Well Model Sensitivity Analysis

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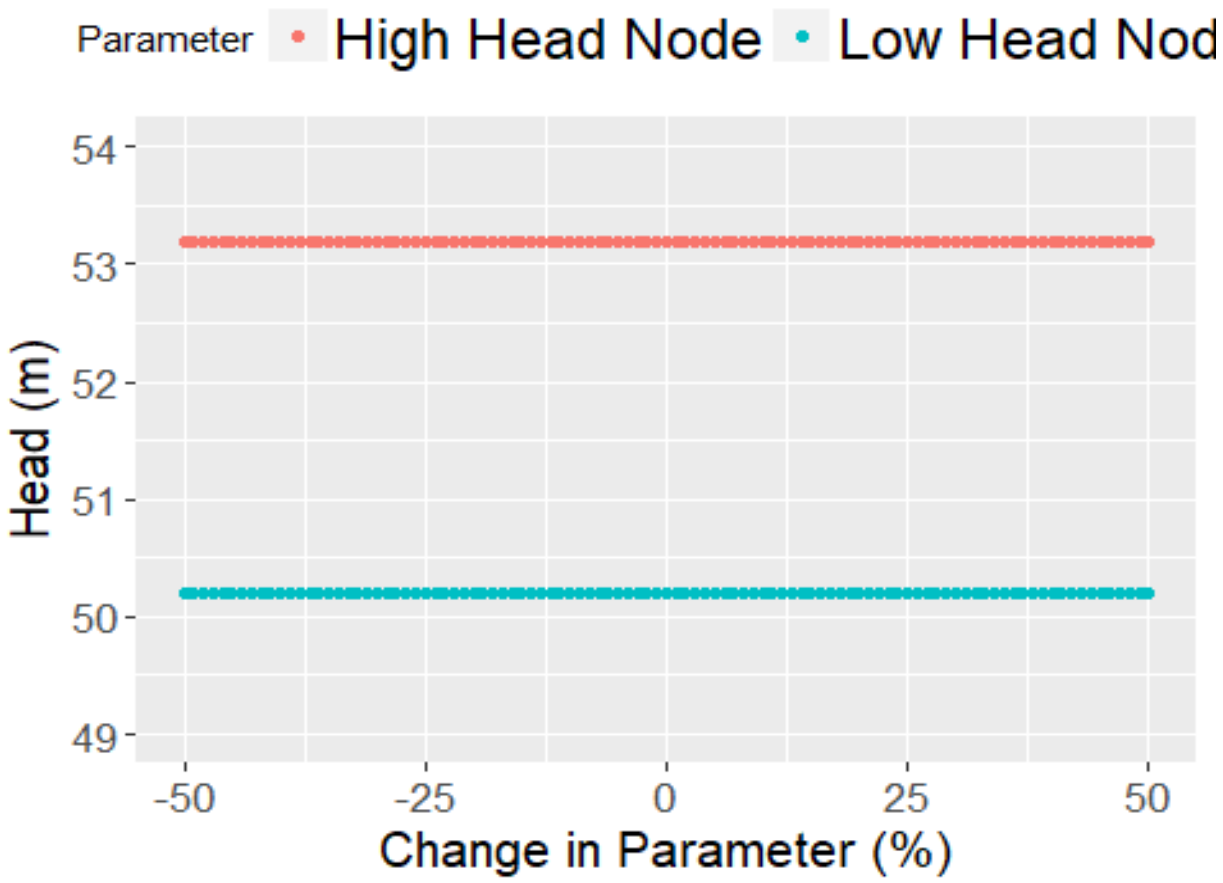
```
#set working directory
setwd("G:\\My Drive\\HSU\\current_Semester\\F18\\Comp3\\well_analysis")
library("data.table")

## Warning: package 'data.table' was built under R version 3.4.4

library("ggplot2")

## Warning: package 'ggplot2' was built under R version 3.4.4

library("reshape2")

##
## Attaching package: 'reshape2'

## The following objects are masked from 'package:data.table':
##
##     dcast, melt

w = fread("w.csv")
k = fread("ksensitivity50.csv")
k

##         k percent  lowhead highhead
##   1:  5.0     -50 50.21121 53.18792
##   2:  5.1     -49 50.21121 53.18792
##   3:  5.2     -48 50.21121 53.18792
##   4:  5.3     -47 50.21121 53.18792
##   5:  5.4     -46 50.21121 53.18792
##  ---
##  97: 14.6      46 50.21121 53.18792
##  98: 14.7      47 50.21121 53.18792
##  99: 14.8      48 50.21121 53.18792
## 100: 14.9      49 50.21121 53.18792
## 101: 15.0      50 50.21121 53.18792
```

Transmissivity and Flow

```
ggplot(w, aes(x = k$percent, y = k$lowhead, color = Parameter))+
  geom_point(aes(y = k$lowhead, col = "Low Head Node"))+
  geom_point(aes(y = k$highhead, col = "High Head Node"))+
  labs(x="Change in Parameter (%)", y = "Head (m)")+
