Assignment LHS

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```
source(here("atm_conduct_function.R"))
```

Question 2:

```
#parameters
factors = c("vm", "h")

#how many parameter sets to run
nsets = 100

#choose distributions for parameters
q = c("qnorm", "qunif")
q.arg = list(list(mean = 250, sd = 30),
             list(min = 950, max = 1050)
             )

#generate samples from LHS
sens_conduct = LHS(NULL, factors, nsets, q, q.arg)
sens_pars = get.data(sens_conduct)
head(sens_pars)
```

```
##         vm      h
## 1 245.8509 1018.5
## 2 248.8718 1004.5
## 3 199.1381 1042.5
## 4 208.8339 1049.5
## 5 227.3375 1032.5
## 6 278.0377 1039.5
```

```
#run model for all of the parameters generated by LHS, using pmap

conductance <- sens_pars %>%
  pmap(atm_conduct)

# turn results in to a dataframe for easy display/analysis
conductance_df = conductance %>% map_dfr(`[`,c("Cat"))

mean(conductance_df$Cat)
```

```
## [1] 15.43957
```

Question 3:

Part a:

```r
kd <- 0.7
k0 <- 0.1
deviation <- 0.01

#parameters
factors = c("kd", "k0", "vm", "h")

#how many parameter sets to run
nsets = 100

#choose distributions for parameters
q = c("qunif", "qunif", "qnorm", "qunif")
q.arg = list(list(min = kd-deviation*kd,
                  max = kd+deviation*kd),
             list(min = k0-deviation*k0,
                  max = k0+deviation*k0),
             list(mean = 250, sd = 30),
             list(min = 950, max = 1050)
             )

#generate samples from LHS
sens_conduct = LHS(NULL, factors, nsets, q, q.arg)
sens_pars = get.data(sens_conduct)
head(sens_pars)
```

```
##        kd      k0       vm      h
## 1 0.70049 0.10011 269.7651 1042.5
## 2 0.69979 0.09969 268.8402  976.5
## 3 0.69475 0.10007 280.4567  984.5
## 4 0.70035 0.10085 284.5105  959.5
## 5 0.69587 0.09943 215.4895 1024.5
## 6 0.69363 0.10013 271.6744 1026.5
```

Part b:

```r
#run model for all of the parameters generated by LHS, using pmap

conductance <- sens_pars %>%
  pmap(atm_conduct)

head(conductance)
```

```
## [[1]]
## [[1]]$Cat
## [1] 17.05375
##
```

```
##
## [[2]]
## [[2]]$Cat
## [1] 16.33894
##
##
## [[3]]
## [[3]]$Cat
## [1] 16.98507
##
##
## [[4]]
## [[4]]$Cat
## [1] 17.40937
##
##
## [[5]]
## [[5]]$Cat
## [1] 13.23796
##
##
## [[6]]
## [[6]]$Cat
## [1] 16.75793
```

```r
# turn results in to a dataframe for easy display/analysis
conductance_df = conductance %>% map_dfr(`[`,c("Cat"))
```

```r
sens_conduct = pse::tell(sens_conduct, t(as.matrix(conductance_df)),
                         res.names=c("Cat"))
```

Part c:

```r
# Plot conductance estimates accounting for parameter uncertainty

ggplot(conductance_df, aes(x=factor(0), y=Cat))+
  geom_boxplot()+
  labs(y="Atmospheric Conductance (cm/s)",
       x = NULL,
       title = "Atmospheric Conductance Range")+
  theme_bw()+
  theme(axis.text.x = element_blank(),
        axis.ticks.x = element_blank(),
        plot.title = element_text(hjust = 0.5))
```

Part d:

