

WTC Mineralisation results

Shun Hasegawa

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lh

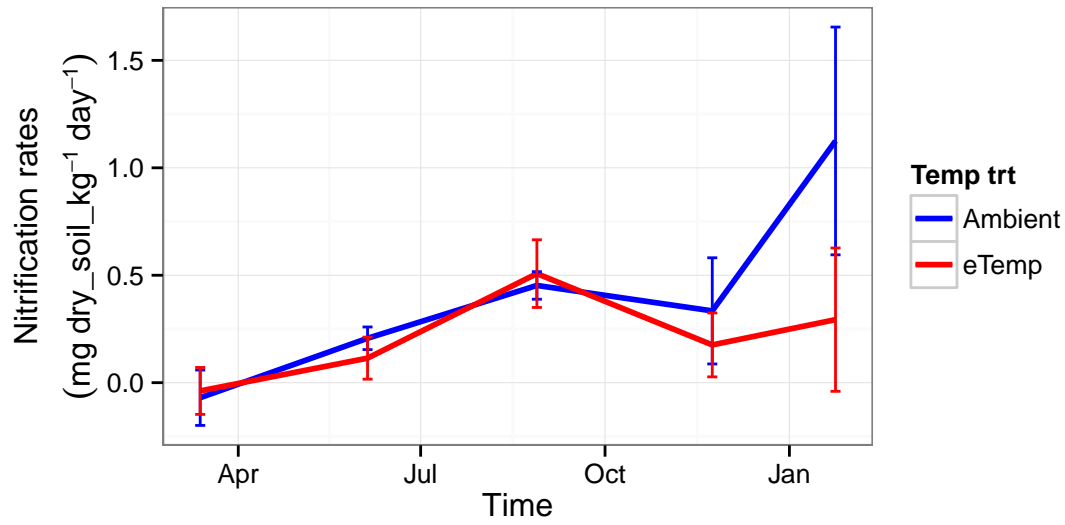


Table 1: Temp trt mean of nitrification rates

date	amb	amb.SE	elev	elev.SE	amb.N	elev.N
2013-03-13	-0.07	0.13	-0.04	0.11	6	6
2013-06-04	0.21	0.05	0.11	0.10	6	6
2013-08-28	0.45	0.06	0.51	0.16	6	6
2013-11-23	0.33	0.25	0.18	0.15	6	6
2014-01-24	1.12	0.53	0.29	0.33	6	6

