:nrow(Store)){  
# if(is.na(Store$Pzero[j])){  
# Store\_failure <- rbind(Store\_failure, Store[j,])  
# Store<-Store[-j,]  
# }  
# }  
  
# no crashes in Store! :D Store.txt in the repo is a Monte Carlo simulation with Heavy clay, 800 days and 5000 runs  
#   
# nrow(Store)  
# head(Store)  
# ncol(Store)

#### LINEAR REGRESSION

Preparing the data

mydata <- read.table("EAGELSON loamy clay sand 5000 runs 800 days.txt")  
head(mydata)

## Z Zr d ConcConst CM.gw c alpha  
## 1 4758.0925 357.7245 0.13576913 11.505491 9.615242 7.606346 1.0718089  
## 2 4699.0284 377.9734 0.13572194 9.867857 14.346724 9.406837 0.9543441  
## 3 1706.6431 321.3043 0.14732550 2.996419 8.626795 9.261121 1.1129852  
## 4 9848.4711 468.7371 0.15099179 5.785591 13.731347 7.674285 1.0965530  
## 5 637.4391 520.1043 0.14714997 3.135697 1.375117 6.068434 1.1517355  
## 6 7112.6880 391.0667 0.09708455 9.169175 3.812370 7.600359 1.3663670  
## lambda meanM sdM meanSmM sdSmM meanP  
## 1 0.3889316 79.844413 31.7518400 19221.997 5615.419 2.138340e+01  
## 2 0.2844405 4.957369 8.5950500 10515.103 3705.077 1.594581e+02  
## 3 0.8572492 3.519459 5.2477229 9519.738 3260.755 5.129694e+02  
## 4 0.6604727 122.759092 22.8220383 16439.406 4661.259 1.011219e+01  
## 5 0.9408076 155.387271 0.6433734 11318.639 4075.762 3.692976e-16  
## 6 0.9110414 2.595424 5.3168290 34146.037 12730.870 6.721964e+02  
## sdP meanCM sdCM minCM maxCM cum\_flux  
## 1 5.213344e+01 66.955557 271.9250321 2.2903105 2102.491132 -16224.3239  
## 2 1.018421e+02 608.701300 990.3989186 2.5849066 6550.123302 648.1257  
## 3 1.734034e+02 154.994651 155.6387495 2.2622612 909.711146 7895.0819  
## 4 4.291703e+01 5.429650 36.1256970 1.1823224 814.918758 -32362.4843  
## 5 3.166434e-15 1.246204 0.4485062 0.4949631 2.022049 -53011.1975  
## 6 1.898939e+02 1596.824234 3125.7137509 5.7435215 34625.196683 232.9741  
## Pzero  
## 1 0  
## 2 0  
## 3 0  
## 4 0  
## 5 0  
## 6 0

attach(mydata)

## The following objects are masked \_by\_ .GlobalEnv:  
##   
## alpha, c, CM.gw, ConcConst, d, lambda, Z, Zr

#   
# dd <-scale(mydata$c)  
# cf <- scale(mydata$cum\_flux)  
# plot(dd, cf)  
# plot(cf,dd)  
# plot(mydata$c, mydata$cum\_flux)  
# plot(mydata$cum\_flux,mydata$c)  
#   
# require(ggplot2)  
  
# lambda\_sum <- do.call(rbind,Store[][[2]])  
# lambda\_sum$time <- rep(1:time,length(lambda))  
  
#   
# data <- read.table("Sandy Clay loam 5000 runs 800 days.txt",header=T)  
# names(data)  
#   
# require(ggplot2)  
# pl <- ggplot(data,aes(x=c,y=cum\_flux, col=lambda\*alpha)) + geom\_point()  
# pl  
#   
#   
# require(dplyr)  
# mydata <- data  
#   
# newdata <- mydata %>% mutate(quantile = ntile(d, 10))  
# names(newdata)  
#   
# pl <- ggplot(newdata,aes(x=c,y=cum\_flux, col=Zr/(lambda\*alpha))) + geom\_point()  
# pl <- pl + facet\_wrap(~quantile)  
# pl  
#   
  