```r
#Plot conductance estimates against each parameter
```

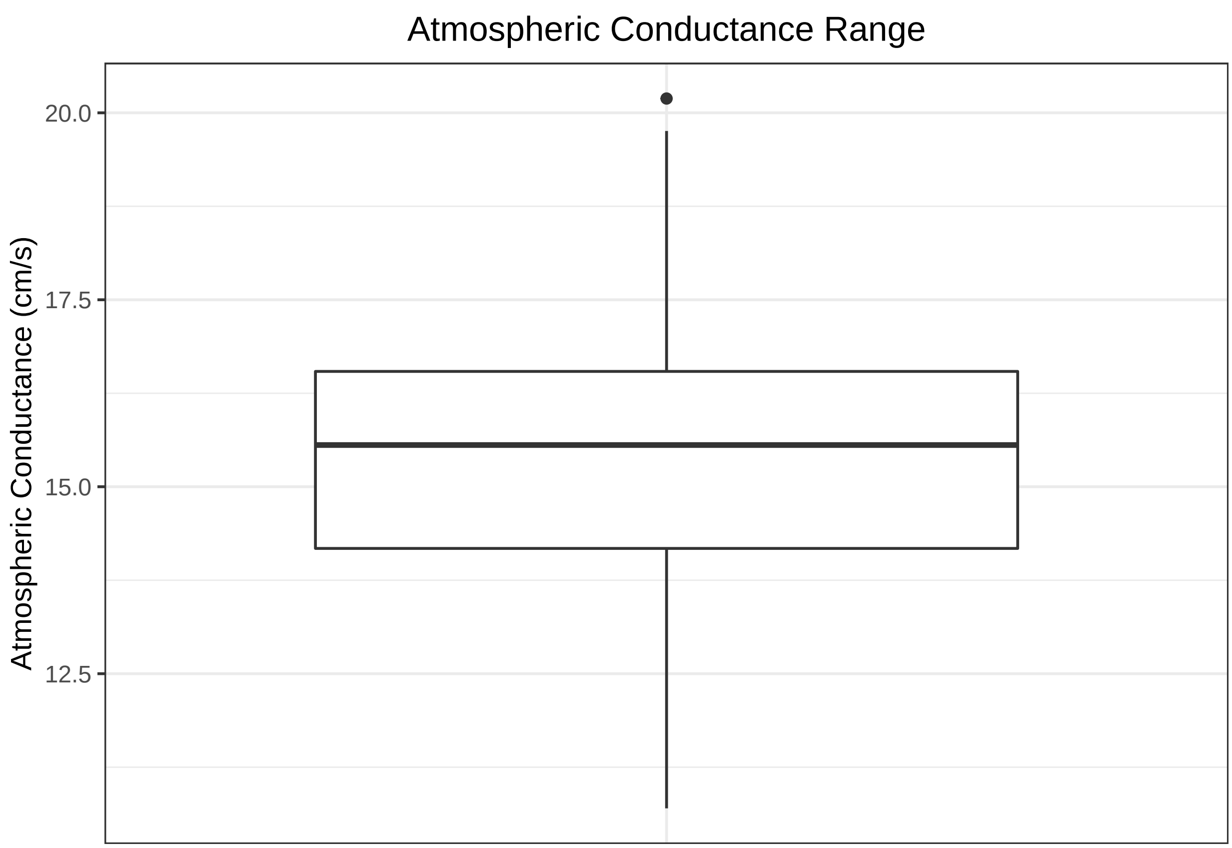

Figure 1: This is the range of atmospheric conductance for the inputted parameters. This shows the conductance estimates in a way that accounts for parameter uncertainty.

```r
# now we use built in LHS functions to analyze parameter sensitivity
pse::plotscatter(sens_conduct, col="blue", cex=5) + title(main = "Conductance Estimates for Parameters")
```

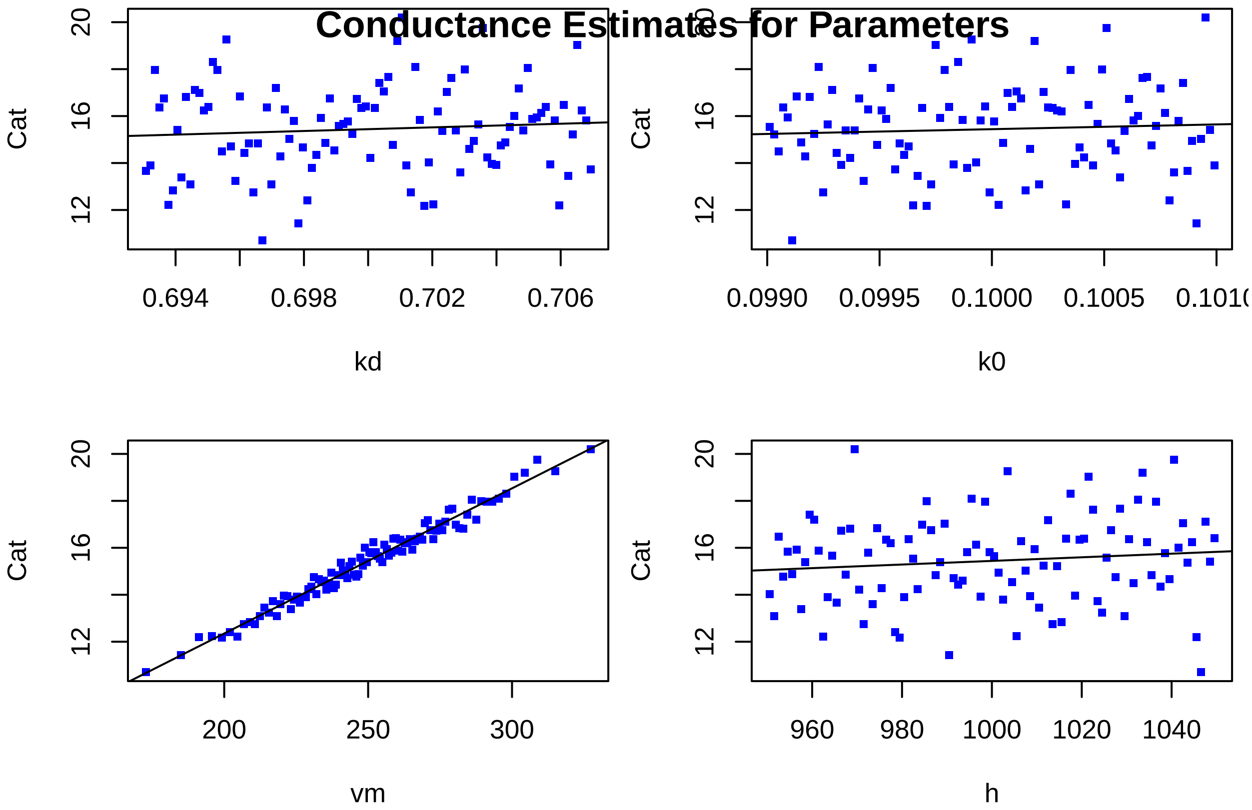

Figure 2: These are the plotted conductance estimates against each of the parameters.