Figure 1: Nitrification rates at temperature treatments

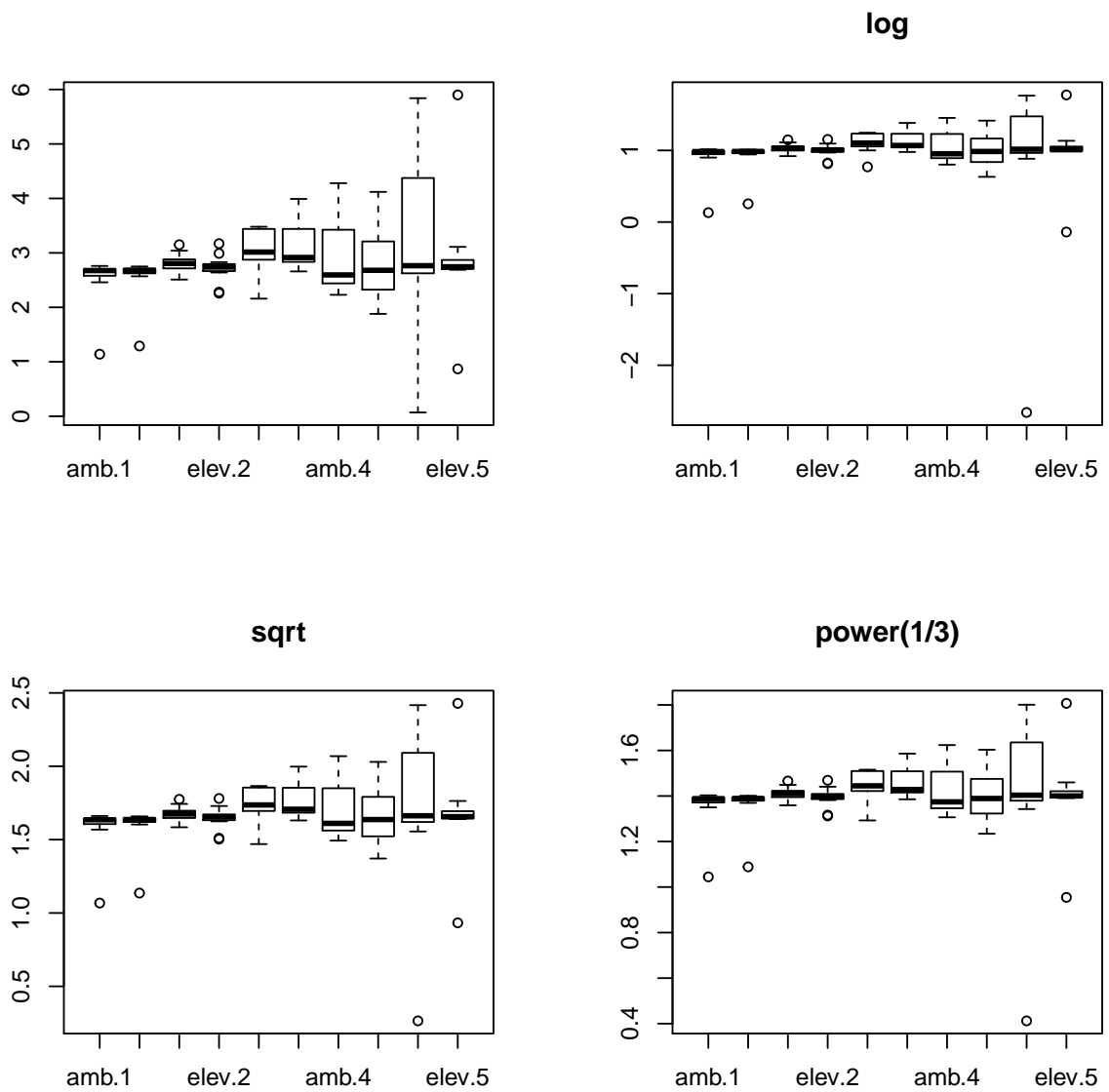
1 Mineralisation

1.1 Nitrification

1.1.1 Temp trt

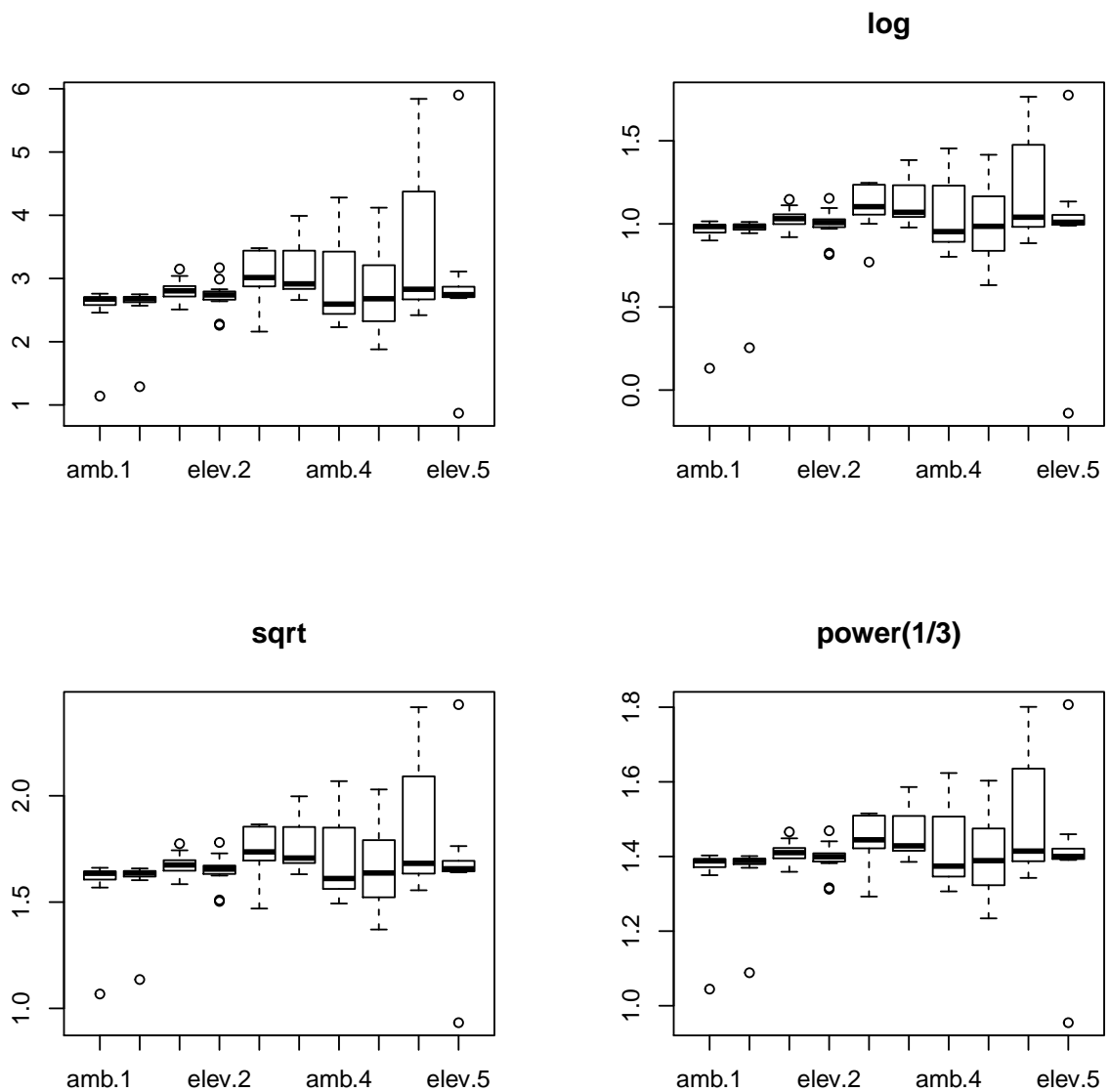
Stats

```
bxplots(value = "nitrification", ofst = 2.6, data = mine)
```



```
# remove the lowest value
```

```
bxplts(value = "nitrification", ofst = 2.6, data = subset(mine,
  nitrification > min(nitrification)))
```



```
# homogeneity in variance is still highly violated but carry
# on anyway this time with log
Nhrm01 <- subset(mine, nitrification > min(nitrification))

# different random factor structure
m1 <- lme(log(nitrification + 2.6) ~ temp * time, random = ~1 |
  chamber/side, data = Nhrm01)
m2 <- lme(log(nitrification + 2.6) ~ temp * time, random = ~1 |
  chamber, data = Nhrm01)
```

```

m3 <- lme(log(nitrification + 2.6) ~ temp * time, random = ~1 |
  id, data = Nhrm01)
anova(m1, m2, m3)

##      Model df    AIC    BIC logLik   Test L.Ratio p-value
## m1         1 13 40.54 75.53 -7.269
## m2         2 12 39.64 71.94 -7.821 1 vs 2   1.104 0.2934
## m3         3 12 38.54 70.83 -7.269

# m3 is slight ly better

# autocorrelation
atcr.cmpr(m3, rndmFac = "id")