###  
#It is something related to larger c values, flip the > sign to < in the below code  
#   
# mydata1 <- subset(mydata,mydata$c>2.5 & mydata$Z > 2000)  
#   
# newdata1 <- mydata1 %>% mutate(quantile = ntile(d, 10))  
#   
# # names(newdata1)  
#   
# pl <- ggplot(newdata1,aes(x=c,y=cum\_flux, col=Zr/(lambda\*alpha))) + geom\_point()  
# pl <- pl + facet\_wrap(~quantile) + ggtitle("Vertical flux vs plant growth factor c, in quantiles of plant mortality d, Z > 2000 mm and c>2.5 ") + theme(plot.title = element\_text(lineheight=.8, face="bold"))   
# pl  
#   
#   
#   
#   
# plot(mydata1$c, mydata1$cum\_flux)   
#   
# zeroflux <- data.frame()  
# for (i in length(mydata)){  
# if(mydata$cum\_flux[i]<50 && mydata$cum\_flux[i]>100){  
#   
# zeroflux[i,] <- rbind(mydata[i,])  
# }  
# }  
#   
# zeroflux  
#   
# summary(mydata$cum\_flux)  
# plot(mydata$cum\_flux, ylim=c(-10000,7000))  
#   
# hist(cum\_flux)  
  
  
# pl <- ggplot(mydata,aes(x=mydata$c,y=mydata$cum\_flux, col=as.factor(mydata$lambda))) + geom\_line()  
# # pl <- pl + geom\_line(aes(x=time,y=M, colour="Moisture"))   
# pl <- pl + facet\_wrap(~mydata$alpha)   
# pl + ggtitle("Plant biomass P and soilmoisture M for varying lambdas") + geom\_line(aes(x=time, y=SmM, colour= "S (soil salt mg/L")) + theme(plot.title = element\_text(lineheight=.4))

# for(i in (9:19))  
# {   
# for(j in (1:8) )  
#   
# {   
# fit <- lm(mydata[,i] ~ mydata[,j], data=mydata) #does a regression for each column in my csv file against my independent variable 'etch'  
# rsq <- summary(fit)$r.squared  
# writelines(paste(rsq,i,"\n"))  
# }  
# }

Mean soilmoisture M

M\_all <- lm(meanM ~ Z + Zr + d + ConcConst + CM.gw + c + alpha + lambda, data = mydata)  
summary(M\_all)

##   
## Call:  
## lm(formula = meanM ~ Z + Zr + d + ConcConst + CM.gw + c + alpha +   
## lambda, data = mydata)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -173.620 -24.468 1.855 24.572 118.940   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 3.647e+00 4.104e+00 0.889 0.374   
## Z -2.536e-04 1.694e-04 -1.496 0.135   
## Zr 7.611e-02 6.525e-03 11.666 <2e-16 \*\*\*  
## d 3.831e+02 7.335e+00 52.227 <2e-16 \*\*\*  
## ConcConst 1.090e+00 1.062e-01 10.271 <2e-16 \*\*\*  
## CM.gw 4.056e-02 1.064e-01 0.381 0.703   
## c -1.187e+01 2.143e-01 -55.401 <2e-16 \*\*\*  
## alpha 3.212e+01 1.766e+00 18.194 <2e-16 \*\*\*  
## lambda 1.749e+01 1.790e+00 9.775 <2e-16 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 32.48 on 4944 degrees of freedom  
## Multiple R-squared: 0.5654, Adjusted R-squared: 0.5647   
## F-statistic: 803.9 on 8 and 4944 DF, p-value: < 2.2e-16

# # Scatterplot Matrices from the car Package  
# library(car)  
# scatterplot.matrix(mydata[9:19], data=mydata,  
# main="Heavy medium clay, 5000 runs, 800 days")  
  