  ylim(49,54)+
  theme(legend.position = "top",legend.text = element_text(size=17),
```

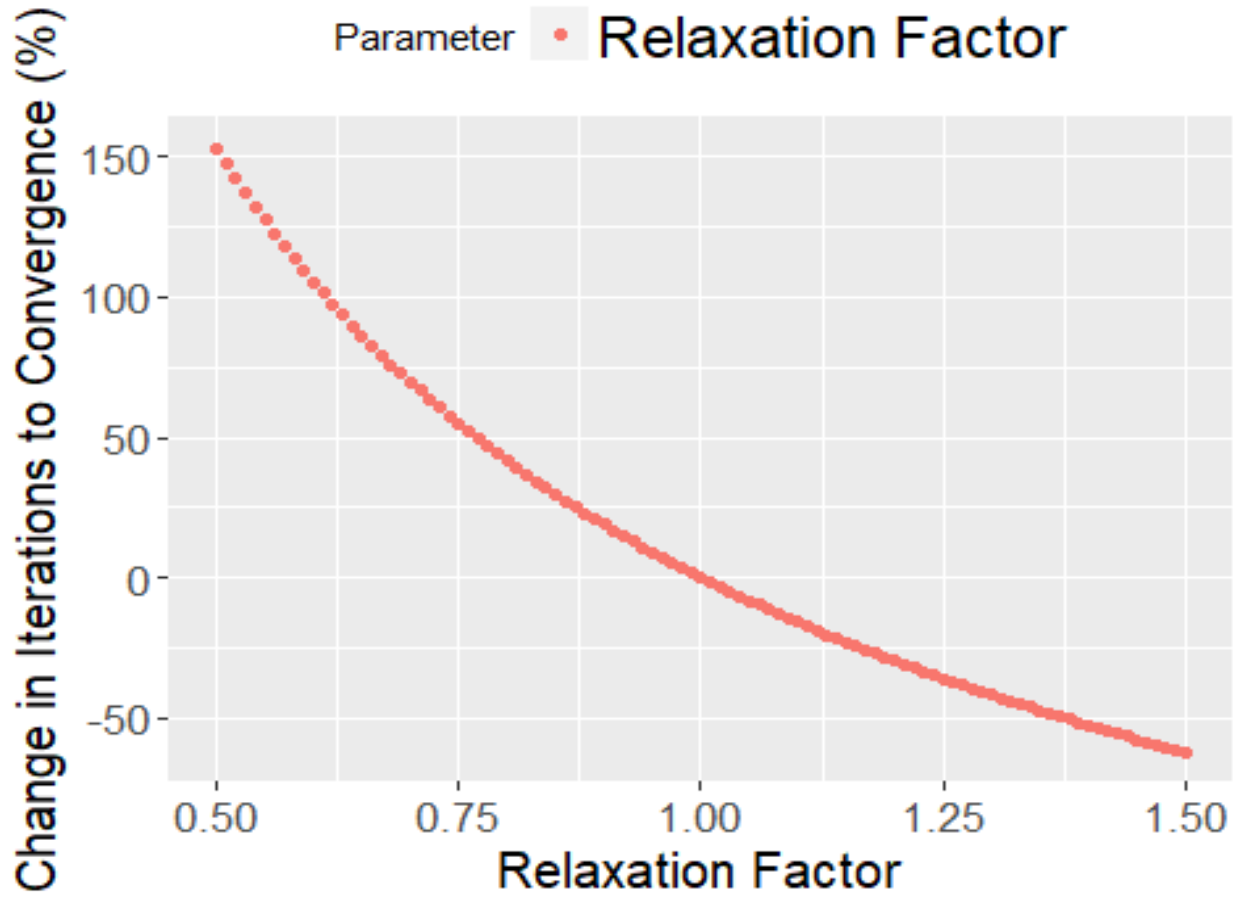
```
        axis.text.x = element_text(size=13),
        axis.text.y = element_text(size=13),
        axis.title = element_text(size=15))
```




```
ggsave("plotkvals.png",width=12, height = 8)
```

Relaxation Factor Sensitivity Analysis

```
w = fread("w.csv")
w$changew = 100*(w$iterations - 429)/(429)
ggplot(w, aes(x = w$relaxation, y = w$changew, color = Parameter))+
  geom_point(aes(y = w$changew, col = "Relaxation Factor"))+
  labs(x="Relaxation Factor", y = "Change in Iterations to Convergence (%)")+
  theme(legend.position = "top",legend.text = element_text(size=17),
        axis.text.x = element_text(size=13),
        axis.text.y = element_text(size=13),
        axis.title = element_text(size=15))
```



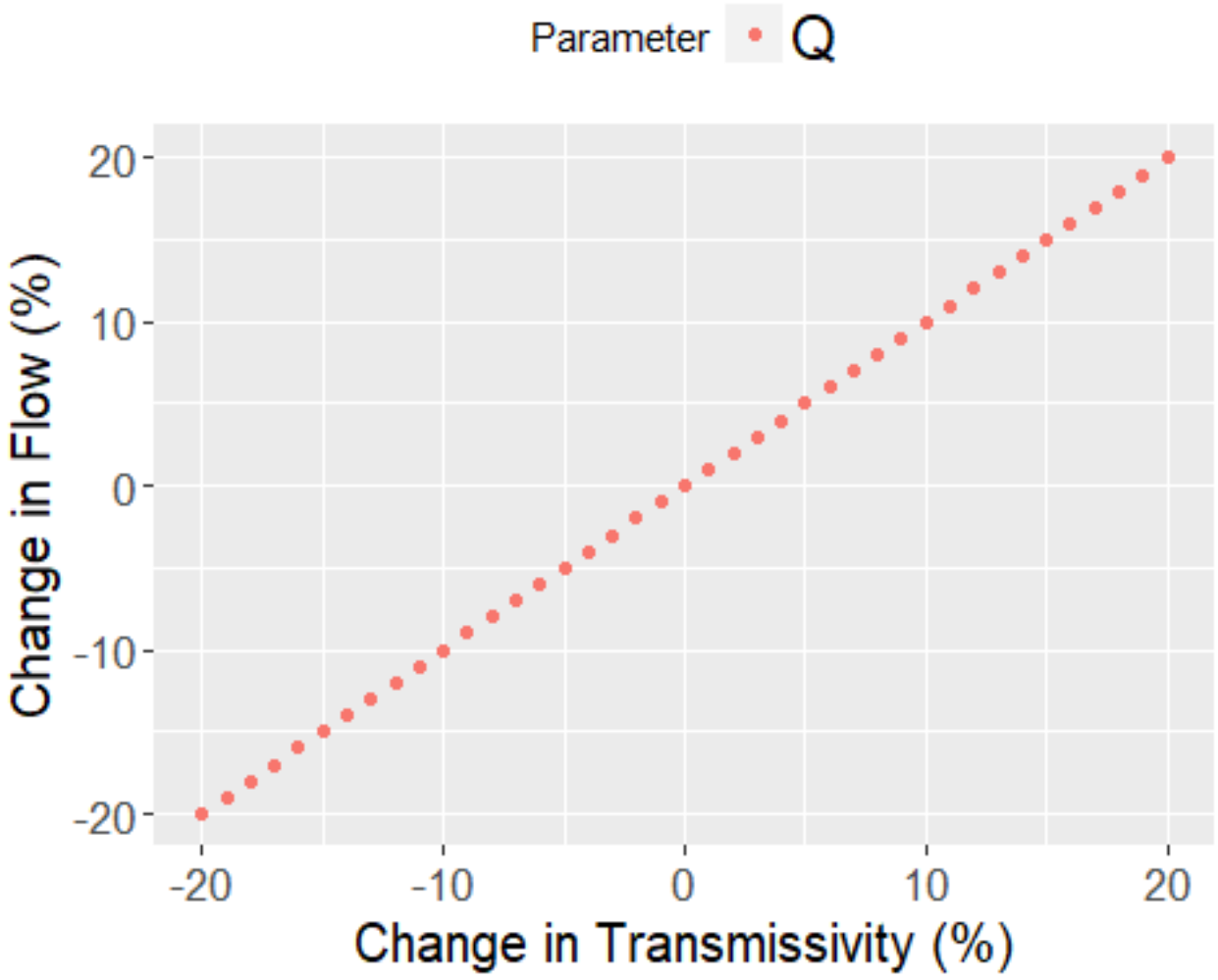

```
ggsave("relaxationfinal1.png",width=12, height = 8)

Q20 = fread("Q20.csv")

Q20$qchange = ((Q20$Q-3434.120)/(3434.120))*100
Q20
```

```
##     transmissivity percent        Q       qchange
##  1:            480     -20 2747.315 -1.999945e+01
##  2:            486     -19 2781.655 -1.899948e+01
##  3:            492     -18 2815.995 -1.799952e+01