## [[1]]
## Linear mixed-effects model fit by REML
##   Data: Nhrm01
##   Log-restricted-likelihood: -7.269
##   Fixed: log(nitrification + 2.6) ~ temp * time
##           (Intercept)      tempelev      time2      time3      time4
##           0.905953      0.017827      0.124222      0.201814      0.146255
##           time5 tempelev:time2 tempelev:time3 tempelev:time4 tempelev:time5
##           0.303516      -0.053631      -0.001049      -0.074482      -0.235265
##
## Random effects:
##   Formula: ~1 | id
##           (Intercept) Residual
## StdDev:      0.069    0.2219
##
## Number of Observations: 119
## Number of Groups: 24
##
## [[2]]
## Linear mixed-effects model fit by REML
##   Data: Nhrm01
##   Log-restricted-likelihood: -7.269
##   Fixed: log(nitrification + 2.6) ~ temp * time
##           (Intercept)      tempelev      time2      time3      time4
##           0.905953      0.017827      0.124222      0.201814      0.146255
##           time5 tempelev:time2 tempelev:time3 tempelev:time4 tempelev:time5
##           0.303516      -0.053631      -0.001049      -0.074482      -0.235265
##
## Random effects:
##   Formula: ~1 | id
##           (Intercept) Residual
## StdDev:      0.07071    0.2214