  
# plot(mydata$Zr,mydata$meanM, main= "Root depth and mean soil moisture")  
# plot(mydata$d,mydata$meanM, main= "Root depth and mean soil moisture")  
# plot(mydata$c,mydata$meanM, main= "Plan growth factor and mean soil moisture")  
#   
# plot(mydata$Z,mydata$meanP, main= "Groundwater depth and mean plant biomass")  
# plot(mydata$d,mydata$meanP, main= "Plant mortality and mean plant biomass")  
# plot(mydata$c,mydata$meanP, main= "Plant growth factor and mean plant biomass")  
# plot(mydata$alpha,mydata$meanP, main= "Alpha and mean plant biomass")  
# plot(mydata$lambda,mydata$meanP, main= "Lambda and mean plant biomass")  
#   
# plot(mydata$Z,mydata$maxCM, main= "Groundwater depth and maximum soil salt concentration")  
# plot(mydata$d,mydata$maxCM, main= "Groundwater depth and maximum soil salt concentration")  
# plot(mydata$ConcConst,mydata$maxCM, main= "Rain salt mass and maximum soil salt concentration")  
# plot(mydata$c,mydata$maxCM, main= "Plant growth factor and maximum soil salt concentration")  
# plot(mydata$alpha,mydata$maxCM, main= "Alpha and maximum soil salt concentration")  
# plot(mydata$lambda,mydata$maxCM, main= "Lambda and maximum soil salt concentration")  
  
# write.table(summary(M\_all)$Coefficients, ""  
  
# # Groundwater depth Z  
# MZ <- lm(meanM ~ Z, data=mydata)  
# summary(MZ)  
#   
# # Root depth Zr  
# MZr <- lm(meanM ~ Zr, data=mydata)  
# summary(MZr)  
#   
# # plant mortality d  
# Md <- lm(meanM ~ d, data=mydata)  
# summary(Md)  
#   
# # salt concentration in rain  
# MConcConst <- lm(meanM ~ ConcConst, data=mydata)  
# summary(MConcConst)  
#   
# # salt concentration in groundwater  
# MCM.gw <- lm(meanM ~ CM.gw, data=mydata)  
# summary(MCM.gw)  
#   
# # plant growth factor c  
# Mc <- lm(meanM ~ c, data=mydata)  
# summary(Mc)  
#   
# # alpha  
# Malpha <- lm(meanM ~ alpha, data=mydata)  
# summary(Malpha)  
#   
# # lambda  
# Mlambda <- lm(meanM ~ lambda, data=mydata)  
# summary(Mlambda)  
#   
  
### comparing the models

### Standard deviation soilmoisture M (sdM)

sdM\_all <- lm(sdM ~ Z + Zr + d + ConcConst + CM.gw + c + alpha + lambda, data = mydata)  
summary(sdM\_all)

##   
## Call:  
## lm(formula = sdM ~ Z + Zr + d + ConcConst + CM.gw + c + alpha +   
## lambda, data = mydata)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -15.360 -5.815 -3.561 -0.816 61.306   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) -3.469e+00 1.512e+00 -2.294 0.0219 \*   
## Z 5.608e-04 6.245e-05 8.980 < 2e-16 \*\*\*  
## Zr 2.137e-02 2.405e-03 8.886 < 2e-16 \*\*\*  
## d -1.649e+01 2.703e+00 -6.100 1.14e-09 \*\*\*  
## ConcConst 4.481e-02 3.913e-02 1.145 0.2522   
## CM.gw 2.186e-02 3.923e-02 0.557 0.5773   
## c 1.006e+00 7.899e-02 12.732 < 2e-16 \*\*\*  
## alpha -3.455e-01 6.507e-01 -0.531 0.5955   
## lambda -6.499e+00 6.595e-01 -9.853 < 2e-16 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 11.97 on 4944 degrees of freedom  
## Multiple R-squared: 0.08406, Adjusted R-squared: 0.08258   
## F-statistic: 56.72 on 8 and 4944 DF, p-value: < 2.2e-16