##  4:            498     -17 2850.335 -1.699955e+01
##  5:            504     -16 2884.675 -1.599959e+01
##  6:            510     -15 2919.015 -1.499962e+01
##  7:            516     -14 2953.355 -1.399966e+01
##  8:            522     -13 2987.695 -1.299969e+01
##  9:            528     -12 3022.035 -1.199973e+01
## 10:            534     -11 3056.380 -1.099962e+01
## 11:            540     -10 3090.720 -9.999653e+00
## 12:            546      -9 3125.060 -8.999688e+00
## 13:            552      -8 3159.400 -7.999723e+00
## 14:            558      -7 3193.740 -6.999758e+00
```

```
## 15:            564      -6 3228.080 -5.999793e+00
## 16:            570      -5 3262.420 -4.999828e+00
## 17:            576      -4 3296.760 -3.999863e+00
## 18:            582      -3 3331.100 -2.999898e+00
## 19:            588      -2 3365.440 -1.999933e+00
## 20:            594      -1 3399.780 -9.999680e-01
## 21:            600       0 3434.120 -2.911954e-06
## 22:            606       1 3468.460  9.999621e-01
## 23:            612       2 3502.800  1.999927e+00
## 24:            618       3 3537.140  2.999892e+00
## 25:            624       4 3571.480  3.999857e+00
## 26:            630       5 3605.820  4.999822e+00
## 27:            636       6 3640.160  5.999787e+00