```

```

##
## Correlation Structure: Compound symmetry
## Formula: ~1 | id
## Parameter estimate(s):
##      Rho
## -0.004878
## Number of Observations: 119
## Number of Groups: 24
##
## [[3]]
## Linear mixed-effects model fit by REML
## Data: Nhrm01
## Log-restricted-likelihood: -6.518
## Fixed: log(nitrification + 2.6) ~ temp * time
##      (Intercept)      tempelev      time2      time3      time4
##      0.905953      0.017827      0.124222      0.201814      0.146255
##      time5 tempelev:time2 tempelev:time3 tempelev:time4 tempelev:time5
##      0.299303      -0.053631      -0.001049      -0.074482      -0.231052
##
## Random effects:
## Formula: ~1 | id
##      (Intercept) Residual
## StdDev:      0.09101  0.2129
##
## Correlation Structure: ARMA(0,2)
## Formula: ~1 | id
## Parameter estimate(s):
## Theta1 Theta2
## -0.2967 -0.1258
## Number of Observations: 119
## Number of Groups: 24
##
## [[4]]
## Linear mixed-effects model fit by REML
## Data: Nhrm01
## Log-restricted-likelihood: -6.788
## Fixed: log(nitrification + 2.6) ~ temp * time
##      (Intercept)      tempelev      time2      time3      time4
##      0.905953      0.017827      0.124222      0.201814      0.146255
##      time5 tempelev:time2 tempelev:time3 tempelev:time4 tempelev:time5
##      0.301732      -0.053631      -0.001049      -0.074482      -0.233481
##
## Random effects:
## Formula: ~1 | id
##      (Intercept) Residual

```

```

## StdDev:      0.07638    0.2189
##
## Correlation Structure: AR(1)
## Formula: ~1 | id
## Parameter estimate(s):
##      Phi
## -0.1472
## Number of Observations: 119
## Number of Groups: 24
##
## [[5]]
## Linear mixed-effects model fit by REML
## Data: Nhrm01
## Log-restricted-likelihood: -6.712
## Fixed: log(nitrification + 2.6) ~ temp * time
##      (Intercept)      tempelev      time2      time3      time4
##      0.905953      0.017827      0.124222      0.201814      0.146255
##      time5 tempelev:time2 tempelev:time3 tempelev:time4 tempelev:time5
##      0.301136      -0.053631      -0.001049      -0.074482      -0.232885
##
## Random effects:
## Formula: ~1 | id
##      (Intercept) Residual
## StdDev:      0.07969    0.2178
##
## Correlation Structure: ARMA(0,1)
## Formula: ~1 | id
## Parameter estimate(s):
##      Theta1
## -0.1865
## Number of Observations: 119
## Number of Groups: 24
##
## [[6]]
##      Model df    AIC    BIC logLik    Test L.Ratio p-value
## model      1 12 38.54 70.83 -7.269
## model2     2 13 40.54 75.53 -7.269 1 vs 2  0.0000  1.0000
## model3     3 14 41.04 78.72 -6.518 2 vs 3  1.5019  0.2204
## model4     4 13 39.58 74.56 -6.788 3 vs 4  0.5404  0.4623
## model5     5 13 39.42 74.41 -6.712

# no need for autocorrelation

# model simplification
MdlSmpl(m3)