# Groundwater depth Z  
# sdMZ <- lm(sdM ~ Z, data=mydata)  
# summary(sdMZ)  
#   
# # Root depth Zr  
# sdMZr <- lm(sdM ~ Zr, data=mydata)  
# summary(sdMZr)  
#   
# # plant mortality d  
# sdMd <- lm(sdM ~ d, data=mydata)  
# summary(sdMd)  
#   
# # salt concentration in rain  
# sdMConcConst <- lm(sdM ~ ConcConst, data=mydata)  
# summary(sdMConcConst)  
#   
# # salt concentration in groundwater  
# sdMCM.gw <- lm(sdM ~ CM.gw, data=mydata)  
# summary(sdMCM.gw)  
#   
# # plant growth factor c  
# sdMc <- lm(sdM ~ c, data=mydata)  
# summary(sdMc)  
#   
# # alpha  
# sdMalpha <- lm(sdM ~ alpha, data=mydata)  
# summary(sdMalpha)  
#   
# # lambda  
# sdMlambda <- lm(sdM ~ lambda, data=mydata)  
# summary(sdMlambda)  
#   
  
### comparing the models

Mean soil SALT mass meanSmM

SM\_all <- lm(meanSmM ~ Z + Zr + d + ConcConst + CM.gw + c + alpha + lambda, data = mydata)  
summary(SM\_all)

##   
## Call:  
## lm(formula = meanSmM ~ Z + Zr + d + ConcConst + CM.gw + c + alpha +   
## lambda, data = mydata)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -16153.1 -2744.1 -204.4 2422.9 24127.5   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) -2.797e+04 5.727e+02 -48.844 <2e-16 \*\*\*  
## Z 1.923e-02 2.364e-02 0.813 0.4161   
## Zr 2.022e+00 9.104e-01 2.221 0.0264 \*   
## d -2.613e+02 1.023e+03 -0.255 0.7985   
## ConcConst 2.053e+03 1.481e+01 138.603 <2e-16 \*\*\*  
## CM.gw 7.831e+00 1.485e+01 0.527 0.5980   
## c 4.008e+01 2.991e+01 1.340 0.1802   
## alpha 1.407e+04 2.464e+02 57.103 <2e-16 \*\*\*  
## lambda 2.240e+04 2.497e+02 89.689 <2e-16 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 4531 on 4944 degrees of freedom  
## Multiple R-squared: 0.8616, Adjusted R-squared: 0.8614   
## F-statistic: 3849 on 8 and 4944 DF, p-value: < 2.2e-16

#   
# # Groundwater depth Z  
# SMZ <- lm(meanSmM ~ Z, data=mydata)  
# summary(SMZ)  
#   
# # Root depth Zr  
# SMZr <- lm(meanSmM ~ Zr, data=mydata)  
# summary(SMZr)  
#   
# # plant mortality d  
# SMd <- lm(meanSmM ~ d, data=mydata)  
# summary(SMd)  
#   
# # salt concentration in rain  
# SMConcConst <- lm(meanSmM ~ ConcConst, data=mydata)  
# summary(SMConcConst)  
#   
# # salt concentration in groundwater  
# SMCM.gw <- lm(meanSmM ~ CM.gw, data=mydata)  
# summary(SMCM.gw)  
#   
# # plant growth factor c  
# SMc <- lm(meanSmM ~ c, data=mydata)  
# summary(SMc)  
#   
# # alpha  
# SMalpha <- lm(meanSmM ~ alpha, data=mydata)  
# summary(SMalpha)  
#   
# # lambda  
# SMlambda <- lm(meanSmM ~ lambda, data=mydata)  
# summary(SMlambda)  
#   
#   
# ### comparing the models

Standard deviation of Soil Salt mass sdSmM (maybe not too important)

### Mean plant biomass P

meanP

P\_all <- lm(meanP ~ Z + Zr + d + ConcConst + CM.gw + c + alpha + lambda, data = mydata)  
summary(P\_all)