```
## integer(0)
```

Part e:

```r
# estimate the Partial Rank Correlation Coefficients

#plot
pse::plotprcc(sens_conduct)
```

```r
#PRCC values for parameters
sens_conduct$prcc
```

```
## [[1]]
##
## Call:
## pcc.default(X = L, y = r, rank = T, nboot = nboot)
```

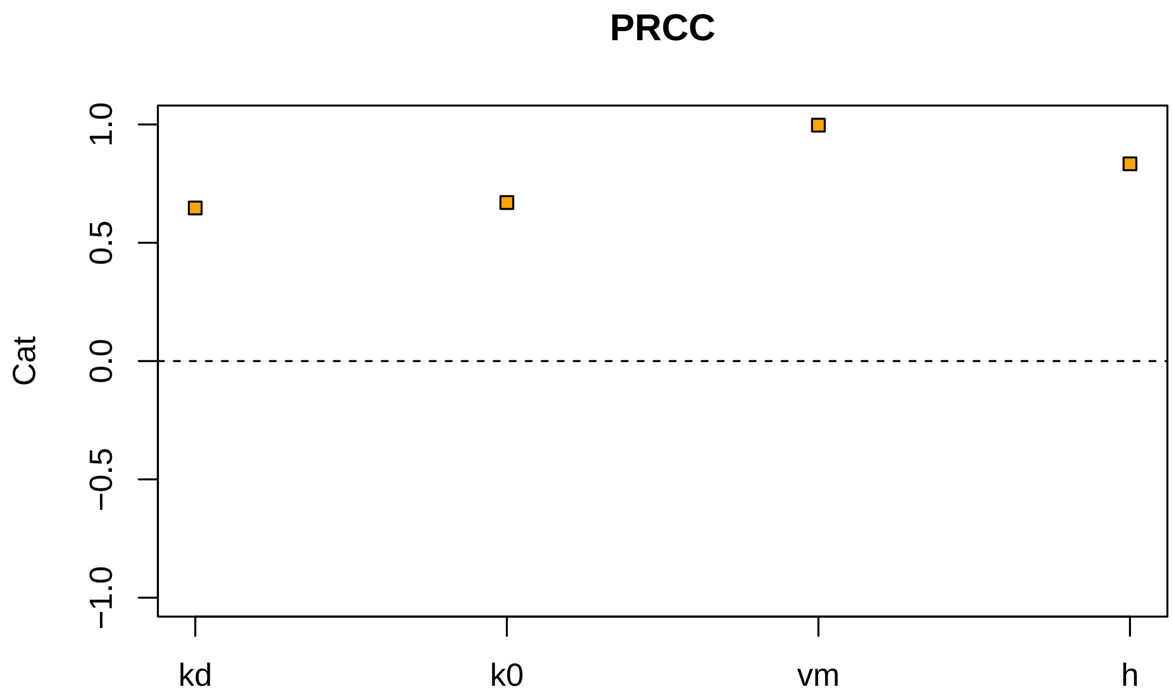

Figure 3: Partial Rank Correlation Coefficients for the parameters kd, k0, vm (windspeed), and h (vegetation height).

```
##
## Partial Rank Correlation Coefficients (PRCC):
##     original
## kd 0.6470723
## k0 0.6699472
## vm 0.9969814
## h  0.8336480
```

Part f:

When analyzing parameter sensitivity, our results indicate that wind speed is the greatest indicator of aerodynamic conductance. Thus, to reduce uncertainty in aerodynamic conductance estimates, one should focus on wind speed. There is evidence that climate change is increasing average wind speeds. Therefore, as our model suggests, atmospheric conductance will also increase with higher wind speeds. Thus, plants will lose more water due to this increased atmospheric conductance, and will be more sensitive to water use.