```



```

## $step.aic
## Stepwise Model Path
## Analysis of Deviance Table
##
## Initial Model:
## log(nitrification + 2.6) ~ temp * time
##
## Final Model:
## log(nitrification + 2.6) ~ time
##
##
##           Step Df Deviance Resid. Df Resid. Dev      AIC
## 1                107      -21.61  2.3917
## 2 - temp:time    4      4.690    111      -16.92 -0.9184
## 3   - temp      1      1.196    112      -15.72 -1.7228
##
## $drop1
## Single term deletions
##
## Model:
## log(nitrification + 2.6) ~ time
##           Df    AIC  LRT Pr(>Chi)
## <none>      -1.72
## time      4  2.39 12.1   0.017 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## $anova.reml
##           numDF denDF F-value p-value
## (Intercept)      1    91 1657.7 <.0001
## time            4    91    3.1 0.0199
##
## $model.reml
## Linear mixed-effects model fit by REML
##   Data: Nhrm01
##   Log-restricted-likelihood: -2.84
##   Fixed: log(nitrification + 2.6) ~ time
## (Intercept)      time2      time3      time4      time5
##    0.91487    0.09741    0.20129    0.10901    0.18079
##
## Random effects:
## Formula: ~1 | id
##           (Intercept) Residual
## StdDev:    0.07443    0.2213
##

```

```

## Number of Observations: 119
## Number of Groups: 24
##
## $model.ml
## Linear mixed-effects model fit by maximum likelihood
##   Data: Nhrm01
##   Log-likelihood: 7.861
##   Fixed: log(nitrification + 2.6) ~ time
## (Intercept)      time2      time3      time4      time5
##    0.91487    0.09741    0.20129    0.10901    0.18079
##
## Random effects:
## Formula: ~1 | id
##      (Intercept) Residual
## StdDev:    0.07287  0.2166
##
## Number of Observations: 119
## Number of Groups: 24

# interaction by temp x time and temp is removed

Fml <- MdlSmpl(m3)$model.reml

# The final model is
lme(log(nitrification + 2.6) ~ time, random = ~1 | id, data = Nhrm01)

## Linear mixed-effects model fit by REML
##   Data: Nhrm01
##   Log-restricted-likelihood: -2.84
##   Fixed: log(nitrification + 2.6) ~ time
## (Intercept)      time2      time3      time4      time5
##    0.91487    0.09741    0.20129    0.10901    0.18079
##
## Random effects:
## Formula: ~1 | id
##      (Intercept) Residual
## StdDev:    0.07443  0.2213
##
## Number of Observations: 119
## Number of Groups: 24

Anova(Fml)

## Analysis of Deviance Table (Type II tests)
##
## Response: log(nitrification + 2.6)