##   
## Call:  
## lm(formula = meanP ~ Z + Zr + d + ConcConst + CM.gw + c + alpha +   
## lambda, data = mydata)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -350.82 -92.04 -25.44 61.60 1059.42   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) -9.024e+01 1.863e+01 -4.843 1.32e-06 \*\*\*  
## Z -5.515e-03 7.692e-04 -7.170 8.62e-13 \*\*\*  
## Zr 2.740e-01 2.962e-02 9.250 < 2e-16 \*\*\*  
## d -1.486e+03 3.330e+01 -44.631 < 2e-16 \*\*\*  
## ConcConst -3.492e+00 4.820e-01 -7.244 5.02e-13 \*\*\*  
## CM.gw 6.403e-01 4.832e-01 1.325 0.185177   
## c 4.351e+01 9.730e-01 44.721 < 2e-16 \*\*\*  
## alpha 3.098e+01 8.015e+00 3.865 0.000113 \*\*\*  
## lambda 1.401e+02 8.124e+00 17.241 < 2e-16 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 147.4 on 4944 degrees of freedom  
## Multiple R-squared: 0.4719, Adjusted R-squared: 0.471   
## F-statistic: 552.2 on 8 and 4944 DF, p-value: < 2.2e-16

# # Groundwater depth Z  
# PZ <- lm(meanP ~ Z, data=mydata)  
# summary(PZ)  
#   
# # Root depth Zr  
# PZr <- lm(meanP ~ Zr, data=mydata)  
# summary(PZr)  
#   
# # plant mortality d  
# Pd <- lm(meanP ~ d, data=mydata)  
# summary(Pd)  
#   
# # salt concentration in rain  
# PConcConst <- lm(meanP ~ ConcConst, data=mydata)  
# summary(PConcConst)  
#   
# # salt concentration in groundwater  
# PCM.gw <- lm(meanP ~ CM.gw, data=mydata)  
# summary(PCM.gw)  
#   
# # plant growth factor c  
# Pc <- lm(meanP ~ c, data=mydata)  
# summary(Pc)  
#   
# # alpha  
# Palpha <- lm(meanP ~ alpha, data=mydata)  
# summary(Palpha)  
#   
# # lambda  
# Plambda <- lm(meanP ~ lambda, data=mydata)  
# summary(Plambda)  
#   
  
### comparing the models

### Standard deviation of plant biomass P (sdP)

sdP\_all <- lm(sdP ~ Z + Zr + d + ConcConst + CM.gw + c + alpha + lambda, data = mydata)  
summary(sdP\_all)

##   
## Call:  
## lm(formula = sdP ~ Z + Zr + d + ConcConst + CM.gw + c + alpha +   
## lambda, data = mydata)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -120.078 -30.021 -2.074 24.788 222.767   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) -4.794e+01 5.743e+00 -8.348 < 2e-16 \*\*\*  
## Z 6.298e-04 2.371e-04 2.656 0.00792 \*\*   
## Zr 9.116e-02 9.130e-03 9.985 < 2e-16 \*\*\*  
## d -5.042e+02 1.026e+01 -49.126 < 2e-16 \*\*\*  
## ConcConst -1.294e+00 1.486e-01 -8.712 < 2e-16 \*\*\*  
## CM.gw -3.269e-02 1.489e-01 -0.219 0.82628   
## c 1.777e+01 2.999e-01 59.239 < 2e-16 \*\*\*  
## alpha 1.880e+01 2.470e+00 7.609 3.29e-14 \*\*\*  
## lambda 2.733e+01 2.504e+00 10.913 < 2e-16 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 45.44 on 4944 degrees of freedom  
## Multiple R-squared: 0.555, Adjusted R-squared: 0.5542   
## F-statistic: 770.7 on 8 and 4944 DF, p-value: < 2.2e-16