## 28:            642       7 3674.500  6.999752e+00
## 29:            648       8 3708.840  7.999718e+00
## 30:            654       9 3743.180  8.999683e+00
## 31:            660      10 3777.520  9.999648e+00
## 32:            666      11 3811.860  1.099961e+01
## 33:            672      12 3846.200  1.199958e+01
## 34:            678      13 3880.540  1.299954e+01
## 35:            684      14 3914.880  1.399951e+01
## 36:            690      15 3949.220  1.499947e+01
## 37:            696      16 3983.560  1.599944e+01
## 38:            702      17 4017.900  1.699940e+01
## 39:            708      18 4052.240  1.799937e+01
## 40:            714      19 4086.585  1.899948e+01
## 41:            720      20 4120.925  1.999944e+01
##     transmissivity percent        Q       qchange
```

Transmissivity and Flow

```
ggplot(Q20, aes(x = Q20$percent, y = Q20$qchange, color = Parameter))+
  geom_point(aes(y = Q20$qchange, col = "Q"))+
  labs(x="Change in Transmissivity (%)", y = "Change in Flow (%)")+
  theme(legend.position = "top",legend.text = element_text(size=17),
        axis.text.x = element_text(size=13),
        axis.text.y = element_text(size=13),
        axis.title = element_text(size=15))
```




```
ggsave("Q111.png",width=12, height = 8)
```