```

```

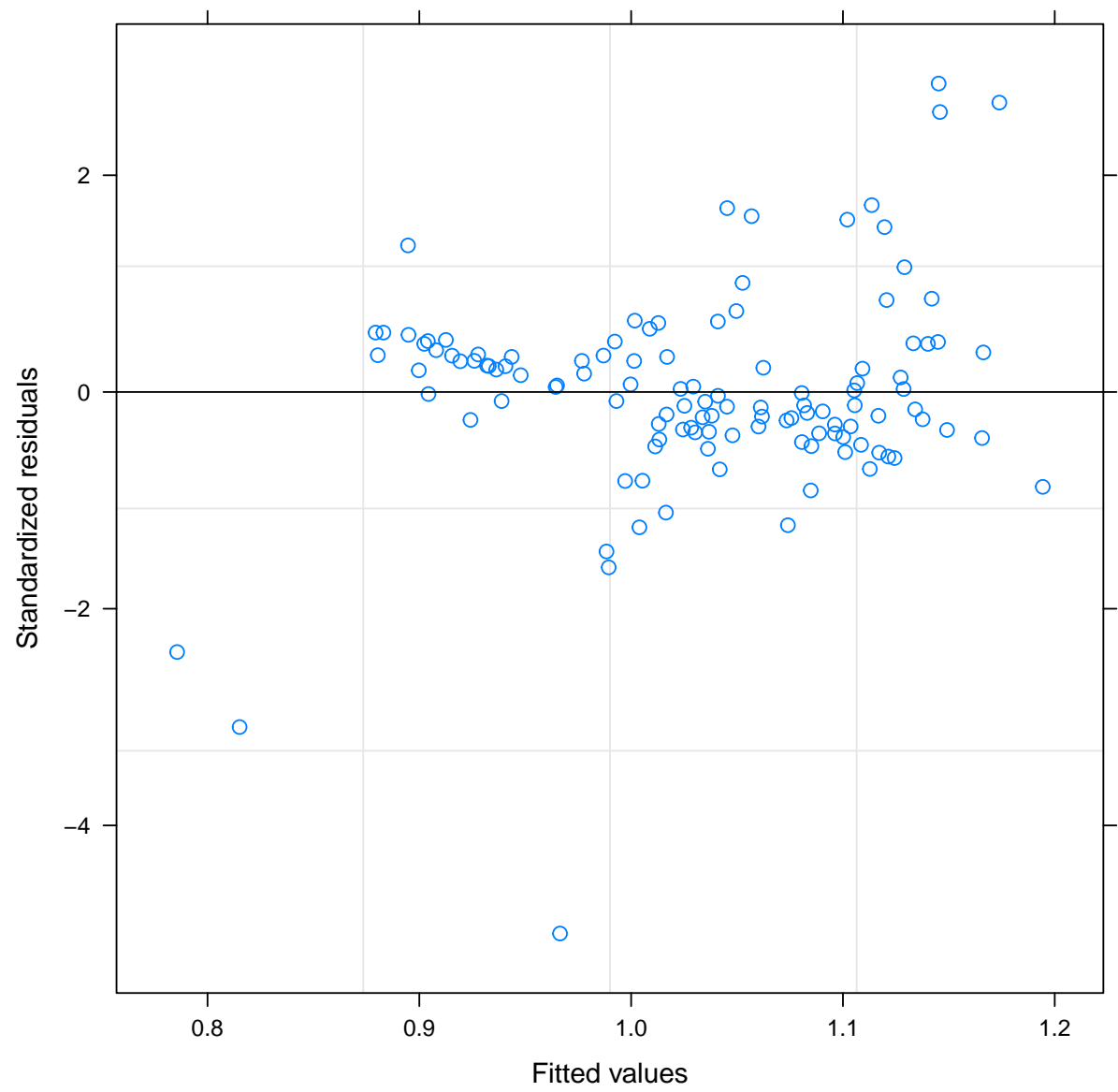
##      Chisq Df Pr(>Chisq)
## time  12.3  4      0.015 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

summary(Fml)

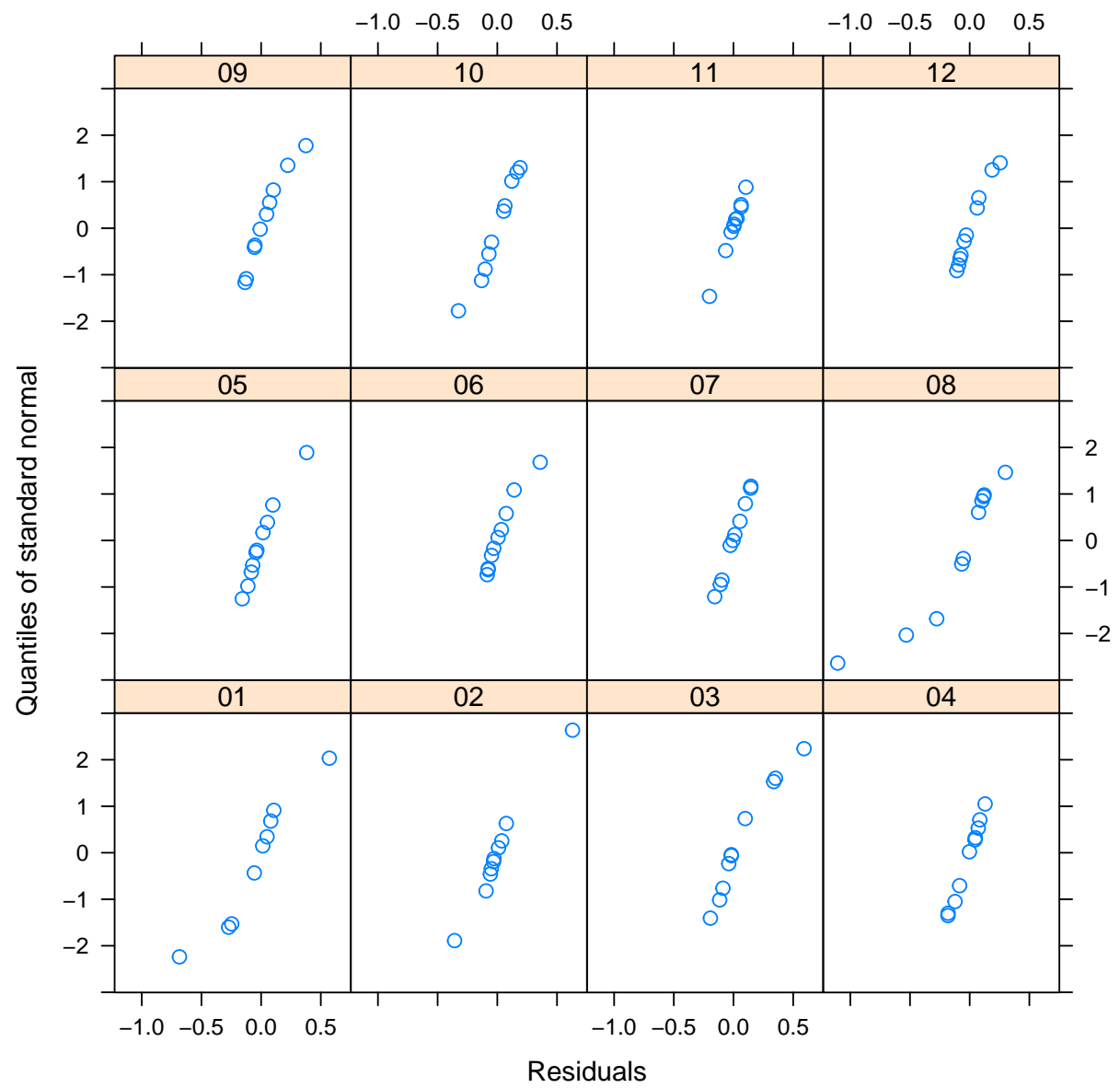
## Linear mixed-effects model fit by REML
## Data: Nhrm01
##      AIC      BIC logLik
##  19.68 38.83 -2.84
##
## Random effects:
## Formula: ~1 | id
##      (Intercept) Residual
## StdDev:      0.07443  0.2213
##
## Fixed effects: log(nitrification + 2.6) ~ time
##              Value Std.Error DF t-value p-value
## (Intercept)  0.9149   0.04765 91  19.200  0.0000
## time2        0.0974   0.06387 91   1.525  0.1307
## time3        0.2013   0.06387 91   3.152  0.0022
## time4        0.1090   0.06387 91   1.707  0.0913
## time5        0.1808   0.06461 91   2.798  0.0063
## Correlation:
##      (Intr) time2  time3  time4
## time2 -0.670
## time3 -0.670  0.500
## time4 -0.670  0.500  0.500
## time5 -0.662  0.494  0.494  0.494
##
## Standardized Within-Group Residuals:
##      Min      Q1      Med      Q3      Max
## -4.99738 -0.36991 -0.01877  0.35543  2.84642
##
## Number of Observations: 119
## Number of Groups: 24

# model diagnosis
plot(Fml)

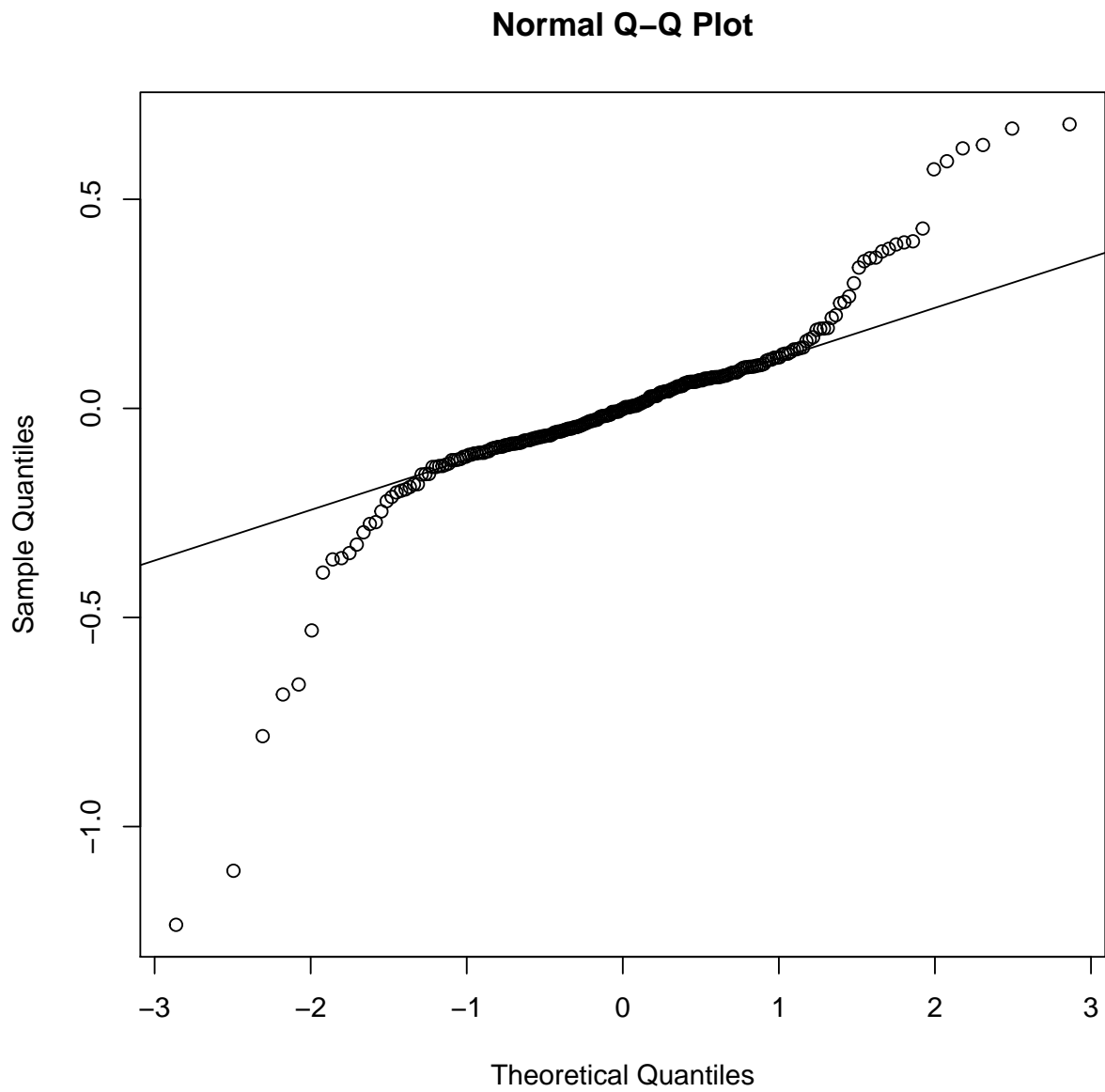
```



```
qqnorm(Fml, ~resid(.) | chamber)
```



```
qqnorm(residuals.lm(Fml))
qqline(residuals.lm(Fml))
```



not very good....