# # Groundwater depth Z  
# sdPZ <- lm(sdP ~ Z, data=mydata)  
# summary(sdPZ)  
#   
# # Root depth Zr  
# sdPZr <- lm(sdP ~ Zr, data=mydata)  
# summary(sdPZr)  
#   
# # plant mortality d  
# sdPd <- lm(sdP ~ d, data=mydata)  
# summary(sdPd)  
#   
# # salt concentration in rain  
# sdPConcConst <- lm(sdP ~ ConcConst, data=mydata)  
# summary(sdPConcConst)  
#   
# # salt concentration in groundwater  
# sdPCM.gw <- lm(sdP ~ CM.gw, data=mydata)  
# summary(sdPCM.gw)  
#   
# # plant growth factor c  
# sdPc <- lm(sdP ~ c, data=mydata)  
# summary(sdPc)  
#   
# # alpha  
# sdPalpha <- lm(sdP ~ alpha, data=mydata)  
# summary(sdPalpha)  
#   
# # lambda  
# sdPlambda <- lm(sdP ~ lambda, data=mydata)  
# summary(sdPlambda)  
#   
#   
# ### comparing the models  
#   
#   
# ```  
#   
# ### mean soil salt concentration (meanCM)  
#   
#   
#   
# ```{r}  
# CM\_all <- lm(meanCM ~ Z + Zr + d + ConcConst + CM.gw + c + alpha + lambda, data = mydata)  
# summary(CM\_all)  
#   
# # Groundwater depth Z  
# CMZ <- lm(meanCM ~ Z, data=mydata)  
# summary(CMZ)  
#   
# # Root depth Zr  
# CMZr <- lm(meanCM ~ Zr, data=mydata)  
# summary(CMZr)  
#   
# # plant mortality d  
# CMd <- lm(meanCM ~ d, data=mydata)  
# summary(CMd)  
#   
# # salt concentration in rain  
# CMConcConst <- lm(meanCM ~ ConcConst, data=mydata)  
# summary(CMConcConst)  
#   
# # salt concentration in groundwater  
# CMCM.gw <- lm(meanCM ~ CM.gw, data=mydata)  
# summary(CMCM.gw)  
#   
# # plant growth factor c  
# CMc <- lm(meanCM ~ c, data=mydata)  
# summary(CMc)  
#   
# # alpha  
# CMalpha <- lm(meanCM ~ alpha, data=mydata)  
# summary(CMalpha)  
#   
# # lambda  
# CMlambda <- lm(meanCM ~ lambda, data=mydata)  
# summary(CMlambda)  
#   
#   
# ### comparing the models

Standard deviation of soil salt concentration sdCM, maybe not too important, can be added later

Neither minimum of soil salt concentration minCM?? can later be added, easily

### Maximum soil salt concentration maxCM

maxCM\_all <- lm(maxCM ~ Z + Zr + d + ConcConst + CM.gw + c + alpha + lambda, data = mydata)  
summary(maxCM\_all)

##   
## Call:  
## lm(formula = maxCM ~ Z + Zr + d + ConcConst + CM.gw + c + alpha +   
## lambda, data = mydata)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -23595 -5973 -2514 2580 247899   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) -2.188e+04 1.796e+03 -12.179 < 2e-16 \*\*\*  
## Z 1.412e+00 7.416e-02 19.041 < 2e-16 \*\*\*  
## Zr 1.225e+01 2.856e+00 4.291 1.82e-05 \*\*\*  
## d -7.131e+04 3.210e+03 -22.214 < 2e-16 \*\*\*  
## ConcConst 5.523e+02 4.647e+01 11.886 < 2e-16 \*\*\*  
## CM.gw 1.703e+01 4.658e+01 0.366 0.715   
## c 1.824e+03 9.380e+01 19.441 < 2e-16 \*\*\*  
## alpha 6.177e+03 7.727e+02 7.993 1.62e-15 \*\*\*  
## lambda 6.507e+03 7.832e+02 8.308 < 2e-16 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 14210 on 4944 degrees of freedom  
## Multiple R-squared: 0.2324, Adjusted R-squared: 0.2311   
## F-statistic: 187.1 on 8 and 4944 DF, p-value: < 2.2e-16

# # Groundwater depth Z  
# maxCMZ <- lm(maxCM ~ Z, data=mydata)  
# summary(maxCMZ)  
#   
# # Root depth Zr  
# maxCMZr <- lm(maxCM ~ Zr, data=mydata)  
# summary(maxCMZr)  
#   
# # plant mortality d  
# maxCMd <- lm(maxCM ~ d, data=mydata)  
# summary(maxCMd)  
#   
# # salt concentration in rain  
# maxCMConcConst <- lm(maxCM ~ ConcConst, data=mydata)  
# summary(maxCMConcConst)  
#   
# # salt concentration in groundwater  
# maxCMCM.gw <- lm(maxCM ~ CM.gw, data=mydata)  
# summary(maxCMCM.gw)  
#   
# # plant growth factor c  
# maxCMc <- lm(maxCM ~ c, data=mydata)  
# summary(maxCMc)  
#   
# # alpha  
# maxCMalpha <- lm(maxCM ~ alpha, data=mydata)  
# summary(maxCMalpha)  
#   
# # lambda  
# maxCMlambda <- lm(maxCM ~ lambda, data=mydata)  
# summary(maxCMlambda)  
#   
#   
# ### comparing the models

### Maximum soil salt concentration maxCM

maxCM\_all <- lm(maxCM ~ Z + Zr + d + ConcConst + CM.gw + c + alpha + lambda, data = mydata)  
summary(maxCM\_all)

##   
## Call:  
## lm(formula = maxCM ~ Z + Zr + d + ConcConst + CM.gw + c + alpha +   
## lambda, data = mydata)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -23595 -5973 -2514 2580 247899   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) -2.188e+04 1.796e+03 -12.179 < 2e-16 \*\*\*  
## Z 1.412e+00 7.416e-02 19.041 < 2e-16 \*\*\*  
## Zr 1.225e+01 2.856e+00 4.291 1.82e-05 \*\*\*  
## d -7.131e+04 3.210e+03 -22.214 < 2e-16 \*\*\*  
## ConcConst 5.523e+02 4.647e+01 11.886 < 2e-16 \*\*\*  
## CM.gw 1.703e+01 4.658e+01 0.366 0.715   
## c 1.824e+03 9.380e+01 19.441 < 2e-16 \*\*\*  
## alpha 6.177e+03 7.727e+02 7.993 1.62e-15 \*\*\*  
## lambda 6.507e+03 7.832e+02 8.308 < 2e-16 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 14210 on 4944 degrees of freedom  
## Multiple R-squared: 0.2324, Adjusted R-squared: 0.2311   
## F-statistic: 187.1 on 8 and 4944 DF, p-value: < 2.2e-16

# # Groundwater depth Z  
# maxCMZ <- lm(maxCM ~ Z, data=mydata)  
# summary(maxCMZ)  
#   
# # Root depth Zr  
# maxCMZr <- lm(maxCM ~ Zr, data=mydata)  
# summary(maxCMZr)  
#   
# # plant mortality d  
# maxCMd <- lm(maxCM ~ d, data=mydata)  
# summary(maxCMd)  
#   
# # salt concentration in rain  
# maxCMConcConst <- lm(maxCM ~ ConcConst, data=mydata)  
# summary(maxCMConcConst)  
#   
# # salt concentration in groundwater  
# maxCMCM.gw <- lm(maxCM ~ CM.gw, data=mydata)  
# summary(maxCMCM.gw)  
#   
# # plant growth factor c  
# maxCMc <- lm(maxCM ~ c, data=mydata)  
# summary(maxCMc)  
#   
# # alpha  
# maxCMalpha <- lm(maxCM ~ alpha, data=mydata)  
# summary(maxCMalpha)  
#   
# # lambda  
# maxCMlambda <- lm(maxCM ~ lambda, data=mydata)  
# summary(maxCMlambda)  
#   
#   
# ### comparing the models

### Cumulative vertical water flux, cum\_flux

cf\_all <- lm(cum\_flux ~ Z + Zr + d + ConcConst + CM.gw + c + alpha + lambda, data = mydata)  
summary(cf\_all)

##   
## Call:  
## lm(formula = cum\_flux ~ Z + Zr + d + ConcConst + CM.gw + c +   
## alpha + lambda, data = mydata)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## -34412 -8649 -1449 7151 96824   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)   
## (Intercept) 1.481e+04 1.627e+03 9.106 <2e-16 \*\*\*  
## Z -5.740e-01 6.716e-02 -8.547 <2e-16 \*\*\*  
## Zr 3.087e+01 2.586e+00 11.937 <2e-16 \*\*\*  
## d -1.155e+05 2.907e+03 -39.744 <2e-16 \*\*\*  
## ConcConst -4.015e+02 4.208e+01 -9.542 <2e-16 \*\*\*  
## CM.gw 2.602e+01 4.219e+01 0.617 0.537   
## c 3.725e+03 8.495e+01 43.852 <2e-16 \*\*\*  
## alpha -2.674e+04 6.998e+02 -38.219 <2e-16 \*\*\*  
## lambda -3.192e+04 7.093e+02 -45.000 <2e-16 \*\*\*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## Residual standard error: 12870 on 4944 degrees of freedom  
## Multiple R-squared: 0.5958, Adjusted R-squared: 0.5951   
## F-statistic: 910.8 on 8 and 4944 DF, p-value: < 2.2e-16

# # Groundwater depth Z  
# cfZ <- lm(cum\_flux ~ Z, data=mydata)  
# summary(cfZ)  
#   
# # Root depth Zr  
# cfZr <- lm(cum\_flux ~ Zr, data=mydata)  
# summary(cfZr)  
#   
# # plant mortality d  
# cfd <- lm(cum\_flux ~ d, data=mydata)  
# summary(cfd)  
#   
# # salt concentration in rain  
# cfConcConst <- lm(cum\_flux ~ ConcConst, data=mydata)  
# summary(cfConcConst)  
#   
# # salt concentration in groundwater  
# cfCM.gw <- lm(cum\_flux ~ CM.gw, data=mydata)  
# summary(cfCM.gw)  
#   
# # plant growth factor c  
# cfc <- lm(cum\_flux ~ c, data=mydata)  
# summary(cfc)  
#   
# # alpha  
# cfalpha <- lm(cum\_flux ~ alpha, data=mydata)  
# summary(cfalpha)  
#   
# # lambda  
# cflambda <- lm(cum\_flux ~ lambda, data=mydata)  
# summary(cflambda)  
#   
  
### comparing the models

### Plant death, P=0, Pzero

Pzero\_all <- lm(Pzero ~ Z + Zr + d + ConcConst + CM.gw + c + alpha + lambda, data = mydata)  
summary(Pzero\_all)

##   
## Call:  
## lm(formula = Pzero ~ Z + Zr + d + ConcConst + CM.gw + c + alpha +   
## lambda, data = mydata)  
##   
## Residuals:  
## Min 1Q Median 3Q Max   
## 0 0 0 0 0   
##   
## Coefficients:  
## Estimate Std. Error t value Pr(>|t|)  
## (Intercept) 0 0 NA NA  
## Z 0 0 NA NA  
## Zr 0 0 NA NA  
## d 0 0 NA NA  
## ConcConst 0 0 NA NA  
## CM.gw 0 0 NA NA  
## c 0 0 NA NA  
## alpha 0 0 NA NA  
## lambda 0 0 NA NA  
##   
## Residual standard error: 0 on 4944 degrees of freedom  
## Multiple R-squared: NaN, Adjusted R-squared: NaN   
## F-statistic: NaN on 8 and 4944 DF, p-value: NA

# Groundwater depth Z  
# PzeroZ <- lm(Pzero ~ Z, data=mydata)  
# summary(PzeroZ)  
#   
# # Root depth Zr  
# PzeroZr <- lm(Pzero ~ Zr, data=mydata)  
# summary(PzeroZr)  
#   
# # plant mortality d  
# Pzerod <- lm(Pzero ~ d, data=mydata)  
# summary(Pzerod)  
#   
# # salt concentration in rain  
# PzeroConcConst <- lm(Pzero ~ ConcConst, data=mydata)  
# summary(PzeroConcConst)  
#   
# # salt concentration in groundwater  
# PzeroCM.gw <- lm(Pzero ~ CM.gw, data=mydata)  
# summary(PzeroCM.gw)  
#   
# # plant growth factor c  
# Pzeroc <- lm(Pzero ~ c, data=mydata)  
# summary(Pzeroc)  
#   
# # alpha  
# Pzeroalpha <- lm(Pzero ~ alpha, data=mydata)  
# summary(Pzeroalpha)  
#   
# # lambda  
# Pzerolambda <- lm(Pzero ~ lambda, data=mydata)  
# summary(Pzerolambda)  
#   
  
### comparing the models